



# 2019/2020 Demand-Side Management Plan Electric and Natural Gas

Public Service Company of Colorado

Proceeding No. 18A-0606EG

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## **Document Layout**

The Plan has four major sections, summarized below:

1. Executive Summary – provides a high-level overview of the strategic direction of the overall 2019/2020 DSM Plan; provides program and product level targets and budgets; identifies budgets by cost category; and addresses customer participation.
2. Program and Product Summaries – a high-level summary of each program area followed by specifics of each DSM product offering.
3. Cost-Benefit Analyses – provides the electric and natural gas Portfolio and Program cost-benefit analysis results for 2019 and 2020.
4. Appendices – presents a list of acronyms; key terms; product rankings; avoided costs; description of budget categories; natural gas DSM \$/Therm and Acknowledgement of Lost Revenue (“ALR”) methodology; and the technical reference manual (deemed savings and forecast technical assumptions).

## Executive Summary: Plan Overview

Public Service Company of Colorado (“Public Service” or “the Company”) submits this combined electric and natural gas 2019/2020 Demand-Side Management Plan (“DSM Plan”) to the Colorado Public Utilities Commission (“Commission”). This Plan is the result of an extensive effort by the Company to assess market potential in our Colorado service territory and devise a plan to reach the Commission-approved annual energy savings goal by offering an inclusive and cost-effective DSM portfolio, delivered to customers via proven marketing techniques.

The Company’s 2019/2020 DSM Plan is grounded in a continuance of preceding years’ successful approaches, in combination with necessary adjustments made to improve DSM offerings to reflect market shifts and integrate emerging technologies; and to be responsive to the Commission’s Decision<sup>1</sup> in the 2017 DSM Strategic Issues (Proceeding No. 17A-0462EG). That Decision resulted in increased energy savings goals for 2019-2023,<sup>2</sup> an energy efficiency budget of \$78 million with the flexibility to exceed the budget by 20%, and modifications to the Company’s financial incentive mechanism to encourage goal achievement.<sup>3</sup>

This Plan meets the requirements of the relevant Commission Decisions and Rules,<sup>4</sup> and aims to meet or exceed the Commission-approved energy savings goal (500 GWh), while maintaining strong cost-effectiveness results in a dynamic environment of low natural gas prices, increasing renewable energy generation, and increasing codes and standards.

To meet the Commission-approved goal for the DSM portfolio, Public Service has developed the Plan under the following high-level approaches:

- Leveraging robust project queues (for products with long planning/construction cycles, such as New Construction);
- Continuing the use of midstream rebate approaches (Cooling and Lighting Efficiency);
- Launching promising new pilots (for example, Residential Battery Demand Response and DSM Geo-targeting); and
- Accelerating market penetration in all customer classes through increased promotions and trade channel development.

Public Service also believes that successful implementation of this Plan will be the result of active participation by stakeholders. These stakeholders include our customers, the Colorado

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<sup>1</sup> Decision No. C18-0417, Proceeding No. 17A-0462EG.

<sup>2</sup> The previous electric energy saving goals were approved Decision No. C14-0731, where the goal was set at 400 GWh annually.

<sup>3</sup> Beginning in 2019, the Company is eligible for a performance incentive of 40% of incremental net benefits above 280 GWh up to 550 GWh upon achievement of at least 400 GWh.

<sup>4</sup> Commission’s Decision Nos. C11-0442 and C11-0645 issued in Proceeding No. 10A-554EG, Decision No. C14-0731 issued in Proceeding No. 13A-0686EG, and Decision No. C14-0731 in Proceeding No. 13A-0686EG; and Rules 4750 to 4760 of the Commission’s Rules Regulating Gas Utilities and Pipeline Operators (the Gas DSM Rules).

Energy Office, Commission Staff, the Office of Consumer Counsel, local governments, environmental and energy efficiency advocates, external consulting groups, efficient equipment manufacturers, distributors and vendors, installation contractors, and customer advocates. Each of the Company's DSM products offers its own opportunities for stakeholder involvement and feedback. In addition, Public Service will continue to host quarterly DSM Roundtable Meetings as a forum for open dialogue and discussion.<sup>5</sup>

### **2019/2020 DSM Plan**

In this filing, Public Service forecasts to achieve annual energy savings of approximately 502 GWh and 701,761 Dth in 2019, at forecasted budget of \$92.4 million and \$14.8 million, respectively. For 2020, forecasts to achieve annual energy savings of approximately 502 GWh and 681,120 Dth, at forecasted budget of \$93.4 million and \$14.9 million, respectively. The 2019 and 2020 electric energy savings goal, 500 GWh annually, was established by the Commission in Proceeding No. 17A-0462EG (Decision No. C17-0417). The Plan is also designed to achieve incremental demand reduction from energy efficiency totaling 90 MW in 2019 and 92 MW in 2020 compared to the annual demand reduction goal of 75 MW from energy efficiency.<sup>6</sup> (Cumulative demand reduction impacts expected from the Company's demand response ("DR") programs and pilots are discussed in the Demand Response Program section of the Plan). Table 1 below provides a summary of the budgets, energy savings targets and demand savings associated with the overall portfolio of energy efficiency and DR.

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<sup>5</sup> The quarterly DSM Roundtable meetings have been held since the 2009/2010 Plan. The meetings offer a chance for interested stakeholders to review and discuss DSM achievements and any programmatic changes with the Company.

<sup>6</sup> Decision No. C18-0417, Proceeding No. 17A-0462EG. This demand reduction goal was not modified as part of Decision No. C18-0743.

**Table 1: 2019/2020 DSM Plan Budgets & Targeted Energy and Demand Savings**

	Budget	Incremental Demand Target (Gen kW)	Energy Savings Target (Gen kWh or Dth)
<b>2019 – Electric</b>			
Energy Efficiency Programs	\$ 85,521,255	90,057	502,021,717
Energy Efficiency Indirect Program	\$ 6,887,507	-	-
<b>Total 2019 Electric EE</b>	<b>\$ 92,408,762</b>	<b>90,057</b>	<b>502,021,717</b>
Demand Response Program	\$ 15,318,509	32,494	37,082
Demand Response Indirect Program	\$ 1,757,673	-	-
<b>Total 2019 Electric DR</b>	<b>\$ 17,076,182</b>	<b>32,494</b>	<b>37,082</b>
<b>2019 Electric TOTAL</b>	<b>\$ 109,484,943</b>	<b>122,551</b>	<b>502,058,799</b>
<b>2019 – Natural Gas</b>			
Energy Efficiency Programs	\$ 13,183,199	0	701,761
Indirect Program	\$ 1,592,065	0	0
<b>2019 Natural Gas TOTAL</b>	<b>\$ 14,775,264</b>	<b>0</b>	<b>701,761</b>
<b>2019 TOTAL</b>	<b>\$ 124,260,207</b>	<b>122,551 kW</b>	<b>502,058,799 kWh 701,761 Dth</b>
<b>2020 – Electric</b>			
Energy Efficiency Programs	\$ 86,374,308	92,250	501,678,907
Indirect Program	\$ 7,009,724	-	-
<b>Total 2020 Electric EE</b>	<b>\$ 93,384,033</b>	<b>92,250</b>	<b>501,678,907</b>
Demand Response Program	\$ 15,805,927	40,494	37,082
Demand Response Indirect Program	\$ 2,119,919	-	-
<b>Total 2020 Electric DR</b>	<b>\$ 17,925,847</b>	<b>40,494</b>	<b>37,082</b>
<b>2020 Electric TOTAL</b>	<b>\$ 111,309,880</b>	<b>132,745</b>	<b>501,715,988</b>
<b>2020 – Natural Gas</b>			
Energy Efficiency Programs	\$ 13,279,986	0	681,120
Indirect Program	\$ 1,587,110	0	0
<b>2020 Natural Gas TOTAL</b>	<b>\$ 14,867,096</b>	<b>0</b>	<b>681,120</b>
<b>2020 TOTAL</b>	<b>\$ 126,176,976</b>	<b>132,745 kW</b>	<b>501,715,988 kWh 681,120 Dth</b>

**Modifications in 2019 and 2020**

While many of the DSM products included in this Plan are the same as those that have been implemented since 2009, products have naturally evolved since that time to promote cost-effectiveness and adapt to the marketplace. The evolution of products has been documented through previous DSM Plans, as well as through the 60-Day Notice process first established in the 2009/2010 Plan Stipulation approved in Proceeding No. 08A-366EG, to afford the Company discretion to make mid-year changes to Plans in order to achieve the greatest level of energy savings.<sup>7</sup>

<sup>7</sup> Decision No. R08-1243. Per the Settlement Agreement, 60/90-Day Notices are required for any proposal to add a new DSM product, reduce rebate levels, adopt new or discontinue existing measures, or change technical

The Plan also reflects additional noteworthy changes that include:

- Updated avoided costs and technical assumptions to reflect current data including use of PLEXOS modelling for the avoided cost of energy.
- New product additions to the portfolio, including Thermostat Optimization and Strategic Energy Management.
- The addition of new measures to the following programs:
  - School Education Kits;
  - Recommissioning;
  - Home Energy Squad;
  - Refrigerator Recycling;
  - Commercial Refrigeration;
  - Strategic Energy Management;
  - Residential Water Heating;
  - ENERGY STAR New Homes;
  - Insulation and Air Sealing;
  - Home Performance with ENERGY STAR; and
  - Single Family Weatherization.
- Measure, pilot, or product retirement including:
  - Computer Efficiency;
  - Electronically Commutated Plug Fans; and
  - Boiler Tune-ups.
- New pilots including Geo-targeting and Residential Battery Demand Response.
- Natural gas program expenditures have increased relative to the 2017/2018 DSM Plan to more than \$14 million which is more than twice the minimum spend requirement.
- Conclusion of the Thermostat Optimization pilot in 2018 which has been converted to a full product and expanded to include ENERGY STAR approved smart thermostats.
- Conclusion of the ENERGY STAR Retail Products Platform Pilot which has been converted to a market transformation offering.

### **2019/2020 Energy and Demand Savings Targets by Program**

Public Service continues a full portfolio of electric and natural gas DSM products to serve all customer segments. Public Service will market its energy efficiency products to each customer

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assumptions or eligibility requirements. Details of 60-Day Notices are posted at: <http://www.xcelenergy.com/About Us/Rates & Regulations/Regulatory Filings/CO DSM>.

segment based on the number of customers, relative size of each customer, and amount of conservation potential at a customer site.

The energy and demand savings targets, and budgets, for these programs are summarized below.

#### Business Electric and Gas Programs

Energy efficiency sales to the Business Programs are achieved through Public Service's Account Managers, end-use equipment vendors, and energy service companies ("ESCOs"), as well as our Business Solutions Center. Proposed targets and budgets for the Business Program in 2019 and 2020 are:

##### *Business Electric Program (2019)*

- Electric budget \$57,692,446
- Electric savings 55,335 Net Gen. kW and 343.8 Net Gen. GWh

##### *Business Natural Gas Program (2019)*

- Natural gas budget \$2,711,209
- Natural gas savings 182,787 Dth

##### *Business Electric Program (2020)*

- Electric budget \$59,115,505
- Electric savings 59,274 Net Gen. kW and 368.9 Net Gen. GWh

##### *Business Natural Gas Program (2020)*

- Natural gas budget \$2,744,332
- Natural gas savings 156,603 Dth

Although economies of scale enable the business segment to offer a comparably lower cost of DSM per unit of energy saved, business DSM is some of the most difficult to achieve over time. This is the case because business customers tend to require very short paybacks on investments and do not readily respond to traditional mass-market appeals. Further, on the natural gas side, the majority of large customers, who present some of the largest energy efficiency potential, are gas transport customers who will neither pay into the Demand-Side Management Cost Adjustment (DSMCA), nor be eligible to participate in the program offerings.

#### Residential Electric and Gas Programs

Public Service has approximately 1.4 million electric and 1.3 million natural gas customers in its residential market in Colorado.<sup>8</sup> The Residential Program includes single-family homes, town homes, apartments, and condominiums. Public Service developed its Plan to recognize that the residential market requires choices of conservation opportunities that accommodate various lifestyles, convenient participation, and information to make wise energy choices presented in useable and understandable forms and formats. The energy savings and demand targets and budgets for the Residential Program in 2019 and 2020 are:

##### *Residential Electric Program (2019)*

- Electric budget \$23,707,054

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<sup>8</sup> Electric and natural gas customers as of 2018.

- Electric savings 33,377 Net Gen. kW and 150.3 Net Gen. GWh

*Residential Natural Gas Program (2019)*

- Natural gas budget \$6,174,347
- Natural gas savings 435,754 Dth

*Residential Electric Program (2020)*

- Electric budget \$23,385,992
- Electric savings 31,797 Net Gen. kW and 126.1 Net Gen. GWh

*Residential Natural Gas Program (2020)*

- Natural gas budget \$6,266,518
- Natural gas savings 451,753 Dth

Low-Income Electric and Gas Programs

The primary objective of the Low-Income Program is to reduce energy consumption in low-income customers' homes and thereby reduce low-income customer bills. The energy savings and demand targets and budgets for the Low-Income Program in 2019 and 2020 are:

*Low-Income Electric Program (2019)*

- Electric budget \$4,121,754
- Electric savings 1,344 Net Gen. kW and 8.0 Net Gen. GWh

*Low-Income Natural Gas Program (2019)*

- Natural gas budget \$4,297,643;
- Natural gas savings 83,220 Dth

*Low-Income Electric Program (2020)*

- Electric budget \$3,872,811
- Electric savings 1,180 Net Gen. kW and 6.7 Net Gen. GWh

*Low-Income Natural Gas Program (2020)*

- Natural gas budget \$4,269,136;
- Natural gas savings 72,765 Dth

Indirect Products and Services

The Company's Indirect Products and Services, for the most part, support the direct products in the DSM portfolio. The Education/Market Transformation area includes eight customer-facing products for providing education, training, and product demonstration, and marketing DSM rebates and incentives. The Planning and Research area includes five services to support the DSM portfolio: Planning and Administration, Program Evaluations, Measurement and Verification, Market Research, and Product Development. While the majority of the Indirect Products and Services do not have savings goals, the Company is offering one energy efficiency pilot, Geo-targeting; however, it does not result in incremental energy or demand savings. Proposed budgets for Indirect Products and Services in 2019 and 2020 are:

*Indirect Products & Services (2019 – Electric)*

- Electric budget \$6,887,507

*Indirect Products & Services (2019 – Natural Gas)*

- Natural gas budget \$1,592,065

*Indirect Products & Services (2020 – Electric)*

- Electric budget \$7,009,724  
*Indirect Products & Services (2018 – Natural Gas)*
- Natural gas budget \$1,587,110

### **Market Transformation and Customer Education**

In this Plan, Public Service is continuing to place increasing emphasis on programs and services that help to redefine the energy efficiency marketplace through market transformation and customer education. The Company believes that market transformation and customer education are some of the lowest cost ways to influence customer decisions and behaviors for the long term.

Public Service defines market transformation as a strategy for influencing the adoption of new techniques or technologies by consumers. The objective is to overcome barriers within a market through coordinating tactics such as education, training, product demonstration, and marketing, often conducted in concert with rebates or other financial incentives.

Activities for which the Company will not attempt to measure savings will have an assumed MTRC ratio of 1.0.<sup>9</sup>

### **Pilot Products**

In Proceeding No. 07A-420E, the Commission distinguished pilots from existing or continuing DSM products. These would be products that are testing unproven delivery methods, markets, or technologies; and for any of these reasons, pilot products may not necessarily achieve an MTRC ratio equal to or greater than 1.0. For market transformation programs, such as pilots, for which the Company intends to claim savings to count against energy savings or demand reduction goals, the Commission requires detail on how the measurement and verification of such savings will be accomplished, and how those efforts are linked to credit for savings.<sup>10</sup>

Public Service offers two pilots in 2019 and 2020 that are fully described in the Indirect Products & Services and Demand Response sections of this Plan, including the Company's overall pilot requirements. These pilots include:

- DSM Geo-targeting (2019 & 2020 – distribution investment deferral)
- Residential Battery Demand Response (2019 & 2020 - demand response)

### **Competitive Acquisition of DSM Resources: Third-Party Providers**

As a result of the Commission's order in Proceeding No. 10A-554EG, Public Service is required to identify the specific products that are open to competitive bidding for implementation.<sup>11</sup> Additionally, Public Service is to set forth the specific criteria by which these bids will be

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<sup>9</sup> The Modified Total Resource Cost (MTRC) test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs. The presumed MTRC of 1.0 for indirect market transformation programs was approved by the Commission in Decision No. C08-0560 (Proceeding No. 07A-420E) paragraph 141, and reaffirmed by Decision No. C11-0442 (Proceeding No. 10A-554EG) paragraph 99.

<sup>10</sup> Decision No. C11-0442 (Proceeding No. 10A-554EG) paragraph 99.

<sup>11</sup> Decision No. C11-0442.

evaluated.<sup>12</sup> Public Service evaluates all bids in two phases, the Pre-qualification phase and the Bid Evaluation phase. The Pre-qualification phase ensures that request for proposal (“RFP”) respondents meet minimum requirements to conduct business on the Company’s behalf. Respondents are evaluated on safety, financial health, terms & conditions adoption, and prior experience. These are also factors in the Bid Evaluation phase but have lower weightings due to the initial evaluation. This helps to ensure business risk to the Company is as low as possible.

The Bid Evaluation phase is based upon up to eight factors and is the phase where the risk of the supplier performing is weighed against the cost to perform. These factors and their weighting are detailed below. Weighting may be adjusted based on specific business needs.

**Table 2a: Bid Evaluation Factors and Weighting**

<b>Evaluation Factors</b>	<b>Explanation</b>	<b>Weighting</b>
Cost	<ul style="list-style-type: none"> <li>• Cost transparency</li> <li>• Total cost of ownership</li> <li>• Bid amount</li> </ul>	45% - 65%
Ability To Perform	<ul style="list-style-type: none"> <li>• Prior experience</li> <li>• Feasible plan</li> <li>• Quality of project team</li> <li>• Ability to meet schedule</li> </ul>	30% - 50%
Safety	<ul style="list-style-type: none"> <li>• Historical safety record</li> </ul>	5% - 15%
Terms & Conditions	<ul style="list-style-type: none"> <li>• Adherence to Xcel Energy standards</li> </ul>	5% - 10%
Financial Health	<ul style="list-style-type: none"> <li>• Pre-qualifier in RFP.</li> </ul>	Pre-qual only
Diversity	<ul style="list-style-type: none"> <li>• Firm’s commitment to diversity and inclusion.</li> </ul>	0% - 15%
Green Business Practices	<ul style="list-style-type: none"> <li>• Firm’s commitment to environmental sustainability.</li> </ul>	0% - 15%
Project Specific Needs	<ul style="list-style-type: none"> <li>• Dependent on project. <i>Examples:</i> field presence in jurisdiction, expertise with specific market segment, unique or proprietary software, etc.</li> </ul>	0% - 15%

The table below identifies all products that have a third-party implementer and further identifies which of these products will have new contracts bid or be sole-sourced in 2019 and 2020. Contracts may be sole-sourced for a variety of reasons, such as the contracted party having unique access to market players or proprietary tools that another firm would not have. Public Service tracks and reports within Annual DSM Status Reports, the administrative costs that are

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<sup>12</sup> In the matter of the application of Public Service Company of Colorado for approval of a number of strategic issues relating to its DSM plan, including long-term electric energy savings goals, and incentives. Proceeding No. 10A-554EG, Decision No. C11-0442, paragraph 81.

incurred when conducting RFPs and any additional costs for managing third-party providers, as required in Decision No. C11-0645.<sup>13</sup>

**Table 2b: 2019/2020 Products with Third-Party Implementers**

<b>Program</b>	<b>RFP Anticipated for 2019/2020</b>	<b>Contract Type (existing)</b>
Business Energy Analysis		Competitive Bid (2018)
Commercial Refrigeration Efficiency		Competitive Bid (2018)
Cooling (Midstream)	2020	Sole-sourced (2015)
Critical Peak Pricing Pilot		Competitive Bid (2018)
Energy Efficient Showerhead	2019	Sole-sourced (2014)
Energy Feedback - Residential	2019	Sole-sourced (2014)
Energy Management Systems		n/a
Energy Savings Kits	2019	Sole-sourced (2014)
ENERGY STAR New Homes	2019	Competitive Bid (2014)
Geo-targeting	2019	n/a
Home Energy Audits	2019	Competitive Bid (2012)
Home Energy Squad	2019	Competitive Bid (2015)
Home Lighting & Recycling		Competitive Bid (2016)
Home Performance with ENERGY STAR	2019	Competitive Bid (2012)
Lighting – Small Business		Competitive Bid (2013)
Lighting Efficiency (Midstream)		Competitive Bid (2014)
Multifamily Buildings	2019	Competitive Bid (2018)
Multifamily Weatherization		Sole-sourced (2015)
New Construction		Competitive Bid (2015)
Non-Profit Energy Efficiency		Sole-sourced (2015)
Peak Partner Rewards		Competitive Bid (2018)
Recommissioning		Competitive Bid (2018)
Refrigerator & Freezer Recycling		Competitive Bid (2015)
School Education Kits	2020	Competitive Bid (2013)
Single-Family Weatherization		Competitive Bid (2014)
Strategic Energy Management		Competitive Bid (2018)

**History of The Company’s DSM Activity in Colorado**

Over the last twenty years, Public Service has entered into several regulatory settlements involving demand-side management in conjunction with its integrated resource/least-cost planning process. The following table identifies those significant to demand-side management:

<sup>13</sup> Decision C11-0645 (Proceeding 10A-554EG), page 5 paragraph 14.

**Table 3a: Regulatory Settlements Involving DSM and Resource Planning**

<b>Proceeding</b>	<b>Proceeding No.</b>	<b>Decision No.</b>	<b>Summary</b>
1999 Integrated Resource Plan	00A-008E	C00-1057	<ul style="list-style-type: none"> <li>• 124 MW (~21 MW) of DSM resources</li> <li>• \$75 million</li> </ul>
2003 Least Cost Resource Plan	04A-214E	C05-0049	<ul style="list-style-type: none"> <li>• 320 MW (Avg. of 40 MW per year)</li> <li>• 800 GWh (Avg. of 100 GWh per year)</li> <li>• \$196 million</li> <li>• 2006 – 2013</li> </ul>
2008 CPCN at Fort St. Vrain Generation Station	07A-469E	C08-0369	<ul style="list-style-type: none"> <li>• Expansion of ISOC and Saver's Switch programs</li> <li>• Initiation of Third-Party Demand Response Program</li> </ul>
2011 Electric Resource Plan	11A-869E	C13-0094 & C13-0323	<ul style="list-style-type: none"> <li>• Informed the methodologies and values for avoided costs</li> </ul>

In addition, legislation and the regularly filed Strategic Issues proceedings at the Public Utilities Commission have addressed major policy issues for DSM programs. The following table identifies the applicable legislation and proceedings:

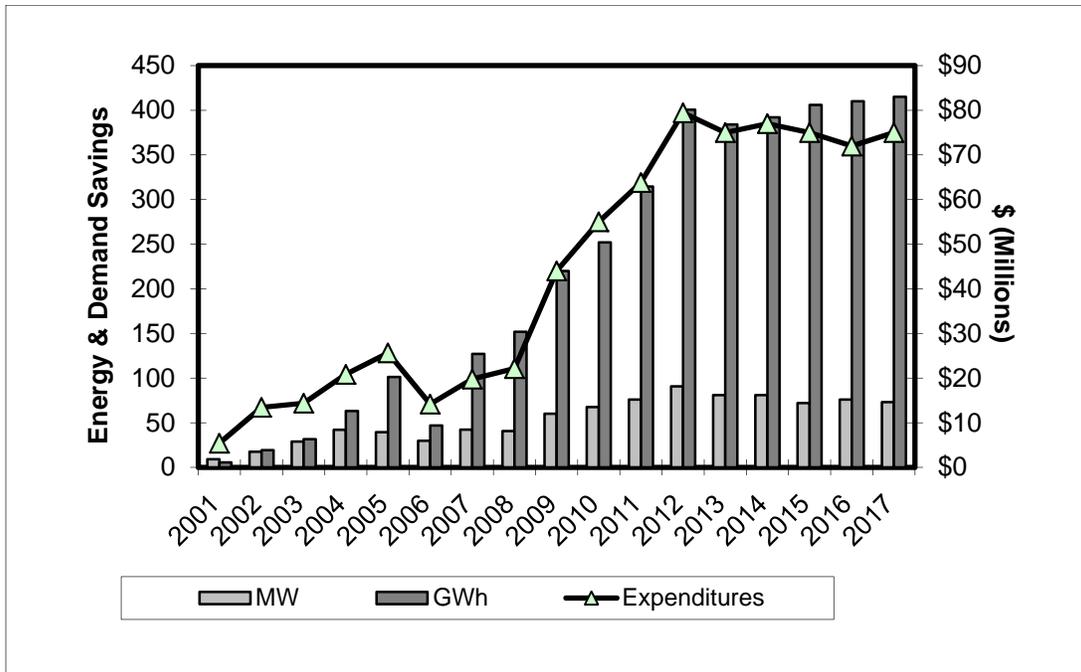
**Table 3b: Legislative and Regulatory Policy Directives for DSM**

<b>Proceeding</b>	<b>Proceeding No.</b>	<b>Decision No.</b>	<b>Summary</b>
House Bill 07-1037	N/A	N/A	<ul style="list-style-type: none"> <li>• Established intent of DSM programs</li> <li>• Established ten-year goals for energy and demand</li> </ul>
2010 Strategic Issues	10A-554EG	C11-0442	<ul style="list-style-type: none"> <li>• Established energy and demand savings goals</li> <li>• Established incentive mechanism</li> <li>• Defined program administration requirements</li> </ul>
2013 Strategic	13A-0686EG	C14-0731	<ul style="list-style-type: none"> <li>• Increased energy</li> </ul>

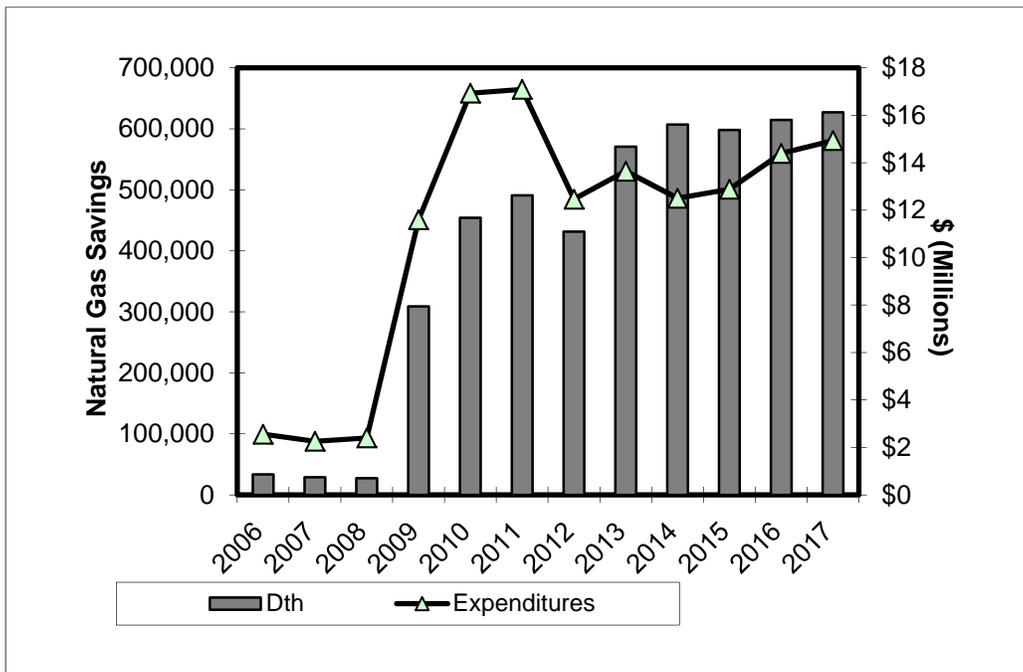
Issues			<p>and demand savings goals</p> <ul style="list-style-type: none"> <li>• Modified the incentive mechanism</li> <li>• Established a budget cap</li> </ul>
House Bill 17-1227	N/A	N/A	<ul style="list-style-type: none"> <li>• Extended energy and demand savings goals through 2028</li> </ul>
2017 Strategic Issues	17A-0462EG	C18-0417	<ul style="list-style-type: none"> <li>• Increased energy savings goals and budget</li> <li>• Modified incentive mechanism</li> <li>• Grandfathering of ISOC customers</li> </ul>

The following figures 1 and 2 below show Public Service’s electric and natural gas savings and expenditures over the past fourteen years.

**Figure 1: Historical Electric Program Savings and Expenditures**



**Figure 2: Historical Natural Gas Program Savings and Expenditures**



## Executive Summary: Electric DSM Tables

The following tables summarize the forecasted impacts of the Company's proposed electric DSM portfolio for 2019 and 2020, including anticipated expenditures, energy savings, demand response, costs by budget category, and Modified Total Resource Cost (MTRC) test ratios.

**Table 4a: Public Service's 2019 Electric DSM Budgets and Targets**

2019	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Business Program</b>				
Commercial Refrigeration Efficiency	\$1,161,381	863	4,914,779	1.41
Compressed Air Efficiency	\$662,960	700	4,569,137	1.49
Cooling	\$4,715,198	5,939	11,449,289	1.37
Custom Efficiency	\$1,035,689	515	4,796,517	1.22
Data Center Efficiency	\$1,781,817	1,746	13,710,005	1.81
Energy Management Systems	\$565,759	36	4,986,861	0.90
Heating Efficiency	\$16,180	7	98,026	1.96
LED Street Lighting	\$43,000	0	2,658,138	0.55
Lighting Efficiency	\$17,578,839	20,089	156,466,275	1.43
Lighting - Small Business	\$6,436,982	5,734	37,061,672	1.12
Motor & Drive Efficiency	\$2,644,398	2,316	13,175,865	1.41
Multifamily Buildings	\$2,143,516	1,280	11,073,258	1.31
New Construction	\$11,511,392	11,436	39,338,167	1.21
Recommissioning	\$475,156	380	3,746,661	0.84
Self Direct	\$799,627	1,025	6,738,491	1.67
Strategic Energy Management	\$5,293,986	3,270	28,972,603	1.57
General Advertising-Bus	\$826,564			
<b>Business Program Total</b>	<b>\$57,692,446</b>	<b>55,335</b>	<b>343,755,746</b>	<b>1.34</b>
<b>Residential Program</b>				
Energy Efficient Showerhead	\$37,727	86	1,011,152	13.36
Energy Feedback Residential	\$2,990,084	5,096	21,731,615	1.22
ENERGY STAR New Homes	\$1,397,326	1,066	3,092,103	0.88
Evaporative Cooling	\$4,204,300	6,122	4,727,651	3.43
High Efficiency Air Conditioning	\$2,039,560	1,819	1,795,587	1.25
Home Energy Squad	\$448,214	395	1,647,889	1.20
Home Lighting & Recycling	\$5,723,745	12,547	89,054,545	2.58
Home Performance with ENERGY STAR	\$650,685	410	219,247	0.65
Insulation & Air Sealing	\$440,996	455	507,035	0.89
Refrigerator & Freezer Recycling	\$1,232,233	599	3,935,695	1.04
Residential Heating	\$911,100	1,056	5,769,742	1.21
School Education Kits	\$1,710,283	1,335	10,433,360	1.30
Water Heating	\$1,083,610	739	5,018,807	1.29
Thermostat Optimization	\$261,695	1,653	1,352,112	1.67
General Advertising-Res	\$575,496			
<b>Residential Program Total</b>	<b>\$23,707,054</b>	<b>33,377</b>	<b>150,296,541</b>	<b>1.88</b>

**Table 4a: Public Service's 2019 Electric DSM Budgets and Targets (cont'd)**

2019	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Low-Income Program</b>				
Energy Savings Kit	\$490,368	329	2,600,605	1.36
Multifamily Weatherization	\$1,081,511	407	1,889,123	0.89
Non-Profit	\$1,119,608	383	1,701,178	0.99
Single-Family Weatherization	\$1,430,268	226	1,778,524	0.70
<b>Low-Income Program Total</b>	<b>\$4,121,754</b>	<b>1,344</b>	<b>7,969,430</b>	<b>0.90</b>
<b>Indirect Products &amp; Services</b>				
<b>Education/Market Transformation</b>				
Business Education	\$176,739	0	0	
Business Energy Analysis	\$760,350	0	0	
Consumer Education	\$899,908	0	0	
Energy Benchmarking	\$94,407	0	0	
Energy Efficiency Financing	\$60,000	0	0	
ENERGY STAR Retail Products Platform	\$509,271	0	0	
Home Energy Audit	\$444,675	0	0	
Partners in Energy	\$799,000	0	0	
<b>Education/Market Transformation Total</b>	<b>\$3,744,350</b>	<b>0</b>	<b>0</b>	
<b>Planning and Research</b>				
EE Market Research	\$350,791	0	0	
EE Measurement & Verification	\$12,000	0	0	
EE Planning & Administration	\$522,162	0	0	
EE Program Evaluations	\$404,005	0	0	
EE Product Development	\$1,840,082	0	0	
Geo-targeting Pilot - EE	\$14,116	0	0	0.81
<b>EE Product Development Total</b>	<b>\$1,854,198</b>	<b>0</b>	<b>0</b>	
<b>EE Planning and Research Total</b>	<b>\$3,143,157</b>	<b>0</b>	<b>0</b>	
<b>EE Indirect Products &amp; Services Total</b>	<b>\$6,887,507</b>	<b>0</b>	<b>0</b>	
<b>EE PORTFOLIO TOTAL</b>	<b>\$92,408,762</b>	<b>90,057</b>	<b>502,021,717</b>	<b>1.37</b>

**Table 4a: Public Service's 2019 Electric DSM Budgets and Targets (cont'd)**

2019	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Demand Response Program</b>				
Critical Peak Pricing Pilot	\$58,400	5,588	0	
Geo-targeting Pilot - DR	\$78,189	0	0	12.37
Peak Partner Rewards	\$1,725,420	12,000	0	
Residential Battery Demand Response	\$323,500	389	-16,752	1.55
Residential Demand Response	\$13,133,000	14,517	53,834	1.83
<b>DR Program Total</b>	<b>\$15,318,509</b>	<b>32,494</b>	<b>37,082</b>	<b>1.75</b>
<b>Planning and Research</b>				
DR Planning & Administration	\$58,018	0	0	
DR Program Evaluations	\$315,573	0	0	
DR Product Development	\$1,384,082	0	0	
<b>DR Planning and Research Total</b>	<b>\$1,757,673</b>	<b>0</b>	<b>0</b>	
<b>DR PORTFOLIO TOTAL</b>	<b>\$17,076,182</b>	<b>32,494</b>	<b>37,082</b>	<b>1.57</b>
<b>PORTFOLIO TOTAL</b>	<b>\$109,484,943</b>	<b>122,551</b>	<b>502,058,799</b>	<b>1.39</b>

**Table 4b: Public Service's 2019 Electric DSM Costs by Category**

2019	Program Planning & Design	Administration & Program Delivery	Advertising/Promotion/ Customer Ed	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
<b>Business Program</b>							
Commercial Refrigeration Efficiency	\$ -	\$ 729,473	\$ 45,100	\$ 348,808	\$ -	\$ 38,000	\$ 1,161,381
Compressed Air Efficiency	\$ -	\$ 200,439	\$ 1,750	\$ 453,553	\$ -	\$ 7,218	\$ 662,960
Cooling	\$ -	\$ 2,207,912	\$ -	\$ 2,492,286	\$ -	\$ 15,000	\$ 4,715,198
Custom Efficiency	\$ -	\$ 797,304	\$ 600	\$ 233,785	\$ -	\$ 4,000	\$ 1,035,689
Data Center Efficiency	\$ -	\$ 220,050	\$ 44,000	\$ 1,495,767	\$ -	\$ 22,000	\$ 1,781,817
Energy Management Systems	\$ -	\$ 202,059	\$ 20,000	\$ 323,937	\$ -	\$ 19,764	\$ 565,759
Heating Efficiency	\$ -	\$ 10,035	\$ -	\$ 6,145	\$ -	\$ -	\$ 16,180
LED Street Lighting	\$ -	\$ -	\$ 43,000	\$ -	\$ -	\$ -	\$ 43,000
Lighting Efficiency	\$ -	\$ 3,055,429	\$ 717,065	\$ 13,751,346	\$ -	\$ 55,000	\$ 17,578,839
Lighting - Small Business	\$ -	\$ 2,939,833	\$ 68,545	\$ 3,401,104	\$ -	\$ 27,500	\$ 6,436,982
Motor & Drive Efficiency	\$ -	\$ 539,581	\$ 36,450	\$ 2,046,767	\$ -	\$ 21,600	\$ 2,644,398
Multifamily Buildings	\$ -	\$ 484,341	\$ 200,000	\$ 1,459,175	\$ -	\$ -	\$ 2,143,516
New Construction	\$ -	\$ 2,991,157	\$ 18,650	\$ 8,071,508	\$ -	\$ 430,077	\$ 11,511,392
Recommissioning	\$ -	\$ 182,950	\$ 76,000	\$ 216,206	\$ -	\$ -	\$ 475,156
Self Direct	\$ -	\$ 130,550	\$ 1,500	\$ 667,577	\$ -	\$ -	\$ 799,627
Strategic Energy Management	\$ -	\$ 2,327,661	\$ 111,397	\$ 2,656,799	\$ -	\$ 198,129	\$ 5,293,986
General Advertising-Bus	\$ -	\$ -	\$ 826,564	\$ -	\$ -	\$ -	\$ 826,564
<b>Business Program Total</b>	<b>\$ -</b>	<b>\$ 17,018,774</b>	<b>\$ 2,210,622</b>	<b>\$ 37,624,762</b>	<b>\$ -</b>	<b>\$ 838,288</b>	<b>\$ 57,692,446</b>
<b>Residential Program</b>							
Energy Efficient Showerhead	\$ -	\$ 20,065	\$ 4,600	\$ 13,062	\$ -	\$ -	\$ 37,727
Energy Feedback Residential	\$ -	\$ 2,990,084	\$ -	\$ -	\$ -	\$ -	\$ 2,990,084
ENERGY STAR New Homes	\$ -	\$ 497,478	\$ 30,861	\$ 645,751	\$ -	\$ 223,236	\$ 1,397,326
Evaporative Cooling	\$ -	\$ 1,108,927	\$ 909,373	\$ 2,151,000	\$ -	\$ 35,000	\$ 4,204,300
High Efficiency Air Conditioning	\$ -	\$ 330,525	\$ 55,000	\$ 1,606,035	\$ -	\$ 48,000	\$ 2,039,560
Home Energy Squad	\$ -	\$ 70,145	\$ 49,424	\$ 114,227	\$ 211,918	\$ 2,500	\$ 448,214
Home Lighting & Recycling	\$ -	\$ 947,283	\$ 643,506	\$ 4,127,957	\$ -	\$ 5,000	\$ 5,723,745
Home Performance with ENERGY STAR	\$ -	\$ 516,782	\$ -	\$ 103,903	\$ -	\$ 30,000	\$ 650,685
Insulation & Air Sealing	\$ -	\$ 21,189	\$ 405	\$ 404,220	\$ -	\$ 15,182	\$ 440,996
Refrigerator & Freezer Recycling	\$ -	\$ 666,886	\$ 205,347	\$ 350,000	\$ -	\$ 10,000	\$ 1,232,233
Residential Heating	\$ -	\$ 82,500	\$ 91,000	\$ 730,100	\$ -	\$ 7,500	\$ 911,100
School Education Kits	\$ -	\$ 527,885	\$ 5,832	\$ 1,176,566	\$ -	\$ -	\$ 1,710,283
Water Heating	\$ -	\$ 229,710	\$ 281,500	\$ 562,400	\$ -	\$ 10,000	\$ 1,083,610
Thermostat Optimization	\$ -	\$ 77,994	\$ -	\$ 177,327	\$ -	\$ 6,374	\$ 261,695
General Advertising-Res	\$ -	\$ -	\$ 575,496	\$ -	\$ -	\$ -	\$ 575,496
<b>Residential Program Total</b>	<b>\$ -</b>	<b>\$ 8,087,453</b>	<b>\$ 2,852,344</b>	<b>\$ 12,162,547</b>	<b>\$ 211,918</b>	<b>\$ 392,792</b>	<b>\$ 23,707,054</b>
<b>Low-Income Program</b>							
Energy Savings Kit	\$ -	\$ 148,442	\$ 108,379	\$ 229,047	\$ -	\$ 4,500	\$ 490,368
Multifamily Weatherization	\$ -	\$ 169,785	\$ 10,851	\$ 885,524	\$ -	\$ 15,351	\$ 1,081,511
Non-Profit	\$ -	\$ 212,162	\$ 3,274	\$ 876,346	\$ -	\$ 27,825	\$ 1,119,608
Single-Family Weatherization	\$ -	\$ 245,186	\$ 80,000	\$ 985,420	\$ -	\$ 119,662	\$ 1,430,268
<b>Low-Income Program Total</b>	<b>\$ -</b>	<b>\$ 775,575</b>	<b>\$ 202,504</b>	<b>\$ 2,976,337</b>	<b>\$ -</b>	<b>\$ 167,338</b>	<b>\$ 4,121,754</b>

**Table 4b: Public Service's 2019 Electric DSM Costs by Category (cont'd)**

2019	Program Planning & Design	Administration & Program Delivery	Advertising/Promotion/Customer Ed	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
<b>Indirect Products &amp; Services</b>							
<b>Education/Market Transformation</b>							
Business Education	\$ -	\$ -	\$ 176,739	\$ -	\$ -	\$ -	\$ 176,739
Business Energy Analysis	\$ -	\$ 109,350	\$ 249,000	\$ 402,000	\$ -	\$ -	\$ 760,350
Consumer Education	\$ -	\$ 389,381	\$ 510,527	\$ -	\$ -	\$ -	\$ 899,908
Energy Benchmarking	\$ -	\$ 94,407	\$ -	\$ -	\$ -	\$ -	\$ 94,407
Energy Efficiency Financing	\$ -	\$ 33,000	\$ 17,000	\$ 10,000	\$ -	\$ -	\$ 60,000
ENERGY STAR Retail Products Platform	\$ -	\$ 498,384	\$ -	\$ -	\$ -	\$ 10,887	\$ 509,271
Home Energy Audit	\$ -	\$ 193,265	\$ 17,014	\$ 196,992	\$ -	\$ 37,404	\$ 444,675
Partners in Energy	\$ -	\$ 719,000	\$ 10,000	\$ -	\$ -	\$ 70,000	\$ 799,000
<b>Education/Market Transformation Total</b>	<b>\$ -</b>	<b>\$ 2,036,787</b>	<b>\$ 980,280</b>	<b>\$ 608,992</b>	<b>\$ -</b>	<b>\$ 118,291</b>	<b>\$ 3,744,350</b>
<b>Planning and Research</b>							
EE Market Research	\$ -	\$ 350,791	\$ -	\$ -	\$ -	\$ -	\$ 350,791
EE Measurement & Verification	\$ -	\$ 12,000	\$ -	\$ -	\$ -	\$ -	\$ 12,000
EE Planning & Administration	\$ -	\$ 522,162	\$ -	\$ -	\$ -	\$ -	\$ 522,162
EE Program Evaluations	\$ -	\$ 32,005	\$ -	\$ -	\$ -	\$ 372,000	\$ 404,005
EE Product Development	\$ -	\$ 1,840,082	\$ -	\$ -	\$ -	\$ -	\$ 1,840,082
Geo-targeting Pilot - EE	\$ -	\$ 7,458	\$ -	\$ 6,658	\$ -	\$ -	\$ 14,116
<b>EE Product Development Total</b>	<b>\$ -</b>	<b>\$ 1,847,540</b>	<b>\$ -</b>	<b>\$ 6,658</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 1,854,198</b>
<b>EE Planning and Research Total</b>	<b>\$ -</b>	<b>\$ 2,764,498</b>	<b>\$ -</b>	<b>\$ 6,658</b>	<b>\$ -</b>	<b>\$ 372,000</b>	<b>\$ 3,143,157</b>
<b>EE Indirect Products &amp; Services Total</b>	<b>\$ -</b>	<b>\$ 4,801,286</b>	<b>\$ 980,280</b>	<b>\$ 615,650</b>	<b>\$ -</b>	<b>\$ 490,291</b>	<b>\$ 6,887,507</b>
<b>EE PORTFOLIO TOTAL</b>	<b>\$ -</b>	<b>\$ 30,683,088</b>	<b>\$ 6,245,751</b>	<b>\$ 53,379,296</b>	<b>\$ 211,918</b>	<b>\$ 1,888,708</b>	<b>\$ 92,408,762</b>
<b>Demand Response Program</b>							
Critical Peak Pricing Pilot	\$ -	\$ 21,200	\$ 5,000	\$ -	\$ 7,200	\$ 25,000	\$ 58,400
Geo-targeting Pilot - DR	\$ -	\$ 67,542	\$ -	\$ 10,647	\$ -	\$ -	\$ 78,189
Peak Partner Rewards	\$ -	\$ 253,420	\$ 142,000	\$ 1,330,000	\$ -	\$ -	\$ 1,725,420
Residential Battery Demand Response	\$ -	\$ 177,500	\$ 5,250	\$ 133,750	\$ -	\$ 7,000	\$ 323,500
Residential Demand Response	\$ -	\$ 3,314,000	\$ 1,150,000	\$ 8,569,000	\$ -	\$ 100,000	\$ 13,133,000
<b>DR Program Total</b>	<b>\$ -</b>	<b>\$ 3,833,662</b>	<b>\$ 1,302,250</b>	<b>\$ 10,043,397</b>	<b>\$ 7,200</b>	<b>\$ 132,000</b>	<b>\$ 15,318,509</b>
<b>Planning and Research</b>							
DR Planning & Administration	\$ -	\$ 58,018	\$ -	\$ -	\$ -	\$ -	\$ 58,018
DR Program Evaluations	\$ -	\$ 15,573	\$ -	\$ -	\$ -	\$ 300,000	\$ 315,573
DR Product Development	\$ -	\$ 1,384,082	\$ -	\$ -	\$ -	\$ -	\$ 1,384,082
<b>DR Planning and Research Total</b>	<b>\$ -</b>	<b>\$ 1,457,673</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 300,000</b>	<b>\$ 1,757,673</b>
<b>DR PORTFOLIO TOTAL</b>	<b>\$ -</b>	<b>\$ 5,291,335</b>	<b>\$ 1,302,250</b>	<b>\$ 10,043,397</b>	<b>\$ 7,200</b>	<b>\$ 432,000</b>	<b>\$ 17,076,182</b>
<b>PORTFOLIO TOTAL</b>	<b>\$ -</b>	<b>\$ 35,974,422</b>	<b>\$ 7,548,001</b>	<b>\$ 63,422,693</b>	<b>\$ 219,118</b>	<b>\$ 2,320,708</b>	<b>\$ 109,484,943</b>

**Table 4c: Public Service’s 2020 Electric DSM Budgets and Targets**

2020	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Business Program</b>				
Commercial Refrigeration Efficiency	\$672,990	516	2,911,442	1.44
Compressed Air Efficiency	\$709,343	737	4,784,175	1.55
Cooling	\$3,539,391	4,871	9,249,617	1.53
Custom Efficiency	\$757,761	343	3,197,678	1.22
Data Center Efficiency	\$1,829,881	1,829	14,539,038	1.89
Energy Management Systems	\$532,829	72	4,582,521	0.94
Heating Efficiency	\$16,297	7	103,747	2.15
LED Street Lighting	\$43,000	0	2,658,138	0.58
Lighting Efficiency	\$20,380,890	24,994	181,557,873	1.56
Lighting - Small Business	\$5,987,360	5,553	34,654,488	1.18
Motor & Drive Efficiency	\$2,644,398	2,316	13,175,865	1.45
Multifamily Buildings	\$2,245,730	1,339	11,521,450	1.34
New Construction	\$12,040,165	12,181	42,085,573	1.23
Recommissioning	\$491,040	441	3,736,530	0.91
Self Direct	\$639,733	769	5,053,868	1.70
Strategic Energy Management	\$5,759,050	3,307	35,135,809	1.63
General Advertising-Bus	\$825,647			
<b>Business Program Total</b>	<b>\$59,115,505</b>	<b>59,274</b>	<b>368,947,811</b>	<b>1.42</b>
<b>Residential Program</b>				
Energy Efficient Showerhead	\$38,017	86	1,011,152	13.46
Energy Feedback Residential	\$3,140,084	4,914	20,141,191	1.14
ENERGY STAR New Homes	\$1,292,286	1,000	2,988,677	0.89
Evaporative Cooling	\$4,404,100	6,632	5,121,782	3.59
High Efficiency Air Conditioning	\$2,820,998	2,704	2,566,184	1.29
Home Energy Squad	\$685,665	613	2,448,239	1.15
Home Lighting & Recycling	\$4,823,414	9,671	68,638,979	2.16
Home Performance with ENERGY STAR	\$650,106	466	310,462	1.02
Insulation & Air Sealing	\$465,908	461	515,024	0.89
Refrigerator & Freezer Recycling	\$1,249,390	743	4,000,307	1.11
Residential Heating	\$77,700	105	566,506	1.32
School Education Kits	\$1,804,317	1,381	10,779,522	1.22
Water Heating	\$1,083,760	739	5,018,807	1.33
Thermostat Optimization	\$334,751	2,282	1,955,134	1.72
General Advertising-Res	\$515,496			
<b>Residential Program Total</b>	<b>\$23,385,992</b>	<b>31,797</b>	<b>126,061,968</b>	<b>1.83</b>
<b>Low-Income Program</b>				
Energy Savings Kit	\$251,424	164	1,300,302	1.23
Multifamily Weatherization	\$1,081,511	407	1,889,123	0.90
Non-Profit	\$1,119,608	383	1,701,178	1.02
Single-Family Weatherization	\$1,420,268	226	1,778,524	0.71
<b>Low-Income Program Total</b>	<b>\$3,872,811</b>	<b>1,180</b>	<b>6,669,128</b>	<b>0.90</b>

**Table 4c: Public Service’s 2020 Electric DSM Budgets and Targets (cont’d)**

2020	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Indirect Products &amp; Services</b>				
<b>Education/Market Transformation</b>				
Business Education	\$176,739	0	0	
Business Energy Analysis	\$760,350	0	0	
Consumer Education	\$899,908	0	0	
Energy Benchmarking	\$97,240	0	0	
Energy Efficiency Financing	\$60,000	0	0	
ENERGY STAR Retail Products Platform	\$509,271	0	0	
Home Energy Audit	\$444,675	0	0	
Partners in Energy	\$836,000	0	0	
<b>Education/Market Transformation Total</b>	<b>\$3,784,183</b>	<b>0</b>	<b>0</b>	
<b>Planning and Research</b>				
EE Market Research	\$382,134	0	0	
EE Measurement & Verification	\$12,000	0	0	
EE Planning & Administration	\$522,162	0	0	
EE Program Evaluations	\$378,737	0	0	
EE Product Development	\$1,854,964	0	0	
Geo-targeting Pilot - EE	\$75,544	0	0	0.93
<b>EE Product Development Total</b>	<b>\$1,930,508</b>	<b>0</b>	<b>0</b>	
<b>EE Planning and Research Total</b>	<b>\$3,225,541</b>	<b>0</b>	<b>0</b>	
<b>EE Indirect Products &amp; Services Total</b>	<b>\$7,009,724</b>	<b>0</b>	<b>0</b>	
<b>EE PORTFOLIO TOTAL</b>	<b>\$93,384,033</b>	<b>92,250</b>	<b>501,678,907</b>	<b>1.42</b>
<b>Demand Response Program</b>				
Critical Peak Pricing Pilot	\$66,000	5,588	0	
Geo-targeting Pilot - DR	\$309,067	0	0	0.83
Peak Partner Rewards	\$1,725,420	20,000	0	
Residential Battery Demand Response	\$365,500	389	-16,752	1.51
Residential Demand Response	\$13,339,940	14,517	53,834	1.83
<b>DR Program Total</b>	<b>\$15,805,927</b>	<b>40,494</b>	<b>37,082</b>	<b>1.68</b>
<b>Planning and Research</b>				
DR Planning & Administration	\$58,018	0	0	
DR Program Evaluations	\$206,937	0	0	
DR Product Development	\$1,854,964	0	0	
<b>DR Planning and Research Total</b>	<b>\$2,119,919</b>	<b>0</b>	<b>0</b>	
<b>DR PORTFOLIO TOTAL</b>	<b>\$17,925,847</b>	<b>40,494</b>	<b>37,082</b>	<b>1.49</b>
<b>PORTFOLIO TOTAL</b>	<b>\$111,309,880</b>	<b>132,745</b>	<b>501,715,988</b>	<b>1.43</b>

**Table 4d: Public Service's 2020 Electric DSM Costs by Category**

2020	Program Planning & Design	Administration & Program Delivery	Advertising/Promotion/Customer Ed	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
<b>Business Program</b>							
Commercial Refrigeration Efficiency	\$ -	\$ 427,207	\$ 9,100	\$ 209,683	\$ -	\$ 27,000	\$ 672,990
Compressed Air Efficiency	\$ -	\$ 222,472	\$ 1,500	\$ 478,336	\$ -	\$ 7,035	\$ 709,343
Cooling	\$ -	\$ 1,712,792	\$ -	\$ 1,811,599	\$ -	\$ 15,000	\$ 3,539,391
Custom Efficiency	\$ -	\$ 597,304	\$ 600	\$ 155,857	\$ -	\$ 4,000	\$ 757,761
Data Center Efficiency	\$ -	\$ 230,050	\$ 41,500	\$ 1,536,331	\$ -	\$ 22,000	\$ 1,829,881
Energy Management Systems	\$ -	\$ 205,723	\$ 20,000	\$ 287,342	\$ -	\$ 19,764	\$ 532,829
Heating Efficiency	\$ -	\$ 10,035	\$ -	\$ 6,262	\$ -	\$ -	\$ 16,297
LED Street Lighting	\$ -	\$ -	\$ 43,000	\$ -	\$ -	\$ -	\$ 43,000
Lighting Efficiency	\$ -	\$ 3,225,108	\$ 692,065	\$ 16,408,717	\$ -	\$ 55,000	\$ 20,380,890
Lighting - Small Business	\$ -	\$ 2,774,253	\$ 19,110	\$ 3,166,497	\$ -	\$ 27,500	\$ 5,987,360
Motor & Drive Efficiency	\$ -	\$ 539,581	\$ 36,450	\$ 2,046,767	\$ -	\$ 21,600	\$ 2,644,398
Multifamily Buildings	\$ -	\$ 484,341	\$ 200,000	\$ 1,561,390	\$ -	\$ -	\$ 2,245,730
New Construction	\$ -	\$ 2,971,114	\$ 5,632	\$ 8,633,342	\$ -	\$ 430,077	\$ 12,040,165
Recommissioning	\$ -	\$ 193,950	\$ 76,000	\$ 221,090	\$ -	\$ -	\$ 491,040
Self Direct	\$ -	\$ 137,550	\$ 1,500	\$ 500,683	\$ -	\$ -	\$ 639,733
Strategic Energy Management	\$ -	\$ 2,664,260	\$ 101,497	\$ 2,599,079	\$ -	\$ 394,214	\$ 5,759,050
General Advertising-Bus	\$ -	\$ -	\$ 825,647	\$ -	\$ -	\$ -	\$ 825,647
<b>Business Program Total</b>	<b>\$ -</b>	<b>\$ 16,395,741</b>	<b>\$ 2,073,601</b>	<b>\$ 39,622,974</b>	<b>\$ -</b>	<b>\$ 1,023,190</b>	<b>\$ 59,115,505</b>
<b>Residential Program</b>							
Energy Efficient Showerhead	\$ -	\$ 20,342	\$ 4,612	\$ 13,062	\$ -	\$ -	\$ 38,017
Energy Feedback Residential	\$ -	\$ 3,140,084	\$ -	\$ -	\$ -	\$ -	\$ 3,140,084
ENERGY STAR New Homes	\$ -	\$ 197,478	\$ 300,861	\$ 597,315	\$ 310,815	\$ 196,632	\$ 1,292,286
Evaporative Cooling	\$ -	\$ 1,129,327	\$ 909,373	\$ 2,330,400	\$ -	\$ 35,000	\$ 4,404,100
High Efficiency Air Conditioning	\$ -	\$ 430,963	\$ 45,000	\$ 2,290,035	\$ -	\$ 55,000	\$ 2,820,998
Home Energy Squad	\$ -	\$ 154,567	\$ 49,707	\$ 168,076	\$ -	\$ 2,500	\$ 685,665
Home Lighting & Recycling	\$ -	\$ 956,203	\$ 629,149	\$ 3,233,061	\$ -	\$ 5,000	\$ 4,823,414
Home Performance with ENERGY STAR	\$ -	\$ 216,782	\$ -	\$ 403,324	\$ -	\$ 30,000	\$ 650,106
Insulation & Air Sealing	\$ -	\$ 21,189	\$ 405	\$ 429,132	\$ -	\$ 15,182	\$ 465,908
Refrigerator & Freezer Recycling	\$ -	\$ 678,158	\$ 211,232	\$ 350,000	\$ -	\$ 10,000	\$ 1,249,390
Residential Heating	\$ -	\$ 6,000	\$ -	\$ 70,700	\$ -	\$ 1,000	\$ 77,700
School Education Kits	\$ -	\$ 543,691	\$ 5,857	\$ 1,254,768	\$ -	\$ -	\$ 1,804,317
Water Heating	\$ -	\$ 229,860	\$ 281,500	\$ 562,400	\$ 310,815	\$ 10,000	\$ 1,083,760
Thermostat Optimization	\$ -	\$ 107,674	\$ -	\$ 220,703	\$ -	\$ 6,374	\$ 334,751
General Advertising-Res	\$ -	\$ -	\$ 515,496	\$ -	\$ -	\$ -	\$ 515,496
<b>Residential Program Total</b>	<b>\$ -</b>	<b>\$ 7,832,320</b>	<b>\$ 2,953,192</b>	<b>\$ 11,922,977</b>	<b>\$ -</b>	<b>\$ 366,688</b>	<b>\$ 23,385,992</b>
<b>Low-Income Program</b>							
Energy Savings Kit	\$ -	\$ 84,022	\$ 48,379	\$ 114,523	\$ -	\$ 4,500	\$ 251,424
Multifamily Weatherization	\$ -	\$ 169,785	\$ 10,851	\$ 885,524	\$ -	\$ 15,351	\$ 1,081,511
Non-Profit	\$ -	\$ 212,162	\$ 3,274	\$ 876,346	\$ -	\$ 27,825	\$ 1,119,608
Single-Family Weatherization	\$ -	\$ 235,186	\$ 80,000	\$ 985,420	\$ -	\$ 119,662	\$ 1,420,268
<b>Low-Income Program Total</b>	<b>\$ -</b>	<b>\$ 701,155</b>	<b>\$ 142,504</b>	<b>\$ 2,861,814</b>	<b>\$ -</b>	<b>\$ 167,338</b>	<b>\$ 3,872,811</b>

**Table 4d: Public Service's 2020 Electric DSM Costs by Category (cont'd)**

2020	Program Planning & Design	Administration & Program Delivery	Advertising/Promotion/Customer Ed	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
<b>Indirect Products &amp; Services</b>							
<b>Education/Market Transformation</b>							
Business Education	\$ -	\$ -	\$ 176,739	\$ -	\$ -	\$ -	\$ 176,739
Business Energy Analysis	\$ -	\$ 109,350	\$ 249,000	\$ 402,000	\$ -	\$ -	\$ 760,350
Consumer Education	\$ -	\$ 389,381	\$ 510,527	\$ -	\$ -	\$ -	\$ 899,908
Energy Benchmarking	\$ -	\$ 97,240	\$ -	\$ -	\$ -	\$ -	\$ 97,240
Energy Efficiency Financing	\$ -	\$ 33,000	\$ 17,000	\$ 10,000	\$ -	\$ -	\$ 60,000
ENERGY STAR Retail Products Platform	\$ -	\$ 498,384	\$ -	\$ -	\$ -	\$ 10,887	\$ 509,271
Home Energy Audit	\$ -	\$ 193,265	\$ 17,014	\$ 196,992	\$ -	\$ 37,404	\$ 444,675
Partners in Energy	\$ -	\$ 752,800	\$ 10,000	\$ -	\$ -	\$ 73,200	\$ 836,000
<b>Education/Market Transformation Total</b>	<b>\$ -</b>	<b>\$ 2,073,420</b>	<b>\$ 980,280</b>	<b>\$ 608,992</b>	<b>\$ -</b>	<b>\$ 121,491</b>	<b>\$ 3,784,183</b>
<b>Planning and Research</b>							
EE Market Research	\$ -	\$ 382,134	\$ -	\$ -	\$ -	\$ -	\$ 382,134
EE Measurement & Verification	\$ -	\$ 12,000	\$ -	\$ -	\$ -	\$ -	\$ 12,000
EE Planning & Administration	\$ -	\$ 522,162	\$ -	\$ -	\$ -	\$ -	\$ 522,162
EE Program Evaluations	\$ -	\$ 30,737	\$ -	\$ -	\$ -	\$ 348,000	\$ 378,737
EE Product Development	\$ -	\$ 1,854,964	\$ -	\$ -	\$ -	\$ -	\$ 1,854,964
Geo-targeting Pilot - EE	\$ -	\$ 14,749	\$ 30,213	\$ 13,317	\$ -	\$ 17,265	\$ 75,544
<b>EE Product Development Total</b>	<b>\$ -</b>	<b>\$ 1,869,713</b>	<b>\$ 30,213</b>	<b>\$ 13,317</b>	<b>\$ -</b>	<b>\$ 17,265</b>	<b>\$ 1,930,508</b>
<b>EE Planning and Research Total</b>	<b>\$ -</b>	<b>\$ 2,816,746</b>	<b>\$ 30,213</b>	<b>\$ 13,317</b>	<b>\$ 310,815</b>	<b>\$ 365,265</b>	<b>\$ 3,225,541</b>
<b>EE Indirect Products &amp; Services Total</b>	<b>\$ -</b>	<b>\$ 4,890,166</b>	<b>\$ 1,010,494</b>	<b>\$ 622,309</b>	<b>\$ -</b>	<b>\$ 486,756</b>	<b>\$ 7,009,724</b>
<b>EE PORTFOLIO TOTAL</b>	<b>\$ -</b>	<b>\$ 29,819,382</b>	<b>\$ 6,179,791</b>	<b>\$ 55,030,073</b>	<b>\$ 14,800</b>	<b>\$ 2,043,971</b>	<b>\$ 93,384,033</b>
<b>Demand Response Program</b>							
Critical Peak Pricing Pilot	\$ -	\$ 21,200	\$ 5,000	\$ -	\$ -	\$ 25,000	\$ 66,000
Geo-targeting Pilot - DR	\$ -	\$ 60,251	\$ 144,787	\$ 21,294	\$ -	\$ 82,735	\$ 309,067
Peak Partner Rewards	\$ -	\$ 253,420	\$ 142,000	\$ 1,330,000	\$ 14,800	\$ -	\$ 1,725,420
Residential Battery Demand Response	\$ -	\$ 80,000	\$ 1,000	\$ 177,500	\$ -	\$ 107,000	\$ 365,500
Residential Demand Response	\$ -	\$ 3,395,940	\$ 1,150,000	\$ 8,694,000	\$ -	\$ 100,000	\$ 13,339,940
<b>DR Program Total</b>	<b>\$ -</b>	<b>\$ 3,810,811</b>	<b>\$ 1,442,787</b>	<b>\$ 10,222,794</b>	<b>\$ -</b>	<b>\$ 314,735</b>	<b>\$ 15,805,927</b>
<b>Planning and Research</b>							
DR Planning & Administration	\$ -	\$ 58,018	\$ -	\$ -	\$ -	\$ -	\$ 58,018
DR Program Evaluations	\$ -	\$ 26,937	\$ -	\$ -	\$ -	\$ 180,000	\$ 206,937
DR Product Development	\$ -	\$ 1,854,964	\$ -	\$ -	\$ 14,800	\$ -	\$ 1,854,964
<b>DR Planning and Research Total</b>	<b>\$ -</b>	<b>\$ 1,939,919</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 180,000</b>	<b>\$ 2,119,919</b>
<b>DR PORTFOLIO TOTAL</b>	<b>\$ -</b>	<b>\$ 5,750,731</b>	<b>\$ 1,442,787</b>	<b>\$ 10,222,794</b>	<b>\$ -</b>	<b>\$ 494,735</b>	<b>\$ 17,925,847</b>
<b>PORTFOLIO TOTAL</b>	<b>\$ -</b>	<b>\$ 35,570,113</b>	<b>\$ 7,622,578</b>	<b>\$ 65,252,867</b>	<b>\$ -</b>	<b>\$ 2,538,707</b>	<b>\$ 111,309,880</b>

## Executive Summary: Natural Gas DSM Tables

The following tables summarize the forecasted impacts of the Company's proposed natural gas DSM portfolio for 2019 and 2020, including anticipated expenditures, energy savings, costs by budget category, and Modified Total Resource Cost (MTRC) test ratios.

**Table 5a: Public Service's 2019 Natural Gas DSM Budgets and Targets**

2019	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Business Program</b>					
Commercial Refrigeration Efficiency	\$71,584	15,072	210,544	\$479,177	2.14
Compressed Air Efficiency	\$0	0			
Cooling	\$0	0			
Custom Efficiency	\$25,917	3,103	119,714	\$75,996	1.54
Data Center Efficiency	\$0	0			
Energy Management Systems	\$60,354	7,298	120,926	\$126,767	1.42
Heating Efficiency	\$718,820	21,363	29,720	\$91,591	1.06
LED Street Lighting	\$0	0			
Lighting Efficiency	\$0	0			
Lighting - Small Business	\$32,839	3,147	95,830	\$494,202	15.95
Motor & Drive Efficiency	\$0	0			
Multifamily Buildings	\$1,044,170	49,636	47,536	\$4,260,939	2.86
New Construction	\$650,300	79,558	122,340	\$452,219	1.11
Recommissioning	\$28,927	3,611	124,818	\$15,892	1.20
Self Direct	\$0	0			
Strategic Energy Management	\$0	0			
General Advertising-Bus	\$78,298				
<b>Business Program Total</b>	<b>\$2,711,209</b>	<b>182,787</b>	<b>67,419</b>	<b>\$5,918,484</b>	<b>1.65</b>
<b>Residential Program</b>					
Energy Efficient Showerhead	\$459,736	53,968	117,389	\$6,885,814	10.91
Energy Feedback Residential	\$407,165	92,886	228,129	\$451,708	2.11
ENERGY STAR New Homes	\$1,972,921	86,336	43,760	-\$48,648	0.99
Evaporative Cooling	\$0	0			
High Efficiency Air Conditioning	\$0	0			
Home Energy Squad	\$275,047	10,250	37,265	\$410,409	2.26
Home Lighting & Recycling	\$0	0			
Home Performance with ENERGY STAR	\$337,185	19,248	57,083	-\$241,371	0.82
Insulation & Air Sealing	\$361,232	20,783	57,535	-\$107,354	0.92
Refrigerator & Freezer Recycling	\$0	0			
Residential Heating	\$1,333,800	62,884	47,146	-\$1,519,721	0.74
School Education Kits	\$609,213	46,226	75,879	\$5,733,869	8.24
Water Heating	\$113,540	5,307	46,743	-\$306,007	0.54
Thermostat Optimization	\$164,005	37,867	230,889	\$295,465	1.60
General Advertising-Res	\$140,504				
<b>Residential Program Total</b>	<b>\$6,174,347</b>	<b>435,754</b>	<b>70,575</b>	<b>\$11,413,662</b>	<b>1.63</b>
<b>Low-Income Program</b>					
Energy Savings Kit	\$178,948	20,911	116,854	\$2,849,669	12.71
Multifamily Weatherization	\$773,681	10,693	13,821	-\$337,376	0.78
Non-Profit	\$431,913	3,999	9,260	-\$220,373	0.74
Single-Family Weatherization	\$2,913,101	47,617	16,346	-\$749,595	0.88
<b>Low-Income Program Total</b>	<b>\$4,297,643</b>	<b>83,220</b>	<b>19,364</b>	<b>\$1,542,325</b>	<b>1.17</b>

**Table 5a: Public Service’s 2019 Natural Gas DSM Budgets and Targets (cont’d)**

2019	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Indirect Products &amp; Services</b>					
<b>Education/Market Transformation</b>					
Business Education	\$19,638	0	0		
Business Energy Analysis	\$78,000	0	0		
Consumer Education	\$133,323	0	0		
Energy Benchmarking	\$34,491	0	0		
Energy Efficiency Financing	\$60,000	0	0		
ENERGY STAR Retail Products Platform	\$7,121	0	0		
Home Energy Audit	\$561,795	0	0		
Partners in Energy	\$89,000	0	0		
<b>Education/Market Transformation Total</b>	<b>\$983,367</b>	<b>0</b>	<b>0</b>		
<b>Planning and Research</b>					
EE Market Research	\$111,942	0	0		
EE Measurement & Verification	\$6,000	0	0		
EE Planning & Administration	\$116,920	0	0		
EE Program Evaluations	\$178,835	0	0		
EE Product Development	\$195,000	0	0		
Geo-targeting Pilot - EE	\$0	0			
<b>EE Product Development Total</b>	<b>\$195,000</b>	<b>0</b>	<b>0</b>		
<b>EE Planning and Research Total</b>	<b>\$608,698</b>	<b>0</b>	<b>0</b>		
<b>EE Indirect Products &amp; Services Total</b>	<b>\$1,592,065</b>	<b>0</b>	<b>0</b>		
<b>EE PORTFOLIO TOTAL</b>	<b>\$14,775,264</b>	<b>701,761</b>	<b>47,496</b>	<b>\$17,573,406</b>	<b>1.47</b>

**Table 5b: Public Service's 2019 Natural Gas DSM Costs by Category**

2019	Program Planning & Design	Administration & Program Delivery	Advertising/Promotion/ Customer Ed	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
<b>Business Program</b>							
Commercial Refrigeration Efficiency	\$ -	\$ 12,600	\$ -	\$ 58,984	\$ -	\$ -	\$ 71,584
Compressed Air Efficiency	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Cooling	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Custom Efficiency	\$ -	\$ 9,500	\$ -	\$ 16,417	\$ -	\$ -	\$ 25,917
Data Center Efficiency	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Energy Management Systems	\$ -	\$ 23,417	\$ 500	\$ 36,437	\$ -	\$ -	\$ 60,354
Heating Efficiency	\$ -	\$ 262,320	\$ 20,000	\$ 420,000	\$ -	\$ 16,500	\$ 718,820
LED Street Lighting	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Lighting Efficiency	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Lighting - Small Business	\$ -	\$ 32,596	\$ -	\$ 244	\$ -	\$ -	\$ 32,839
Motor & Drive Efficiency	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Multifamily Buildings	\$ -	\$ 123,134	\$ -	\$ 921,036	\$ -	\$ -	\$ 1,044,170
New Construction	\$ -	\$ 230,729	\$ 3,304	\$ 373,747	\$ -	\$ 42,520	\$ 650,300
Recommissioning	\$ -	\$ 10,200	\$ 250	\$ 18,477	\$ -	\$ -	\$ 28,927
Self Direct	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Strategic Energy Management	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
General Advertising-Bus	\$ -	\$ -	\$ 78,298	\$ -	\$ -	\$ -	\$ 78,298
<b>Business Program Total</b>	<b>\$ -</b>	<b>\$ 704,495</b>	<b>\$ 102,352</b>	<b>\$ 1,845,342</b>	<b>\$ -</b>	<b>\$ 59,020</b>	<b>\$ 2,711,209</b>
<b>Residential Program</b>							
Energy Efficient Showerhead	\$ -	\$ 216,587	\$ 72,898	\$ 170,251	\$ -	\$ -	\$ 459,736
Energy Feedback Residential	\$ -	\$ 407,165	\$ -	\$ -	\$ -	\$ -	\$ 407,165
ENERGY STAR New Homes	\$ -	\$ 435,823	\$ 74,432	\$ 1,228,126	\$ -	\$ 234,540	\$ 1,972,921
Evaporative Cooling	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
High Efficiency Air Conditioning	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Home Energy Squad	\$ -	\$ 60,586	\$ 80,848	\$ 22,964	\$ 108,150	\$ 2,500	\$ 275,047
Home Lighting & Recycling	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Home Performance with ENERGY STAR	\$ -	\$ 102,507	\$ -	\$ 204,678	\$ -	\$ 30,000	\$ 337,185
Insulation & Air Sealing	\$ -	\$ 28,778	\$ 2,005	\$ 320,441	\$ -	\$ 10,008	\$ 361,232
Refrigerator & Freezer Recycling	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Residential Heating	\$ -	\$ 85,100	\$ 64,000	\$ 1,172,700	\$ -	\$ 12,000	\$ 1,333,800
School Education Kits	\$ -	\$ 412,104	\$ 3,231	\$ 193,877	\$ -	\$ -	\$ 609,213
Water Heating	\$ -	\$ 17,394	\$ 2,000	\$ 75,150	\$ -	\$ 18,996	\$ 113,540
Thermostat Optimization	\$ -	\$ 59,506	\$ -	\$ 100,873	\$ -	\$ 3,626	\$ 164,005
General Advertising-Res	\$ -	\$ -	\$ 140,504	\$ -	\$ -	\$ -	\$ 140,504
<b>Residential Program Total</b>	<b>\$ -</b>	<b>\$ 1,825,550</b>	<b>\$ 439,918</b>	<b>\$ 3,489,059</b>	<b>\$ 108,150</b>	<b>\$ 311,670</b>	<b>\$ 6,174,347</b>
<b>Low-Income Program</b>							
Energy Savings Kit	\$ -	\$ 66,036	\$ 44,010	\$ 64,402	\$ -	\$ 4,500	\$ 178,948
Multifamily Weatherization	\$ -	\$ 113,397	\$ 1,032	\$ 646,186	\$ -	\$ 13,065	\$ 773,681
Non-Profit	\$ -	\$ 81,411	\$ 1,186	\$ 332,258	\$ -	\$ 17,058	\$ 431,913
Single-Family Weatherization	\$ -	\$ 209,232	\$ 30,000	\$ 2,559,637	\$ -	\$ 114,232	\$ 2,913,101
<b>Low-Income Program Total</b>	<b>\$ -</b>	<b>\$ 470,076</b>	<b>\$ 76,228</b>	<b>\$ 3,602,484</b>	<b>\$ -</b>	<b>\$ 148,855</b>	<b>\$ 4,297,643</b>

**Table 5b: Public Service’s 2019 Natural Gas DSM Costs by Category (cont’d)**

2019	Program Planning & Design	Administration & Program Delivery	Advertising/Promotion/Customer Ed	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
<b>Indirect Products &amp; Services</b>							
<b>Education/Market Transformation</b>							
Business Education	\$ -	\$ 4,200	\$ 15,438	\$ -	\$ -	\$ -	\$ 19,638
Business Energy Analysis	\$ -	\$ 6,000	\$ 12,000	\$ 60,000	\$ -	\$ -	\$ 78,000
Consumer Education	\$ -	\$ 47,191	\$ 86,132	\$ -	\$ -	\$ -	\$ 133,323
Energy Benchmarking	\$ -	\$ 34,491	\$ -	\$ -	\$ -	\$ -	\$ 34,491
Energy Efficiency Financing	\$ -	\$ 43,000	\$ 17,000	\$ -	\$ -	\$ -	\$ 60,000
ENERGY STAR Retail Products Platform	\$ -	\$ 6,716	\$ -	\$ -	\$ -	\$ 405	\$ 7,121
Home Energy Audit	\$ -	\$ 238,061	\$ 56,254	\$ 231,000	\$ -	\$ 36,480	\$ 561,795
Partners in Energy	\$ -	\$ 80,200	\$ 1,000	\$ -	\$ -	\$ 7,800	\$ 89,000
<b>Education/Market Transformation Total</b>	<b>\$ -</b>	<b>\$ 459,858</b>	<b>\$ 187,824</b>	<b>\$ 291,000</b>	<b>\$ -</b>	<b>\$ 44,685</b>	<b>\$ 983,367</b>
<b>Planning and Research</b>							
EE Market Research	\$ -	\$ 111,942	\$ -	\$ -	\$ -	\$ -	\$ 111,942
EE Measurement & Verification	\$ -	\$ 6,000	\$ -	\$ -	\$ -	\$ -	\$ 6,000
EE Planning & Administration	\$ -	\$ 116,920	\$ -	\$ -	\$ -	\$ -	\$ 116,920
EE Program Evaluations	\$ -	\$ 10,835	\$ -	\$ -	\$ -	\$ 168,000	\$ 178,835
EE Product Development	\$ -	\$ 195,000	\$ -	\$ -	\$ -	\$ -	\$ 195,000
Geo-targeting Pilot - EE	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>EE Product Development Total</b>	<b>\$ -</b>	<b>\$ 195,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 195,000</b>
<b>EE Planning and Research Total</b>	<b>\$ -</b>	<b>\$ 440,698</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 168,000</b>	<b>\$ 608,698</b>
<b>EE Indirect Products &amp; Services Total</b>	<b>\$ -</b>	<b>\$ 900,556</b>	<b>\$ 187,824</b>	<b>\$ 291,000</b>	<b>\$ -</b>	<b>\$ 212,685</b>	<b>\$ 1,592,065</b>
<b>EE PORTFOLIO TOTAL</b>	<b>\$ -</b>	<b>\$ 3,900,677</b>	<b>\$ 806,322</b>	<b>\$ 9,227,886</b>	<b>\$ 108,150</b>	<b>\$ 732,230</b>	<b>\$ 14,775,264</b>

**Table 5c: Public Service's 2020 Natural Gas DSM Budgets and Targets**

2020	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Business Program</b>					
Commercial Refrigeration Efficiency	\$34,266	5,630	164,295	\$190,468	2.16
Compressed Air Efficiency	\$0	0			
Cooling	\$0	0			
Custom Efficiency	\$34,126	4,654	136,378	\$131,184	1.64
Data Center Efficiency	\$0	0			
Energy Management Systems	\$58,239	6,487	111,393	\$125,080	1.46
Heating Efficiency	\$718,820	28,872	40,166	\$337,500	1.19
LED Street Lighting	\$0	0			
Lighting Efficiency	\$0	0			
Lighting - Small Business	\$32,839	3,147	95,830	\$500,409	16.14
Motor & Drive Efficiency	\$0	0			
Multifamily Buildings	\$1,252,000	53,193	42,486	\$4,654,984	2.80
New Construction	\$506,817	51,627	101,865	\$381,182	1.13
Recommissioning	\$28,927	2,993	103,466	\$7,132	1.09
Self Direct	\$0	0			
Strategic Energy Management	\$0	0			
General Advertising-Bus	\$78,298				
<b>Business Program Total</b>	<b>\$2,744,332</b>	<b>156,603</b>	<b>57,064</b>	<b>\$6,249,641</b>	<b>1.78</b>
<b>Residential Program</b>					
Energy Efficient Showerhead	\$459,736	53,968	117,389	\$7,007,122	11.00
Energy Feedback Residential	\$427,165	89,936	210,542	\$530,649	2.24
ENERGY STAR New Homes	\$1,848,007	75,359	40,779	-\$173,160	0.97
Evaporative Cooling	\$0	0			
High Efficiency Air Conditioning	\$0	0			
Home Energy Squad	\$369,071	15,731	42,624	\$678,764	2.50
Home Lighting & Recycling	\$0	0			
Home Performance with ENERGY STAR	\$341,805	19,248	56,312	-\$202,357	0.85
Insulation & Air Sealing	\$366,319	20,835	56,876	-\$64,986	0.95
Refrigerator & Freezer Recycling	\$0	0			
Residential Heating	\$1,353,800	62,884	46,450	-\$1,377,348	0.77
School Education Kits	\$626,354	46,226	73,802	\$5,829,672	8.20
Water Heating	\$114,758	5,385	46,922	-\$295,991	0.56
Thermostat Optimization	\$218,999	62,181	283,935	\$488,630	1.75
General Advertising-Res	\$140,504				
<b>Residential Program Total</b>	<b>\$6,266,518</b>	<b>451,753</b>	<b>72,090</b>	<b>\$12,280,492</b>	<b>1.68</b>
<b>Low-Income Program</b>					
Energy Savings Kit	\$150,441	10,455	69,498	\$1,390,728	8.61
Multifamily Weatherization	\$773,681	10,693	13,821	-\$311,370	0.80
Non-Profit	\$431,913	3,999	9,260	-\$208,482	0.75
Single-Family Weatherization	\$2,913,101	47,617	16,346	-\$623,414	0.90
<b>Low-Income Program Total</b>	<b>\$4,269,136</b>	<b>72,765</b>	<b>17,044</b>	<b>\$247,462</b>	<b>1.03</b>

**Table 5c: Public Service's 2020 Natural Gas DSM Budgets and Targets (cont'd)**

2020	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Indirect Products &amp; Services</b>					
<b>Education/Market Transformation</b>					
Business Education	\$19,638	0	0		
Business Energy Analysis	\$78,000	0	0		
Consumer Education	\$133,323	0	0		
Energy Benchmarking	\$35,525	0	0		
Energy Efficiency Financing	\$60,000	0	0		
ENERGY STAR Retail Products Platform	\$7,121	0	0		
Home Energy Audit	\$561,795	0	0		
Partners in Energy	\$93,000	0	0		
<b>Education/Market Transformation Total</b>	<b>\$988,402</b>	<b>0</b>	<b>0</b>		
<b>Planning and Research</b>					
EE Market Research	\$118,187	0	0		
EE Measurement & Verification	\$6,000	0	0		
EE Planning & Administration	\$116,920	0	0		
EE Program Evaluations	\$160,602	0	0		
EE Product Development	\$197,000	0	0		
Geo-targeting Pilot - EE	\$0	0			
<b>EE Product Development Total</b>	<b>\$197,000</b>	<b>0</b>	<b>0</b>		
<b>EE Planning and Research Total</b>	<b>\$598,708</b>	<b>0</b>	<b>0</b>		
<b>EE Indirect Products &amp; Services Total</b>	<b>\$1,587,110</b>	<b>0</b>	<b>0</b>		
<b>EE PORTFOLIO TOTAL</b>	<b>\$14,867,096</b>	<b>681,120</b>	<b>45,814</b>	<b>\$17,481,485</b>	<b>1.48</b>

**Table 5d: Public Service’s 2020 Natural Gas DSM Costs by Category**

2020	Program Planning & Design	Administration & Program Delivery	Advertising/Promotion/ Customer Ed	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
<b>Business Program</b>							
Commercial Refrigeration Efficiency	\$ -	\$ 12,600	\$ -	\$ 21,666	\$ -	\$ -	\$ 34,266
Compressed Air Efficiency	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Cooling	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Custom Efficiency	\$ -	\$ 9,500	\$ -	\$ 24,626	\$ -	\$ -	\$ 34,126
Data Center Efficiency	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Energy Management Systems	\$ -	\$ 23,906	\$ 500	\$ 33,833	\$ -	\$ -	\$ 58,239
Heating Efficiency	\$ -	\$ 252,320	\$ -	\$ 450,000	\$ -	\$ 16,500	\$ 718,820
LED Street Lighting	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Lighting Efficiency	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Lighting - Small Business	\$ -	\$ 32,596	\$ -	\$ 244	\$ -	\$ -	\$ 32,839
Motor & Drive Efficiency	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Multifamily Buildings	\$ -	\$ 245,822	\$ -	\$ 1,006,178	\$ -	\$ -	\$ 1,252,000
New Construction	\$ -	\$ 200,094	\$ 3,307	\$ 260,896	\$ -	\$ 42,520	\$ 506,817
Recommissioning	\$ -	\$ 10,200	\$ 250	\$ 18,477	\$ -	\$ -	\$ 28,927
Self Direct	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Strategic Energy Management	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
General Advertising-Bus	\$ -	\$ -	\$ 78,298	\$ -	\$ -	\$ -	\$ 78,298
<b>Business Program Total</b>	<b>\$ -</b>	<b>\$ 787,037</b>	<b>\$ 82,355</b>	<b>\$ 1,815,920</b>	<b>\$ -</b>	<b>\$ 59,020</b>	<b>\$ 2,744,332</b>
<b>Residential Program</b>							
Energy Efficient Showerhead	\$ -	\$ 216,587	\$ 72,898	\$ 170,251	\$ -	\$ -	\$ 459,736
Energy Feedback Residential	\$ -	\$ 427,165	\$ -	\$ -	\$ -	\$ -	\$ 427,165
ENERGY STAR New Homes	\$ -	\$ 435,823	\$ 70,832	\$ 1,073,440	\$ -	\$ 267,912	\$ 1,848,007
Evaporative Cooling	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
High Efficiency Air Conditioning	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Home Energy Squad	\$ -	\$ 94,169	\$ 81,473	\$ 33,789	\$ 157,141	\$ 2,500	\$ 369,071
Home Lighting & Recycling	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Home Performance with ENERGY STAR	\$ -	\$ 102,327	\$ 4,800	\$ 204,678	\$ -	\$ 30,000	\$ 341,805
Insulation & Air Sealing	\$ -	\$ 28,778	\$ 2,005	\$ 325,528	\$ -	\$ 10,008	\$ 366,319
Refrigerator & Freezer Recycling	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Residential Heating	\$ -	\$ 105,100	\$ 64,000	\$ 1,172,700	\$ -	\$ 12,000	\$ 1,353,800
School Education Kits	\$ -	\$ 423,407	\$ 3,253	\$ 199,694	\$ -	\$ -	\$ 626,354
Water Heating	\$ -	\$ 17,862	\$ 2,000	\$ 75,900	\$ -	\$ 18,996	\$ 114,758
Thermostat Optimization	\$ -	\$ 89,826	\$ -	\$ 125,547	\$ -	\$ 3,626	\$ 218,999
General Advertising-Res	\$ -	\$ -	\$ 140,504	\$ -	\$ -	\$ -	\$ 140,504
<b>Residential Program Total</b>	<b>\$ -</b>	<b>\$ 1,941,043</b>	<b>\$ 441,765</b>	<b>\$ 3,381,527</b>	<b>\$ 157,141</b>	<b>\$ 345,042</b>	<b>\$ 6,266,518</b>
<b>Low-Income Program</b>							
Energy Savings Kit	\$ -	\$ 73,740	\$ 40,000	\$ 32,201	\$ -	\$ 4,500	\$ 150,441
Multifamily Weatherization	\$ -	\$ 113,397	\$ 1,032	\$ 646,186	\$ -	\$ 13,065	\$ 773,681
Non-Profit	\$ -	\$ 81,411	\$ 1,186	\$ 332,258	\$ -	\$ 17,058	\$ 431,913
Single-Family Weatherization	\$ -	\$ 209,232	\$ 30,000	\$ 2,559,637	\$ -	\$ 114,232	\$ 2,913,101
<b>Low-Income Program Total</b>	<b>\$ -</b>	<b>\$ 477,780</b>	<b>\$ 72,218</b>	<b>\$ 3,570,283</b>	<b>\$ -</b>	<b>\$ 148,855</b>	<b>\$ 4,269,136</b>

**Table 5d: Public Service’s 2020 Natural Gas DSM Costs by Category (cont’d)**

2020	Program Planning & Design	Administration & Program Delivery	Advertising/Promotion/Customer Ed	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
<b>Indirect Products &amp; Services</b>							
<b>Education/Market Transformation</b>							
Business Education	\$ -	\$ 4,200	\$ 15,438	\$ -	\$ -	\$ -	\$ 19,638
Business Energy Analysis	\$ -	\$ 6,000	\$ 12,000	\$ 60,000	\$ -	\$ -	\$ 78,000
Consumer Education	\$ -	\$ 47,191	\$ 86,132	\$ -	\$ -	\$ -	\$ 133,323
Energy Benchmarking	\$ -	\$ 35,525	\$ -	\$ -	\$ -	\$ -	\$ 35,525
Energy Efficiency Financing	\$ -	\$ 43,000	\$ 17,000	\$ -	\$ -	\$ -	\$ 60,000
ENERGY STAR Retail Products Platform	\$ -	\$ 6,716	\$ -	\$ -	\$ -	\$ 405	\$ 7,121
Home Energy Audit	\$ -	\$ 238,061	\$ 56,254	\$ 231,000	\$ -	\$ 36,480	\$ 561,795
Partners in Energy	\$ -	\$ 83,780	\$ 1,000	\$ -	\$ -	\$ 8,220	\$ 93,000
<b>Education/Market Transformation Total</b>	<b>\$ -</b>	<b>\$ 464,473</b>	<b>\$ 187,824</b>	<b>\$ 291,000</b>	<b>\$ -</b>	<b>\$ 45,105</b>	<b>\$ 988,402</b>
<b>Planning and Research</b>							
EE Market Research	\$ -	\$ 118,187	\$ -	\$ -	\$ -	\$ -	\$ 118,187
EE Measurement & Verification	\$ -	\$ 6,000	\$ -	\$ -	\$ -	\$ -	\$ 6,000
EE Planning & Administration	\$ -	\$ 116,920	\$ -	\$ -	\$ -	\$ -	\$ 116,920
EE Program Evaluations	\$ -	\$ 10,602	\$ -	\$ -	\$ -	\$ 150,000	\$ 160,602
EE Product Development	\$ -	\$ 197,000	\$ -	\$ -	\$ -	\$ -	\$ 197,000
Geo-targeting Pilot - EE	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>EE Product Development Total</b>	<b>\$ -</b>	<b>\$ 197,000</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 197,000</b>
<b>EE Planning and Research Total</b>	<b>\$ -</b>	<b>\$ 448,708</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ 150,000</b>	<b>\$ 598,708</b>
<b>EE Indirect Products &amp; Services Total</b>	<b>\$ -</b>	<b>\$ 913,182</b>	<b>\$ 187,824</b>	<b>\$ 291,000</b>	<b>\$ -</b>	<b>\$ 195,105</b>	<b>\$ 1,587,110</b>
<b>EE PORTFOLIO TOTAL</b>	<b>\$ -</b>	<b>\$ 4,119,041</b>	<b>\$ 784,163</b>	<b>\$ 9,058,729</b>	<b>\$ 157,141</b>	<b>\$ 748,022</b>	<b>\$ 14,867,096</b>

**DSM Participation**

Decision No. C14-0731 in 2013 DSM Strategic Issues (Proceeding No. 13A-0686EG) directed the Company to “collect, define, and analyze participant and non-participant rates. In future DSM plan filings, the Company shall explain how these data were collected and used for each program.”<sup>14</sup> Furthermore, the Commission clarified in Decision No. C14-0997 that “we also require that the Company set forth proposals for tracking participants and non-participants for specific programs and measures and to provide estimates of participant and non-participant counts in its DSM Plans. While we recognize that, for certain programs or measures it may be difficult or prohibitively expensive to collect such data, it is reasonable for the Commission to consider plans for tracking participation and non-participation when programs and measures are proposed in a DSM Plan filing and when we review the cost-effectiveness and ratepayer impacts of those programs and measures.”<sup>15</sup>

Tracking Participants / Non-Participants

To most effectively comply with the Decision, Public Service has determined that participant counts should be collected at the customer level (rather than at the premise level as had been done in the past) and provided by DSM product and by customer class. Because customers may participate in more than one product within a single year, the total number of portfolio participants will not be a direct summation of the individual product participation counts. In order to identify the non-participants, the Company will provide the number and percentage that the portfolio participation count makes up of total Public Service customers (eligible for DSM).<sup>16</sup>

<sup>14</sup> Paragraph 115, pg. 39.

<sup>15</sup> Paragraph 24, pg. 8.

<sup>16</sup> Public Service gas transport customer classes are not eligible to participate in DSM.

Going forward, the Company will begin to identify the number of customers participating in each DSM product in a given year within the DSM Annual Status Report. Additionally within the Status Report, a portfolio participation and non-participation count will be provided.

The Company believes a thorough analysis of participants and non-participants must go beyond a counting of participation each year. It must also consider the amount of cumulative consumption savings realized by individual customers each year, due to the participation in DSM products over several program years. To this end, the Company will also identify the estimated percentages of business and residential customers by their range of consumption savings attributable to DSM participation since the expansion of the DSM programs in 2009. The extent of individual participation can further be compared to the cumulative rate impacts of DSM program since 2009. The combination of these factors results in the level and distribution of bill savings among business and residential customers. This additional participation data analysis is included in the DSM Annual Status Reports.

### *Key Assumptions*

Participation data is provided with the following key assumptions:

- A participant will be “one individual customer” (based on account number) participating in DSM in a given year.<sup>17</sup> Customers may have multiple premises,<sup>18</sup> multiple projects, and/or participate in multiple DSM products across multiple years. (This represents a shift from historical reporting of “participant” which was based on premises).
- Some participation related data analysis is provided only at the portfolio level, such as non-participant<sup>19</sup> data; this approach ensures that the endeavor is not undertaken in a manner that is costly or extensively laborious.
- Downstream products’ participation counts will be actual customer counts based on tracked participation data (means of tracking as identified in Tables 6b and 6c).
- Where mid/upstream products’ do not track participation at the customer level, counts will be an estimate within both the DSM Plans and the Annual DSM Status Reports, unless otherwise noted, given the nature of the approach and difficulty and cost associated with specific customer tracking.

### Product-Specific Considerations

Products with unique participant tracking approaches are described below:

*Cooling – Midstream:* The participating tracking mechanism for the midstream rebate portion of the product will be determined in conjunction with the selected third-party implementer. The data will either be directly uploaded into Salesforce—the Company’s tracking software—or tracked separately and manually added to the Salesforce data for the third-party implemented portion of product participation.

*Lighting Efficiency and Small Business Lighting – Midstream:* Product participation for the midstream component of the product is derived through monthly sales reporting from the third-party implementer. This data is manually entered into Salesforce and is also tracked separately.

*Energy Efficient Showerhead:* Public Service uploads a participation report from the third-party implementer into Salesforce; however, a manual calculation needs to be completed (given current Salesforce configuration), in order to identify the total number of unique customers that receive a showerhead.

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<sup>17</sup> Within the Detailed Technical Assumptions table at the end of [Appendix G: Technical Reference Manual](#) of this Plan, the Company identifies “units,” which differ from “participants.” Units are the total number of equipment installed by measure.

<sup>18</sup> A premise is an individual physical location where a customer is served; a customer may have multiple premises associated with their one account, and vice versa a premise could have multiple customer accounts. For tracking participants, individual customer accounts will be tracked as one participant.

<sup>19</sup> A non-participant is a Public Service customer who is eligible to participate in DSM, but has not chosen to do so. This type of data point is able to be tracked based on total Public Service customers and/or Public Service customers by class (business or residential).

*ENERGY STAR New Homes:* Upstream participation is based on the number of unique new home builders participating in the product each year and is tracked by the third-party implementer. Downstream participation is based on the number of homes completed in the product by that smaller number of builders. In other words, each home is purchased and occupied by a unique customer and no customer is assumed to own more than one participating home during the product year. Therefore, participation estimates included herein will reflect the number of homes.

*Home Lighting & Recycling:* This product is wide-reaching with a significant amount of bulbs sold and distributed across both the Residential and Business populations. Because the product achieves the vast majority of participation through retail outlets that do not track information on the customers purchasing the bulbs in the product, some estimation of the breadth of participation—based on average bulbs per customer, total installed bulbs, and the product saturation rate—has been performed.

*Multifamily Weatherization and Multifamily Buildings:* Participants are considered to be both residents living within housing units that receive energy-efficiency measures (regardless of whether they paid for improvements or received them as a direct-install measure), as well as the building and/or equipment owners, who may not represent the metered, bill-payer given the nature of multifamily building units.

*School Education Kits:* The Company presumes one customer account per kit. However, it is possible that there may be very limited circumstances where a customer could receive two or more kits in one program year and/or multiple kits over the course of several program years (not unlike potential duplicate participation in other DSM products), but these instances cannot be tracked.

#### Class Participation Calculations

To estimate the count of unique customers participating within each segment (Business or Residential), calculations must be made to estimate the duplication of participation across the individual products. Summing the participation across products and then applying adjustments to account for duplicate participation results in an accurate measure of the breadth of participation within each segment. The methods to estimate duplicate participation across various types of products are described below:

*Individually-Tracked Products:* To estimate the amount of duplicate participation expected to occur in the 2019 and 2020 program years, the ratio of the sum of unique participation within each product observed in the 2017 program year over the unique participation within the Business or Residential segment is calculated. For instance, for the Business class of customers in the 2017 program year, individually-tracked products had a sum of 6,690 unique accounts within products, but these represented only 4,744 unique accounts within the Business class. This results in a factor of 29.08% to account for duplicate participation across the individually tracked products.

*Non-Individually-Tracked Products:* For the Home Lighting & Recycling product it is not feasible to track the individual participation. Home Lighting & Recycling includes an upstream delivery model that represents very large participation and does not provide an opportunity to identify the individual participants. For 2019 and 2020, behavioral products for both the Business and Residential classes will be applied to a large fraction of the population, with the individual participants not yet determined. For these products, duplicate participation is estimated by multiplying the fraction of population represented by each product by each other. For instance, if in 2019, the Home Lighting & Recycling product is expected to reach 25% of the Residential class population, and the Residential Behavioral product is expected to reach 40% of the Residential class, the duplicate participation is estimated at 10% ( $25\% * 40\%$ ) of the Residential class. The total fraction of the Residential class population participating in either of these products is estimated by summing the total fraction of the two products at 65% ( $25\% + 40\%$ ) and then subtracting the duplicate participation fraction (10%) to get a fraction of 55% of the Residential class population participating in at least one of these products.

## DSM Participation Tables

The following tables included in this Plan present the Company's best estimates for participation and non-participation in DSM programs in 2019 and 2020, based on the methodology for estimating participation described above.

- 6a: 2019/2020 Electric Participant & Non-Participant Estimates, Percentage
- 6b: 2019/2020 Electric Participation Estimates, Average Rebate and Savings by DSM Product
- 6c: 2019/2020 Natural Gas Participation Estimates

**Table 6a: 2019/2020 Electric Participant & Non-Participant Estimates, Percentage**

	Total Unique DSM Participants[1]		Total PSCo Customers		PSCo Customers Participating in DSM		PSCo Customers Not Participating in DSM	
	Count	%	Count	%	Count	%	Count	%
2019 Total	817,510	100%	1,400,975	100%	817,510	58%	583,465	42%
Business	20,492	3%	103,837	7%	20,492	20%	83,345	79%
Residential	797,018	97%	1,297,138	93%	797,018	61%	500,120	39%
2020 Total	699,874	100%	1,428,995	100.00%	699,874	49%	729,121	51%
Business	14,428	2%	105,914	7%	14,428	14%	91,846	86%
Residential	685,446	98%	1,323,081	93%	685,446	52%	637,635	48%

**Table 6b: 2019/2020 Electric Participation Estimates, Average Rebate and Savings by DSM Product**

Product	2019 Estimated Participants	Average Rebate Per Customer	Average kWh Savings Per Customer	2020 Estimated Participants	Average Rebate Per Customer	Average kWh Savings Per Customer
<b>Business Program</b>						
Commercial Refrigeration Efficiency	74	\$4,714.30	66,363	55	\$6,342.88	52,863
Compressed Air Efficiency	72	\$6,299.34	63,460	79	\$5,741.17	60,559
Cooling	1,011	\$2,465.17	11,325	1,000	\$2,492.29	9,250
Custom Efficiency	7	\$33,397.85	685,217	8	\$29,223.12	399,710
Data Center Efficiency	49	\$30,525.85	279,796	49	\$30,525.85	296,715
Energy Management Systems	38	\$8,524.65	131,233	37	\$8,755.04	123,852
Heating Efficiency	58	\$105.95	1,690	64	\$96.02	1,621
LED Street Lighting	13	\$0.00	204,472	13	\$0.00	204,472
Lighting Efficiency	4,596	\$2,992.02	34,044	4,507	\$3,051.04	40,283
Lighting - Small Business	4,534	\$752.70	8,175	4,100	\$832.40	8,453
Motor & Drive Efficiency	163	\$12,556.85	80,834	148	\$13,796.88	88,816
Multifamily Buildings	1,116	\$1,307.50	9,922	1,228	\$1,188.58	9,385
New Construction	104	\$77,910.31	379,712	94	\$86,252.49	449,728
Recommissioning	116	\$1,863.85	32,299	116	\$1,863.85	32,211
Self Direct	4	\$166,894.30	1,684,623	3	\$222,525.73	1,684,623
Strategic Energy Management	105	\$25,302.85	275,930	146	\$18,197.25	240,656
<b>Residential Program Total</b>						
Energy Efficient Showerhead	2,366	\$5.52	427	2,366	\$5.52	427
Energy Feedback Residential	540,744	\$0.00	40	522,550	\$0.00	39
ENERGY STAR New Homes	4,903	\$131.70	631	2,550	\$253.24	1,172
Evaporative Cooling	3,764	\$571.47	1,256	4,077	\$527.59	1,256
High Efficiency Air Conditioning	3,695	\$434.65	486	5,249	\$305.97	489
Home Energy Squad	1,750	\$65.27	942	2,575	\$44.36	951
Home Lighting & Recycling	247,381	\$16.69	360	144,754	\$28.52	474
Home Performance with ENERGY STAR	392	\$265.06	559	392	\$265.06	792
Insulation & Air Sealing	16,280	\$24.83	31	17,780	\$22.73	29
Refrigerator & Freezer Recycling	7,000	\$50.00	562	7,000	\$50.00	571
Residential Heating	7,200	\$101.40	801			
School Education Kits	62,500	\$18.83	167	67,500	\$17.43	160
Water Heating	1,270	\$442.83	3,952	1,270	\$442.83	3,952
Thermostat Optimization	17,564	\$10.10	77	30,925	\$5.73	63
<b>Low-Income Program</b>						
Energy Savings Kit	10,230	\$22.39	254	5,115	\$44.78	254
Multifamily Weatherization	35	\$25,300.68	53,975	35	\$25,300.68	53,975
Non-Profit	39	\$22,470.42	43,620	39	\$22,470.42	43,620
Single-Family Weatherization	1,500	\$662.95	1,186	1,500	\$662.95	1,186
<b>Indirect Products &amp; Services</b>						
Business Education	1,385	\$0.00	0	1,385	\$0.00	0
Business Energy Analysis	316	\$1,272.15	0	316	\$1,272.15	0
Consumer Education	25,499	\$0.00	0	25,499	\$0.00	0
Energy Benchmarking	265	\$0.00	0	273	\$0.00	0
Energy Efficiency Financing	15	\$666.67	0	15	\$666.67	0
ENERGY STAR Retail Products Platform	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
Home Energy Audit	1,889	\$104.28	0	1,889	\$104.28	0
Partners in Energy	N/A			0		
<b>Demand Response</b>						
Residential Battery Demand Response	250	\$535.00	-67	250	\$535.00	-67
Critical Peak Pricing Pilot	15	\$0.00	0	15	\$0.00	0
Peak Partner Rewards	N/A			N/A		
Residential Demand Response	12,000	\$714.08	4	12,000	\$714.08	4
Geo-targeting Pilot - DR	N/A			N/A		

**Table 6c: 2019/2020 Natural Gas Participation Estimates**

<b>Product</b>	<b>2019 Natural Gas DSM Participation Estimated</b>	<b>2020 Natural Gas DSM Participation Estimated</b>
<b>Business Program</b>		
Commercial Refrigeration Efficiency	102	102
Compressed Air Efficiency	0	0
Cooling	0	0
Custom Efficiency	2	2
Data Center Efficiency	0	0
Energy Management Systems	9	9
Heating Efficiency	194	194
LED Street Lighting	0	0
Lighting Efficiency	0	0
Lighting - Small Business	176	176
Motor & Drive Efficiency	0	0
Multifamily Buildings	384	384
New Construction	60	60
Recommissioning	28	28
Self Direct	0	0
Strategic Energy Management	0	0
<b>Residential Program Total</b>		
Energy Efficient Showerhead	31,484	31,484
Energy Feedback Residential	385,978	385,978
ENERGY STAR New Homes	4,000	4,000
Evaporative Cooling	0	0
High Efficiency Air Conditioning	0	0
Home Energy Squad	1,750	1,750
Home Lighting & Recycling	0	0
Home Performance with ENERGY STAR	392	392
Insulation & Air Sealing	15,863	15,863
Refrigerator & Freezer Recycling	0	0
Residential Heating	3,620	3,620
School Education Kits	40,000	40,000
Water Heating	930	930
Thermostat Optimization	16,675	16,675
<b>Low-Income Program</b>		
Energy Savings Kit	12,873	12,873
Multifamily Weatherization	30	30
Non-Profit	29	29
Single-Family Weatherization	2,200	2,200
<b>Indirect Products &amp; Services</b>		
Business Education	593	593
Business Energy Analysis	119	119
Consumer Education	34,000	34,000
Energy Benchmarking	167	167
Energy Efficiency Financing	90	90
ENERGY STAR Retail Products Platform	0	0
Home Energy Audit	2,579	2,579
Partners in Energy	N/A	N/A
<b>Demand Response</b>		
Residential Battery Demand Response	0	0
Critical Peak Pricing Pilot	0	0
Peak Partner Rewards	0	0
Residential Demand Response	0	0
Geo-targeting Pilot - DR	0	0

## Business Program

### A. Description

The Business Program offers prescriptive and custom DSM products to commercial and industrial customers in the Colorado service territory.<sup>20</sup> Public Service has a total of 251,263 gas and electric commercial and industrial customer premises in Colorado.<sup>21</sup> A breakdown of business premises by type is shown in the table below.

**Table 7: Business Premise Counts by Type<sup>22</sup>**

	<b>Natural Gas Only</b>	<b>Electric Only</b>	<b>Both Gas &amp; Electric</b>	<b>Total</b>
Commercial	37,924	137,165	72,967	248,056
Industrial	2,725	388	94	3,207
<b>Total</b>	<b>40,649</b>	<b>137,553</b>	<b>73,061</b>	<b>251,263</b>

Public Service divides business customers into two sub-segments for marketing purposes: (1) large customers and (2) small- and medium-sized customers. Large customers are typically single or aggregated electric customers with demand usage of over 500 kW, natural gas customers with annual loads of 5,000 Dth or more, and/or national customers, such as fast-food chains. The Company assigns an Account Manager to large customers to serve as a liaison with Public Service on a variety of energy topics. Small- and medium-sized business customers work with the Company's Business Solutions Center (BSC) to answer any questions they may have on their accounts and to discuss Company resources for potential energy efficiency projects.

#### Products

An extensive portfolio of products is planned for the Business Program in 2019 and 2020 including 16 electric and eight natural gas products. All of the natural gas products coincide with their electric counterparts such as Custom Efficiency where electric, natural gas, or electric and natural gas savings can be analyzed. The Business product rankings are shown in Table 8 below.

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<sup>20</sup> The majority of The Company's high natural gas consumption customers are transportation-only customers that do not purchase gas directly from the Company, and therefore those customers are exempt from the Demand-Side Management Cost Adjustment (DSMCA) and ineligible to participate in the Company's energy efficiency products.

<sup>21</sup> Premise counts as of July 2018.

<sup>22</sup> Natural gas transportation-only customer are excluded.

**Table 8: Business Product Rankings**

2019-2020	Rank
Lighting Efficiency	4
Lighting - Small Business	7
Multifamily Buildings	8
Strategic Energy Management	11
Data Center Efficiency	12
Motor & Drive Efficiency	14
New Construction	15
Commercial Refrigeration Efficiency	16
Cooling	18
Self Direct	20
Compressed Air Efficiency	22
Custom Efficiency	26
Energy Management Systems	27
Recommissioning	29
Heating Efficiency	30
LED Street Lighting	33

The newest product being launched for the Colorado market is the Strategic Energy Management product. This product was the result the combination and enhancement of the Process Efficiency and Energy Information Systems products included in previous DSM Plans.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The Business Program is anticipated to contribute 343.8 GWh and 182,787 Dth in 2019 and 368.9 GWh and 156,603 Dth in 2020. This is approximately 68% and 26% respectively of the 2019 achievements and 74% and 23% respectively of the 2020 achievements. Each of the product targets were reviewed by the Company's energy efficiency team for reasonability and appropriateness based on market potential.

The product's energy savings and participation, and corresponding budgets, are shown in Tables 9a through 9d below.

**Table 9a: 2019 Electric Business Program Budgets and Targets**

2019	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Business Program</b>				
Commercial Refrigeration Efficiency	\$1,161,381	863	4,914,779	1.41
Compressed Air Efficiency	\$662,960	700	4,569,137	1.49
Cooling	\$4,715,198	5,939	11,449,289	1.37
Custom Efficiency	\$1,035,689	515	4,796,517	1.22
Data Center Efficiency	\$1,781,817	1,746	13,710,005	1.81
Energy Management Systems	\$565,759	36	4,986,861	0.90
Heating Efficiency	\$16,180	7	98,026	1.96
LED Street Lighting	\$43,000	0	2,658,138	0.55
Lighting Efficiency	\$17,578,839	20,089	156,466,275	1.43
Lighting - Small Business	\$6,436,982	5,734	37,061,672	1.12
Motor & Drive Efficiency	\$2,644,398	2,316	13,175,865	1.41
Multifamily Buildings	\$2,143,516	1,280	11,073,258	1.31
New Construction	\$11,511,392	11,436	39,338,167	1.21
Recommissioning	\$475,156	380	3,746,661	0.84
Self Direct	\$799,627	1,025	6,738,491	1.67
Strategic Energy Management	\$5,293,986	3,270	28,972,603	1.57
General Advertising-Bus	\$826,564			
<b>Business Program Total</b>	<b>\$57,692,446</b>	<b>55,335</b>	<b>343,755,746</b>	<b>1.34</b>

**Table 9b: 2020 Electric Business Program Budgets and Targets**

2020	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Business Program</b>				
Commercial Refrigeration Efficiency	\$672,990	516	2,911,442	1.44
Compressed Air Efficiency	\$709,343	737	4,784,175	1.55
Cooling	\$3,539,391	4,871	9,249,617	1.53
Custom Efficiency	\$757,761	343	3,197,678	1.22
Data Center Efficiency	\$1,829,881	1,829	14,539,038	1.89
Energy Management Systems	\$532,829	72	4,582,521	0.94
Heating Efficiency	\$16,297	7	103,747	2.15
LED Street Lighting	\$43,000	0	2,658,138	0.58
Lighting Efficiency	\$20,380,890	24,994	181,557,873	1.56
Lighting - Small Business	\$5,987,360	5,553	34,654,488	1.18
Motor & Drive Efficiency	\$2,644,398	2,316	13,175,865	1.45
Multifamily Buildings	\$2,245,730	1,339	11,521,450	1.34
New Construction	\$12,040,165	12,181	42,085,573	1.23
Recommissioning	\$491,040	441	3,736,530	0.91
Self Direct	\$639,733	769	5,053,868	1.70
Strategic Energy Management	\$5,759,050	3,307	35,135,809	1.63
General Advertising-Bus	\$825,647			
<b>Business Program Total</b>	<b>\$59,115,505</b>	<b>59,274</b>	<b>368,947,811</b>	<b>1.42</b>

**Table 9c: 2019 Natural Gas Business Program Budgets and Targets**

2019	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Business Program</b>					
Commercial Refrigeration Efficiency	\$71,584	15,072	210,544	\$479,177	2.14
Compressed Air Efficiency					
Cooling					
Custom Efficiency			119,714	\$75,996	1.54
Data Center Efficiency	\$0	0			
Energy Management Systems			120,926	\$126,767	1.42
Heating Efficiency	\$718,820	21,363	29,720	\$91,591	1.06
LED Street Lighting	\$0	0			
Lighting Efficiency					
Lighting - Small Business			95,830	\$494,202	15.95
Motor & Drive Efficiency	\$0	0			
Multifamily Buildings			47,536	\$4,260,939	2.86
New Construction	\$650,300	79,558	122,340	\$452,219	1.11
Recommissioning	\$28,927	3,611	124,818	\$15,892	1.20
Self Direct					
Strategic Energy Management	\$0	0			
General Advertising-Bus	\$78,298				
<b>Business Program Total</b>	<b>\$1,547,929</b>	<b>119,603</b>	<b>71,252</b>	<b>\$5,996,782</b>	<b>1.65</b>

**Table 9d: 2020 Natural Gas Business Program Budgets and Targets**

2020	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Business Program</b>					
Commercial Refrigeration Efficiency	\$34,266	5,630	164,295	\$190,468	2.16
Compressed Air Efficiency					
Cooling					
Custom Efficiency			136,378	\$131,184	1.64
Data Center Efficiency	\$0	0			
Energy Management Systems			111,393	\$125,080	1.46
Heating Efficiency	\$718,820	28,872	40,166	\$337,500	1.19
LED Street Lighting	\$0	0			
Lighting Efficiency					
Lighting - Small Business			95,830	\$500,409	16.14
Motor & Drive Efficiency	\$0	0			
Multifamily Buildings			42,486	\$4,654,984	2.80
New Construction	\$506,817	51,627	101,865	\$381,182	1.13
Recommissioning	\$28,927	2,993	103,466	\$7,132	1.09
Self Direct	\$0	0			
Strategic Energy Management	\$0	0			
General Advertising-Bus	\$78,298				
<b>Business Program Total</b>	<b>\$1,367,128</b>	<b>89,122</b>	<b>57,737</b>	<b>\$6,327,939</b>	<b>1.78</b>

## Budgets

Achievement targets were developed as a result of an organic participation and energy savings estimation process for each product, which was rolled up to the Business Program total. Similarly, budgets for each product were developed based on the anticipated level of achievement and cost of market penetration, including review of historical data for the past several years and experience with similar products in Minnesota.

Rebate budgets were established according to the desired number of product participants and estimated average project size. Next, budget components, such as advertising and promotion, were developed as part of the product planning process. Then, product delivery budgets, including Company labor and external resources, were calculated. The resulting budgets from this planning process are shown in the executive summary section of the Plan.

The Company is continuing to closely manage DSM expenditures due to concerns about reduced cost-effectiveness of many DSM products given low gas commodity prices, increases in renewable energy generation, and the rate impact on non-participating customers.

Additional details are presented in the product descriptions that follow this overview section.

## **C. Application Process**

Application processes vary by product. See individual product summaries following this overview for more information.

## **D. Market Objectives & Strategies**

Market analysis shows that the commercial segment had the highest potential for energy savings within indoor and outdoor lighting, cooling and ventilation, data servers, and refrigeration end-uses. In the industrial market segment, pumps, lighting, compressed air, fans, cooling, and drives show the greatest-end use potential.

Transactional research is also conducted by Public Service to identify who is participating in our DSM products. Specific detail from our rebate applications, including customer name, vendor, type of equipment, etc., is collected on each transaction and added to a database. This information is monitored to determine metrics such as: participation/non-participation in DSM products, market segments utilized, and equipment types our customers use. By analyzing specific end-use data, Public Service can continue to shape the Business Program to further meet the needs of the market.

Trade allies, end-use equipment vendors, energy services companies, and Public Service's Account Managers and marketing team work individually and collaboratively to drive participation in the Business Program. While coordination of DSM participation by the largest business customers typically requires regular personal communications and site visits, Public Service also utilizes newsletters, customer events, direct mail, email communications, and

awareness advertising to reach Business Program customers. A challenge in marketing energy efficiency is that it's not a topic on the top of customers' minds – they are busy managing the core aspects of their businesses, particularly for those who do not have dedicated onsite energy managers. Customers tend to focus on purchase price (or “first costs”) rather than lifetime costs and are often unlikely to replace equipment prior to failure. Customers may also not be aware of energy efficient equipment and process options available to them when the need arises to make purchase decisions. Yet, opportunities are growing in marketing energy efficiency to customers as awareness on conservation, climate change, and the environment increases leading to an affinity for energy-saving actions. To support marketing efforts, Public Service employs an integrated approach to marketing communications, where the tactics are designed to work in concert with each other and reinforce key messages over time.

### Strategy

Public Service follows the “AIDA” (awareness, interest, desire, action) process for encouraging customers to participate in DSM products. The following are the steps in this process:

1. Create awareness of electricity and/or natural gas impacts on bottom-line profits, and quantify potential cost savings and available rebates.
2. Promote interest in DSM products by providing more information about the offerings, including payback examples and case studies, through a variety of customer touch-points.
3. Instill the desire for participation in DSM products by quantifying the impacts of a bundle of potential energy savings technologies and processes, based on specific product and industry information for each targeted market segment.
4. Move the customer toward action by offering a variety of product options with varying degrees of financial commitment and/or long-term customer involvement.

### Key Messages and Target Audience

When communicating with customers, Public Service uses several overarching key messages including:

- Energy efficiency reduces operating costs and improves the bottom line.
- Public Service helps lower energy bills by offering rebates and incentives for installing highly efficient equipment, using energy-saving building designs and optimizing existing equipment to maximize comfort and energy savings.
- Rebates and incentives shorten payback periods for energy-efficient equipment and systems, providing lasting savings for years to come.
- Energy efficiency helps reduce environment impacts.

Public Service also markets its products differently to the various business sub-populations, depending on the target audience. Each of these target audiences are identified by key shared characteristics before analyzing their motivations. Once motivations are identified, Public Service can adjust the above key messages to meet the customers' specific needs.

### *Small- and Medium-Sized Businesses*

Small and medium-sized business customers traditionally own or work in buildings in segments such as offices, retail, healthcare, education, lodging, light manufacturing and grocery. They are motivated differently than larger businesses and are busy trying to keep their businesses

successful and running smoothly which means energy is a low-interest category. Small business owners are motivated by how to save money and how to make things more convenient. Key messages used to address these needs include:

- Energy savings go right to profits.
- Partnering with the property manager (where applicable) to employ energy savings can lower energy costs, improve ambiance, and increase the owner's property value.

### *Large Businesses*

Large commercial customers traditionally own or work in buildings in segments such as office, retail, education, healthcare, restaurants, auto dealerships and congregations. These customers recognize the value of environmental responsibility and sustainability efforts; but in doing so want to weave these efforts into their long-term financial strategies. Industrial manufacturing in Colorado is most concentrated in the areas of food and beverage, chemicals, computer and electrics, and machinery. They are highly engaged in getting the most production from every unit of energy, to keep operating costs low and eliminate waste. In all, these customers are the most energy-savvy and are constantly monitoring their equipment and processes. Key messages used to address both these customer groups include:

- Energy is a large part of the operating budget.
- Rebates help reduce up-front costs, shorten payback periods and provide ongoing savings for years to come.
- Energy savings go right to the bottom line as increased profits.
- Investing in energy savings is a smart decision.
- Energy-efficient equipment and systems help increase reliability while decreasing maintenance costs.
- Saving energy helps reduce environment impacts and meet sustainability goals.

### Marketing Tactics

Marketing tactics center on product-specific promotions, solutions-based marketing, and a variety of communications vehicles.

*Product-specific Promotions:* Product-specific marketing efforts tie back to the overriding message, offering specific examples of concrete ways to do more. These examples show customers and trade partners the direct, personal impacts of their efforts, offering examples of energy savings, paybacks and lifetime savings or personal rewards.

*Solutions-based Marketing:* These communications focus on product combinations that offer solutions for a specific customer segment (e.g., schools) or solutions that address common customer concerns (e.g., weather, energy costs, environmental) rather than marketing a single product.

### *Communications Vehicles:*

- Product collateral, including feature sheets, applications, customer case studies, savings calculators, participating vendor lists and cross-product energy-savings guides.
- Newsletters for specific products or cross promotion, such as the Energy Exchange for trade partners and Energy Solutions for Public Service customers.
- Websites.

- Direct mail campaigns for specific product end uses announcing new incentives or for customer education, as well as general direct mail pieces targeted at specific market segments.
- Events, including product and technical training, customer education and customer recognition.
- Speaking opportunities in local industry meetings, business events (i.e. Chambers, National Association of Industrial and Office Properties, and Building Owners and Managers Association) and local conferences.
- Media relations, including free placement in appropriate media, focusing primarily on customer stories and product information and changes.
- Advertising in business magazines, newspapers, the internet and radio spots.

## **E. Program-Specific Policies**

The Company has adopted several general policies that are followed across products in the Business Program. Individual products may have additional, unique policies as noted in each of the product summaries that follow. The general policies provide guidelines; however, they may be altered under specific circumstances and/or for specific periods of time when warranted for promotional events or other purposes.

The program-level policies include:

- *Proof of installation:* All products require documentation of installation, such as proof-of-purchase (e.g., invoices) or a site verification.
- *Payback requirements:* The payback policy for custom conservation products:
  - a. Rebates may be paid on projects with payback of at least 1 year.
  - b. Project payback must be less than the project lifetime, which varies by product and technology.
- *Studies:* Study funding cannot exceed 75% of the study cost and studies must be completed within three months.
- *Load Shifting:* Load shifting occurs when a measure shifts electrical energy and demand usage to an off-peak period, without necessarily reducing the total load served over a defined time period. Potential load shifting projects need to meet all existing eligibility requirements of the applicable product as well as additional persistence requirements.
- *Study-Driven Savings:* If a customer implements measures that are less than a one year payback, they will not receive a rebate, but Public Service will claim the study-driven savings regardless. The Company believes that our financial and technical help in identifying and/or analyzing energy efficiency measures provides sufficient influence on the customer's decision to implement those measures.

## **F. Stakeholder Involvement**

Since 2009, the primary avenue for external party involvement has been the quarterly DSM Roundtable Meetings. The Roundtable Meetings are open to all interested parties who want more

information on Public Service's DSM products and would like to provide feedback into the design, planning, and implementation of the products.

Beyond the Roundtable Meetings, each DSM product manager involves applicable trade allies and other stakeholder groups, as needed, in the development of the Company's products. The Company also participates in regional and national efforts to design and develop the best DSM products for business customers. For example, participation in the Consortium for Energy Efficiency's (CEE's) planning and research efforts to promote energy efficiency technologies.

In 2014, the Company launched the *Partners in Energy* program to support communities in developing and implementing comprehensive energy action plans. The Company continues to work with local community partners through this initiative, to reach out to businesses to support them in reducing their energy consumption by participating in the Company's DSM products. This innovative approach will give local businesses greater access to DSM resources through non-traditional channels. This approach leverages joint marketing opportunities and community momentum to drive additional customer participation.

## **G. Rebates & Incentives**

Business rebates are offered for custom and prescriptive products to promote high efficiency technology implementation. Rebates and incentives vary by product and can be offered to customers, vendors, distributors and manufacturers. The Company may also decide it prudent to offer bonus rebates to customers and/or trade partners to boost participation if implementation lags and budget allows.

Indirect products, such as Business Energy Analysis and Business Education support participation in business DSM products.

## **H. Evaluation, Measurement & Verification**

The specific product measurement and verification plans are described in the EM&V section of this Plan; and products that will undergo comprehensive evaluations in 2019 or 2020 are also noted that section.

## ➤ Commercial Refrigeration Efficiency

### A. Description

The Commercial Refrigeration Efficiency product offers refrigeration maintenance and upgrades to commercial customers with significant refrigeration loads, notably restaurants, and grocery, convenience, and liquor stores. Refrigeration systems in these targeted facility types typically account for over 50% of the building's energy use and run 24 hours per day, year-round.

This product consists of five major components:

1. *Free Onsite Energy Assessment* – Each customer will be offered a free onsite facility energy assessment and walk-through to identify and explain key energy efficiency opportunities. The assessment will be performed by a third-party implementer. A copy of the assessment report will be provided to the customer, and will include a prioritization of identified opportunities.
2. *Direct Install for Immediate Savings* – While onsite for the energy assessment, the third-party implementer will perform free installation of the following energy savings measures, where applicable:
  - a. Screw-in LEDs for walk-in coolers/freezers;
  - b. Pre-rinse sprayers for restaurant and commercial kitchens;
  - c. Aerators in public restrooms and kitchen sinks; and
  - d. Additional installed measures may be added in the future if deemed cost-effective to the product
3. *Full Coil Cleaning* – As part of the onsite visit, the third-party implementer will perform a free coil-cleaning service, including materials and training for self-contained equipment. Since coil cleaning should be performed annually, customers will be provided with a coil cleaning brush, an instructional “How-To” sheet, and an onsite tutorial, to equip them with the tools and knowledge to complete this task on a regular basis using in-house staff. The Company will claim energy savings for the initial cleaning performed onsite by the third-party implementer.
4. *Rebated Refrigeration Measures* – These measures are the core of the product offering. In order to qualify for the rebate, the equipment must be professionally installed. These measures include:
  - Enclosed Reach-in Cases: Rebates will be available for reach-in cases with doors when the customer replaces existing open multi-deck cases with equivalent storage (cubic feet or linear feet) or adds doors to existing open multi-deck cases.
  - Walk-in Electronically Commutated Motors (ECM): Rebates will be available for the replacement of evaporator fan motors with new, more efficient motors, (typically ECM) in walk-in coolers and freezers where none previously existed.

- LED Case Lighting: Rebates will be available for the installation of LED case lighting, including horizontal and vertical solutions, to replace existing mixed populations of older lighting technologies.
- Anti-Sweat Heater Controls: Rebates will be available for efficient anti-sweat heater controls installed on existing commercial cooler and freezer doors to prevent the door from fogging or having condensation buildup on the glass.
- Floating Head Pressure Controls: Rebates will be available for floating head pressure controls through the custom process. The floating head pressure control will control the compressor pressure based on outside temperature.
- Demand Controlled Ventilation: Rebates will be available for kitchen only, if hoods are located elsewhere they may be eligible through the custom product. These are available for electric only, gas only and combo customers.
- Dishwashers: Rebates are available for new equipment only, refurbished equipment will not be rebates. Both under counter and doors qualify.

5. *Turn-Key Services* – The customer will be provided with proactive project management, by the third-party implementer, to assist with the implementation of prescriptive projects, including coordination between the customer, Public Service, and the installation contractors/trade allies to complete the improvements and submit rebate applications.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The energy savings targets for this product were derived from the process evaluation completed in 2017, as well as historical data, market data, and equipment deemed savings values.

Based upon the evaluation both customers and trade partners will be targeted more aggressively to educate and create awareness around the Commercial Refrigeration Efficiency product as well as its offerings.

### Budgets

Public Service plans to work with a third-party implementer to provide this product. The forecasted expenditures in 2019 and 2020 are based on projected participation levels, promotion, and administration expenses. The majority of the product costs are for administration, vendor marketing/training, and customer rebates.

## **C. Application Process**

The Company plans to promote the product through the outreach efforts of a third-party implementer. Secondary outreach is likely to occur through the Company's Account Managers, Business Solution Center's (BSC) Energy Efficiency Specialists, contracted trade allies, and/or other marketing efforts such as mailings, newsletters, and the Company website.

The application process will include:

1. *Customer Intake:* The Company will work with the third-party implementer to establish and follow a set protocol for receiving and qualifying customers who are interested in this product. Interested customers will be contacted to schedule an installation/assessment.
2. *Identify Opportunities:* After completion of direct installation measures, the third-party implementer will use the assessment results to work with the customer and Public Service to identify deeper prescriptive savings opportunities.
3. *Turn-Key Support:* The third-party implementer will offer proactive project management to assist with implementation of the prescriptive rebate projects, including coordination between the customer, the Company, and the installation contractors/trade allies to complete projects and submit rebate applications.

## **D. Marketing Objectives & Strategies**

The marketing strategy for Commercial Refrigeration Efficiency is built upon the Company's and the third-party implementer's experience working in the Colorado market. The strategy incorporates best practices learned from similar refrigeration programs offered across the United States, and is integrated within the Company's larger marketing efforts. The Company and third-party implementer will develop targeted marketing collateral that may include sell-sheets, direct mail, email communications, case studies, and leave-behinds.

The third-party implementer will use education and training to market the product while building trade ally and customer knowledge about energy efficiency technologies and encouraging better energy decisions.

*Marketing Channels:* The third-party implementer will use several marketing channels for the product, including:

- Product Field Staff: Field staff will be the on-the-ground marketing team, conducting targeted outreach to relevant customer groups and industry associations in addition to working directly with customers.
- Account Management and BSC Staff: The third-party implementer will build relationships with Public Service's Account Managers and BSC staff to drive customer participation. The product will also be promoted to select Lighting–Small Business product participants to offer more comprehensive savings opportunities, where applicable.
- Trade Partners: The third-party implementer will engage trade partners as early as possible through training to increase their ability to reach customers at an appropriate time so that the product can influence a buying decision.
- Direct Marketing: Public Service will work with the third-party implementer to incorporate marketing materials into product training sessions, direct mailings to target customer segments (grocers, restaurants, convenience and liquor stores), and distribute at targeted locations.
- Industry Associations: The Company will work with the third-party implementer to develop relationships and marketing strategies with food service, sales associations and

liquor store associations to target the major players within the commercial and industrial refrigeration customer segment.

## **E. Product-Specific Policies**

Commercial Refrigeration Efficiency has the following product-specific policies:

- All rebated equipment must be new and meet all product rules and requirements. The rebate application must be submitted within 12 months of the invoice date.
- Rebates assume a one-for-one replacement of retrofit fixtures that will result in energy savings.
- The product is available to retail business customers with electricity and natural gas service, or electricity service only. Natural gas-only customers are not eligible.

## **F. Stakeholder Involvement**

There are relatively few trade allies who specialize in refrigeration, but Public Service will target this network, and use other marketing outreach as described in *Section D* above, to ensure that all qualified organizations have the opportunity to participate.

## **G. Rebates & Incentives**

Customers may apply for prescriptive and custom rebates for qualifying equipment. Third-party implementer services and direct installations will be performed at no additional cost to the customer.

## ➤ **Compressed Air Efficiency**

### **A. Description**

The Compressed Air Efficiency product helps customers address inefficiencies in their compressed air systems. The product encourages repair and redesign of existing systems, and encourages the purchase of efficient options for new and replacement systems. The product has three components:

1. Prescriptive rebates for the most common high-efficiency options such as no-loss air drains, cycling dryers, purge controls, mist eliminators, and for certain variable frequency drive (VFD) compressors;
2. Rebates for studies that help customers identify efficiency opportunities from fixing leaks as well as from redesign or replacement of system components; and
3. Custom rebates for implementation of unique improvements identified by studies, improvements can include capital purchases, such as qualifying compressors and “process” changes, such as piping modifications or horsepower (hp) reductions.

Rebates are available for any size of compressed air equipment through the product’s custom component. For equipment over 50 hp, customers are advised to complete a system study prior to submitting an application for a custom efficiency rebate. Examples of equipment replacement that may qualify for the custom rebate include:

- Replacing a 40 hp compressor with a 50 hp compressor;
- After completing a compressed air study, replacing an existing 150 hp air compressor with two 75 hp compressors and controls; and
- After completing a compressed air study, replacing an existing 150 hp air compressor with a 150 hp VFD compressor.

The Compressed Air Efficiency product is available to all electric commercial and industrial customers within the Company’s service area. The primary participants are mid-sized business customers that have some or all of the following characteristics:

- Demand of 100+ kW, and/or
- Operate within energy-intensive industries (e.g., food processing, mining, etc.).

In addition, there is a secondary target of small business customers that may have some or all of the following characteristics:

- Limited internal resources to purchase, install and finance projects;
- Limited technical expertise; and/or
- A focus on short-term paybacks.

Members of the trade are also targeted to increase product education and engagement, including equipment manufacturers and installers, as well as design engineers and electricians.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Participation and savings targets were established in light of recent product trends and experience, including performance from 2013 through 2017. Trade feedback, an evaluation of potential customers within the Colorado service territory, and results from the product's 2014 comprehensive evaluation also informed target-setting.

### Budgets

Historical budgets were analyzed to project the product budget for 2019 and 2020. Other factors such as planned promotions, trainings, and staffing influenced deviations from historical trends. The budget is largely driven by rebates and internal labor, as well as consulting fees. Specifically:

- *Rebates* – The budget for rebates is established by estimating participation for the product and applying the rebate amounts per kW and kWh.
- *Internal labor* – Compressed Air Efficiency is a labor-intensive product. It is one of the few products in Colorado that has prescriptive, study-based, and custom components. The study and custom components require Xcel Energy staff to conduct detailed analysis for preapproval of each potential project. Labor is typically 25% to 30% of the product cost.
- *Consulting* – A consultant provides measurement and verification (M&V) services, as needed.

## **C. Application Process**

Customers can learn about the product through various channels, including from a Public Service account representative, compressed air vendor, website literature, or product advertising. Applications must be signed by the customer, but can be submitted by customer representatives including building owners, contractors, engineering firms, energy services companies, and equipment vendors. Typically, the customer or a vendor selling to the customer identifies a project and starts the application process described below.

### **Compressed Air Prescriptive Measures**

For prescriptive measures, the application process is similar to other prescriptive products:

- Customers may apply for rebates by completing and signing the application and providing an itemized invoice for the installed equipment. The equipment must be new and meet all the qualifications detailed on the application. The customers may submit a rebate application within twelve months after the invoice date. Once the paperwork is completed and submitted, rebate checks are mailed to the customer, or alternative rebate recipient, within six weeks, as indicated on the application.
- The replacement compressor must be for a new variable speed drive compressor with horsepower that is less than the replaced load/no-load or inlet modulation compressor or a new air compressor with a factory integrated variable speed drive qualify for prescriptive rebates. If the retrofit or new compressor does not meet the requirements or

is greater than 49 horsepower, customers may apply for preapproval through the custom product.

- The replacement or installment of a new refrigerated cycling dryer must be 75 SCFM to 2799 SCFM and must not be used as backup. Non-cycling refrigerated dryer are not eligible. The replacement or installment of a new mist eliminator filter must be 500 SCFM to 2299 SCFM and must not be used as backup. The rated pressure drop of all mist eliminators must be 0.75 pounds per square inch gage or less over the lifetime. The installment of only new dew point controls (purge controls) must be for systems that are 90 SCFM to 2499 SCFM and cannot be used as backup. Dryers must have a dew point sensor at discharge to monitor demand and only desiccant heatless dryers are eligible. Anything that doesn't meet the requirements listed above would be processed through the custom product.

### **Compressed Air Studies**

In order to begin the study process the customer will first obtain a study estimate from a participating compressed air vendor/contractor. A list of eligible participating providers and trade partners is available on the Company's website.<sup>23</sup> The customer submits the Compressed Air Efficiency study application and the proposed cost of the study to a Company Account Representative. To receive preapproval, the study application must propose to include the following components:

- An ultrasonic leak survey to locate and tag air leaks, and estimate the cost of inefficiencies due to system leaks and misuses;
- An efficiency report with system recommendations and estimate of energy cost savings due to each recommendation;
- Characterization of major compressed air system components including:
  - Compressor ID, model, manufacturer, nameplate hp, motor nameplate hp type, capacity, pressure rating in psig age, and control type;
  - Compressor motor size, efficiency, and age;
  - Type, capacity, and age of dryers and other conditioning equipment;
  - Type of automatic compressor controls, if any;
  - Description of major compressed air end uses;
  - Location and layout of piping and major system components; and
  - Inspection of compressed air system components and identification of problem areas.
- Identification of system loading of major compressed air users including size, frequency, and duration of use;
- Measurement of power, pressure and flow for a minimum of seven days for all systems;
- Summary of the results of the leak and unregulated demand inspection, including the location and approximate size of each leak;
- Summary of the execution steps and cost estimate to repair the leaks, unregulated end-uses and inefficient compressed air applications;

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<sup>23</sup> <http://www.xcelenergy.com/staticfiles/xcel/Marketing/Files/CO-Bus-Compressed-Air-Participating-Providers.pdf>

- Recommendations for improvements to customer's maintenance procedure and equipment retirement/replacement schedules; and
- Recommendations for follow-up actions to improve operation and efficiency, including the installation of new equipment.

To receive the study rebate, the completed study report must show data was collected on the preapproval date or within the allotted preapproval timeframe. The customer must repair at least 75% of the air loss due to leaks as identified by the study and included in the completed report. Once the customer has repaired the leaks, the customer will inform their Account Representative. The customer and Account Representative review the list of identified leaks and note the repair status of each leak. The customer and Account Representative both sign the verification section of the application and submit it to the product manager along with copies of invoices and other required information as stipulated in the preapproval letter.

### **Custom Compressed Air**

If the customer chooses to implement recommended capital improvements to the compressed air system that do not qualify for prescriptive rebates, they may apply for preapproval of their project through the Company's Custom Efficiency product application process. Please see the [Custom Efficiency](#) product section of this Plan for a description of the process to be followed.

## **D. Marketing Objectives & Strategies**

Account Representatives and compressed air vendors are the primary marketing conduits for this product and will market the product through their direct relationships with customers. In addition, the following strategies will help meet product targets in 2019 and 2020:

Targeting Industrial Customers. Industrial customers make up a sizeable market that has the potential to bring in large compressed air projects. The Company targets these customers with direct contact (which may include mailings, email blasts, etc.) to create awareness and answer questions about the product.

Leveraging Trade Partners. The trade partners operating in Colorado are a significant factor in the success of this product. Working directly with these trade partners helps to identify potential participants early in the planning stages of a project. The Company continually strives to demonstrate how incorporating incentives into trade partners' bids can be a benefit to their businesses.

Competition amongst the small group of vendors is high due to the mid-to-large industrial/manufacturing markets targeted. Therefore, the Company trains each trade partner individually. Throughout 2019 and 2020, training with trade partners will continue. The trainings provide a forum to review the vendor's work, make recommendations for a better end-product, and solicit feedback on the effectiveness of the Compressed Air product.

Delivering Marketing Collateral. Marketing collateral is an important tool to provide customers with useful, easy to follow guidelines for the product. The Company continuously solicits feedback from customers and trade partners to improve these materials. Collateral is

available for customers, trade partners, and others. Customers and trade partners can request hard copies of the material or they can access material on Xcel Energy's website. The collateral includes:

- **Compressed Air Information Sheet** – Helps describe the product to customers and trade partners. Provides examples of projects that may qualify, business reasons to participate, and a summary of the procedures to follow.
- **Compressed Air Application (for qualifying prescriptive measures)** – Lists qualifying prescriptive measures. The customer fills out several sections including technical information related to the proposed and existing equipment.
- **Compressed Air Study Application** – A document that customers fill out to start the process of participation. The customer or vendor is asked to fill out several sections including information about the location, applicable rates, project description, equipment supplier, technical information about existing and proposed equipment, and project verification.
- **Participating Study Providers List** – A list of trade partners who have submitted studies in the past or expressed an interest in participating in the product. The list is provided for the convenience of customers who do not have a working relationship with a vendor. The Company does not endorse any particular provider over another and is willing to amend or add partners as the market changes.
- **Compressed Air Study Template** – A detailed example of a study that is comprehensive and provides value to customers' energy saving efforts.

## **E. Product-Specific Policies**

Compressed Air studies and custom projects require pre-approval before purchase and installation. This process helps to minimize free ridership and it ensures the technical and financial soundness of projects that are awarded rebates. All compressed air equipment projects must have a payback period over one year.

The system requirements include:

- Electrically driven compressed air systems;
- Minimum 50 hp total installed air compressor capacity (excluding backup equipment); and
- Systems must operate at least 40 hours per week (2,000 hours per year).

## **F. Stakeholder Involvement**

Customers, trade partners, and other stakeholders are currently engaged at the specific project level. Feedback is garnered individually from each participant and once a trend develops (positive or negative), the Company makes a change to the product design. If it is a small change, it is then discussed internally and possibly with a few key trade partners and, if deemed

acceptable, implemented. A larger change would possibly involve review by the product's external technical resources or other third-party.

## **G. Rebates & Incentives**

The Compressed Air Efficiency product helps customers lower operating costs by offering rebates on compressed air studies and by providing rebates on compressed air equipment. Rebates apply to new and leased equipment, but not to used equipment. All rebates are subject to Product-Specific Policies (Section E above) and Business Program Policies.

Study rebate levels are described in Appendix H: Technical Reference Manual and are described in the study funding application as well as on the Company's website.

Prescriptive rebates for compressed air equipment are available for no-loss air drains, cycling dryers, mist eliminators, dew point controls, and select variable speed drive compressors. Prescriptive rebate levels are shown in the Appendix H: Technical Reference Manual, on the rebate application, and on the Company's website.

In 2019 and 2020, the product will begin rebating customers based upon the marginal energy value of the energy savings.

## ➤ Cooling

### A. Description

The Cooling product encourages Public Service business customers to consider high-efficiency options when choosing to replace existing cooling equipment. Cooling is typically the second or third largest user of electricity for business customers.

The Cooling product offers a broad range of prescriptive rebates for high-efficiency equipment options. Some cooling solutions require individual “custom” evaluations to determine the savings and rebate potential; those projects follow the guidelines of the Company’s [Custom Efficiency](#) product.

Prescriptive participants receive rebates to help buy down the initial capital cost and shorten the payback period. The new equipment also provides better reliability and lower maintenance costs, as well as lower utility bills via energy savings. Public Service reviewed and adopted best practices for DSM product development and product structure from across the country. The Company currently follows the guidelines of the International Energy Conservation Code (IECC) 2015 for equipment definitions, standard formulas, and minimum recommended efficiencies. These sources, along with Public Service’s historical experience, allowed the Company to develop influential prescriptive rebates that encourage the most efficient choice of equipment in the majority of equipment categories.

Midstream measures under this product are designed to deliver incentives to market actors who sell qualifying high-efficiency HVAC equipment by increasing stocking levels and upselling. The Midstream measures are designed to adapt to market changes, and the Company will continue working with relevant industry players to enhance the product to include new midstream incentives for “beyond-code efficient” equipment. In 2019 the product will explore working with contractors to promote additional measures.

### B. Targets, Participants & Budgets

#### Targets and Participants

Cooling targets are based on the achievements of past years, estimates of market penetration, and a review of potential cooling technology efficiency improvements.

Participation was derived from prior years’ (2017 and 2018) performance. Additional factors included feedback from trade partners, product participation trends, average project size, and historical participation.

The Midstream offering includes a variety of non-incentive services intended to support customers and contractors in achieving greater energy efficiency from HVAC upgrades. Such services include:

- Education, system performance training, and sales tools for contractors on high-efficiency cooling components, controls, and features on packaged HVAC units. Trainings will include sales, marketing, cost-effectiveness (ROI), and financing of these features.
- Improved comfort and indoor air quality for customers.

### Budgets

Historical cost and participation information was analyzed to project expenditures. External resources and discussions with local stakeholders were used to ascertain expenditures and market equipment cost. Comparative spending analysis of past-year activity is generally conducted but is not the determining factor, since other external variables like promotions, materials, and staffing influence future costs.

Rebates, incentives, labor, and promotions influence the budget:

- *Rebates:* Developed using the average project rebate cost from the detailed technical assumptions, multiplied by anticipated participation levels.
- *Administration:* Determined by estimating the number of full-time employees needed to manage the product and execute the marketing strategy and rebate process, including Account Management and Business Solution Center (BSC) support.
- *Promotions:* The estimated promotional budget anticipates several customer and trade partner communications and events during the year.

For the midstream offering, external resources and discussions with local stakeholders are leveraged to establish the market potential for HVAC equipment. Incentives and third-party implementer costs influence the budget:

- *Incentives:* Midstream incentives to HVAC distributors influence the sale of high-efficiency products to contractors, thereby increasing the availability of these products for customers in the marketplace.
- *Administration:* A third-party implementer will facilitate recruiting and management of distributors, design and management of the web-based paperless rebate application, and process individual applications. Internal administration and advertising costs are minimal; Account Management and BSC budgets are not required. Rebate Operations costs are minimal.

## **C. Application Process**

### *Prescriptive Measures:*

Applications for the product are available from trade allies and on Xcel Energy's website.<sup>24</sup> Customers may apply for rebates by completing the prescriptive Cooling application and providing a detailed purchase invoice for the newly installed equipment. The equipment must be

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<sup>24</sup>[https://www.xcelenergy.com/programs\\_and\\_rebates/business\\_programs\\_and\\_rebates/equipment\\_rebates/cooling\\_efficiency](https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/equipment_rebates/cooling_efficiency)

new and meet all the qualifications detailed on the application. After the customer has installed the equipment, the application and invoice must be submitted to Public Service within twelve months of the invoice date. Applications may be mailed to Public Service or submitted directly to participants' Account Manager or the BSC. Once the paperwork is received and processed, rebate checks will be mailed to the customer, or alternate recipient, as indicated on the application, within six to eight weeks.

*Midstream Incentive:*

A critical component of the midstream measure is its use of a web-based paperless application. A paperless system is critical for ease of participation and for reducing the cost per kWh saved. Incentives will be paid to participating distributors on a bi-weekly basis. The distributor must submit the following information into an online application in order to receive the incentive:

Qualifying Equipment Information:

1. Manufacturer
2. Model
3. Number of units installed
4. Unit Serial numbers

Installation Site Information:

5. Business name and address where the equipment is to be installed
6. Contact information (customer, or contractor, or installer)

Sales Information:

7. Invoice number and date

*Custom Cooling:*

Customers with projects that save cooling energy, but do not have a corresponding prescriptive rebate, can submit custom cooling projects for evaluation under the Custom Efficiency product, with preapproval.

The sales cycle for cooling projects is typically influenced by the size and complexity of equipment. It may take two years to study, purchase, and install a new, large system, while smaller rooftop units (RTUs) can take only two weeks to replace. For this reason, the Cooling product makes every effort to remind customers to evaluate high-efficiency options when they are faced with a purchasing decision.

## **D. Marketing Objectives & Strategies**

The Cooling product creates a base level of knowledge in the marketplace through newsletters and direct mail to customers and trade allies. These tactics make customers aware of the key benefits of energy efficiency and its applicability to cooling systems, and gives the trade a platform from which to educate customers on high-efficiency solutions for their particular applications. The product provides literature and tools for the customers and trade to evaluate rebates and incorporate them into purchase decisions. In addition, customers are served by Public Service's Account Managers and BSC who educate them on energy efficiency, evaluating rebate

potential, and the rebate application process. The trade can find similar assistance through the Trade Relations Manager. The Cooling product also benefits from opportunities identified for participants via the Company's Business Energy Analysis and Recommissioning products.

Marketing communications will revolve around the benefits of energy efficiency through paybacks, lifecycle costs, and environmental benefits. Newer cooling equipment is typically more efficient, more reliable and may have more effective controls than an older system providing both energy and non-energy benefits to the end user. Public Service uses generally-accepted information from sources such as ENERGY STAR<sup>®</sup>, the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), the Federal Energy Management Program (FEMP), and others to educate customers on no- and low-cost ways to save energy, such as performing regularly scheduled maintenance and simple tune-up tips to ensure systems are operating optimally.

To reach its energy savings target, Cooling needs to continue to evaluate new products and processes. Custom cooling strategies, such as ice storage, have been identified as an area of growth offering significant on-peak savings. Additionally, midstream participants have identified several opportunities to increase the number of custom opportunities. Therefore, the product will also seek to explore options to utilize the current midstream approach, offering participants to identify additional custom projects and may explore incentives through midstream market actors to promote these opportunities. The midstream offering currently provides rebates to distributors to promote high-efficiency equipment.

### **Why target distributors?**

1. Distributors control equipment stocking and sales.
2. Influence contractors' purchase decisions which influence customer purchases.
3. Minimize downstream markups and lost opportunities.
4. Fewer market actors enable lower implementation costs.
5. Meets customer's demand for immediate replacement.
6. Distributors influence majority of equipment sales.
7. Most qualified sales staff with financial, technical, and sales skills.

The product will explore adding additional measures for contractors as a part of the midstream offering. Contractors have constant interaction with HVAC systems during installation and maintenance services. This puts them in a unique position to identify potential system improvements and insure quality throughout the system. These measures will fall into three possible categories:

- 1) System Performance Improvements – System performance improvements center around the field measurement and testing relative to the proposed ASHRAE Standard 221P: Test Method to Field-Measure and Score the Cooling and Heating Performance of an installed unitary HVAC system. The testing allows a contractor to determine the current performance of the system, which will help identify needed improvements, implement those improvements, and then retest system performance.
- 2) Accelerated Replacement (AR) – focuses on replacing inefficient HVAC equipment before it would normally be replaced. Many HVAC units can operate for many years

after their designed effective useful life, and in many cases building owners choose to repair units and replace parts instead of purchasing a new unit. An AR offering can work to identify these units and offer incentives and training to encourage the replacement of these units.

- 3) Prescriptive Measures – Prescriptive measures for contractors may include add-ons to existing HVAC systems such as Advanced Rooftop Controllers (ARC), improved economizers, or other controls technologies.

## **E. Product-Specific Policies**

The prescriptive Cooling product does not rebate back-up equipment because deemed energy savings will not be realized. In addition, portable equipment is not eligible for a rebate.

For the midstream approach:

*Qualifying Distributors:* A qualifying distributor is an entity that purchases qualifying equipment directly from the manufacturer and sells such equipment to be installed at a qualifying customer's facility. A vendor who purchases equipment from a distributor does not qualify. Under certain circumstances, a manufacturer and/or a manufacturer's representative may serve as its own distributor and sell directly to the end-use customer. In this case, the manufacturer/distributor can qualify.

*Qualifying Customers:* Must be commercial electric customers in Public Service's service territory.

*Qualifying Equipment:* Qualifying equipment must be new and permanently installed at the end-use customer. Current qualifying equipment includes RTUs, split systems (including fan coil units) consisting of one evaporator and one condenser, condensing units, packaged terminal air conditioners/heat pumps, water source heat pumps, air-cooled chillers, and ductless mini-split systems. Downstream rebates will not be available for these equipment types.

## **F. Stakeholder Involvement**

Because cooling systems can be very complex, trade partner support is imperative to achieving the product's energy savings and participation targets. The Company has engaged trade allies in product design and improvement through focused trainings and outreach events. Members include manufacturer's representatives, and equipment contractors.

A successful market transformation offering — the midstream approach — rests on the coordination of efforts across many stakeholders. The most successful market transformation offerings have involved multiple organizations, providing overlapping market interventions.

## **G. Rebates & Incentives**

Most of the components of the product provide prescriptive rebates based on the size of the unit in tons combined with an efficiency bonus to encourage customers to exceed minimum qualifying efficiencies.

Generally, Public Service has set the minimum qualifying efficiency at a point that nominally exceeds the IECC 2015 minimum efficiency requirements to encourage customers to purchase the most efficient equipment, while ensuring that manufacturers have equipment that meets the criteria of the product.

The proposed rebate level averages approximately 60% of the incremental cost. This level balances the cost-effectiveness of the product with the incentive needed to motivate the customer to purchase efficient equipment, achieving a payback of less than five years in most cases. Rebates are designed to buy down the incremental cost of purchasing efficient equipment, which is increasing with the stricter code requirements in the market.

The midstream approach provides distributor incentives based on the size of the unit in tons.

## ➤ Custom Efficiency

### A. Description

The Custom Efficiency product offers custom electric and gas rebates to all business customers who install qualifying energy efficiency measures not covered under traditional prescriptive products.

The product also provides study funding up to 75% of the study cost—not to exceed \$25,000—to help customers identify project savings.

Interval usage data provided by advance metering will enhance the pre and post evaluation of custom projects and will help to identify how the customer is using energy.

Many types of energy saving measures may not be eligible for a prescriptive rebate, but could be eligible for a custom rebate, including, but not limited to, the following:

<b>Equipment</b>	<b>Application</b>
Compressed Air	New equipment, reduction in horsepower (hp) of compressors, storage, vacuum pumps, and variable speed drive compressors, reduction of compressor run time
Controls	CO <sub>2</sub> based ventilation, compressed air and refrigeration controls
Cooling	Heat recovery, process cooling and controls
Lighting	Lumen output changes, exterior lighting, LED and daylighting, retrofits (not one-to-one)
Miscellaneous	Energy efficient windows (film, argon, Low E), humidification, insulation, printing presses, welders, and elevator modernization (DC to AC motor conversion)
Motors & Drives	Motors > 200 hp, Drives > 200 hp, any motor type outside the prescriptive parameters, and Drives for non-fan, non-pump processes.
Refrigeration	Ammonia compressors, freezer doors, and evaporative condensers
Process changes	<ul style="list-style-type: none"><li>• New system produces more output than the old system while using the same amount of energy as the old system.</li><li>• New system produces the same output as the old system using less energy.</li><li>• Reconfigure system layout.</li></ul>
Load Shifting	Ice Storage and other load shifting technologies.

### B. Targets, Participants & Budgets

#### Targets and Participants

The energy savings target was determined by looking at both historical performance and projects that are currently in the product pipeline, as well as consideration of current economic conditions.

The participation target was derived from historical product performance over the last three years, in particular from the 2017 average project size and mix of custom technologies.

### Budgets

Historical cost and participation information is tracked and analyzed to project future expenditures. For the Custom Efficiency product, administration, advertising, and customer rebates are the primary budget drivers:

- *Administration:* Custom Efficiency is a labor-intensive product due to the intensive pre-approval process and analysis components.
- *Advertising:* The budget supports marketing of DSM resources to business customers.
- *Rebates:* The budget for rebates is established based on an estimation of participation levels, multiplied by the rebate per kW amount in the technical assumption models.

## **C. Application Process**

The application process for custom projects is more involved than those for prescriptive measures. Each custom project must meet specific eligibility requirements. This process can be broken into distinct steps: Application Submission, Project Analysis, Project Acceptance or Rejection, and Project Completion:

### *Application Submission:*

Account Managers and/or the BSC work with a customer and their vendor to identify a project with energy efficiency opportunities and start the application process. In addition to the two-page application which must be signed by the customer, an electronic “workbook” must be filled out with a detailed description of the project.

### *Project Analysis:*

Engineers review the project information and enter pertinent data into a Modified Total Resource Cost (MTRC) test model to determine the projected energy savings, benefit/cost ratio and payback. The model calculates energy savings for various end-uses (lighting, motors, cooling, compressed air, etc.) to ensure consistency in analysis from one project to another. All calculations are based on approved American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) methods or other similar industry standards. Based on the modeled results, the project either passes or fails.

### *Project Acceptance or Rejection:*

Once the engineers have completed the analysis, an approval or rejection letter is sent to the customer. The letter provides critical information regarding the project, including: project rebate amount, project description and costs, energy savings, and any conditions that must be met to receive the rebate (e.g., measurement and verification). Should a project be rejected, a rejection letter is sent to the customer with an explanation as to why the project was not approved.

### *Project Completion:*

When a project is completed, the customer will inform their Account Manager or Energy Efficiency Specialist. The customer and Account Manager or Energy Efficiency Specialist

sign the verification section of the application and submit it along with copies of invoices and other required information as stipulated in the approval letter. If the final documentation matches the approved project information, the project the paperwork is submitted to Rebate Operations for issuance of the rebate.

Occasionally, projects must undergo re-analysis because the final project parameters do not match the original project application. This may be due to minor changes in project scope, changes in final project cost, or the purchasing of similar, but not identical, equipment to what was analyzed during the approval analysis. In these cases, the actual project information will be given to the technical staff for review and re-analysis. The original analysis will be updated with the new information to determine if the project still meets passing criteria. A passing project will be awarded a rebate based on the calculated savings from the updated analysis. A project that fails on re-analysis will not be issued a rebate.

## **D. Marketing Objectives & Strategies**

Marketing is conducted primarily by Account Managers, leveraging their direct relationships with customers. In addition, the Company will use the following strategies to achieve the product's energy savings targets in 2019 and 2020:

- *Target Industrial Customers.* Colorado's industrial base is relatively small, but these few customers offer tremendous opportunity. Many of the opportunities will come from specialized applications or processes requiring a greater insight into the individual customer's operations. To achieve this, the Company relies heavily on leads from Account Managers and outreach to the vendor community.
- *BSC Energy Efficiency Specialists.* The BSC provides direct support to the non-managed commercial customers.
- *Use of Collateral.* Public Service has developed a broad range of marketing collateral for the product; this information is available in electronic format on Xcel Energy's website<sup>25</sup> and in hard copy format for customers, trade allies, and internal Public Service staff. This material is continually reviewed and revised based on feedback from participants and as changes are made to the product. The key collateral includes:
  - Custom Efficiency Brochure – This is the primary tool for Account Managers that helps describe the product to customers and trade allies. It provides examples of projects that may qualify; business reasons to participate; and a summary of the procedures to follow.
  - List of Potential Projects – Project types that have fared well in Colorado and Minnesota serve as the basis for this list. The list includes both electric and natural gas conservation measures.

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<sup>25</sup>[https://www.xcelenergy.com/programs\\_and\\_rebates/business\\_programs\\_and\\_rebates/equipment\\_rebates/custom\\_efficiency](https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/equipment_rebates/custom_efficiency)

- Trade Partner Website<sup>26</sup> – This resource was designed specifically for the Company’s trade allies. It includes all of the collateral indicated above and other helpful information.
- Energy Exchange – A quarterly email newsletter that goes out to all trade allies who have registered to be part of the trade ally network.
- Custom Specific Workshops – Workshops will be conducted for vendors and/or customers to communicate project opportunities specific to custom end-use situations.

## **E. Product-Specific Policies**

All custom projects must have an MTRC ratio of equal to or greater than 1.0; and a simple payback of over one year, and less than the estimated life of the product to be eligible for a rebate. Rebates are capped at 60 percent of the incremental project cost.

## **F. Stakeholder Involvement**

Customers, trade allies, and other stakeholders are engaged at the project level to gather input regarding best practices, methods, and support for evaluating new technologies.

## **G. Rebates & Incentives**

Rebates apply to new and leased equipment. Used or portable equipment are not eligible. To determine eligibility for a rebate, all projects are analyzed as described in the application process. Rebates are calculated based on the demand reduction (kW) yielded by the project. Additional details are identified in the Electric and Natural Gas Forecast Technical Assumptions within Appendix H: Technical Reference Manual. For 2019 and 2020, Public Service will offer an incentive level of \$500.00 per peak coincident kW and \$100 per off-peak kW for electric energy savings projects and \$4 per Dth for natural gas savings projects.

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<sup>26</sup>[https://www.xcelenergy.com/working\\_with\\_us/trade\\_partners](https://www.xcelenergy.com/working_with_us/trade_partners)

## ➤ Data Center Efficiency

### A. Description

The Data Center Efficiency product helps customers address energy conservation opportunities in both new and existing data centers, as well as other computing spaces. This specialized product was designed in response to the significant energy savings potential of these customers and their projected growth in energy use in data centers and computing spaces.

There are numerous ways data centers can become more energy efficient, including:

- High efficiency servers;
- Server virtualization/consolidation;
- Airflow improvements;
- Electrical equipment;
- High-efficiency cooling;
- Humidification;
- Power systems;
- High-efficiency lighting;
- Electrically commutated (EC) plug fans;
- Plate and frame heat exchangers; and
- Virtual Desktop Infrastructures (VDI).

Through a 2018 modification, the Data Center Efficiency product acquired the remaining cost effective measures of the former Computer Efficiency product. Any size data center or computing space may participate. The product encourages a holistic approach to energy efficiency within the data center or data closet or computing space.

For existing facilities, the product provides funding toward an on-site evaluation and analysis and rebates based on the energy savings resulting from implementation. Projects will be analyzed and rebated using a custom model. However, prescriptive rebates for EC plug fans, plate and frame heat exchangers, servers and VDI equipment are available. Data center customers can also apply for prescriptive equipment rebates from other products offered in the Company's DSM portfolio. Data Center prescriptive equipment rebates will also be available to non-data center customers.

For new facilities, the product delivers expert knowledge and resources to help data center owners optimize the efficiency of their facilities during the siting, design and early construction and operation stages of the new data center. Aligned closely with the design of the Energy Design Assistance (EDA) offering within New Construction (for commercial new construction projects), this Data Center offering will provide free consulting during the site selection and design phases of new data center construction projects and provide financial incentives to offset the increased costs of more advanced energy systems. The product commences with the customer's first discussions with the Company regarding siting of a new data center and ends after construction and occupancy of the last in-scope portion of the data center.

Public Service maintains a list of approved study providers to perform data center studies and analysis. Study paths leverage the study providers, who have been provided training on Company tools, to conduct the analysis.

15-minute interval data could show an operator if cooling is adjusting properly to match changes in IT load. It could also be used as a basic indication if fan speeds, compressors or free cooling are adjusting as IT load or outside air changes.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Electric energy savings and participation targets were determined by looking at historic participation and identified projects from the last several years.

In the new construction market, the Company plans to promote this offering to owners and operators of new data center facilities. For 2019, the Company expects two new projects to begin design assistance in this sector.

### Budgets

Budgets were developed commensurate with the electric energy savings target, based on historical cost of achievements. The largest cost in the budget is for energy efficiency project implementation and study rebates.

## **C. Application Process**

Customers learn about the product through a variety of channels, including: the product website, Account Managers and trade partners or study providers. In addition, the Company will identify data center experts to help with education of the product to customers. Product applications are available through all of these channels. Customers may submit an application through their Account Manager or a trade partner or send it via mail or email to Public Service.

Customers building a new data center need to submit their application in the early phases of design to ensure recommended strategies are included in final design plans. The data center design study will follow the New Construction product's Energy Design Assistance guidance for facilities.

Pre-approval is required to receive rebates for studies and custom measures. Prescriptive measures do not require pre-approval and will be rebated for implemented projects.

## **D. Marketing Objectives & Strategies**

The marketing strategy for Data Center Efficiency leverages a variety of channels, including Account Managers, trade relations managers, professional organizations and direct customer

communications. The goal of the Data Center Efficiency product is to build and/or retrofit data centers and computing spaces, with their copious electronic equipment, to be as efficient as possible. Because the market for this product is so specific, Public Service will have Account Management focus on recruiting data center customers to participate. Account Management and a product engineer will work together to maintain contact with data center customers from identification of potential energy saving measures through implementation of the recommended measures. Face-to-face contact with our customer base is necessary to engage them in the product.

The Company will also conduct meetings with study providers and design firms to provide rebate information and other support for customer engagement. The Company will use these meetings to discuss new potential energy saving measures and best practices to encourage energy efficiency in a data center. Additional study providers will be sought after to help data center customers identify potential energy saving strategies at their location.

Soliciting Data Center Efficiency participation has typically required significant marketing effort to influence customers; many are reluctant to make changes to their mission-critical operations and upgrades require agreement across many function areas.

Public Service will offer on-site walkthrough audits of a customer's data center by a product engineer to help identify energy efficiency opportunities. Once the walkthrough audit is complete, the customer will receive a report that describes the identified opportunities and the possible paths for earning a rebate. This offer is intended to generate awareness of the product to data centers that have not previously participated in the product.

## **E. Product-Specific Policies**

### *Existing Facilities*

Customers may perform a study by selecting a pre-qualified study provider<sup>27</sup>. If they select a provider who is not on the Company's list, the new provider will be required to submit qualifications prior to receiving study funding approval.

The Company typically evaluates measures identified within a study as one project, based on the customer's indication to implement all measures included in the project. Pre-approved projects must be cost-effective. If at least two years has passed since a project was approved, the technical staff will re-analyze it to determine if the savings/payback has changed. This re-analysis is conducted prior to issuing a rebate check.

Studies, once pre-approved, need to be submitted to Public Service within three months of issuance of the pre-approval letter.

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<sup>27</sup> <http://www.xcelenergy.com/staticfiles/xcel/PDF/Marketing/CO-BUS-Data-Center-Efficiency-Provider-List.pdf>

### New Facilities

To participate in this measure, customers will work directly with contracted agents of the Company who will facilitate the integrated design and modeling components of the measure. The choice of contracted providers is influenced primarily by the fact that the new Data Center market is highly dynamic and complex. To manage the risk introduced by this complexity, the Company chose to move forward with a limited provider delivery model. As the market evolves, the Company will evaluate the potential to open the consulting services of this measure up to other providers in a manner similar to the existing Data Center Efficiency studies and EDA offerings.

### Computing Spaces

For prescriptive VDI measures and prescriptive high efficiency servers, all equipment rebated through the measure must be new and meet all measure rules and requirements. A minimum of 10 units must be purchased in order to qualify for the rebate. The application must be submitted within twelve months of the invoice date.

## **F. Stakeholder Involvement**

The Company continues to develop collateral and education materials to support the product. As participant feedback is received, suggestions will be evaluated for feasibility of incorporating changes.

The Company has been an active participant in the Consortium for Energy Efficiency (CEE) Data Centers and Servers Initiative<sup>28</sup>. The initiative focuses on collaboration among utilities striving for energy efficiency standards for data center equipment, including knowledge sharing of data center efficiency product development.

Xcel Energy is also a member of AFCOM<sup>29</sup>, the leading association of data center and facilities management professionals.

## **G. Rebates & Incentives**

*Study rebate:* Data Center Efficiency studies for existing facilities will be rebated up to 75% of the data center study cost, not to exceed \$25,000. This cap will be re-evaluated if a very large data center is being reviewed.

*Custom rebate:* Rebates are calculated based on the demand reduction (kW) yielded by the custom project. For 2019 and 2020, Public Service will offer an incentive of \$500 per peak coincident kW and \$100 per off-peak kW.

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<sup>28</sup> <http://www.cee1.org/content/committee-work>

<sup>29</sup> <http://www.afcom.com>

*Prescriptive rebate:*

EC Plug Fans – New Construction	\$700/fan
Plate and Frame Heat Exchanger	\$150/ton
Virtual Desktop Infrastructures (VDI)	\$10/unit
High Efficiency Servers – 400 – 600W Titanium Rated Power Supply	\$5/unit
High Efficiency Servers – 600 – 1000W Titanium Rated Power Supply	\$10/unit
High Efficiency Servers - >1000W Titanium Rater Power Supply	\$20/unit

*Data Center New Construction rebate:* The product will provide rebates on the actual savings of a project based on the times of day the project saves energy compared to the modeled baseline.

## ➤ Energy Management Systems

### A. Description

The Energy Management Systems (EMS) product offers customers consultation and rebates for installing systems that control and reduce a building's energy usage both on- and off-peak. Electric and natural gas customers are eligible for participation in this product.

An EMS is a computer system designed specifically for the automated, centralized control of electromechanical functions within a customer's facility. Typically, the EMS controls a building's heating, cooling, ventilation, or lighting. The system may be referred to as a building automation system (BAS) or the more general term of direct digital controls (DDC). EMS and DDC may sometimes refer to systems that control the customers' process-related equipment for the purpose of energy reduction or demand management.

The product's scope includes only existing buildings or process equipment. For such buildings or equipment, the product incentivizes new EMS and the replacement of non-functional or obsolete EMS. For current systems, additional functionality, software or programming may be incentivized after an acceptable amount of time since any prior rebates. Potential measures that pair well with the EMS product are shown in the table below.

#### EMS Control Strategies

<p><b>Resets</b></p> <ul style="list-style-type: none"> <li>• Supply air/discharge air temperature</li> <li>• Condenser return water temperature</li> <li>• Chilled water supply temperature and pressure</li> <li>• VAV fan duct pressure and flow</li> </ul>	<p><b>Scheduling</b></p> <ul style="list-style-type: none"> <li>• Holiday scheduling</li> <li>• Zonal scheduling</li> <li>• Override control</li> <li>• Night setup/setback</li> <li>• Optimum start/stop</li> <li>• Morning pre-cooling or warm-up</li> </ul>
<p><b>Ventilation Control</b></p> <ul style="list-style-type: none"> <li>• Ventilation control tied to occupancy sensing</li> <li>• Supply air volume/OSAC management</li> <li>• Carbon dioxide sensing</li> </ul>	<p><b>Lighting</b></p> <ul style="list-style-type: none"> <li>• Lighting sweep</li> <li>• Occupancy sensors</li> <li>• Daylight dimming</li> <li>• Zonal lighting control</li> </ul>
<p><b>Miscellaneous</b></p> <ul style="list-style-type: none"> <li>• Simultaneous heating/cooling control</li> <li>• Economizer optimization</li> <li>• Zone-based HVAC control</li> <li>• Chiller staging</li> <li>• Boiler control</li> <li>• Building space pressure</li> <li>• VSD control</li> <li>• Heating or Cooling Lockouts</li> </ul>	<p><b>Demand Control</b></p> <ul style="list-style-type: none"> <li>• Demand limiting, load shedding, or load optimization</li> <li>• Duty cycling</li> <li>• May be used for controllable load demand response</li> </ul>

## **B. Targets, Participants & Budgets**

### Targets and Participants

EMS energy savings and participation targets were established considering recent product trends, average project size, typical project costs, and the product's historical performance. The resulting targeted participation was decreased slightly in each year, compared to the prior plan. Recent trends contributing to the new targets include:

- Increases in the customer costs-per-retrofit project, which contributes to lower pass-rates for custom analysis;
- Trade partner focus on the territory's booming new construction market; and
- Decreasing addressable market of older existing buildings of the target size.

The target for EMS's marketing activities includes the owners or managers of existing commercial buildings that:

- Have not installed or upgraded controls systems for at least 10 years;
- Have one entity that incurs the energy costs (without individually metered tenants); and
- Are of sufficient size to likely have acceptable energy savings compared to costs, which tend to be buildings of at least 100,000 ft<sup>2</sup>.

To target smaller buildings, the Company may adjust processes or standardize certain calculations related to lower-cost systems. The Company will implement only those adjustments that are designed to be cost-effective and meet established engineering standards.

### Budgets

Anticipated participation levels guided budget development. Historical costs were also considered, but administrative and promotional costs were substantially reduced. The product's budget is driven by rebate and labor costs:

- Rebates – The budget for rebates is estimated using historical data and analyzing anticipated payouts per kW, kWh, and Dth.
- Internal labor – EMS is a labor-intensive product due to the preapproval process and analysis component of the product.

## **C. Application Process**

The application process for the EMS product is similar to the Custom Efficiency product or end-use study where each project is individually analyzed and preapproved prior to installation. Applications must be signed by the customer but can be submitted by other participants including: building owners, contractors, engineering firms, energy services companies and equipment vendors. The general application steps and requirements are as follows:

### 1. Application Submission

Typically, the Company's account management team works with a customer and their vendor to identify a project with energy efficiency opportunities and starts the application process.

The application form is available from Account Managers as well as on Xcel Energy's website.<sup>30</sup> The scope of work (SoW) provided by the vendor to the participating customer must be included with the application form submitted to the Company. A well-defined SoW must include enough detail to allow the Company's internal engineers to analyze the savings opportunities. Details should include at minimum:

- *General Building Information* – Total building square footage as well as square footage to be controlled, year built, building use type, and annual electric and natural gas use.
- *Type of Equipment In Use* – Includes lighting fans/air handling, cooling and heating, and each piece of equipment's specifications and operating conditions.
- *Process* – Existing and new connected kW and operating hours; existing and new gas BTU/h and full-load hours.
- *Controls* – Existing and new temperature setbacks and resets, outside air optimization, DDC conversions, variable air volume boxes.

## 2. Application Review

Upon receipt of a completed application (along with a scope of work), the application is reviewed for completeness and the project is entered and tracked by the Company's DSM management system.

## 3. Project Analysis

The Company's engineer completes an initial analysis of the project application.<sup>31</sup>

The engineer reviews the project information and enters pertinent data into a spreadsheet model to determine the projected energy savings, benefit-cost ratio and payback. The model enables consistency in analysis from one project to another. EMS calculations are based on approved American Society of Heating, Refrigerating, and Air-Conditioning Engineers methods or other similar industry standards.

## 4. Project Acceptance or Rejection

Once the project analysis is approved, a preapproval letter is sent to the customer. The preapproval letter provides critical information regarding the project, including potential project rebate amount, the project description and costs, and any conditions that must be met to receive the rebate (e.g., measurement and verification). For rejected projects, a rejection letter is sent informing the customer why their project is not eligible. A copy of the preapproval or rejection letter is also sent to the Account Manager. The Company retains all project documents, including the application, specification sheets, proposals and analysis models.

## 5. Completion

The final step in the process is verification that the project was implemented. The customer fills out the verification section of the application and provides invoices for the completed project. Customers may submit American Institute of Architects project continuation sheets

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<sup>30</sup> [http://www.xcelenergy.com/Programs\\_and\\_Rebates/Business\\_Programs\\_and\\_Rebates/Equipment\\_Rebates/Energy\\_Management\\_Systems](http://www.xcelenergy.com/Programs_and_Rebates/Business_Programs_and_Rebates/Equipment_Rebates/Energy_Management_Systems)

<sup>31</sup> Xcel Energy may use a sub-contracted consultant as for initial EMS analysis and data entry, but only with review by an Xcel Energy Efficiency Engineer.

in lieu of invoices. The Company checks the completed documents for any variances from the project proposal, including cost variances of 10% or more. The Company re-analyzes projects with variances for rebate and impact adjustments.

## **D. Marketing Objectives & Strategies**

Marketing is primarily conducted by Account Managers, leveraging their direct relationships with customers. In addition, the following strategies will help meet energy savings targets:

### **1. Trade Partner Communications**

EMS is substantially marketed to and through trade partners, which primarily consist of equipment manufacturers and distributors; electrical contractors; and mechanical contractors. The Company provides extensive, in-person training sessions at each EMS trade partner location. For each EMS project, the Company communicates with each trade partner personally, via phone or email. Occasionally, the Company also emails trade partners with non-project-specific information. The “Energy Exchange”, a quarterly email newsletter also goes out to all trade partners who have registered to be part of the Company’s trade ally network. Communications may also include links to tools that will help with project analysis such as Department of Energy resources. Each contact reminds trade partners of the product and how it is benefits both them and their customers.

### **2. Collateral**

Customers and trade partners can access material electronically on Xcel Energy’s website.<sup>32</sup> Marketing materials include:

- *Product Information Sheet* – The primary tool for sales staff that helps describe the product to customers and vendors. It provides examples of qualifying projects, business reasons to participate, and a summary of procedures.
- *Product Application and Worksheet* – The document that customers fill out to start the process of participation. The customer or vendor is asked to complete several sections including information on the business location, Account Manager, applicable rates, project description, and technical information related to proposed and existing equipment, equipment supplier and project verification upon completion. The worksheet aspect is used to gather all of the necessary information about the project and the building. Filling out the worksheet completely enables a smooth analysis process.

### **3. Target Market**

All commercial and industrial facilities within the Company’s service area are eligible to participate. The bulk of energy management systems are installed in commercial facilities (office buildings, schools, etc.). The product focus is on managed accounts and large unmanaged accounts. Approximately 80% of these customers are concentrated within the Denver metro area, thus marketing campaigns are focused in this area. Systems for new

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<sup>32</sup> [http://www.xcelenergy.com/Programs\\_and\\_Rebates/Business\\_Programs\\_and\\_Rebates/Equipment\\_Rebates/Energy\\_Management\\_Systems](http://www.xcelenergy.com/Programs_and_Rebates/Business_Programs_and_Rebates/Equipment_Rebates/Energy_Management_Systems)

buildings are eligible only to the extent that the systems have extensive control strategies that exceed all codes and standards.

Therefore, the primary targets for marketing activities are the owners or managers of existing commercial buildings: that:

- Have not installed or upgraded controls systems for at least 12 years;
- Have one entity who incurs the energy costs (without individually metered tenants); and
- Are of sufficient size to likely have acceptable energy savings compared to costs, which tend to be buildings of at least 100,000 ft<sup>2</sup>.

## **E. Product-Specific Policies**

Information pertaining to minimum requirements is included on the application. Much like the Custom Efficiency product, EMS projects require:

- Preapproval before any equipment is purchased or installed, or any contracts are signed or binding commitments are made;
- A cost-effective metric ratio equal to or greater than one; and
- A payback between one and 15 years based on the analysis.

## **F. Stakeholder Involvement**

Customers, trade partners, and other stakeholders are currently engaged at the project level. Feedback is garnered individually from each participant. The Company works with these stakeholders to identify product trends that may require changes to product design. Public Service will also discuss potential changes with trade partners or third-party implementers.

## **G. Rebates & Incentives**

EMS offers rebates of up to \$700 per peak coincident kW saved, plus up to \$0.035 per annual kWh saved. EMS also offers Public Service natural gas customers up to \$4 per Dth saved. Rebate amounts are based on project performance and cost-effectiveness.

## ➤ Heating Efficiency

### A. Description

Public Service's Heating Efficiency product provides rebates for business customers who purchase high-efficiency natural gas or dual-fuel commercial equipment for space heating, water heating or process heating loads less than 30 percent. Available rebates are designed to promote the installation of high-efficiency equipment that improves combustion and seasonal efficiency above standard levels for both natural gas and electricity. While this product is only available for Public Service's retail natural gas and electric business customers, those who choose to switch from a third-party natural gas provider can also be eligible for natural gas measures. This product is not available for *Gas Transport Only* customers. The product has several components which include: hot water boiler systems, water heaters, boiler auxiliary equipment improvements, pipe insulation, unit heaters and other unique (custom) heating systems. The product's electric component provides a rebate for Electronically Commutated Fan Motors (ECMs) for commercial furnaces. The Company is also adding two new measures, Ozone Laundry and direct installations of pipe insulation. These measures will allow for natural gas savings while offering low costs of installation. The details for each product measure are described below.

#### 1. Hot Water Boiler Systems

Public Service rebates hot water boilers that exceed the minimum efficiency levels established by 2015 International Energy Conservation Code (IECC) standards. IECC requires a minimum efficiency of 82% on 2,500 MBTU/h or larger units and requires a minimum efficiency of 80% on hot water boilers less than 2,500 MBTU/h. Rebates are eligible for the installation of a new boiler where no previous boiler existed, the current boiler is no longer operational, or an upgrade is being made.

#### 2. Water Heater Systems

Commercial water heating systems that exceed the minimum efficiency levels established by the 2015 IECC standards are eligible for a rebate. These can be either tankless or storage systems, and must be greater than or equal to 75,000 BTU/h and more than 92% efficiency.

#### 3. Boiler Auxiliary Equipment Improvements

The performance of a boiler system can be enhanced with controls and system efficiency improvements. Boiler auxiliary equipment rebates are based on the incremental cost of efficient equipment and are calculated based on a percentage of the incremental project cost (i.e. how much it costs to perform that portion of the project, not the entire project cost). The following will be rebated:

##### *a) Boiler Efficiency Retrofits*

- Modular burner controls (addition of controls to existing equipment) with 5:1 turndown ratio or greater;
- Outdoor air reset controls;

- Stack dampers; and
- Steam trap replacement/parts.

*b) Pipe Insulation*

- Insulation rebates are for boiler or water heater pipes and are based on the pipe's diameter and the linear feet of insulation; and
- Direct Installation of Pipe Insulation by a third-party vendor is available.

#### 4. Unit Heaters

Electricity savings for the non-condensing power vent unit heater and condensing unit heaters are for the fan that is associated with a unit heater; infrared unit heaters do not have a fan.

Rebates are for customers who install:

- A non-condensing power vent unit heater with a minimum efficiency of 83%;
- A condensing unit heater with a minimum efficiency of 90%; or
- Infrared heater with a minimum efficiency of 80%.

#### 5. Ozone Laundry

Ozone laundry is a midstream offering. It is an add-on retrofit generator for improving the energy and water efficiency of multi-load washers. To be eligible, ozone laundry systems must transfer ozone into the water through Venturi Injection or bubble diffusion. Ozone laundry equipment works most effectively in cold water, significantly reducing or eliminating the need to heat water.

#### 6. Custom Heating

Equipment installations performed outside of the prescriptive scope may be eligible for rebates available through the Custom Efficiency product. All projects require preapproval prior to purchase and installation and must conform to all Custom Efficiency product guidelines. More Custom Efficiency rebates and guideline information can be found on the Company's website.<sup>33</sup>

These projects require individual evaluation to determine how much energy will be saved and to ensure cost-effectiveness. Projects that typically fall under the custom category include, but are not limited to:

- Large boiler systems (greater than 10 million BTU/h);
- Carwash boilers;
- Pool boilers;
- Boiler control systems; and
- Process load over 30%.

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<sup>33</sup> [http://www.xcelenergy.com/Energy\\_Solutions/Business\\_Solutions](http://www.xcelenergy.com/Energy_Solutions/Business_Solutions)

## **B. Targets, Participants & Budgets**

### Targets and Participants

Project pipeline and market potential were evaluated to determine participation and energy savings targets. Participation increased rapidly through the first few years of the product's natural gas energy efficiency offerings, but due to low natural gas prices, pipeline momentum has slowed in recent years. To increase participation in the product, the Company will review potential new prescriptive measures identified through Custom Efficiency, as technology improves and markets change. The Company will also explore different product delivery models to increase the cost effectiveness of the program. Midstream ozone laundry and direct installation of pipe insulation measures will be used to test effectiveness of different delivery models.

### Budgets

For the Heating Efficiency product, rebates are the largest expense, with promotional costs and labor also being factors. The following summarizes the budget drivers:

- *Rebates* – calculated using average rebate cost per Dth, kW, and kWh.
- *Promotions* – important to build awareness and provide education on the benefits of high-efficiency heating systems.
- *Labor* – determined by estimating the number of full-time employees needed to manage the product and execute the marketing strategy and rebate process.

## **C. Application Process**

Rebate applications are available on the Xcel Energy website.<sup>34</sup> Hard copies are also available via Account Managers, the Trade Relations Manager, and trade allies. Participants in the product may submit their application through their Account Manager or the Business Solutions Center (BSC). Customers must apply for rebates within 12 months of equipment purchase and start-up. Participants are required to complete an application, provide manufacturer equipment specifications and an invoice, as proof of purchase.

The following equipment information must be included on the application when applying for a boiler rebate:

- use (space heat and/or domestic water heat or both);
- manufacturer;
- model number;
- boiler size (in million BTU/h);
- full-load efficiency;
- process load percentage; and
- quantity.

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<sup>34</sup> [http://www.xcelenergy.com/Energy\\_Solutions/Business\\_Solutions](http://www.xcelenergy.com/Energy_Solutions/Business_Solutions)

Information required for other equipment may include:

- fluid temperature;
- pipe location (inside/outside) linear feet;
- pipe diameter;
- project cost; and
- serial number.

Preapproval is not required before the customer buys or installs equipment for prescriptive measures, but will be required for custom projects in accordance with the Custom Efficiency product policies.

#### **D. Marketing Objectives & Strategies**

The objective of the Heating Efficiency product is to provide education and incentives that motivate customers to purchase high-efficient heating equipment and run their existing heating systems at optimum efficiency. Boiler systems are typically installed in mid- to large-sized facilities. The product marketing strategy supports identification of and targeted messaging to the different facilities for efficiency improvement.

The Heating Efficiency product follows the marketing strategy of other prescriptive products, leveraging the BSC to improve the level of knowledge on heating efficiency in the marketplace. The Company also provides a newsletter and direct-communication campaigns to customers and trade allies, and participates in trade shows and other events. These tactics make customers aware of the key benefits of energy efficiency and its applicability to heating systems. The Company provides fact sheets and rebate applications to customers directly, and via trade allies, to encourage them to consider leveraging Heating Efficiency rebates as they make equipment purchase decisions. An online case study helps customers, identifying the energy and non-energy benefits of upgrading to high-efficiency and auxiliary equipment. In addition, Public Service's Account Managers and BSC will educate customers on the project's energy savings potential, impact of the rebate on the payback calculation, and how to complete the application process. Trade allies can get similar assistance from the Company's Trade Relations Manager.

The Heating Efficiency product may also follow-up on customer opportunities identified following participation in the Business Energy Analysis product—communications will center on the benefits of energy efficiency through reduced paybacks and lifecycle costs, and greater environmental benefits.

#### **E. Product-Specific Policies**

*Gas Transport Only* customers cannot participate in rebates for the Heating Efficiency product. Participating customers must be a business retail natural gas customer of Public

Service and must be an electric only or a combination electric and gas customer to qualify for the electric ECM rebate.

## F. Stakeholder Involvement

Public Service routinely consults with several of the major equipment suppliers and contractors for guidance when refining the Heating Efficiency product for Colorado. These stakeholders provided insight into the types of products to rebate, the incremental and total equipment costs to be expected, and how the application process can be improved. The Company also works closely with state and local governments to promote energy efficiency and holds semi-annual Heating Advisory Board meetings to engage with contractors and seek feedback and input on product updates and other considerations in delivering this product.

## G. Rebates & Incentives

<u>Equipment</u>		<u>Rebate</u>
Hot Water Boiler	85% minimum efficiency	\$700 per million BTU/h*
	92% minimum efficiency	\$3,000 per million BTU/h*
Water Heater	Tankless or with storage	\$400 per 100,000 BTU/h*
Pipe Insulation		\$5 - \$9 per linear foot
Electronically Commuted Motor (ECM)		\$100 per motor
Non-Condensing Unit Heater	83% minimum efficiency	\$50 per 100,000 BTU/h*
Condensing Unit Heater	90% minimum efficiency	\$150 per 100,000 BTU/h*
Infrared Heater	90% minimum efficiency	\$250 per 100,000 BTU/h*

\* MMBTU/h is based on boiler input capacity. 1 MMBTU/h equals 1 million BTU per hour. Boilers smaller than 1 MMBTU/h still qualify for rebates.

### Improvements and Add-ons

The improvements and add-ons are only eligible for a rebate if a breakout of the equipment costs is clearly indicated on the invoice.

<u>Equipment</u>	<u>Rebate</u>
Modular burner controls >5:1 turndown ratio	\$750 per million BTU/h*; \$2,000 maximum
Outdoor air reset controls	\$250 per million BTU/h*
Stack dampers	\$250 per million BTU/h*
Steam trap replacements	25% of trap cost up to \$250 per trap maximum

\* MMBTU/h is based on boiler input capacity. 1 MMBTU/h equals 1 million BTU per hour. Boilers smaller than 1 MMBTU/h can qualify for rebates.

## ➤ LED Street Lights

### **A. Description**

The Company's LED Street Lights product captures energy savings for local municipalities on the Street Lighting Service (SL) Rate by replacing legacy Company-owned street lights with LED fixtures.

The Company owns approximately 95,000 cobrahead-style street lights across its service territory with nearly three-fourths of those lights being concentrated within a small number of larger municipalities. Replacement of the current bulbs (70 Watt, 100 Watt, 150 Watt, 250 Watt, and 400 Watt fixtures) with more efficient LED fixtures will result in significant energy savings. Cobrahead replacements offered through this voluntary product will be provided to customers who opt-in to the new SL Rate to transition to LED technology, for both retrofits and new installations. The Company intends to replace 100% of cobrahead fixtures within 10 years. Although Xcel Energy will be closely monitoring the performance and cost-effectiveness of decorative-style LED fixtures going forward, no decorative options are being offered at this time.

### **B. Targets, Participants & Budgets**

#### Targets and Participants

The Company is forecasting replacement of 5,470 Company-owned cobrahead street light fixtures—through retrofits and new installations—in 2019 and 5,470 units in 2020. The replacement schedule is tied to an energy savings target of approximately 2.6 GWh in 2019 and 2020 which represents the annual savings estimates.

#### Budgets

Equipment and labor costs for LED installation are not being recovered through the DSMCA and therefore are not included in the DSM Plan budget for this product. The Company is including minimal DSM budget for customer engagement activities and energy savings reporting.

### **C. Application Process**

Customers are required to submit their preference for the Option A or Option B rate.

### **D. Marketing Objectives & Strategies**

The product will have a marketing budget to develop customer communications, case studies, and allow for customers who many have opted out to now participate. Should the Company choose to pursue any additional LED marketing campaigns, these efforts will be supported out of our O&M budget.

## **E. Product-Specific Policies**

Voluntary product participation is available for only Public Service customers on the Street Lighting Service (SL) Rate. The upgraded street lighting infrastructure will remain under Public Service ownership.

*Note:* The Company offers separate rebates for customer-owned street lighting within the Lighting Efficiency product.

## **F. Stakeholder Involvement**

Local municipalities on the Company's SL Rate are the primary product stakeholders. The Company consulted with local municipalities regarding this product through several outreach meetings in October 2014, March 2015, and April 2015. Collaboration will continue as implementation continues in 2019 and 2020.

## **G. Rebates & Incentives**

No rebate will be offered for this product because the Company is the equipment-owner. SL ratepayers will benefit from the ability to transition to the new technology under the new, lower rate enabled by the lower energy consumption and competitive cost of the LEDs.

## ➤ **Lighting Efficiency**

### **A. Description**

The Lighting Efficiency product offers prescriptive and custom rebates to Xcel Energy electric business customers who install qualifying energy-efficient lighting equipment in existing or new buildings. Rebates are offered to encourage customers to purchase energy-efficient lighting by lowering the upfront costs associated with this equipment.

The product's main offerings include the following:

- Prescriptive rebates for qualifying lighting measures and projects<sup>35</sup> that save energy such as:
  - LED fixtures that replace inefficient systems, including incandescent, HID and fluorescent. LED measures include both interior and exterior fixtures, retrofit kits, and lamps for new construction and retrofit applications.
- Custom rebates for energy-saving lighting projects that do not fall within the requirements of the prescriptive rebates.
- Midstream LED lamp rebates called Business LED Instant Rebate.

#### Prescriptive Lighting Rebates

The product offers rebates for qualifying lighting equipment that is more efficient than existing equipment in retrofit situations or more efficient than standard equipment in new construction applications. Lighting measures applicable to a prescriptive rebate format are ones that are commonly installed in the marketplace and have an easily identifiable means to determine energy savings.

#### Custom Lighting Rebates

Energy-saving lighting measures and lighting controls projects that do not fit into a prescriptive rebate category can be evaluated through the Custom Efficiency analysis. Requirements include that the customer obtains pre-approval before proceeding with the project, and the customer gathers and provides all information needed to analyze the energy savings potential of the project. In addition, for advanced lighting controls projects all equipment must be new and the control retrofit must be for an existing building.

Additionally, as the importance of managing peak demand continues to grow, the Company will explore ways to incentivize and incorporate load management technologies and strategies. Interval data from advanced meters will help the Company better identify strategies to shift energy use from peak to off-peak periods.

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<sup>35</sup> [http://www.xcelenergy.com/Save\\_Money\\_&\\_Energy/Rebates/Lighting\\_Efficiency\\_-\\_CO](http://www.xcelenergy.com/Save_Money_&_Energy/Rebates/Lighting_Efficiency_-_CO)

### Business LED Instant Rebates

The product offers upfront rebates to customers on qualifying LED screw-in or pin-based lamps and downlight retrofit kits and fixtures that are purchased from distributors participating in the LED Instant rebate program.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The product's participation and energy savings targets were determined by looking at historical participation levels, as well as the large number of LED products that are expected to be commercially available during the time period of this Plan. Previous project characteristics, including equipment type/mix, were also used to develop projected average cents-per-kWh rebate for each measure.

### Budgets

Historical expenditures were analyzed to project the budget. The main budget drivers include:

- *Participant Incentives* – The vast majority of the budget is allocated for rebates. This budget reflects the new rebate levels and projected customer participation in each measure, which was based on 2017 and some of 2018 participation across the offerings.
- *Administration* – These budgets are based on past product performance with a slight increase built in for expanded product offerings, engineering, and account management involvement. The budget also includes third-party implementer costs for the implementation of Business LED Instant Rebate efforts and technical assistance with complex lighting projects.
- *Advertising and Promotion* – A promotional budget was developed based on historical expenditures on marketing activities. Promotions are targeted to customers and trade partners and typically focus around activities such as new or revised product offerings, case studies featuring successful projects, educational opportunities such as events, and bonus rebates.

## **C. Application Process**

Customers may hear of the Lighting Efficiency product through several channels, including the Company's website, advertising, direct mail, email promotions or through the lighting trade. Account Managers work directly with the Company's largest customers to help them identify energy saving opportunities in lighting and the Business Solutions Center (BSC) is available for all business customers, particularly small- and mid-sized business customers, who need information on lighting rebate products.

### Lighting Efficiency Retrofit and New Construction Applications

The application process for the prescriptive retrofit and new construction products is similar to other prescriptive products. Customers may apply for rebates by completing the application and providing a detailed invoice for the newly installed equipment. The customers may submit a rebate application after the equipment has been purchased and installed. The replacement of

fixtures must provide equivalent lighting levels between the baseline and proposed scenarios and result in energy savings.

The equipment must be new and meet all the qualifications detailed on the application form. After the customer has installed the equipment, the application and invoice must be submitted to the Company within 12 months of the invoice date for retrofit projects and 24 months of the invoice date for new construction projects. Once the paperwork is completed and submitted, rebate checks will be mailed to the customer as indicated on the application within six to eight weeks.

#### Business LED Instant Rebates

Customer validation that the end-use customer is within Xcel Energy electric service territory is conducted at the point of sale. Participating distributors will apply an incentive to the retail price to decrease the qualified product cost. Customers will not be required to submit a rebate application as the participating distributor will provide the sales data to the utility.

#### Custom Efficiency Lighting

Applications for energy saving lighting projects that do not fit into the prescriptive paths may be reviewed using the Custom Efficiency or Advanced Lighting Control product preapproval application and the accompanying Lighting Evaluation Worksheet. Project analysis and preapproval of Custom Efficiency and Advanced Lighting Control lighting projects is required prior to equipment purchase and installation.

### **D. Marketing Objectives & Strategies**

The key marketing objective is to raise awareness, interest and participation in the Lighting Efficiency product, contributing to goals for energy savings and demand reduction.

#### Marketing Strategy

Lighting Efficiency is primarily promoted through Company Account Managers, Energy Efficiency Specialists within the BSC via inbound and outbound telemarketing, through Colorado's lighting and electrical trade via the Company's Channel Managers, and by traditional marketing vehicles such as advertising, mailings, Web content and tools, email and other sales promotions.

Account Managers and the BSC market the Lighting Efficiency product to customers—especially mid- to large-sized commercial and industrial customers, where the majority of the product's savings are realized—within their day-to-day interactions.

Significant market segments for potential Lighting Efficiency savings include: office buildings, manufacturing sites, retail establishments, schools, and 24-hour facilities. Marketing campaigns targeted to those customer segments are executed during one-on-one Account Manager meetings, BSC scripted calls, and/or via mass communications that drive inquiries to the Company's inbound phone center.

### Marketing to Trade Partners

The Company's outreach and relationship building with lighting and electrical trade, professional engineers, architects and lighting designers is another key strategy to reach important business segments and indirectly influence the purchase and installation of energy-efficient lighting systems. The Company establishes and maintains contact with this audience by:

- In-person training and presentations by the Channel Managers at industry events and trade shows, such as the Energy Efficiency Expo held in first quarter of each year, for both customers and trade allies;
- The Lighting Advisory Board, described in section *F. Stakeholder Involvement* below;
- *Energy Exchange*, a quarterly email that is sent to the trade discussing energy efficiency lighting applications, case studies, product changes, and other pertinent topics; and
- Trade website,<sup>36</sup> including applications, specific brochures and informational pieces directed toward the trade, and updates on product offerings.

### Marketing to Small Business Customers

The Company accesses this harder-to-reach market primarily through direct mail, email, and the BSC, as well as via outreach conducted by the Company's Lighting – Small Business third-party implementer.

In addition, several printed marketing pieces are available on the Company's website<sup>37</sup> for viewing or download. These pieces are targeted to large-, medium- and small-sized business customers, as well as trade partners. The website offers information on lighting technologies, case studies of successful lighting upgrades, and external sources highlighting reasons to pursue lighting upgrades or implement efficient lighting sources.

- *Prescriptive Rebate Applications* – Applications detail product requirements, rebate levels and additional information to help customers complete the form and submit it for rebate with accompanying invoices and equipment specifications.
- *Resource Documents* – The Lighting Efficiency webpage links to several documents on energy efficient lighting technologies, written by outside organizations such as E-Source, that further identify lighting efficiency sources and opportunities.

## **E. Product-Specific Policies**

Lighting Efficiency has a number of product-specific policies:

- All rebated equipment must be new, meet all product rules and requirements, and the application must be submitted within 12 months of the invoice date for retrofit projects and 24 months of the invoice date for new construction projects.

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<sup>36</sup>[http://www.xcelenergy.com/Energy\\_Partners/Trade\\_Partners/Commercial\\_Programs/Lighting\\_Efficiency\\_for\\_Trade\\_Partners\\_-\\_CO](http://www.xcelenergy.com/Energy_Partners/Trade_Partners/Commercial_Programs/Lighting_Efficiency_for_Trade_Partners_-_CO)

<sup>37</sup> [http://www.xcelenergy.com/Save\\_Money\\_&\\_Energy/Rebates/Lighting\\_Efficiency\\_-\\_CO](http://www.xcelenergy.com/Save_Money_&_Energy/Rebates/Lighting_Efficiency_-_CO)

- Non-DLC and non-ENERGY STAR® products must meet the DLC or ENERGY STAR product eligibility category definitions.
- New Construction rebates will be offered for new facilities, spaces overhauled for a new purpose, spaces where new lighting is required for safety/code requirements and spaces with fixtures that are at the end of their useful life.
- Customers who purchase lights in bulk can earn rebates on select LED lamps for stocking purposes. Lamps in storage must remain on the premises.
- In cases where the customer is unable to obtain an equipment invoice, the Company will send an Account Manager to complete an onsite field verification to confirm that equipment was installed as stated on the application.
- Preapproval is required for Custom Efficiency and Advanced Lighting Control lighting projects prior to the purchase and installation of lighting equipment. The customer has up to 24 months after the preapproval date to implement the lighting project. Custom and Advanced Lighting Control projects that exceed their planned timeframe, or have significant equipment deviations from the original plan, require reanalysis and approval.

## **F. Stakeholder Involvement**

Stakeholder involvement in the Lighting Efficiency product comes through a Lighting Advisory Board and the quarterly DSM Roundtable Meetings. The Lighting Advisory Board was formed as a collaborative effort between several key lighting professionals and the Company's management team. The objectives of the board are to identify gaps in the Company's product offerings, suggest areas of improvement, and to offer a forum for open discussion of lighting topics. Several recommendations from the board have been addressed through the Company's product development process and incorporated into the product. The Board will continue to meet on a regular basis, or as long as needed.

## **G. Rebates & Incentives**

The Lighting Efficiency product offers rebates through the retrofit and new construction prescriptive components, and/or Custom Efficiency and Advanced Lighting Controls, and/or the Business LED Instant Rebate component.

The Company will use the most appropriate rebate channel to implement rebates.

## ➤ Lighting – Small Business

### A. Description

The Lighting – Small Business product offers prescriptive and custom rebates to Public Service’s small- and mid-sized business customers who install qualifying energy efficient lighting equipment in existing buildings with a peak demand of 400kW or less.

The product aims to overcome specific barriers that often prevent small businesses from investing in energy efficiency measures, such as:

- Limited knowledge of energy savings potential in lighting system upgrades;
- Limited time to complete all the necessary steps to upgrade lighting system;
- Limited capital to make lighting improvements;
- Uncertainty of value when facility is not owner-occupied; and/or
- Limited access to qualified contractors due to small margins on some projects.

To address these issues, the product consists of the following components:

1. *Outreach* – Intensive outreach by a third-party implementer will bring resources and support to the customer, rather than relying on the customer to seek them out.
2. *Onsite audit* – Each customer will be offered an on-site facility audit through the Business Energy Analysis product to identify lighting energy savings opportunities to save money and improve light quality. The audit is designed to be a simple, one-stop service that keeps customer time requirements to a minimum. The customer will receive a report that outlines the recommended lighting upgrades, rebates and the associated estimated energy savings.

Substantial rebates are offered to offset the cost of installing qualifying energy efficient fixtures and lamps, as follows:

Direct Install for Immediate Savings – Customers with an annual peak demand of less than 100 kW will qualify for participation in the direct install (DI) component of the product. While onsite for the audit, the customer will receive free installation of the following energy savings measures, where applicable:

- a. Select screw-in LED lamps; and
- b. Aerators in public restrooms and kitchen sinks.

Prescriptive Lighting Rebates – See Lighting Efficiency product for details, only retrofit projects are offered through Lighting – Small Business.

Business LED Instant Rebates – See Lighting Efficiency product for details.

Custom Lighting Rebates – See Lighting Efficiency product for details.

3. *Connect with a contractor* – The product will connect the customer to a network of qualified contractors, approved by the Company, and assist the customer, as needed, in hiring a contractor.
4. *Install lighting upgrades* – The third-party implementer serves as a liaison between the customer and the contractor, maintaining engagement with the customer to ensure that recommended measures get implemented.
5. *Processing Application* – The third-party implementer will assist the customer in reviewing and submitting their application(s) for rebate.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The targets for this product were derived from historical data, market data, and equipment deemed savings values in Colorado. Trade participation and feedback, and lighting industry economic and market trends also influenced estimates.

### Budget

The forecasted expenditures in 2019 and 2020 for this product are based on projected participation levels, promotion, and administrative expenses. The majority of the product costs are driven by third-party costs for implementation of the product, in addition to customer rebates and promotional expenses.

## **C. Application Process**

The Company promotes the Lighting – Small Business product primarily through the outreach efforts of a third-party implementer. Secondary outreach is likely to occur through the Company's Account Managers, contracted trade allies, and/or other marketing efforts such as mailings, newsletters, and the Company website.

The BSC is also available for all small- and mid-sized business customers, who may inquire about lighting rebates. The BSC may refer new leads to the third-party implementer for follow-up. The third-party implementer is expected to aggressively promote the product to increase participation.

Customers are encouraged to receive an energy audit through the Business Energy Analysis product. The third-party implementer will assist customers in reviewing their audit report, identify the lighting opportunities the customer wants to pursue, connecting the customer with a contractor, applying for rebates for qualifying equipment, reviewing completed applications, and ensuring that there is a detailed invoice for the newly installed equipment.

The third-party implementer will also assist customers in applying for a Custom Efficiency lighting rebate for projects that do not fit into the prescriptive rebate offerings. Project analysis

and preapproval of Custom Efficiency lighting projects is required prior to equipment purchase and installation; the third-party implementer assists the customer with that process.

After the customer has installed the equipment, the rebate application and invoice must be submitted to the Company within 12 months of the invoice date. Once the paperwork is completed and submitted, rebate checks will be mailed to the customer as indicated on the rebate application. Once completed paperwork is submitted, rebate payments are usually issued in six to eight weeks.

## **D. Marketing Objectives & Strategies**

The key marketing objective is to raise awareness, interest and participation in the product, contributing to achievement of the Company's energy savings goal. The product is marketed primarily through the third-party implementer—they are required to meet the implementation targets for which they are contracted and they will deliver the marketing strategies needed to meet them.

## **E. Product-Specific Policies**

Lighting – Small Business has a number of product-specific policies:

- The product is for customers with peak electricity demand of 400kW or less; customers with an annual demand of 100 kW or below may qualify for direct installation of specific measures at the time of the audit (as described above).
- All rebated equipment must be new, meet all product rules and requirements, and the application must be submitted within 12 months of the invoice date.
- The replacement of fixtures must provide equivalent lighting levels between the baseline and proposed scenarios and result in energy savings.
- Preapproval is required for Custom Efficiency small business lighting projects prior to the purchase and installation of lighting equipment. The customer has up to 24 months after the preapproval date to implement the lighting project. Custom projects that exceed that timeframe, or have significant equipment deviations from the original plan, require reanalysis and approval.

## **F. Stakeholder Involvement**

The third-party implementer has considerable influence on the success of the product, as they will be the face of the Company to potential participants. The Company expects that the third-party implementer will engage stakeholders in the implementation of this product.

Lighting trade partners are an important stakeholder as they will be performing the lighting retrofits as well as promoting the product to customers. The Company expects the third-party implementer to continue to grow the trade partner list of qualified contractors available for lighting retrofits. The trade partners on this list will have a vested interest in the product's success, as they will benefit from the work generated by the audits.

Stakeholders are also involved in the product through the Lighting Advisory Board and quarterly DSM Roundtable Meetings. The Lighting Advisory Board was formed as a collaborative effort between several key lighting professionals and the Company's management team. The objectives of the board are to identify gaps in the product offerings, suggest areas of improvement, and to offer a forum for open discussion of lighting topics. The Board will continue to meet on a regular basis, or as long as needed.

## **G. Rebates & Incentives**

Lighting – Small Business offers rebates through for retrofit prescriptive components, and/or custom efficiency. Third-party implementer project management services and direct installations will be performed at no additional cost to the customer.

## ➤ Motor and Drive Efficiency

### A. Description

Public Service's Motor and Drive Efficiency product strives to assist customers with awareness and incentives to reduce the barriers associated with equipment purchases. Over time, the product offerings have adjusted to market and regulatory conditions, and incorporated input from completed product evaluations.

The Company offers prescriptive incentives for:

- Variable Frequency Drives (VFDs), which save energy consumed by motors when the demands on the motor allow for lower and varying speeds;
- Constant Speed Motor Controllers, which provide savings on devices that require constant speeds, like escalators, and under-loaded conveyers; and
- Motors that exceed the Department of Energy (DOE) efficiency standards for motors by 1.0 efficiency point.

Custom rebates are available for motors or motor-related equipment that fall outside the prescriptive criteria. Custom rebates are targeted for equipment that allows customers to operate efficiently, and provides multiple benefits like longer equipment life span, and reduced maintenance costs.

### B. Targets, Participants & Budgets

#### Targets and Participants

The product's energy savings and participation targets are based on performance in recent years, and empirical research from primary and secondary research sources, including:

- Other utility programs
- Interactions with trade partners.

#### Budgets

The product budget was derived from rebate levels associated with the anticipated measure quantities that are forecasted to deliver energy savings in 2019 and 2020. Historical actual expenses also influence forecasted expenditures. The budget has been tightened by delivering efficiencies within labor and advertising cost categories.

### C. Application Process

Customer awareness occurs through various marketing channels: the Company's website, direct and email promotions, Public Service's account management team, end-use equipment trade allies, and occasional advertising or direct mail. Rebate applications are available to download

on the Company's website.<sup>38</sup> Paper applications are also provided by the account management team or participating trade partners, as needed.

#### *Prescriptive Rebate Applications*

The rebate application process for prescriptive motors and drives is similar to other prescriptive product rebates. Customers may apply for a rebate up to 12 months after the equipment has been purchased and installed. The equipment must be new and meet all qualifications detailed on the rebate application form. Once the paperwork is completed and submitted, the application package is reviewed for accuracy and entered into the Company's customer relationship management system. Rebate checks are mailed to customers with qualifying applications within six to eight weeks.

#### *Custom Rebate Applications*

For motors, drives, or related equipment that does not fit into the prescriptive offer, the customer may apply for a custom motors rebate using the application and information worksheet available within the [Custom Efficiency](#) product. Project analysis, engineering analysis and preapproval of custom projects is required prior to equipment purchase and installation.

## **D. Marketing Objectives & Strategies**

The overall marketing objective is to drive qualifying energy savings by raising awareness, interest, and participation in the product.

The product is primarily promoted through Company account representatives, mechanical and electrical contractors, and via traditional marketing vehicles such as advertising, mailings, website content, email, and other sales promotions.

Account representatives include:

- *Account Managers*, who work directly on projects with large commercial and industrial customers, where the majority of savings are realized; and
- *Energy Efficiency Specialists at the Business Solutions Center* responding to inbound calls and initiating outbound telemarketing, specializing in marketing to small- and medium-sized businesses.

Significant market targets include (HVAC systems within) office buildings, schools, and retail establishments. Manufacturing sites are also potential participants. However, the Company's service territory has few manufacturing sites, and prescriptive VFDs do not contribute prescriptive savings from most processing equipment.

As outreach to mechanical and electrical contractors, the Company's channel and product managers actively engage in:

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<sup>38</sup> <http://www.xcelenergy.com/staticfiles/xcel/Marketing/Managed%20Documents/CO-Bus-Motors-Motor-Rebate-Application.pdf>

- Presentations at industry events and trade shows, such as the Company's Energy Efficiency Expo held each year, for both customers and trade allies.
- Sponsorship and presence at industry events such as the conference of the Electrical Apparatus and Service Association.
- In-person trainings at the contractors' offices.
- The *Energy Exchange*, a quarterly email that is sent to trade partners to share information on energy efficiency projects, case studies, product changes, and other pertinent topics.

## **E. Product-Specific Policies**

All rebated equipment must be new and meet all product rules and requirements; and the rebate application must be submitted within 12 months of the purchase date. Additional product-component policies include:

- For prescriptive rebates, VFDs must automatically control the speed of existing or new motors.
- For HVAC in new construction, VFD rebates are available for a limited subset of horsepower levels.
- Custom projects require either preapproval or other acceptable project documentation, prior to purchase. The customer has up to 24 months after preapproval to implement the project. Custom projects that exceed this timeframe, or have significant equipment deviations from the original plan, require reanalysis and approval.

## **F. Stakeholder Involvement**

Public Service's Motor and Drive Efficiency product has been successful because of external support from trade allies and other stakeholders that understand the product and assist in driving customer education and awareness. Customers benefit from hearing a consistent message from a variety of sources. Product inputs come from customers, account representatives, the quarterly DSM Roundtable Meetings, workgroups, primary and secondary research, and through discussions with other utilities. Comments are considered and implemented if and when appropriate.

## **G. Rebates & Incentives**

Rebates are paid directly to customers unless the customer reassigns the rebate to their vendor as an alternate rebate recipient.<sup>39</sup> The product offers the following rebates:

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<sup>39</sup> See *Alternative Rebate Recipient* section of the rebate application form:  
<http://www.xcelenergy.com/staticfiles/xcel/Marketing/Managed%20Documents/CO-Bus-Motors-Motor-Rebate-Application.pdf>.

<b>Description</b>	<b>Horsepower (hp)</b>	<b>Rebate Amount</b>
Enhanced efficiency motors (exceeds the DOE efficiency standards for motors by 1.0 efficiency point.)	1 hp – 200 hp	Tiered rebate offer depending on the horsepower, and on whether the motor is an efficiency upgrade or if it is for new or restored capacity.
VFDs controlling motors used on fans and pumps	1 hp – 200 hp	Tiered rebate offer depending on the controlled horsepower.
Constant Speed Motor Controllers	5 hp to 3,000 hp	Tiered rebate offer depending on the controlled horsepower.
Custom for larger and non-prescriptive motors, drives, or related measures	Outside the prescriptive parameters	Individual project rebates determined under the Custom Efficiency product guidelines.

## ➤ Multifamily Buildings

### A. Description

The Multifamily Buildings product is designed to engage multifamily building equipment owners<sup>40</sup> in deploying DSM measures that will lower customers' energy consumption. The multifamily customer segment has historically been a difficult market to reach with traditional DSM products because building / equipment owners may not be the metered bill-payer for individual units. The product was designed to encourage DSM participation in this market segment by offering an energy assessment and direct installation measures, both in-unit and in some common areas, at no additional cost to the customer. The assessment will also identify larger efficiency improvement opportunities which will primarily focus on mechanical and lighting systems and common-area improvements. Rebates will be offered to equipment owners to pursue these larger energy improvement projects.

The product will engage customers in a three-stage process for multifamily buildings:

- Stage 1. Energy assessment
- Stage 2. Direct-install measures
- Stage 3. Traditional energy efficiency improvements (comprehensive building upgrades, custom or prescriptive projects, etc.)

#### Stage 1: Energy Assessment

The first step is completing an on-site energy assessment ("assessment"). The assessment will identify opportunities for improving building energy efficiency via a specific set of direct-install measures (eligible measures are listed below under Stage 2). The assessment will include an inspection of a sample of units within each building, typically one of each unit type (e.g., 1 studio, 1 one-bedroom, 1 two-bedroom), as well as larger, capital-intensive projects for the whole building (Stage 3).

#### Stage 2: Direct-Install

The second stage of participation is direct installation of energy savings measures identified in the energy assessment. Installation is completed by the Company's third-party implementer. There are five eligible measures for Stage 2 that will be installed for no cost to customers:

- LED lamps
- Low-flow showerheads
- Kitchen and bathroom sink faucet aerators
- LED exit signs
- Other cost-effective measures to be identified

Participants will work with the third-party implementer to schedule installation.

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<sup>40</sup> Equipment owner could be the building owner, the tenant, or other third-party.

### Stage 3: Prescriptive or Custom Energy Efficiency Improvements

The third stage for participants involves the completion of prescriptive or custom energy-efficiency improvement projects such as HVAC upgrades, common-area lighting upgrades, or other projects currently eligible through the Company's prescriptive offerings or Custom Efficiency product.

Implementation of Stage 3 projects may be challenging for a number of reasons: lack of ownership willingness, long sales cycle, capital constraints, market economics, etc. to overcome these barriers the third-party implementer will provide participants with advice on selecting a contractor and reviewing bids as well as periodically provide follow up consultations. Access to AMI interval data would help the third-party implementer during these consultations if they could show customers how their energy usage may effect their energy costs and what the savings might look like after energy efficiency upgrades.

The third-party implementer is crucial to the success of the product, as a consistent point of contact for participants. The third-party implementer will be responsible for advertising and recruiting participants, delivering the Stage 1 on-site energy assessment and Stage 2 measure installations, and successfully converting participants into Stage 3 projects in conjunction with the Company's Account Managers or Energy Efficiency Specialists.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The Company estimates that there are approximately 250,000 units in existing multifamily buildings within Public Service's service territory. The Company had participants enrolled and implementing Stage 2 projects within the Multifamily Buildings Pilot starting in 2015.

The participation targets for energy assessments, direct installs, and larger energy efficiency projects for 2019 and 2020 were based on forecasts provided by the third-party implementer.

### Budgets

The bulk of the product expenditures will be for product administration and incentives to customers in the form of energy assessments and direct-installation of energy-efficient equipment. The budget also includes costs for prescriptive and custom rebates from Stage 3 projects.

Direct-install costs were developed based on the actual costs contracted between the Company and the third-party implementer and the forecasted participation. Rebates for Stage 3 are estimated by the third-party implementer based on deemed values from the anticipated mix of prescriptive and custom DSM measures.

## **C. Application Process**

The product is available to multifamily buildings that are Public Service electric and/or natural gas customers. To participate, customers must apply through the third-party implementer, who

will review applications and approve participants. Applications will be reviewed on a first-come, first-served basis. Upon meeting the qualifications for participation, customers will work with the implementer to schedule an on-site assessment (Stage 1).

## **D. Marketing Objectives & Strategies**

The third-party implementer will recruit customers by leveraging their existing customer relationships and market expertise. Options for direct promotion by the Company may include the following:

- Marketing materials and brochures;
- A Web-page to educate interested customers, explaining how to participate and the benefits of participating;
- Attending multifamily events in the Company's service territory; and/or
- Co-hosting educational events with the third-party implementer.

## **E. Product-Specific Policies**

All multifamily buildings must be Public Service electric and/or natural gas customers with five or more units per building to participate in this product. This primarily includes market-rate qualified buildings.\*<sup>41</sup> If a property has multiple buildings and at least 80 percent of the buildings qualify, the entire property may participate in the program.

## **F. Stakeholder Involvement**

Initially, the Company worked closely with a number of external stakeholders to design this product initially. Today, the product has ongoing relationships with:

- Platte River Power Authority
- Energy Efficiency Business Coalition
- Ft. Collins Utility
- Southwest Energy Efficiency Project
- Colorado Energy Office
- City and County of Denver
- City of Boulder
- Boulder County
- ACEEE

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<sup>41</sup> Low income qualified buildings should participate in the Low Income Multifamily Weatherization product. If for some reason a building doesn't qualify for low income, the property can qualify for the market rate program.

- Colorado PUC Staff

The Company has also been active with national multifamily working group efforts to research successful utility multifamily programs and network with those program managers and staff. Primarily, the Company has participated in ACEEE's Utility Multifamily Working Group and E Source's Multifamily Leaders Group.

The Company has also worked with third-party implementers and other vendors to understand the tools and services available to this customer segment.

## **G. Rebates & Incentives**

The product provides an on-site energy assessment (Stage 1) and eligible direct-install measures (Stage 2) to participants at no additional cost. The product will provide direct rebates for eligible projects completed in Stage 3 based on savings calculations from the Company's Custom Efficiency model and prescriptive products' deemed technical assumptions.

## ➤ New Construction

### A. Description

The New Construction product influences building owners, architects, and engineers to include energy efficient systems and equipment in their design for new construction and/or major renovation projects. Since the Company services building owners of different areas and size, the whole-building New Construction product offers two core components:

1. Energy Design Assistance (EDA)
2. Energy Efficient Buildings (EEB)

Both components are available to non-residential customers in Public Service's electric and natural gas service territory.

#### 1. Energy Design Assistance

The EDA offering provides a source of energy expertise to encourage energy efficient building design and construction practices. EDA offers design assistance in support of integrated design process by providing comprehensive computer modeling of the planned design, funding to offset the cost of design time associated with the increased energy analysis, financial incentives to improve the cost-effectiveness of a package of energy-efficient measures, and field verification to ensure that the strategies are installed per the design intent. Public Service covers the average energy modeling cost of an EDA project for customers.

According to *Best Practices Benchmarking for Energy Efficiency Programs*<sup>42</sup>, it is crucial for new construction DSM products to engage early in the design process and utilize integrated design modeling. The report states that, "Integrated design adds value because cost-effective energy savings opportunities decline as the project progresses through the various design stages." EDA uses computer energy models and a well-established, collaborative method for exchanging information with design professionals, contractors, developers, and building owners throughout the integrated design process. Important information is provided at critical points in the design process about the value and application of strategies for reducing peak demand and energy use. By analyzing integrated systems in the beginning of the design process, customers can make a building significantly more efficient, more comfortable for the occupants, and less costly to operate in the future.

In addition to technical assistance, Public Service provides financial incentives to building owners to improve the cost-effectiveness of energy efficient materials and equipment. Incentives are paid only after a verification process is completed, which typically occurs within three months of building occupancy. Verification ensures that the measures were installed as proposed, and provides an added degree of confidence in the project's calculated energy savings.

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<sup>50</sup> <sup>42</sup> *National Energy Efficiency Program Best Practices Study*, Quantum Consulting Inc., Dec. 2004, pg. NR8-2. Available:  
[http://aceee.org/files/proceedings/2004/data/papers/SS04\\_Panel5\\_Paper21.pdf](http://aceee.org/files/proceedings/2004/data/papers/SS04_Panel5_Paper21.pdf)

EDA will increase its focus on technologies and strategies that mitigate peak loads and reduce revenue requirements on the system. As technologies such as electricity storage become more economically viable for developers, EDA will encourage customers to incorporate them into building designs, as they can be used to support load shifting improvements. By increasing focus on system peak reductions, the product aims to identify and incentivize strategies that will maximize economic and environmental benefits for participants.

EDA offers three tracks for customer involvement:

#### *Basic Track*

The Basic track is for Public Service customers interested in the opportunity to participate in a collaborative design process and identify energy savings opportunities using new technologies and energy methodology. The following requirements apply to the Basic track:

- Square footage: Greater than 50,000 square feet (new construction, major renovation or addition)
- Design phase: Schematic design or early design development
- Energy Savings: minimum of 15% peak coincident demand savings and 15% natural gas savings; and
- For major building renovations, building must include significant renovations to at least two of the following three systems: building envelope, lighting/electrical, or mechanical systems.

#### *Enhanced Track*

The Enhanced track is for Public Service customers interested in obtaining sustainable building certifications, such as the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®)<sup>43</sup>. The Enhanced track allows for further analysis in daylighting, lighting, and mechanical system comparison and building orientation. The following requirements apply to the Enhanced track:

- Square footage: Greater than 50,000 square feet (new construction, major renovation or addition)
- Design phase: Pre-design or early schematic design
- Energy Savings: minimum of 30% peak coincident demand savings and 15% natural gas savings; and
- For major building renovations, building must include significant renovations to at least two of the following three systems: building envelope, lighting/electrical, or mechanical systems.

#### *Express Track*

The Express track is for Public Service customers whose projects are of a common type (such as multifamily, office, school, etc.) and draws on results from previous modeling experience of similar building types and systems to calculate hourly building simulations of the actual project. The following requirements apply to the Express track:

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<sup>43</sup>USGBC, LEED, <http://www.usgbc.org/leed>.

- Square footage: Greater than 50,000 square feet (new construction, major renovation or addition);
- Design phase: Schematic design or early design development (same as basic track);
- Energy Savings: minimum of 15% peak coincident demand savings and 15% natural gas savings; and
- For major building renovations, building must include significant renovations to at least two of the following three systems: building envelope, lighting/electrical, or mechanical systems.

Public Service administers EDA using third-party implementers to help identify product candidates, facilitate meetings with the design teams (including the owner), and complete energy modeling activities. Energy modelers are chosen based on a set of qualification criteria to become a third-party implementer of EDA services. Qualification opportunities are open as Public Service deems appropriate. Third-party implementers are paid on a pay-for-performance basis.

## 2. Energy Efficient Buildings

The EEB offering is intended to provide a simplified approach to optimizing energy efficiency options in new construction or major renovations. This component addresses the portion of the new construction market not suited for the full-scale energy modeling offered through EDA. Projects must be a minimum of 10,000 square feet. Projects are also generally less than 70,000 square feet and have passed the schematic design stage of new construction. However, any size project above 10,000 square feet may qualify provided the project has not awarded bids for equipment.

Focusing on the needs of small building owners, the EEB offering provides a comprehensive list of typical energy efficiency measures that can be incorporated into the new/major renovation building design, as well as the rebate amount available for each measure. Incentives are provided for heating and cooling, lighting, building envelope, electric motors, refrigeration, and custom opportunities. Customers will receive a rebate tailored to their building after the project has been constructed and onsite verification completed.

Public Service administers EEB using both internal and external resources to review the calculations and rebates, and verify installation. The EEB offering is managed by a third-party implementer to assist the customer with the EEB process.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Participation is estimated using actual historical product data. All non-residential customer segment types are eligible to participate in EDA; however, typical projects fall in the sectors of office, schools, retail, multifamily, and healthcare. The EDA energy savings targets were estimated based on the average energy savings of participating buildings when compared to the usage of a baseline building. The baseline building is defined as a building compliant with the

American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) 90.1 standards, or the local jurisdiction's code, whichever is more stringent.

### Budgets

Once targets were established, the budget was developed based on historical cost and participation information. Average project modeling drives the budget, construction incentives, measurement and verification (M&V), and promotional expenses. The following are the specific budget drivers:

- *Consulting Payments:* Much of the product delivery budget is associated with the cost of modeling for customer projects. Modeling costs are estimated to be approximately \$100 per kW saved for all three tracks. Modeling costs are then split between the year modeling begins and the year in which the project will be completed due to final as-built modeling being used in rebate calculations. There are also minimal dollars allocated for EEB for a third-party implementer.
- *Incentives:* Incentives are calculated based on the marginal value of energy saved by the as-modeled and as-verified building compared to the utility load shape of its baseline design.
- *M&V:* Completed in two steps for the offering and described in the M&V section of this Plan. Cost estimates are based on construction documentation and site review and are analyzed on a per-project basis.
- *Promotions, Advertising and Customer Education:* Promoting the product through specific advertising campaigns, trade shows, and training opportunities is an important part of New Construction and aids in shifting the market towards higher efficiency. As such, historical data was used to determine the appropriate level of expenditure on product marketing.

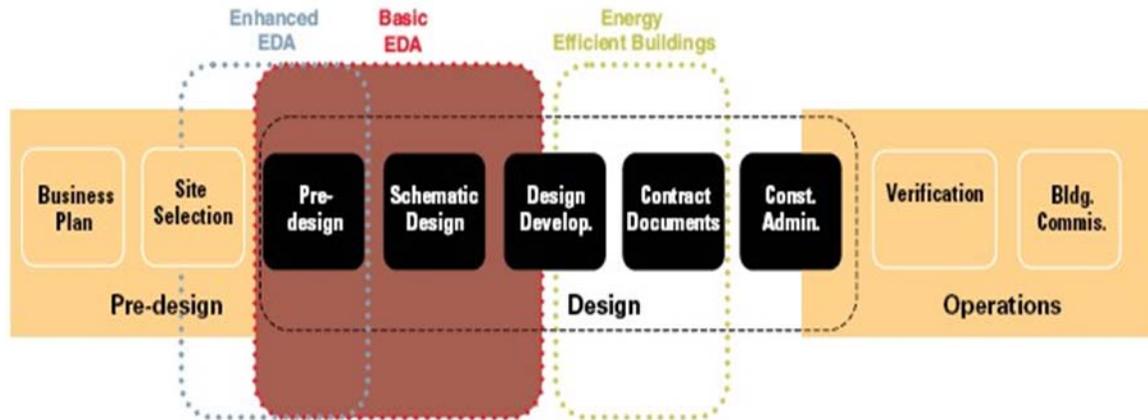
## C. Application Process

The rebate application process differs between EDA and EEB.

### Energy Design Assistance

The application process for EDA is more involved than for prescriptive products and follows the design schedule of a new construction project as outlined in the following diagram.

### *Building Design Process*



The average timeframe for project completion can range from two to five years depending on project schedules. For example, projects beginning modeling in 2019 will likely be completed in 2021 or beyond.

The application steps for the product include:

*1. Application Submittal:* Each project is evaluated by Public Service and the third-party implementers to ensure the project meets eligibility requirements. Customers who are interested in participating in the product must meet the design schedule requirements. Once approved to participate in the EDA offering, the customer receives an email approving the project and explaining next steps.

*2. Introductory Meeting:* An introductory meeting with the customer, design team, the third-party implementer, the Public Service Account Manager, and other key parties, takes place within two weeks of approval, depending on the design schedule. This meeting sets the tone for the collaborative approach, by explaining how the process works, who is involved, and what results should be expected. Initial project details, such as baseline systems, are collected during this meeting.

3. *Preliminary Analysis*: Using project details and costs from the design team, the third-party implementer begins the modeling process. Analysis is completed using a whole-building energy simulation computer program. Modeling software and protocols are established by Public Service, with reference to ASHRAE 90-1 standards, or the local jurisdiction's code, whichever is more stringent. Further analysis under the Enhanced track, if applicable, is also completed using the relevant modeling program and code base.

Within this analysis, different energy efficiency opportunities are explored that fit into the project criteria—payback analysis, energy expectations, and original design strategy. A meeting is then held to review these strategies to find the ones that meet the original project criteria and which ones should be considered moving forward.

4. *Final Energy/Strategy Analysis*: Energy efficiency opportunities are then packaged together in design alternatives to show expected building energy savings, paybacks and incentives. A whole-building approach is used to identify the net effect of multiple strategies on a project. This approach provides opportunity for more energy savings impact, by trading less effective ideas that may be in the budget for more effective, new concepts. The packaging of design alternatives also provides protection against pitfalls in the value-engineering phase of the design/construction process, which typically cuts individual elements of projects based on their first-cost and impact on the tangible elements of the building, with little regard for ongoing energy use. These energy alternatives are then presented to the design team and the customer to choose the best approach for their project.

5. *Construction Document Review*: Once the design team completes construction documents (CDs), a third-party implementer reviews the CDs and adjusts the energy model as needed. This energy model is used to determine the expected incentives from Public Service and to verify compliance with the energy savings intent of the customer. A review of the CDs energy analysis is completed before construction.

6. *Verification*: The final step in the EDA offering occurs when Public Service completes an onsite verification of the energy alternative addressed within the energy model. Equipment and systems are logged to evaluate performance variables as appropriate to verify consistency with modeling assumptions. The actual results are compared to the estimated savings to determine the final customer rebate.

### Energy Efficient Buildings

The application process is similar to other Public Service prescriptive products; however, preapproval is required to allow for calculations of energy-efficient measures, review of construction documents for verification of project design, and final verification of actual installation.

The first step in the process is for the customer to submit a preapproval application and agreement to Public Service. Once received, Public Service will review the project to confirm the project timeline, building square footage, and customer interest in energy efficiency options. Once the application is preapproved, the customer will receive an email from Public Service's consultant explaining the terms of the EEB offering and processes. An introduction meeting

invitation will be extended to the customer to provide energy efficiency advice. The building owner will then submit the project data throughout the construction of the project, and upon completion, for review by Public Service. The customer will receive the final construction rebate once the project and onsite verification have been completed.

## **D. Marketing Objectives & Strategies**

The New Construction product is primarily marketed through the Company's sales team and external third-party implementers to reach architects, engineers, general contractors, and Public Service customers, as detailed below. The Company fosters a collaborative approach, meeting with design teams to show how the product works and how it is beneficial to customers. Marketing strategies used within the product scope include trade shows, electronic newsletters, face-to-face meetings, advertising, and participation with various trade organizations including American Institute of Architects, Association of General Contractors, U.S. Green Building Council, and ASHRAE. A secondary market is building owners and developers. The EEB offering, on the other hand, is primarily marketed to developers and customers.

*Primary Market* – General Contractors, Architects, Mechanical and Electrical Engineers:

- Implement energy efficiency strategies
- Influence customer/developer decisions
- Trusted by owner
- Often suggest New Construction product to owners and developers
- Key to actual inclusion of strategies and cooperation

*Secondary Market* – Owners and Developers:

- Make initial decision on budget
- Hire and contract with an architect, engineers, and general contractor(s)
- Initiate conversations on energy efficiency
- Make final decision on equipment choices
- Key to moving general contractors to energy efficiency strategies within a limited budget

Public Service continually works to improve and update the information available to customers on the website and/or for events. There are several pieces of collateral used for the New Construction product:

- *Product Feature Sheet*: explains the features and the benefits of the product;
- *Case Studies*: provides examples of how various customers have benefited from participating in the product;
- *Process Flow Chart*: detail information on the product processes; and
- *White Papers*: explain different options for energy efficiency in lighting, heating, cooling, envelope, and other measures.

The EEB offering provides Public Service with the opportunity to conduct a larger marketing effort for New Construction. Customers may hear of the EEB offering through several channels,

including Account Managers, the Business Solutions Center, architects and engineers, general contractors, or equipment trade partners. Several strategies are used, such as:

- *Product Feature Sheet*: Explains the features and the benefits of the product;
- *Trade and Customer Seminars*: In-person opportunities to educate customers and trade partners on the benefits of new construction; an important part of the marketing strategy;
- *Conferences and Exhibits*: In-person expertise to help customers determine what product best fits their needs, as well as guidance on the EEB and EDA processes; and
- *E-newsletters*: Another avenue to educate the market on the product and benefits of reviewing new construction projects for energy efficiency opportunities.

## **E. Product-Specific Policies**

New code adoption only impacts new EDA project starts. Since the sales cycle for EDA is typically two to five years—from project initiation and design to the completion and occupancy of a physical building—many of the projects expected to finish in 2019 have already been identified by the Company and third-party implementers. The following policies are in place for the New Construction product:

- *Natural Gas Impacts*. In taking the whole-building approach, there are times when an efficiency measure may cause a decrease in one fuel consumption, but an increase in consumption of another fuel. In these situations, Public Service will account for both the decreases (energy savings) and increases in fuel consumption and will issue the rebate accordingly.
- *Completion of several opportunities*. The EEB offering will require installation of new equipment in both the electrical and mechanical sections of the building. Buildings that only require adjustments to one “section” will be referred to the Company’s other prescriptive products.
- *Ineligibility for additional products*. The New Construction product is a holistic approach to whole-building energy efficiency. For this reason, customer participation in either New Construction offerings (EDA or EEB) will preclude customer’s participation in Xcel Energy’s prescriptive and custom (component) rebate programs.
- *Design Team Incentive deadlines*. Design Teams in the EDA offering may submit design team incentive (DTI) request applications as late as two years after the project has finished (Construction completed and M&V performed).
- *Technological eligibility*. Technologies such as fluorescent lighting and metal-halide lighting will not be eligible for rebates in the New Construction product.

## **F. Stakeholder Involvement**

Customers, trade allies, and other stakeholders are engaged at the project level. Feedback is garnered individually from participants and when feedback trends are identified, Public Service will develop recommended changes for consideration in product design. Public Service will also discuss potential changes with trade partners or third-party implementers.

The Company continues to coordinate with other utilities and organizations to improve and effectively deliver the New Construction offerings. In addition, surveys are used to gather feedback from participants to continually improve the product.

## **G. Rebates & Incentives**

EDA provides rebates to customers based on the times of day the above-code measures included in the project are saving energy compared to the modeled baseline. Public Service also reimburses design team members to offset the incremental cost of their participation from \$8,000 to \$12,000 per project, depending on the square footage of the building. Design Teams can claim these incentives as late as two years after project completion (M&V). The EEB offering covers analysis of measure opportunities and provides both prescriptive and custom rebates for measures above code.

## ➤ **Recommissioning**

### **A. Description**

Building recommissioning is the process of reviewing existing equipment and systems within a building to ensure that they are working as efficiently as possible and operating as intended. The product covers both recommissioning and retrocommissioning. *Recommissioning* is commissioning a building that has already been commissioned in the past. *Retrocommissioning* is commissioning a building that has never been commissioned. The Recommissioning product is designed to assist electric and/or natural gas business customers in improving the efficiency of their existing building operations by identifying existing functional systems that can be “tuned up” to run as efficiently as possible through low- or no-cost improvements.

Examples of typical recommissioning measures include:

- Calibration/tune-up of energy management system points;
- Adjustment of outside air and return air dampers;
- Resetting the chilled water and hot water supply temperatures;
- Optimum start/stop of air handlers and makeup air units (early shutdown in the evening, late start in the morning);
- Resetting of a chiller’s condenser water temperature; and
- Eliminating simultaneous heating and cooling.

Recommissioning generally consists of two main steps: diagnosis (studies) and implementation. Public Service offers rebates for recommissioning studies and the implementation of recommissioning measures. The customer selects and hires a qualified trade partner to complete the study and implementation.

The Recommissioning product has four different paths a customer can choose:

1. *Study and implementation* – Customers receive funding for both the study and implementation from Public Service. Public Service works with the customer from the beginning of the project until the end. The study path has historically been the most popular choice customers within Recommissioning.
2. *Fast track implementation* – This path is for customers who have either performed a study outside of this product offering, or have identified a few recommissioning measures within their building without doing a comprehensive study. To qualify Public Service will review the study and/or recommended energy savings opportunities to determine recommissioning implementation rebates.
3. *Small Building Tune-Up* – This path is an option targeted to buildings less than 50,000 square feet. An onsite study is performed, but focuses on a more targeted checklist of measures, along with the study vendor completing fixes on-site as appropriate. This option opens the door to owners of smaller buildings to recommissioning activities without having to spend limited capital on a costly study.
4. *Building Operator Certification* – This path is intended to encourage the training and certification of building operators through the Building Operator Certification (BOC) offering. Building operators may complete Level I or Level II BOC training. The training

sessions will influence building operators to identify energy efficient opportunities and make energy conscious decisions.

Advanced meter enabled 15-minute interval data will help customers determine if there is potential to shift energy use from peak to off peak periods during operations of their buildings.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Energy savings and participation targets were determined by looking at historical performance as well as projects currently in the pipeline.

### Budgets

Budgets were developed commensurate with the energy savings targets, based on historical costs. Most of the budget is driven by the number of studies completed and number of customers who implement projects in a given year.

## **C. Application Process**

Customers interested in the Recommissioning product need to apply for pre-approval of their study prior to the start of the study. To obtain pre-approval, the customer will submit an application and a proposal from their recommissioning trade partner that outlines the scope of the project. After the customer receives pre-approval, the study can begin. When the study is completed, Public Service's internal engineers review the study to ensure that it meets our requirements and that the energy savings calculations are reasonable. After study approval, the trade partner will present their final recommendations to the customer and the customer can apply for the study rebate. At this point, the customer will select which measures to implement. After they finish implementation, they will receive their rebate check for the individual measures.

The typical sales cycle for a regular recommissioning project (study and implementation) takes one to two years to complete. Once pre-approved, the study can typically take three months to complete and receive final approval. Another year or more may go by before the customer receives internal approval for their expenditures needed to complete the final recommendations.

If a customer wants to participate in the Fast Track implementation option, where they receive implementation rebates only, they obtain pre-approval for implementation rebates prior to completing the measures. To obtain pre-approval, they need to submit either their study or their project proposal, along with calculations, for review. After fast track approval the customer can begin implementation. Once the implementation is finished they will receive their rebate check for the implemented measures. The sales cycle for fast track projects is typically shorter than a regular recommissioning project since they have already completed a study or may only be requesting a proposal from the trade partner.

To participate in the Small Building Tune-Up option, customers submit an application to their Account Manager or Business Solutions Center representative. The vendor will then schedule a time to perform the study.

## **D. Marketing Objectives & Strategies**

Customers learn of the product through their Public Service Account Manager, Business Solutions Center representative, direct marketing efforts and via recommissioning trade partners.

The marketing strategy is to educate customers and trade partners on what recommissioning entails and the benefits of recommissioning a building. Due to the long sales cycle, it is important to continually build the study pipeline to meet future year's targets. To build the pipeline and to attract customers and trade partners, various marketing tactics such as educational seminars, in person meetings, case studies and the product website are utilized.

The primary market segment for Recommissioning is commercial customers that are 50,000 square feet or larger, such as offices or hospitals. These customers are good candidates due to the following:

- Office real estate owners are looking for quick paybacks on their buildings and want to cut their operating costs without sacrificing tenant comfort. Recommissioning is an ideal option for these customers as many measures are low/no cost with quick payback.
- Hospitals are intense energy users and their energy systems frequently run as if there is full load, although that often is not the case. There are many opportunities for low cost savings in hospitals and medical centers.

A comprehensive list of marketing materials has been developed for customers, trade partners and Account Managers, including:

- Product feature sheet – explains the features and the benefits of the product;
- Study pre-approval application;
- Study rebate application – used to receive a study rebate after the study has been approved;
- Fast track pre-approval application;
- Recommissioning guidebook – information booklet that explains recommissioning, benefits, process, etc.;
- Trade partner list – contains approved providers who have participated in our product in the past;
- Case studies – provides examples of how other customers in various sectors benefited from participating in recommissioning;
- Process flow chart;
- Provider tips booklet – helps providers through the process;
- Customer website – snapshot of our product and links to many useful resources and marketing materials;
- Trade partner website – contains information on the product and tips that are specific to trade partners participating in the product. The website also has links to all of the marketing materials for easy access; and

- Recommissioning calculation tool – helps trade partners with basic calculations of common recommissioning energy savings measures.

Recommissioning trade partners play a key role in the success of the product since customers rely on trade partners to identify energy saving opportunities in their building. The Company will continue to identify additional trade partners to help meet future demand. The Company will continue to provide trade partner seminars to educate the trade on how to participate in the product. The goal is to make sure that trade partners understand expectations for the product and provide the necessary tools to help customers through the process.

## **E. Product-Specific Policies**

Recommissioning has a few policies that are specific to the product which include:

- *Study/analysis driven credit:* If a customer implements measures that are less than a one-year payback or over a seven-year payback, they will not receive a rebate, but Public Service will claim the study/analysis-driven savings. The Company believes that our help identifying and/or analyzing energy efficiency measures provide sufficient influence on the customer's decision to implement those measures.
- *Measure implementation:* Customers must implement 75% of the identified measures with a less than one-year payback, up to \$10,000 in costs before receiving their study rebate. Customers are allowed to pick which measures they want to implement with payback periods one year or greater. A typical recommissioning study may suggest anywhere from five to ten measures, with varying costs and paybacks.
- *Maintenance:* The Recommissioning product may claim energy savings for major maintenance measures identified and implemented through the recommissioning process.
- *Rebate/energy savings validity:* If at least two years has passed since a project was approved, the technical staff re-analyzes it with current rates to determine if the savings/payback has changed. This re-analysis is conducted prior to issuing a rebate.
- *Customer eligibility:* The product is available to retail business customers with both electricity and natural gas service, or electricity only service. Gas only service customers are not eligible for this product. Multi-family buildings (such as apartments or condo buildings) are not eligible for this product. They may participate in the Multi-Family Building Efficiency product.

If it becomes too burdensome for the customer to provide an invoice or other formal documentation supporting the implementation of a recommissioning measure (e.g. recommissioning measure implementation cost was part of a larger project), the Company will accept only their signature as documentation of implementation, as long as the customer accepts foregoing any implementation rebate they may have qualified for. In such cases, because Public Service helped fund the study identifying the recommissioning measure, the Company will claim credit for the measure but will not issue an additional implementation rebate to the customer.

## **F. Stakeholder Involvement**

The Company values feedback from customers and trade partners and makes an effort to gather their input to ensure the product is effective. As ideas are generated from stakeholders, they will be reviewed and implemented, if feasible. The Company will meet with our active trade partners to discuss product specifics and to obtain feedback. Continuous communication with this group through informal conversations and project work provides opportunities to keep this feedback channel open.

## **G. Rebates & Incentives**

The Recommissioning product offers two types of customer rebates: study and implementation.

*Study rebate:* Public Service will pay up to 75% of the recommissioning study cost, up to \$25,000. Payment of the remaining balance by the customer ensures customer commitment to implementing measures found within their study.

*Implementation rebate:* Public Service will pay \$500/peak coincident kW plus \$0.034/kWh saved, and an additional \$4/Dth saved for Public Service natural gas customers, up to 60% of the recommissioning measure costs that are identified in recommissioning studies or pre-approved through the Fast Track implementation option.

*Building Operator Certification rebate:* Public Service will pay \$500 per participant for the completion of BOC Level I or Level II training.

## ➤ Self Direct

### A. Description

The Self Direct product provides large commercial and industrial customers in Colorado the opportunity to control all stages of their project's rebate application process. Participating customers will identify, engineer, implement, and commission qualifying energy efficiency projects to receive rebates for implementing those projects. The dollar value of the rebates will be calculated based on the incremental energy savings achieved. Because the Self Direct product shares many of the features of the Custom Efficiency product, it can be viewed as a traditional custom product targeted towards a unique subset of customers.

A fundamental principle and differentiating factor of the Self Direct product is that the customer performs all of the work and incurs all of the costs for the identification study, design, engineering, measurement & verification (M&V), and reporting work associated with the energy saving projects. Large customers with energy saving evaluation resources may choose to participate in the Self Direct product because they believe that it is beneficial for them to perform more of the administrative and engineering activities, and in doing so, receive a higher rebate over Public Service's other DSM products.

Participation in the Self Direct product will generally follow this sequence:

1. Public Service pre-qualifies customers who are eligible for participation.
2. Once pre-qualified, a customer identifies energy savings opportunities, then develops and submits a project proposal.
3. Public Service provides confirmation of application receipt, reviews the project proposal, and requests additional information as necessary.
4. Public Service notifies the customer of pre-approval or denial of the application, including the estimated rebate and energy savings from the project, and finalizes a mutually agreed upon M&V plan.
5. Public Service encourages the customer to attend a project planning meeting to discuss final rebate application preparation and project details.

If the customer chooses to implement the pre-approved project they must follow the requirements detailed in the M&V plan and conduct all necessary steps in order to verify energy savings. Any data required for pre-installation monitoring detailed in the M&V plan should be submitted to the Company and approved before the customer implements the energy efficiency measures. Upon acceptance of the data the customer can then implement the measures and perform any follow-up monitoring as described in the M&V plan.

Once the project is implemented and operational and all necessary M&V is completed, the customer will submit their project completion report with required details. Public Service will review the report, request any additional data, and calculate the final rebate. The rebate will be paid by check upon completion of the project and Public Service's approval of the project completion report.

15-minute interval data will help educate customers on when they use energy which may help them make more informed decisions about which projects to submit through the Self Direct product. The interval data will also help customers determine if there is potential for load shifting at any of their locations.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Energy savings and participation targets have been estimated based on projects currently in the pipeline, as well as analysis of historical performance.

### Budgets

The product budget was estimated based on the project pipeline and historical participation. No M&V costs are budgeted for because customers incur the costs associated with M&V for custom projects. Budget dollars are focused on customer rebates as customers are responsible for managing the project from start to finish.

## **C. Application Process**

Customers are most likely to hear about the Self Direct product through their Account Manager or trade partners. Customers must be pre-qualified for participation before submitting a project application. The customer is responsible for providing the Company with justification for eligibility (pre-qualification). Justification must include, but is not limited to, a list of the customer's account numbers, locations, and meter numbers to be aggregated (to meet the minimum aggregated peak load requirement – see Section E below).

Once pre-qualified, the customer will submit a project application for each Self Direct project. The project applications may contain a single measure, or a combination of multiple measures at a single, or multiple customer sites. All energy conservation measures must be at customer locations that receive electric service from the Company.

### Project Application

The project application must include the following components:

- Description of the customer, including electric and gas rate classifications, business activities at involved sites, names and roles of personnel involved in the project, and those personnel's history of and expertise with energy efficiency projects.
- Description of the proposed project(s) including technology, locations, implementation schedule, expected measure life, how the project fits into the customer's operations, and a description of previous implementations of similar technology or projects. The project description should include product specification sheets, white papers, quotes from vendors to validate cost estimates, and other supporting documentation. Self Direct project applications may contain a single measure, or a combination of multiple measures at a single or multiple locations. All energy efficiency measures must be at customer locations receiving electric service from the Company.

- For new buildings, the application must contain computer energy modeling specific to the planned building to forecast the base case and efficient energy use. Computer modeling should be in accordance with the protocol specified within the Energy Design Assistance approach of the New Construction product.
- Engineering calculations to forecast energy and demand savings, participant O&M benefits and costs, and the estimated rebate.
- Benefit-cost calculations to determine the MTRC test ratio, including a discussion of the sensitivity of the MTRC and payback to various inputs, and the perceived accuracy of the inputs.
- Description of the controls the customer will use to reduce the likelihood of project cost and schedule overruns.
- Description of the proposed monitoring activities that will be used to track and document energy and demand savings. Pre- and post-installation metering and verification will be required for all projects with predicted energy savings greater than 0.25 GWh, unless the Company and customer agree upon another methodology. The Company reserves the right to require data measurement and verification for projects of any size.
- Any information reasonably requested by the Company to document and support the application.

#### Project Completion Report

The format of the project completion report must include the following components:

- Description of all deviations from the application package including equipment substitution, cost adjustments, operating procedures, etc.;
- Documentation of all actual costs incurred including invoices, internal labor, incremental operation and maintenance costs, etc.;
- Raw monitoring results and engineering calculations to demonstrate actual energy and demand savings based on monitoring results;
- Requested rebate amount; and
- Any information reasonably requested by the Company to document and support the project completion report.

### **D. Marketing Objectives & Strategies**

The Self Direct product is marketed to large customers who have expressed an interest in overseeing their own energy efficiency improvement projects. Other marketing efforts will focus on potential participants based on customer energy use, conservation potential, and in-house experience and expertise with energy efficiency improvement projects.

### **E. Product-Specific Policies**

The Self Direct product is open to Public Service commercial and industrial electric customers who have an aggregated peak load of at least 2 MW in any single month and an aggregated annual energy consumption of at least 10 GWh. The customer of record must be the same for all aggregated meters to qualify for this product. New customers, or existing customers with new

facilities, that demonstrate predicted demand and usage above the minimum requirements, may participate in the Self Direct product.

The MTRC test ratio for each application will be calculated based on the combination of all measures proposed in the application. The Company will provide an MTRC calculator to facilitate the calculation. The customer will again use the MTRC calculator to calculate the final project MTRC value and include this in the project completion report using the actual implementation costs, energy conservation data, non-energy costs and/or benefits and the calculation methodology provided by the Company. The Company will verify the MTRC for the completed project upon review of the project completion report.

Participants in the Self Direct product will be allowed to participate in other DSM products offered by the Company, but will not be rebated for the same energy efficiency measure through two different DSM products. No funding will be paid by Public Service for the identification (study) of projects being rebated through the Self Direct product. Customer may enroll their new facilities in either the Self Direct product or the New Construction product, but not both. If the customer chooses to participate in the Self Direct product for a new building project, the design work and energy modeling shall follow the protocol established in the New Construction product; however, the customer will be required to pay for all energy modeling costs.

## **F. Stakeholder Involvement**

Customers, trade allies, and other stakeholders are currently engaged at the project level. Feedback is garnered individually from participants. The Company will evaluate trends for product improvement and, after discussion with key stakeholders and/or third-party consultants, will implement potential changes (via 60-Day Notice, as needed).

## **G. Rebates & Incentives**

Self Direct provides rebates on the actual savings of a project based on the times of day the project will save energy compared to the baseline, commensurate with the customer's management of all stages of the project. Rebates will be limited to 50% of the incremental costs of the project. Rebates will apply to new and long-term leased equipment, but not to used equipment. The maximum lifetime and payback for a measure is limited to the lease duration. All measures submitted in a Self Direct project application will be combined for calculation of financial tests and rebate levels. Rebates will not be given for applications with expected paybacks of less than one year. Rebate levels will be adjusted downward so that no project (with rebates included) has a payback less than one year.

## ➤ Strategic Energy Management

### A. Description

The Strategic Energy Management (SEM) product is new for 2019. It combines and replaces the Process Efficiency product and the Energy Information Systems (EIS) measures from prior plans, and it adds enhancements to both of the prior offers.

SEM is a holistic approach to managing energy for persistent savings and continuous improvement. In addition to capital equipment improvements for energy efficiency, the product also stresses system-level operational change as well as cultural change from customers' senior management, mid-management and other personnel.

The product provides customers a shared Strategic Energy Management Consultant (SEMC). The SEMC will typically be sourced by the Company's third-party subcontractor. The SEMC is shared, in that they may be assigned to multiple customers. However, the same individual(s) will remain assigned to the customer throughout the customer's participation in the product.

Due to the magnitude and complexity of this holistic approach:

- SEMC costs vary greatly from customer to customer. Costs are often not determinable until later phases of the customer's activity.
- Significant internal Company resources are required for completing project analyses and verifying adherence to all measurement and verification (M&V) requirements.
- Where feasible, additional providers who are experts in the field of strategic energy management may augment the SEMC's work, or are experts in the operation of the customer's particular processes or technologies.
- Lastly, the Company provides support, in partnership with trade allies, to customize the offering to match customer needs.

The product has two "paths" for individual customer participation, an EIS path and a Process path. Non-process-related commercial customers, such as large office buildings, will participate in the EIS Path. All other qualifying customers can begin in either the EIS path or the Process path. After each phase, a customer may change paths or potentially combine paths.

#### EIS Path

The EIS path is typically for customers who have made some capital improvements, and are ready to begin a formalized plan for ongoing commissioning and/or continuous improvement. The initial focus is to identify low-cost and no-cost measures, drive the customer to consistently implement the measures, and demonstrate repeated and consistent improvement. A goal is for the customers to begin habitually looking for continued improvement on their own, and develop a greater receptiveness to new system improvements for energy efficiency.

The SEMC advises the customer about the implementation of appropriate data collection systems that accurately describe the energy performance of their facilities and associated systems. The

data is then compiled into a web-based tool (known as an EIS), for analyzing, reporting, and graphically visualizing real-time energy performance indicators.

The data collection systems and EIS are a requirement of the EIS path, but the customer can choose from a wide range of suppliers. The Company has determined minimum requirement of EIS tools to ensure that the M&V protocol for savings will be consistent from customer to customer. The Company has pre-qualified a growing number of EIS tools that meet those requirements. After verification of the system installation, the Company will pay an installation incentive to help defray the upfront cost of the system. The SEMC then helps the customer interpret usage patterns, identify opportunities for energy savings, and ultimately verify energy savings from the opportunity's implementation.

### Process Path

In the Process path, the initial focus is to identify major improvements in particular equipment and/or business processes, which may include capital equipment improvements for energy efficiency. During or after the equipment improvements, low-cost and no-cost measures are promoted to help the customer maximize the efficient operation of the systems, or to give customers additional options for improvement.

The process path incorporates data visualization techniques that are similar to those of the EIS path. However, the data is gathered and analyzed at specific points in time by the SEMC who works within phases of each path, as outlined in the following paths and phases.

	<b>EIS Path</b>	<b>Process Path</b>
Phase 1a	<p>A high-level analysis is performed using a standardized energy management assessment (EMA). The EMA includes:</p> <ol style="list-style-type: none"> <li>1. Reviews management practices, including project budgeting and capital allocation, polices and communications related to energy use</li> <li>2. Measures past progress in energy management and, where possible, benchmarks that progress against firms in similar industries</li> <li>3. Analyses interval data, personnel interviews, and an operational overview</li> <li>4. Establishes energy performance objectives and assigns accountability to an individual energy champion or team</li> <li>5. Develops a map of major energy end uses and costs</li> <li>6. Establishes measureable goals for improvement</li> <li>7. Promotes additional resources or programs, such as the U.S. Department of Energy's 50001 Ready program.</li> </ol>	
Phase 1b	<p>Assist the customer in defining an EIS implementation scope, including:</p> <ul style="list-style-type: none"> <li>• End-use targets, metering points, and depth of metering</li> <li>• Preferences about EIS characteristics</li> <li>• Communication needs</li> <li>• Existing sources of data</li> <li>• Assistance in designing the EIS solution</li> </ul>	N/A
Phase 2	<p>The SEMC will work with the customer on a regular and repeated basis to:</p> <ul style="list-style-type: none"> <li>• Identify energy efficiency opportunities of all types, with an initial focus on systemic operational improvements;</li> <li>• Identify opportunities for employee engagement;</li> <li>• Set goals and create a prioritized project register and implementation plan;</li> <li>• Document any new measures as they are discovered and implemented; and</li> <li>• Support any supplemental sub-metering and data-logging as necessary to confirm assumptions of the energy analysis.</li> </ul>	<p>The SEMC will complete a detailed, comprehensive study of major energy-using systems, with a report that details and recommends specific improvements for processes and/or equipment.</p> <p>The Company and the SEMC then:</p> <ul style="list-style-type: none"> <li>• Estimate project costs and rebates to support the projects; and</li> <li>• Work with the customer to set goals and create a prioritized project register and implementation plan.</li> </ul>
Phase 3	<p>Annually, the team will compile an analysis delineating savings achievement from each measure category. Subject to cost-benefit criteria, incentives will be awarded to offset costs incurred for the implementation, measurement, or verification of measures. The SEMC then reprioritizes the project register and implementation plan, and gains customer alignment for continued improvement.</p>	<p>Equipment rebates for this product include both prescriptive and custom measures, adhering to applicable policies and rebate levels for those project types.</p> <p>Document any new measures as they are discovered and implemented.</p>

The program will offer formal SEM cohorts in each plan year. Cohort participants engage in SEM activities as a group and each cohort will consist of five to ten customers with similar energy challenges. Over 12 to 18 months, each cohort will meet in six to nine workshops led by a technically proficient SEM coach. The coach will facilitate peer-sharing about energy modeling, opportunity discovery, and employee engagement. Friendly competitions may also be used to drive results.

### Measure Categories

To ensure persistence of savings, the Company will follow appropriate monitoring guidelines and participants will be held to those requirements in return for eligibility toward incentives related to energy-efficiency activities pursued. The table in the [EM&V section](#) of this Plan describes the protocols for verifying savings from each of the measure categories.

The product may encourage, measure, and validate four categories of measures:

- Capital equipment or process automation measures – Including purchases of new equipment that is more efficient than baseline conditions. Savings relating to new system purchases will be analyzed and incented using the traditional “bottom-up” analysis methods through the Company’s prescriptive and custom programs.
- Recommissioning-type measures – Consist of low- and no-cost Recommissioning opportunities addressing failure or underperformance of installed systems and equipment that can be fixed by making small adjustments, typically not requiring new equipment. Only measures that would have qualified under the Company’s Recommissioning product would qualify within this category of measure.
- Systemic Operational and Maintenance (Systemic O&M) measures - Capital equipment or process automation measures that consist of equipment and processes whose automation capabilities don’t currently exist or are underutilized. Systemic O&M measures are typically more robust and reliable than behavioral measures. Systemic O&M measures may include:
  - Automated operation – the installation, programming, or reprogramming of automated functions for improved energy efficiency.
  - Standardized procedures – significant changes to documented standard operating procedures, with formalized management directive and assigned accountabilities, for the purpose of more efficient process operation.

Examples of Systemic O&M measures include: programming reduced system pressure or lower condensing pressure, scheduled precooling, optimizing pump variable frequency drive controls, or tying variable air volume operation to occupancy sensors.

- Behavioral measures - Measures that require manual intervention with repeated decision-making to achieve energy savings that may not be feasible through system automation. Behavioral measures rely on the choice of individuals to change the way they use equipment. Behavioral savings is the reduction in energy use by customer personnel that is statistically attributable to behavioral measures conducted as part of the product.

Examples of behavioral measures include workshops and targeted training sessions, gamification, competitions, dashboarding, and the placement of informational kiosks.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The participation forecast reflects an anticipated increase in the participation rates from enrollees as well as an increase in the rate of new enrollments, as compared to prior program years.

### Budgets

The budget was developed by applying historical participation rates and provider costs to the anticipated enrollment rate.

## **C. Application Process**

Application for enrollment in the product consists of customer interviews, bill analysis, interval usage analysis where available, and an in-person “expectations” meeting. If both parties agree, the meetings culminate in the signing of a Memorandum of Understanding (MOU) between the Company and the customer. The MOU defines each phase of the path, and is customized to reflect the customer’s specific need. By signing the MOU, the customer formally acknowledges influence of, and participation in the product. Once SEMC begins onsite meetings and the MOU is signed, conditional preapproval is established for measures the customer subsequently pursues.

## **D. Marketing Objectives & Strategies**

The product is resource-intensive and its potential depends greatly on the customer’s level of engagement. Therefore, the Company’s Account Representatives and Product Management market it, with the assistance of the Company’s third-party implementers.

The Company expects that its largest, most engaged and progressive customers will participate. As EIS matures and case studies are created, more customers are expected to take interest.

During the plan period, the Company will evaluate the potential for using interval usage data to better engage small & medium customers.

## **E. Product-Specific Policies**

### Quantifying Energy Savings

Quantifying energy savings from Systemic O&M measures and Behavioral measures will involve calculations using a “top-down” method of statistical modeling using a multi-variable regression analysis. For each customer, the regression model will be developed in accordance

with the “BPA MT&R Reference Guide”.<sup>44</sup> To avoid double-counting, the Company will reduce the savings implied by the regression model by the amount of the achievements associated with New System and Recommissioning measures, where applicable. The net, adjusted savings may also include savings resulting from the purchase of energy-efficient equipment that did not qualify for savings or rebates as New System or Recommissioning measures.

### Eligibility

Eligible customers for SEM are those with annual consumption of more than 4 GWh within a location or contiguous set of premises. Customers with slightly lower annual consumption may be considered for enrollment on an individual basis, depending on expected costs and opportunities. The Company will screen potential usage, demand, energy intensity if available, history of implementation, and management receptiveness to energy efficiency goals. Because the product is resource intensive, not all large customers will qualify.

## **F. Stakeholder Involvement**

Although trade partners cannot enroll customers, the customer may use any trade partner to install measures or provide customer-contracted services. Primary stakeholders include the customers, third-party subcontractors, and Company representatives. The Company works with these stakeholders to identify product trends and potential changes to product design.

## **G. Rebates & Incentives**

For implemented Capital equipment measures, the Company will award rebates equivalent to the prescriptive or custom rebates the customer would have received had the customer not enrolled in the EIS product. Recommissioning measures will be incentivized at the same rates in affect under the Recommissioning product.

Annualized adjusted Systemic O&M and Behavioral measures may qualify for incentives, subject to cost-benefit criteria. The incentives will be relatively small, and intended to incentivize the customer to maintain EIS software, collect data such as production, occupancy, or shift scheduling information.

For Phase 1 of the EIS path, the Company offers an incentive of up to 30% of the EIS installation costs, once the system is installed and verified.

To influence customer commitment, either path’s detailed study funding may include a small proportion of customer contribution, up to \$7,500.

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<sup>44</sup> <https://www.bpa.gov/EE/Policy/IManual/Documents/MTR-Reference-Guide-Rev6.pdf>

## Residential Program

### A. Description

Public Service will continue to offer a wide range of product offerings to serve residential customers in 2019 and 2020. The DSM products that make up the Residential Program will be available to over 1.25 million electric and 1.28 million natural gas customers.<sup>45</sup> These customers traditionally reside in single-family homes, multi-family homes, and apartments/condominiums. To address this varied set of customers, the Company will offer a unique set of products targeted to reach the vast majority of the residential market and provide customers with multiple opportunities to participate.

While the Business Program focuses on customers with large energy savings projects, the Residential Program is truly a mass-market program that will touch tens of thousands of customers annually. The products are implemented in a manner that enables large numbers of customers to participate and benefit from the products.

The residential DSM products focus on educating customers on energy efficiency and giving them simple ways to participate, encouraging long-term commitment to reduce energy use. The Company offers a comprehensive set of products including prescriptive rebates for heating and cooling equipment, home lighting, whole house solutions for new or existing homes, lessons on energy efficiency to school-aged children, energy savings through behavior change, and refrigerator recycling.

#### Products

A thorough portfolio of residential products is planned for 2019 and 2020 including 14 electric and ten natural gas products. Like the Business program, all of the natural gas products coincide with their electric counterparts. The Residential product rankings are shown in Table 10 below.

**Table 10: Residential Program Product Rankings**

2019-2020	Rank
Home Lighting & Recycling	1
School Education Kits	2
Energy Feedback Residential	3
Energy Efficient Showerhead	5
Evaporative Cooling	6
Thermostat Optimization	10
Residential Heating	13

<sup>45</sup> Customers counts as of July 31, 2018.

ENERGY STAR New Homes	17
Water Heating	19
Refrigerator & Freezer Recycling	21
Home Energy Squad	23
High Efficiency Air Conditioning	24
Insulation & Air Sealing	25
Home Performance with ENERGY STAR	31

In developing and refining the portfolio of products, Public Service worked closely with external consultants familiar with residential and low-income products nationally. This included assessing possible new products, developing technical assumptions for new energy efficiency measures, evaluating the Colorado climate and energy code impacts, and performing an initial cost-effectiveness analysis. The Company researched other utility offerings to learn about new products, understand their challenges, and discover how the existing products could be improved. The Company worked with industry consultants and vendors such as E-Source, ACEEE, and CEE to learn about energy efficiency activities across the nation. In addition, Public Service spoke with local energy industry members to shape and refine products and discuss partnership opportunities.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The Company's residential DSM products have a large reach to customers and provide a wide portfolio of offerings that will allow all customers to participate. The Residential Program is anticipated to contribute 150.3 GWh and 435,754 Dth in 2019 and 126.1 GWh and 451,753 Dth in 2020. This is approximately 30% and 62% respectively of the 2019 achievements and 25% and 66% respectively of the 2020 achievements.

**Table 11a: 2019 Electric Residential Program Budgets & Targets**

2019	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Residential Program</b>				
Energy Efficient Showerhead	\$37,727	86	1,011,152	13.36
Energy Feedback Residential	\$2,990,084	5,096	21,731,615	1.22
ENERGY STAR New Homes	\$1,397,326	1,066	3,092,103	0.88
Evaporative Cooling	\$4,204,300	6,122	4,727,651	3.43
High Efficiency Air Conditioning	\$2,039,560	1,819	1,795,587	1.25
Home Energy Squad	\$448,214	395	1,647,889	1.20
Home Lighting & Recycling	\$5,723,745	12,547	89,054,545	2.58
Home Performance with ENERGY STAR	\$650,685	410	219,247	0.65
Insulation & Air Sealing	\$440,996	455	507,035	0.89
Refrigerator & Freezer Recycling	\$1,232,233	599	3,935,695	1.04
Residential Heating	\$911,100	1,056	5,769,742	1.21
School Education Kits	\$1,710,283	1,335	10,433,360	1.30
Water Heating	\$1,083,610	739	5,018,807	1.29
Thermostat Optimization	\$261,695	1,653	1,352,112	1.67
General Advertising-Res	\$575,496			
<b>Residential Program Total</b>	<b>\$23,707,054</b>	<b>33,377</b>	<b>150,296,541</b>	<b>1.88</b>

**Table 11b: 2020 Electric Residential Program Budgets and Targets**

2020	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Residential Program</b>				
Energy Efficient Showerhead	\$38,017	86	1,011,152	13.46
Energy Feedback Residential	\$3,140,084	4,914	20,141,191	1.14
ENERGY STAR New Homes	\$1,292,286	1,000	2,988,677	0.89
Evaporative Cooling	\$4,404,100	6,632	5,121,782	3.59
High Efficiency Air Conditioning	\$2,820,998	2,704	2,566,184	1.29
Home Energy Squad	\$685,665	613	2,448,239	1.15
Home Lighting & Recycling	\$4,823,414	9,671	68,638,979	2.16
Home Performance with ENERGY STAR	\$650,106	466	310,462	1.02
Insulation & Air Sealing	\$465,908	461	515,024	0.89
Refrigerator & Freezer Recycling	\$1,249,390	743	4,000,307	1.11
Residential Heating	\$77,700	105	566,506	1.32
School Education Kits	\$1,804,317	1,381	10,779,522	1.22
Water Heating	\$1,083,760	739	5,018,807	1.33
Thermostat Optimization	\$334,751	2,282	1,955,134	1.72
General Advertising-Res	\$515,496			
<b>Residential Program Total</b>	<b>\$23,385,992</b>	<b>31,797</b>	<b>126,061,968</b>	<b>1.83</b>

**Table 11c: 2019 Natural Gas Residential Program Budgets & Targets**

2019	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Residential Program</b>					
Energy Efficient Showerhead	\$459,736	53,968	117,389	\$6,885,814	10.91
Energy Feedback Residential	\$407,165	92,886	228,129	\$451,708	2.11
ENERGY STAR New Homes	\$1,972,921	86,336	43,760	-\$48,648	0.99
Evaporative Cooling					
High Efficiency Air Conditioning					
Home Energy Squad	\$275,047	10,250	37,265	\$410,409	2.26
Home Lighting & Recycling					
Home Performance with ENERGY STAR	\$337,185	19,248	57,083	-\$241,371	0.82
Insulation & Air Sealing	\$361,232	20,783	57,535	-\$107,354	0.92
Refrigerator & Freezer Recycling					
Residential Heating	\$1,333,800	62,884	47,146	-\$1,519,721	0.74
School Education Kits	\$609,213	46,226	75,879	\$5,733,869	8.24
Water Heating	\$113,540	5,307	46,743	-\$306,007	0.54
Thermostat Optimization	\$164,005	37,867	230,889	\$295,465	1.60
General Advertising-Res	\$140,504				
<b>Residential Program Total</b>	<b>\$6,174,347</b>	<b>435,754</b>	<b>70,575</b>	<b>\$11,413,662</b>	<b>1.63</b>

**Table 11d: 2020 Natural Gas Residential Program Budgets and Targets**

2020	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Residential Program</b>					
Energy Efficient Showerhead	\$459,736	53,968	117,389	\$7,007,122	11.00
Energy Feedback Residential	\$427,165	89,936	210,542	\$530,649	2.24
ENERGY STAR New Homes	\$1,848,007	75,359	40,779	-\$173,160	0.97
Evaporative Cooling					
High Efficiency Air Conditioning					
Home Energy Squad	\$369,071	15,731	42,624	\$678,764	2.50
Home Lighting & Recycling					
Home Performance with ENERGY STAR	\$341,805	19,248	56,312	-\$202,357	0.85
Insulation & Air Sealing	\$366,319	20,835	56,876	-\$64,986	0.95
Refrigerator & Freezer Recycling					
Residential Heating	\$1,353,800	62,884	46,450	-\$1,377,348	0.77
School Education Kits	\$626,354	46,226	73,802	\$5,829,672	8.20
Water Heating	\$114,758	5,385	46,922	-\$295,991	0.56
Thermostat Optimization	\$218,999	62,181	283,935	\$488,630	1.75
General Advertising-Res	\$140,504				
<b>Residential Program Total</b>	<b>\$6,266,518</b>	<b>451,753</b>	<b>72,090</b>	<b>\$12,280,492</b>	<b>1.68</b>

## Budgets

Achievement targets were developed as a result of a participation and energy savings estimation process for each product, which was rolled up to the Residential Program total. Similarly, budgets for each product were developed based on the anticipated level of achievement and cost of market penetration, including review of historical data for the past three and half years, and experience with similar products in Minnesota.

## Market Analysis

The Company's Residential Program reflects the primary market opportunities for residential energy savings in four areas: whole home and building envelope, HVAC, education and behavior change, and common measures.

1. *Whole Home and Building Envelope:* With increased awareness of energy costs, interest in conservation, and varied energy performance of existing homes, there continues to be good energy efficiency opportunities for residential customers in new or existing homes.  
Products: ENERGY STAR New Homes, Home Performance with ENERGY STAR, Insulation & Air Sealing
2. *HVAC:* Public Service believes evaporative cooling is an excellent low cost source for cooling in the Colorado climate. The Company also realizes that customers are looking for central air conditioning and heating options. To address this demand, the Company offers products focused on quality installation of new units and replacement of inefficient, existing systems.  
Products: Evaporative Cooling, Residential Heating, and High Efficiency Air Conditioning
3. *Education and Behavior Change:* The Company funds initiatives to educate customers, enhance participation in direct impact products, and influence market transformation.  
Products: Energy Feedback Residential and School Education Kits
4. *Common Measures:* The Company supports rebates and incentives for prescriptive, energy-saving measures focused on the most common household equipment.  
Products: Home Energy Squad, Home Lighting & Recycling, Refrigerator & Freezer Recycling, Energy Efficiency Showerhead, and Water Heating.

## **C. Application Process**

Application processes vary by product. See individual product summaries following this overview for more information.

## **D. Marketing Objectives & Strategies**

Trade allies, end-use equipment vendors, energy services companies, Public Service's call center representatives and marketing team are the primary drivers for realization of the planned achievements in the Residential Program. The Company utilizes newsletters, customer events,

direct mail, telemarketing, email communications, and awareness advertising to reach customers. A challenge in marketing energy efficiency is that it's not a topic on the top of customers' minds. Customers tend to focus on purchase price (or "first costs") rather than lifetime costs and are unlikely to replace equipment prior to failure. Customers may also not be aware of energy efficient equipment options available to them when the need arises to make purchase decisions. Yet, opportunities are growing in marketing energy efficiency to customers because energy costs and climate change have led to increased awareness and affinity for energy-saving actions. To support marketing efforts, Public Service employs an integrated approach to marketing communications, where the tactics are designed to work in concert with each other and reinforce key messages over time.

Furthermore, residential DSM product managers and product developers periodically meet with the Company's residential Customer Care Centers and energy efficiency specialists to determine how the energy efficiency products and services are being received in the marketplace, and solicit ideas for existing product improvement or new product introduction.

### Strategy

Public Service follows the "AIDA" (awareness, interest, desire, action) process for encouraging customers to participate in DSM products. The following are the steps in this process:

1. Create awareness of electric and/or gas prices and potential savings from energy efficiency offerings.
2. Promote interest in DSM products by providing information about the offerings across a variety of customer touch-points.
3. Instill the desire for participation in DSM products by showing how customers can reduce their "first costs" via rebates in the near-term and reduce their monthly energy bills in the long-term with energy-efficient appliances and equipment.
4. Move the customer toward action by providing a wide range of product offerings to address one or more of their needs.

### Key Messages and Target Audience

When communicating with customers, Public Service uses several overarching key messages including:

- Energy efficiency reduces monthly energy bills due to lower operating costs.
- Public Service helps lower energy bills by offering rebates and incentives for installing highly efficient equipment.
- Energy efficiency helps reduce environmental impacts.

## **E. Program-Specific Policies**

There are several general policies that apply to Public Service's Residential Program. Individual products may have additional, unique policies as noted in each of the product summaries that follow.

Residential Program policies include:

- *Proof of installation:* Nearly all residential DSM products in the Company's portfolio require documentation of installation through either proof of purchase (i.e. detailed invoices) or by measurement and verification.
- *Installation date:* Determines rebate eligibility and amount. Other products may have more specific requirements to qualify for a rebate.
- *Load Shifting:* Load shifting occurs when a measure shifts electrical energy and demand usage to an off-peak period, without necessarily reducing the total load served over a defined time period. Potential load shifting projects need to meet all existing eligibility requirements of the applicable product as well as additional persistence requirements.

## **F. Stakeholder Involvement**

Throughout the product development process, Public Service has discussions with key external parties. The discussions are often initiated via work groups, public forums like the quarterly DSM Roundtable Meetings, one-on-one meetings, phone calls, and/or brainstorming sessions. In developing this Plan, the Company had discussions with local stakeholders, including: City/County of Boulder, City of Denver, Colorado Energy Office, Colorado Department of Public Health and Environment, Energy Efficiency Business Coalition (EEBC) and Denver Water.

In addition to discussion with Colorado area contacts, Xcel Energy had also worked with national organizations in the past when developing many of the DSM products, including: ACEEE, CEE, U.S. Department of Energy, U.S. Environmental Protection Agency, E Source, and the Southwest Energy Efficiency Project (SWEET).

These organizations continue to provide feedback on the Company's DSM products to suggest areas for future improvement.

Additionally, as the Company explores new ways to reach the residential market, we continue to work with local communities as key partners. In 2014, the Company launched the *Partners in Energy* program to support communities in developing and implementing comprehensive energy action plans. Local energy plans are a platform to drive participation in the Company's DSM products. In 2018 and 2019, the Company will continue to support and grow community partnerships through *Partners in Energy*, by configuring our DSM products and resources to support the unique energy goals and markets of individual communities.

## **G. Rebates & Incentives**

Residential rebates are prescriptive, and vary by product.

Indirect Programs such as Consumer Education, Energy Efficiency Financing, and Home Energy Audits support customer learning, and influence participation in residential prescriptive products.

## **H. Evaluation, Measurement, & Verification**

The specific product measurement and verification plans are described in the EM&V section of this Plan; and products that will undergo comprehensive evaluations in 2019 or 2020 are also noted that section.

## ➤ Energy Efficient Showerhead

### A. Description

The Energy Efficient Showerhead product is designed to offer year-round natural gas and electric savings to Public Service customers. Residential natural gas and combination gas and electric customers are eligible to receive free (or discounted), energy-efficient showerheads and faucet aerator kits to help reduce their energy and water use.

Eligible customers are contacted and offered multiple kit options based on their past participation in the Energy Efficient Showerhead product. Kit combinations may include one or more of the following units:

- 1.5GPM showerhead
- 0.5GPM bathroom faucet aerator
- 1.5GPM kitchen faucet aerator

The free kit is mailed to customers who make the decision to request the energy efficiency measures within the promotional period. In addition to the showerheads and aerators, the kits include Teflon tape and illustrated installation instructions. Participants receive one kit per household.

Customers may also purchase showerheads and aerators individually through the Xcel Energy Store, which are mailed to the customer. Rebates are available for eligible customers and are applied at the point of purchase. In many cases, these rebates cover the full cost of the equipment. Limits on the number of showerheads and aerators per customer are the same as if the customer had ordered a kit.

The Company contracts with third-party implementers to manage customer requests and distribute the kits and individual equipment. Customer participation is tracked and provided to the Company following the distribution of the kits or individual equipment.

### B. Targets, Participants & Budgets

#### Targets and Participants

The Company set the product targets for participation and energy savings based on past performance of the product. Actual savings will be driven by the customer's water heater energy source and service type (electric and/or natural gas) and customer installation rates.

#### Budgets

The product budget was developed based upon the cost of reaching the proposed energy savings targets – using 2017 product performance as a guide for the cost of the showerheads/aerators, fulfillment charges, postage, and all necessary marketing efforts. Since the third-party

implementer will manage all day-to-day activities outside of marketing, minimal internal Company labor is allocated to this product.

### **C. Application Process**

Customers are notified of this product through direct mail and/or email, typically distributed in the spring (and occasionally fall) targeting different areas of the service territory. Customers have a limited amount of time (approximately 45 to 60 days for direct mail and a one to two weeks for email) to respond to the third-party implementer. Once the customer responds to the offer, they are shipped one free energy-savings kit within six weeks. If a customer orders their products from the Xcel Energy store, the products are shipped within 2-6 business days; however, these customers are required to pay shipping if the total cost of the order is under \$49.

In addition to the direct mail and email campaigns, Public Service will continue to seek out or consider proposed partnerships with other organizations or cities to distribute free energy efficient showerheads and/or aerators.

### **D. Marketing Objectives & Strategies**

An average of 4 percent of customers who received a direct mail or email offer in 2017 requested the product. Based on this data, the Company has developed a marketing plan utilizing direct mail and/or email campaigns and partnerships to reach the participant goal. The marketing collateral requests the customer to indicate whether their water heater runs on gas or electricity.

### **E. Product-Specific Policies**

Natural gas and combination gas and electric customers who have not previously participated are eligible for the offer. Additionally, past participants may be offered additional or replacement units through follow-up marketing offers based on when they participated. If an eligible customer who did not receive the offer becomes aware of the product and would like a free kit, they will receive one if budget allows.

The Company is aware of the Colorado Senate Bill 103 which prohibits the sale of products not certified with the WaterSense<sup>®</sup> label beginning in September 2016, effectively lowering the baseline. However, because this is a retrofit product the product assumes the federal minimum GPM for plumbing products as the baseline.

### **F. Stakeholder Involvement**

In past program years, Public Service has partnered with local cities and counties on their water efficiency initiatives. The Company plans to continue its support of these types of programs in 2019 and 2020.

## **G. Rebates & Incentives**

The product generally provides free energy efficient equipment rather than a rebate to the customer—the price for that equipment is classified as the rebate in the product budget. While the majority of participants choose this option, the product also offers more expensive showerheads with additional features (handheld showerheads, for instance) at a discounted price. In these cases, the rebate covers only a portion of the cost of the equipment and is subtracted directly from the cost at the point of purchase.

## ➤ Energy Feedback Residential

### A. Description

The Energy Feedback product provides targeted communication of energy-use comparisons and information called the Home Energy Report (HER) to Public Service's Colorado residential customers, providing specific recommendations and feedback to motivate and educate customers on how to reduce their energy consumption. Customers receive new information with each HER that is delivered by mail or email, or a combination of both formats. An online version of this information along with additional energy-awareness and savings tools is available for all Public Service residential customers.

The product's main offerings include the following two components:

*Personalized Home Energy Reports* – A targeted direct mailing and/or email that provides specific recommendations and feedback designed to motivate customers to reduce their energy consumption. The individualized reports provide:

- Customers' energy use compared to the average of similar homes with similar characteristics (neighbor comparison);
- Personalized energy efficiency recommendations and tips based on an analysis of the household's energy usage, demographics, home characteristics and information provided by the participant; and
- Advice on how customers can easily implement energy efficiency measures based on their individual circumstances.

The group of randomly assigned customers receiving the HERs is referred to as the Treatment Group. The third-party implementer uses its extensive experience with utility behavioral programs and data analytics capabilities to identify which of these customers receive a mailed print version of the HER, an emailed report only, or both print and email reports.

The group of randomly assigned customers who do not receive the HERs is referred to as the Control Group.

Energy savings from the Treatment Group are compared against those of the Control Group in order to determine the DSM product's energy savings. The savings results are reported to the Company each month. The Company is investigating deemed savings as an alternate methodology for claiming energy savings.

Interval usage data is expected to have a large impact on this product offering, as the Company will be able to better identify opportunities to reduce energy use and educate customers. The Company is evaluating the product offering and looking for ways to improve it.

*Online Portal* – An online suite of tools that gives customers greater insight into their energy consumption and actions they can take to become more energy efficient. These tools are available to all Public Service residential customers in Colorado, and provide the same

information that customers receive in their HERs, with a more robust set of customization options and energy-savings tools. These tools offer customers flexibility to analyze their consumption and provide options for customers to update their profiles to make future HERs even more personalized and useful.

Customers who engage in the online portal are compared to similar customers who have not accessed the portal, in order to determine energy savings resulting from customers' use of the tools. Savings from customers who are part of the HER Treatment Group who also use online tools will have all savings measured as part of their HER savings calculation. Only savings from customers who are not part of the HER Treatment Groups will be counted as attributable to online savings.

Participants are given the opportunity to opt-out of outbound communications at any time.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The Company has developed specific energy savings and participation targets for each product component:

*Home Energy Report:* Participants in the 2018 product will carry over and remain in the print and email groups for 2019 and 2020. New participants will be added in 2019 and 2020 to account for participant loss based on attrition.

*Online Portal:* All Public Service residential customers have access to the online portal; however customers must sign up for My Account in order to access it.

The online portal follows an opt-in model where customers will receive targeted marketing messages encouraging them to access it and actively participate. This differs from the HERs, where customers are randomly selected to receive reports unless they opt out. Some participants may be single-fuel service customers while others may receive both natural gas and electric service from Public Service. Therefore, each fuel service counts as a "participant," meaning a dual-fuel customer will count as a gas participant and also as an electric participant.

### Budgets

The majority of the product's budget is allocated to third-party implementation services, which includes preparing and mailing the HERs, data analytics, marketing and conducting an ongoing regression analysis of Treatment and Control Group participants to determine the electric and natural gas savings. Administrative costs for customer data extraction and product administration to be completed by Public Service are based on costs derived from previous program years.

The multi-state budget for the online portal is largely fixed due to the information technology and delivery method, and does not change as more customers use the tools and services. A share of the online portal license fees are apportioned to this product's budget based on customer counts for each state and fuel type.

## **C. Application Process**

There is no customer application for this product. Participants for the print and email Treatment Groups are secured using a random selection process administered by the third-party implementer. New participants will be informed of their selection at the beginning of treatment and will be given the opportunity to opt-out from receiving the Treatment Group communications (HER) at any time. Appropriately-sized Control Groups are identified by the third-party implementer and enable isolation of effects attributable to each Treatment Group. The Control Group customers have not and will not be directly contacted or targeted by the Company or third-party implementer's marketing efforts regarding this product. The online portal is opt-in. Customers become participants once they log onto My Account and go to the online tool.

## **D. Marketing Objectives & Strategies**

Customers who receive HERs may choose to participate in other DSM products, and this becomes more likely when a specific DSM product is cross-promoted on the HER itself. The Company plans to continue to utilize this effective marketing channel for targeted promotion of other energy-saving DSM products and services.

## **E. Product-Specific Policies**

Customer confidentiality and data privacy practices will be stringently applied in accordance with Xcel Energy's Privacy Policy, available on the Company's website.<sup>46</sup>

Customer assistance will be provided to participants and non-participants in the same manner.

## **F. Stakeholder Involvement**

This product was piloted prior to launch, based on recommendations from stakeholders participating in the DSM Roundtable, from 2010-2014.

## **G. Rebates & Incentives**

Rebates are not offered as part of the product.

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<sup>46</sup> <https://www.xcelenergy.com/staticfiles/xcel/StaticFiles/xe/Admin/Xcel%20Online%20Privacy%20Policy.pdf>

## ➤ ENERGY STAR New Homes

### A. Description

The ENERGY STAR® New Homes (ESNH) product provides builders of single-family and small multifamily homes with an incentive to exceed local building codes and common construction practices. Homebuilders are encouraged to look at the “whole house” as a system when considering deployment of energy saving construction methods and installation of energy-efficient appliances. Homeowners benefit with lower energy bills, fewer maintenance concerns, higher resale value, and a more comfortable, quiet home. With interval data, homeowners would also have a way to see how efficient their home is starting out and gain a deeper appreciation and understanding of that efficiency.

The current product structure gives builders the flexibility to mix and match efficient technologies and building practices to meet the product requirements and qualify for a rebate. To qualify for a rebate, participants are required to build homes that exceed local building jurisdictions’ energy codes by at least 10%. To measure this, a rating must be completed on each home by a Residential Energy Services Network (RESNET) certified Home Energy Rating System (HERS) rater. The HERS rater provides a valuable service by consulting with the homebuilder during the construction phase and ensures the designed energy efficiency measures have been properly installed in the home. HERS raters will complete the rating for each home using a RESNET accredited software approved by the Company and will provide select informational details to the Company’s third-party implementer for evaluation. Energy savings are determined individually for each home based on the difference between the energy used by the reference home (or baseline home; modeled to match the local jurisdictional energy code) and the energy used by the new as-built home. The Company plans to evaluate this product structure in 2019 to determine necessary adjustments to help the product remain cost-effective while adapting to accommodate higher energy codes and value-based energy savings.

The Company utilizes a third-party implementer that works directly with local HERS raters to get homes enrolled in the product. HERS raters in the state of Colorado have established strong relationships with the builder community. HERS rating companies have the flexibility to participate in this product by completing a standard scope of work administered and managed by the Company’s third-party implementer. The HERS rater will model each home and test the home to measure the level of energy efficiency achieved. Once the home is completed, the HERS rater provides the required information to the third-party implementer who then determines if the home meets the product requirements and is eligible for a rebate. The third-party implementer is responsible for reviewing the information submitted by the rater, working with the rater to correct or provide missing information and then reporting it to the Company. The third-party implementer provides product training for the rater and will assist with builder training as needed.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The product targets builders who construct single-family and small multifamily homes (duplex, triplex, fourplex). Energy savings and participation targets are based on historical product performance and growth forecast assumptions in the residential new construction marketplace. New construction growth continues to improve and barring any significant impacts to the financial sector, the Company anticipates this growth will continue to occur around 5% year over year. As more jurisdictions adopt higher energy codes such as 2012, 2015, and 2018 IECC, it is expected that participation will be lower in the entry level rebate tiers. A home that meets the minimum 10% Better-than-Code (BTC) participation requirement in a 2009 IECC jurisdiction will likely not readily meet the minimum 10% BTC threshold once their jurisdiction adopts the 2012 IECC. Under IECC 2012, the baseline home is now more energy efficient and the energy savings the Company can claim for these homes is reduced. Generally speaking for 2019 and 2020, Public Service expects a shift in participation from mid-level BTC code tiers to lower BTC tiers for jurisdictions adopting higher energy codes. As a result, overall product savings targets are impacted and the Company anticipates the average claimable energy savings on a per-home basis to be lower than in previous years.

### Budgets

The product budget is primarily driven by forecasted participation for 2019 and 2020 and established rebate levels are designed to encourage participation. Additional costs include; product administration, promotional and outreach activities, measurement and verification. Product administration costs include Company labor and third-party implementer services, which were competitively bid and implemented beginning in 2015. Builder rebates and energy rater administrative fees together comprise approximately 69% of the product budget and are the single largest expense component.

## **C. Application Process**

Enrollment for this product is typically completed by the HERS raters on behalf of their clients (builders). HERS raters have strong, long established relationships with most of the builders operating within the Company's Colorado service territory. To initiate the enrollment process, HERS raters will contact builders to encourage their participation, or the builder will contact a rater and express interest in constructing an energy-efficient home. The rater will explain the product offering and potential rebates available, review the home's blueprints and building schedule, and enter the home details into the third-party implementer's tracking database. The rater consults with the builder throughout the construction phase to build a home that qualifies for the product rebate.

When the home is completed, the HERS rater will perform an air-tightness test on the house and determine the energy impacts using REM/Rate or Ekotrope. This information is submitted to the third-party implementer who will review and approve each home. The builder will receive a rebate based on the local energy code requirement and the percent BTC achieved. Specific gas and electric energy savings are determined by the Company using the HERS rater's modeling

information. There is no rebate application for the builder or rater to complete since all required information is entered by the HERS rater into the third-party implementer's database using a web portal interface. The third-party implementer reviews and ensures all information is accurate and captured and works directly with the energy rater to correct any omissions or errors. Once the data is deemed complete, the third-party implementer is responsible for manually entering selected portions of the collected data for each home into the Company's database.

#### **D. Marketing Objective & Strategies**

The Company will update existing builder and homebuyer marketing materials and make them available to participants. The objective of the builder marketing material is to increase product awareness and effectively communicate product benefits (energy savings, economics, and comfort/durability) along with the requirements for participation. The homebuyer collateral was created as an aid for builders to easily explain the benefits of an energy efficient home to their potential clients. Additionally, a certificate of completion was created for the homebuyer. The certificate demonstrates the home successfully completed the product requirements and contains useful information such as the HERS index achieved and who rated the home. The development of new marketing materials will be driven in part by the outreach plans of the third-party implementer and feedback received from participants. The product does not utilize mass marketing campaign efforts as a method of driving participation.

The Company's third-party implementer will engage in outreach activities with participants and stakeholders. The outreach objectives are intended to maintain good working relationships with builders and raters, ensuring they are satisfied with the product offering and to provide education and training support where needed. The third-party implementer will initiate monthly product update communications to all participants, and hold in-person and conference-call meetings with raters along with routine email and phone communications.

The third-party implementer will provide training to participants (primarily raters) on the product requirements, REM/Rate or Ekotrope modeling software and use of their database system to improve efficiency and ensure more accurate data reporting. These activities are expected to encourage energy-efficient building practices resulting in increased energy savings. The third-party implementer will offer up to 30 no-cost professional sales training sessions to realtors and builders' sales agents throughout the year. The Company is also evaluating opportunities to work with the net-zero energy (NZE) home community to jointly provide training on energy efficiency and NZE homes with architects and builders. The Company's third-party implementer is working with ESNH participating energy raters to identify pathways for implementing this joint training activity. The ESNH product shares common interests with the NZE community since the best path to reach net-zero is to start with a highly energy-efficient home. The Company is also considering how renewable programs and the ESNH product may be jointly marketed to customers. Other types of training will be identified with the assistance of the product participants, key stakeholders and the third-party implementer who will be responsible for developing specific outreach plans. Key stakeholders include organizations such as local homebuilder associations, the Colorado Energy Office, the Colorado Code Compliance Collaborative and other related industry organizations.

## **E. Product-Specific Policies**

This product currently applies to builders of residential single-family buildings, small multifamily buildings and townhomes that receive combined electric and natural gas service, or natural gas-only service, from Public Service. Structures that have common conditioned space such as hallways and elevator shafts are not eligible to participate in the product. Additional product requirements are:

1. Raters must be RESNET certified and use the RESNET modeling software approved by the Company to model each home.
2. Raters must provide a RESNET-registered HERS rating for each home. Sample ratings are not accepted.
3. Raters must complete a Rater Field Checklist and the home must pass the applicable sections.
4. Builders will receive a rebate based on the local energy code requirement and the percent BTC. The percent improvement is determined using REM/Rate or Ekotrope software to model the energy used by the reference home (or baseline home; modeled to match the local jurisdictional energy code) and the energy used by the new as-built home. The energy use is converted to MMBTU and the following formula is used to determine the percent improvement: 
$$\frac{\text{Ref\_Home\_MMBTU} - \text{As-Built\_Home\_MMBTU}}{\text{Ref\_Home\_MMBTU}}$$
5. Homes that achieve ENERGY STAR certification and receive a percent BTC rebate (as detailed in Section G below) may be eligible for an additional \$100 rebate.
6. Natural gas-only participants are not eligible to receive the lighting rebate for installing high efficiency lighting, ENERGY STAR® radon fans, or heat pump water heater measures.
7. In 2019, homes that receive electric-only service from the Company are not eligible to participate in the product. Beginning in 2020, electric only homes will be eligible to participate.
8. Homes qualifying for a product rebate are not eligible for Company's *separate prescriptive* rebates under the following products; Evaporative Cooling, Heating Efficiency, High Efficiency A/C, Insulation & Air Sealing, Thermostat Optimization, and Water Heating.
9. Impacts from PV or other renewable generation systems installed in the home will not be included in the percent BTC improvement (rebate) or energy savings calculations.

## **F. Stakeholder Involvement**

The Company maintains ongoing relationships with the U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy, which jointly oversee the national ENERGY STAR program. The Company is an active Sponsor and participant in the national program, recognizing

the strong customer awareness of the ENERGY STAR brand, and has received several ENERGY STAR awards for this product.<sup>47</sup>

This product has received significant interest and input from external Colorado stakeholders in preparation of Plan filings and during Plan Settlement. This input has been valuable and taken under consideration for the product design.

The Company serves on the new home construction committee of the Consortium for Energy Efficiency, which meets regularly and works closely with the EPA. The third-party implementer attends RESNET conferences on behalf of the Company.

Public Service will strive to work with and engage Colorado stakeholders, such as the Colorado Energy Office, Southwest Energy Efficiency Project, Energy Efficiency Business Coalition, the Colorado Energy Code Collaborative, the City of Denver and others to partner when possible and continue the product's success.

The Company will issue monthly communications to participating builders and energy raters, providing year-to-date product updates on participation, achievement, expenditures, and other important product information as it arises. The Company's third-party implementer communicates regularly with participating energy raters and builders, including requests for their input on training and education gaps related to energy efficiency and more specifically, how the product can assist filling those gaps.

## G. Rebates & Incentives

Builders with qualifying homes are eligible to receive a rebate based on the local energy code requirement and the percent BTC improvement achieved (see *Product-Specific Policies* for details). A builder's home must achieve a minimum 10% BTC improvement to qualify.

### Combo/Gas Only Homes - Rebate Levels – 2009 IECC or Lower, and Percent BTC

Percent BTC	Rebate
10% - 14.999%	\$200
15% - 19.999%	\$350
20% - 24.999%	\$500
25% - 29.999%	\$650
30% - 34.999%	\$800
35% - 39.999%	\$1,000
40% and higher	\$1,400

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<sup>47</sup> View the ENERGY STAR Awards Archive: <https://www.energystar.gov/about/awards/awards-archive>

**Combo/Gas Only Homes - Rebate Levels – 2012 IECC or Higher and Percent BTC**

<b>Percent BTC</b>	<b>Rebate</b>
10% - 14.999%	\$250
15% - 19.999%	\$400
20% - 24.999%	\$600
25% - 29.999%	\$900
30% - 34.999%	\$1,300
35% - 39.999%	\$2,000
40% and higher	\$2,550

**Electric Only Homes - Rebate Levels – 2012 IECC or Higher, and Percent BTC**

<b>Percent BTC</b>	<b>Rebate</b>
10% - 14.999%	\$650
15% - 19.999%	\$800
20% - 24.999%	\$1000

The ENERGY STAR certified rebate is an *add-on* rebate available to qualifying homes that have earned ENERGY STAR certification and meet the following:

- a) Home must have both electric and gas service from Public Service. Gas-only or electric-only homes served by the Company are not eligible;
- b) Home must qualify for a percent BTC rebate;
- c) HERS rater verifies the home meets all national ENERGY STAR certification requirements and;
- d) ENERGY STAR label is applied to the home’s electrical breaker box.

**ENERGY STAR Certified Rebate**

ENERGY STAR certified	\$100
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The ENERGY STAR appliance rebate is another *add-on* rebate available to qualifying homes that have earned a percent BTC rebate and installed one or any combination of the qualifying appliances listed below. Homes that receive natural gas-only service from the Company are not eligible for high efficiency lighting rebates, ENERGY STAR® radon fans, or heat pump water heater.

**Appliance & Lighting Rebate Levels for Qualifying Homes**

<b>Appliance/Lamp</b>	<b>Rebate</b>
ENERGY STAR Clothes Washer	\$30
Heat Pump Water Heater	\$400
High Efficiency Lighting – 2009 IECC or lower with LEDs - Minimum 20 lamps	\$20
High Efficiency Lighting – 2012 IECC or higher with 100% High Efficiency (LEDs)	\$10
ENERGY STAR certified Smart Thermostat	\$50
ENERGY STAR radon fan	\$20

## ➤ **Evaporative Cooling**

### **A. Description**

The Evaporative Cooling product provides a rebate to Public Service's residential electric customers who purchase and install energy-efficient evaporative cooling equipment, and incentives for trade allies to promote the product to their customers.

Evaporative Cooling encourages customers and trade partners to purchase evaporative coolers (also known as swamp coolers) rather than central air conditioning. Customers benefit by reducing the up-front cost of buying evaporative cooling units, saving energy throughout the lifetime of the equipment, and reducing electric bills.

Qualifying equipment must be new, permanently installed evaporative cooling units. Portable coolers or systems with vapor compression backup are not eligible, neither is used or reconditioned equipment.

For homes in dry climates, such as Colorado, evaporative cooling provides an experience like an air conditioner, but with less energy use and significantly lower operating costs.

### **B. Targets, Participants & Budgets**

#### Targets and Participants

Targeted energy savings are based on past activity, current market conditions, and projected sales of evaporative coolers. Proposed savings are estimated on a per unit basis using the projected number of participants. Participation in this product is weather-sensitive. Cooler-than-normal summers have been shown to result in lower participation, as customers may forgo their decision to install a unit or choose to delay purchasing a unit if the weather is mild.

#### Budgets

The budget was developed based on historical and projected participation and the funds needed to promote and administer the product to achieve the associated level of savings. Much of the product's budget goes towards customer rebates for the purpose of lowering the cost of purchasing energy-efficient evaporative cooling equipment. Other key budget categories are related to driving participation, including advertising and promotions, educating customers about evaporative cooling, trade incentives, improvements in the rebate process, retail store engagement, and events and sponsorships.

### **C. Application Process**

Customers may self-install, or work with a contractor to install the evaporative cooling equipment.

The application process varies, depending on where and how the customer purchase and installation occurs.

**Traditional rebate process.** When a customer (or contractor) submits the paper or online application, an invoice is required. It is reviewed for accuracy, ensuring that rebate qualifications are met prior to mailing a rebate check. An online application form is available.<sup>48</sup> Invoices or receipts must detail purchased equipment. If the application is not a replacement unit, a receipt for additional components (e.g. remote thermostat, purge pump, supply ducts, roof jack, etc.) must be included, or these items must be detailed on the invoice. If the invoice documentation does not meet the non-replacement criteria, the application may be processed as a replacement and receive a lesser rebate amount.

**“Instant rebates” process.** Instant rebates are planned for many retail locations. Customer eligibility will be verified before the rebate code is generated, which is done prior to payment. Multi-ducted, non-replacement premium system rebates are not available through this process; the customer should use the traditional rebate process.

**“Instant rebates” through wholesalers/distributors process.** Instant rebates are planned for use by trade partners (contractors) for several wholesaler/distributor locations. The customer’s address is verified before the purchase, and a customer email address is required. The contractor must use a valid Xcel Energy contractor ID and be in good standing with PSCo. Further, the contractor must verify that 100% of the instant rebate will be passed on to the customer.

## **D. Marketing Objectives & Strategies**

The main objective of the Evaporative Cooling product is to promote the use of efficient evaporative coolers to customers with older, less-efficient models, and to promote efficient evaporative coolers in place of air conditioning to customers installing a home cooling system for the first time. Public Service propels customer awareness of the product through a variety of sources including targeted marketing communications, advertising, events and sponsorships, the Xcel Energy website,<sup>49</sup> email and social media, HVAC contractors and retailers. Strategic marketing efforts include:

- Newspaper and print advertising, typically in the spring and summer;
- Point of Purchase displays at big box stores and appliance retailers;
- Targeted customer emails, newsletters, bill messaging and social media;
- Internet ads and search engine promotions (Google, Yahoo, Bing);
- Sponsorships and events; and
- Contractor education, training and incentives.

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<sup>48</sup> [www.xcelenergy.com/digital\\_application](http://www.xcelenergy.com/digital_application)

<sup>49</sup> <http://www.xcelenergy.com/staycool> and <http://www.xcelenergy.com/co-evap>

Public Service has partnered with numerous equipment manufacturers, distributors, dealers and retailers in the state of Colorado who receive our product literature and assistance promoting the product. Contractors and builders in Colorado are an essential partner in creating customer awareness of Evaporative Cooling and, thus, will receive information on any product changes directly.

In addition, Public Service utilizes a trade relations manager to assist with communicating product details to the dealer and distributor channels. Other activities of the channel manager may include training sessions on product specifics, product-related trade partner meetings, and meetings with manufacturers and manufacturers' representatives.

## **E. Product-Specific Policies**

Customers must purchase qualifying units in order to be eligible for a rebate. Units are pre-qualified for the product based primarily on manufacturer specifications. Equipment is added to the list of qualifying units as Public Service is notified of their release.

Qualifying equipment must be new and be a permanently installed direct or direct/indirect, and one or two-stage evaporative cooling unit. Portable coolers or systems with vapor compression backup are not eligible, nor is used or reconditioned equipment. Customers can replace an existing evaporative cooler or central A/C system, or purchase a first-time installed evaporative cooling unit, to qualify for a rebate.

There are three equipment tiers available for the Evaporative Cooling product:

- Standard System/Tier 1: Qualifying evaporative cooling units with airflow output of 2,500 cubic feet per minute (CFM) or greater.
- Premium System/Tier 2: Qualifying evaporative cooling units with media saturation effectiveness of 85% or greater. The units must be manufactured with remote thermostat control and periodic purge water control (e.g. purge pump) or have these two items purchased and included on an invoice.
- Whole House System/Tier 3: In addition to 85% saturation effectiveness, remote thermostat control and periodic purge water control, qualifying evaporative cooling units must be indirect/directly cooling the whole house with a minimum of three supply ducts installed.

## **F. Stakeholder Involvement**

Public Service works with customers, trade partners, wholesalers/distributors, retailers, manufacturers, and manufacturer representatives. Trade partners are defined as Colorado contractors who provide equipment and installation of evaporative coolers to customers. Wholesalers/distributors are defined as businesses such as Johnstone Supply, Winair, and Hercules who provide evaporative cooling and other HVAC equipment to trade partners. Retailers include "big box" stores such as The Home Depot, Lowe's and Sutherlands, and may also include wholesalers/distributors who sell direct to customers as well as trade partners. Each stakeholder is important to the success of the product.

## G. Rebates & Incentives

Customers must purchase qualifying units in order to be eligible for a rebate. A list of pre-approved, qualifying evaporative coolers is updated regularly, based on information provided by the manufacturers, manufacturer representatives, and wholesaler/distributors, and made available to all stakeholders.

Customers may receive up to a \$1,200 rebate, depending on the equipment purchased. The rebate cannot exceed the amount paid. There is a limit of two evaporative cooler rebates per premise per calendar year.

Qualifying equipment must be new and be a permanently installed direct, indirect or two-stage evaporative cooling unit. Portable coolers or systems with vapor compression backup are not eligible, nor is used or reconditioned equipment. Customers can replace an existing evaporative cooler or purchase an evaporative cooler for the first time at their premise (i.e., non-replacement) to qualify for a rebate.

There are three equipment categories available for the Evaporative Cooling product:

- Standard system: Qualifying evaporative cooling units with airflow output of 2,500 cubic feet per minute (CFM) or greater.
  - Premium system: Qualifying evaporative cooling units with Media Saturation Effectiveness of 85% or greater. The units must include a remote thermostat and a periodic purge pump.
  - Multi-ducted premium system: In addition to 85% Saturation Effectiveness, remote thermostat control and periodic purge water control, qualifying evaporative cooling units must be indirect/directly cooling the premise with a minimum of three supply ducts installed.
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- Standard System: The replacement rebate amount is \$200, and the non-replacement rebate is \$400. Taxes and ancillary items, such as hoses, are not covered by the rebate.
  - Premium System: The replacement rebate amount is \$600, and the non-replacement rebate is \$800.
  - Multi-ducted premium systems: The replacement rebate is \$600, and the non-replacement rebate amount is \$1,200 to the customer.

Trade incentives are provided to trade partners who have invoiced customers for equipment and installation of evaporative coolers. Trade partners will receive trade incentives when their customers receive an evaporative cooling rebate, only when their PSCo-provided trade ID number is included in the rebate application.

Rebates and Incentives 2019-2020		Customer rebate	Trade incentive
Standard evaporative cooler systems	Replacement	\$200	\$100
	Non-replacement cooler purchase	\$400	\$100
Premium evaporative cooler systems	Replacement	\$600	\$150
	Non-replacement purchase	\$800	\$150
Multi-ducted premium evaporative cooler systems	Replacement	\$600	\$150
	Non-replacement	\$1,200	\$150

## ➤ High Efficiency Air Conditioning

### A. Description

The High Efficiency Air Conditioning (HEAC) product comprehensively addresses energy efficiency opportunities related to central air conditioners (AC), air source heat pumps (ASHP), mini-split heat pumps (dMSHP), ground source heat pumps (GSHP), and the Western Cooling Control (WCC).

The HEAC product is comprised of five measures, each meeting a different need in the cooling marketplace.

- **Standard AC/ASHP systems with Quality Installation (QI)** - 13 to 14.99 Seasonal Energy Efficiency Ratio (SEER) – Defined as new central AC and ASHP systems with “matched” indoor and outdoor components, in new or existing homes. Equipment must be Air-Conditioning, Heating, & Refrigeration Institute (AHRI) performance-certified at standard rating conditions. Approximately 75 – 80% of new AC systems purchased are in this efficiency range.

According to energy.gov<sup>50</sup>, approximately 27% of the rated efficiency of a new system can be achieved through Quality Installation (QI). QI is a process, based on standards developed by the Air Conditioning Contractors of America (ACCA) which contractors must follow to ensure that the total energy savings potential of newly installed equipment is realized. QI includes sealing all visible ducts, having at least 400 cubic feet per minute (CFM) of air flow per cooling ton, using ACCA’s Manual D (load calculation) and Manual S (equipment sizing) standards to determine the right size and type of equipment for each customer’s unique home, and charging the new system with refrigerant to within 3 degrees of the manufacturer’s recommended sub-cool target temperature. Only participating trade partners who have a technician with North American Technician Excellence (NATE) certification<sup>51</sup> in AC or ASHP can offer this rebate.

- **High Efficiency AC/ASHP systems with Quality Installation (QI)** – Defined as new central AC and ASHP systems with “matched” indoor and outdoor components, and with thermostatic expansion valves (TXVs), in new or existing homes, that meet certain energy efficiency standards as outlined in Section G below, are eligible for a rebate. The intent of the rebate is to encourage consumers to purchase units that meet or exceed the ENERGY STAR® high efficiency standard of at least 15 SEER and 12.5 Energy Efficiency Ratio (EER). Only participating trade partners who have a technician with North American Technician Excellence (NATE) certification in AC or ASHP can offer this rebate.
- **Mini-Split Heat Pumps (MSHP)** – The mini-split heat pump equipment serves residential customers who either cannot install traditional split, central air conditioning systems, or have

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<sup>50</sup>[https://www.energystar.gov/ia/home\\_improvement/downloads/ESQI\\_factsheet.pdf?a0fa-c969](https://www.energystar.gov/ia/home_improvement/downloads/ESQI_factsheet.pdf?a0fa-c969)

<sup>51</sup>[www.natex.org](http://www.natex.org)

hard-to-heat/cool areas of their homes, or who simply prefer this technology. To be eligible to participate, residential electric customers must purchase and install a unit that has a rated efficiency of 15 SEER, 11 EER, and 9 Heating Seasonal Performance Factor (HSPF). The unit must be used for cooling and heating purposes. There is not a QI component, and NATE certification is not a requirement. Any trade partner can offer this rebate.

- **GSHP with Quality Installation (QI)** – The GSHP equipment measure serves a small market niche of consumers who seek out the most highly efficient technology. To be eligible to participate, residential electric customers must purchase and install a unit that is ENERGY STAR® certified. The ENERGY STAR® certified GSHP performance criteria are a minimum of 3.3 Coefficient of Performance (COP) and 14.1 EER. Equipment must be AHRI performance-certified at standard rating conditions. Rebates will be given for GSHPs that are installed as closed-loop systems and are used for both heating and cooling. Only participating trade partners who have a technician with NATE certification in GSHP can offer this rebate.
- **Western Cooling Control** – The Western Cooling Control (WCC) device effectively increases the capacity of a central AC or ASHP unit by capturing cooling energy left in the refrigerant within, as well as the water condensed on, the cooling coil after a cooling cycle has completed. Due to the fact that many newer cooling units have built-in features that provide similar benefits to the WCC device, this measure is available only to customers with units installed in 2009 or prior. There is not a QI component to this measure; NATE certification is not a requirement. Any trade partner can offer this rebate.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Participation and energy savings levels for this product are based on increased marketing efforts to the most cost effective measures within the product, and working through trade partners and stakeholders to engage customer participation.

### Budgets

The budget forecast is based upon forecasted participation. Contractors are paid a QI incentive at all SEER levels, further encouraging their support of the product and a financial interest to continue quality installation practices. There is a trade incentive for mini-split heat pumps as well, for the purpose of encouraging participation in this cost-effective rebate offering. The budget also includes costs for verifying a percentage of the new equipment installations in the field to ensure they meet ACCA quality installation standards and expected energy savings; for advertising and marketing; and for other administrative expenses including labor and contractor training.

## **C. Application Process**

The application process differs by type of rebate. Standard and High Efficiency AC and ASHP systems with QI share one rebate application form, whereas GSHP, dMSHP, and the WCC have separate application forms.

The most recent version of the rebate application forms are provided to participating contractors who have met the Company's participation requirements. The Company may reject applications made using outdated application forms. Customers can directly access application forms for rebate measures that do not require using a participating contractor; those forms are available on the Company's [web site](#).

All information requested on the rebate applications must be provided in order for the rebate process to be completed. Information needed on the invoice is specified on the back of each rebate application form; this information must be provided in order for the rebate process to be completed.

When corrections are needed to rebate applications, the Company sends a request to the contractor. If no response is received, open tickets are closed after 120 days, and the customer is notified. Applications may be resubmitted.

#### **D. Marketing Objectives & Strategies**

The HEAC product seeks to increase awareness and the demand for the QI process within the Company's service area, help customers and participating contractors offset costs associated with QI and high efficiency equipment/solutions, reduce customers' energy costs, and increase their comfort. To support these goals, the Company plans to implement the following marketing strategies to increase product awareness:

- Use of the HVAC contractor community as the primary marketing channel. The Company's Channel Manager is responsible for conducting trade partner training, meetings, telephone calls, emails, and newsletters to keep the trade informed and engaged in the product. In addition, a qualified contractor list is available on the Company's website and participating contractors are expected to assist in promoting the product. The Company provides brochures for contractors to distribute to customers as well.
- Company marketing and advertising strategies will be used to create customer awareness. This may include bill inserts, bundled marketing campaigns, community newsletters, webinars, promotional booths at public events, radio and/or television advertising, sponsorships.
- The Company's website also includes information regarding the product and is updated as needed to more effectively reach customers. This includes information on proper equipment sizing and airflow, product details and where to find qualified contractors. The site also hosts webpages designed specifically for contractors to obtain information about the product.

## E. Product-Specific Policies

The technician's NATE certification can be used by one contractor company only, for the purpose of qualifying the company to offer high efficiency rebates.

Contractors who do not comply with the product requirements and guidelines are not allowed to participate in the product. Requirements may include taking and passing Company-provided training classes, for the purpose of increasing the energy savings and/or increasing customer satisfaction with the rebate process.

These rebates are available to residential Xcel Energy account holders with electric service provided by Xcel Energy. Additional qualifications are found in Section A, Description, and as follows:

To be eligible for a MSHP rebate, the unit must be used for cooling and heating purposes; therefore, mini-split air conditioners (cooling only units) do not qualify. The AHRI certificate must be in the residential category of "Variable-speed Mini-Split and Multi-Split Heat Pumps." Multiple head mini-split systems qualify.

To be eligible for a GSHP rebate, customers must purchase a qualifying unit. High efficiency equipment rebates will not be paid without QI from an approved contractor. Contractors must have a NATE-certified or International Ground Source Heat Pump Association (IGSPHA) accredited technician on staff, attend all required trainings conducted by the Company, follow all program guidelines, and be approved by the Company.

To be eligible for the WCC device rebate, the existing furnace must have been installed in 2009 or prior.

To be eligible for the Standard AC equipment with QI, High-efficiency AC/ASHP equipment with QI, and GHSP with QI rebates:

- The customer must use a registered contractor with a NATE-certified technician for the installation of the new system. These contractors have agreed to the terms of the product and meet the requirements related to quality installation practices. A list of registered contractors can be found on the Xcel Energy website.<sup>52</sup>
- The "matched system" must be listed in AHRI's Residential Directory.<sup>53</sup> This directory is used to identify product classification, determine efficiency ratings, and confirm matched systems.
- In order to verify that the equipment has been properly installed, the contractor must commission the new system when the outdoor temperature is sufficient to create a steady state – as specified in the Xcel Energy QI guidelines based on ACCA standards.<sup>54</sup> There is a section within the customer rebate application to indicate the quality installation

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<sup>52</sup><http://www.xcelenergy.com/cotrades>

<sup>53</sup> <https://www.ahridirectory.org/ahridirectory/pages/home.aspx>

<sup>54</sup> <http://www.acca.org/quality-standard/qi/>

process is being followed. Testing can only occur when the outside temperature is 67 degrees or higher, or 60 degrees is acceptable if the Field Diagnostic Services, Inc. (FDSi) diagnostic tool is used. The equipment installation and testing for QI must be completed before the rebate application is submitted for processing by the Company.

- The Company will accept proof that Aeroseal duct sealing has been completed, as an alternative to other acceptable duct sealing methods stated on the rebate application.
- For AC systems, the use of a furnace’s variable speed fan to increase the SEER rating above the nominal rating is allowed for determining rebate eligibility, provided that the overall furnace and air conditioning combination rating can be found in the AHRI’s Residential Directory ([www.ahridirectory.org](http://www.ahridirectory.org)). The furnace does not have to be new, in order to use it for an increased efficiency rating. The homeowner or contractor must supply the furnace model number and serial number on the application and invoice.

## **F. Stakeholder Involvement**

The Company considers stakeholders for the HEAC product to be the HVAC contractors and distributors, the Colorado Energy Office (CEO), local municipalities within the Public Service service territory, and environmental organizations. Stakeholders are invited to share their product suggestions during the Company’s quarterly DSM Roundtable Meetings. In addition, Xcel Energy is a member of the Consortium for Energy Efficiency (CEE), and monitors and participates in its initiatives related to residential HVAC equipment.

## **G. Rebates & Incentives**

Rebates are payable to residential Xcel Energy account holders with electric service from Xcel Energy, or to an alternate rebate recipient of their choosing. All measures must meet all requirements to receive the rebate. The rebate is paid according to the lesser value of the technical requirements of various measures, including SEER, EER, HSPF, and COP.

The Company will also pay the following incentives associated with customer rebates to participating, registered contractors in good standing.

<b><u>Measure type</u></b>	<b><u>Efficiency minimums</u></b>	<b><u>Customer rebate</u></b>	<b><u>Contractor incentive</u></b>
Standard AC with QI	under 15 SEER and 12.5 EER	\$300	\$100
High efficiency AC with QI	15 SEER, 12.5 EER	\$500	\$50
MSHP	15 SEER, 11 EER, 9 HSPF	\$300	\$100
GSHP with QI	15 SEER, 14.1 EER, 3.3 COP	\$300/heating ton	\$50
WCC device	Furnace older than 2010	\$35	\$0

Homeowners may receive the equipment rebate directly or may provide written permission for the rebate to be paid directly to the contractor or to another designated alternate rebate recipient. Builders, as the original purchaser of equipment, are eligible to receive an equipment rebate; however, the rebate will only be issued once so builders should coordinate with the homeowners

as to who will receive the rebate. The QI incentive is paid to the contractor company when the account holder, or alternate rebate recipient, is paid the rebate.

Customers who receive a rebate through another DSM product (e.g., Home Performance with ENERGY STAR® or ENERGY STAR® New Homes) for the same equipment are not eligible to receive a rebate through this product. By accepting a rebate, the customer agrees to reasonably accommodate M&V consultants.

Rebate applications must be submitted by July 31 of the year following purchase and installation to qualify for a rebate.

## ➤ Home Energy Squad®

### A. Description

The Home Energy Squad product offers installation services and discounted equipment costs to customers who seek to improve their home's energy efficiency, increase their comfort, and lower their utility bills.

The Home Energy Squad team will install a number of moderate-impact, low-cost measures for combination natural gas and electric, and electric-only, customers. The product seeks to assist customers in overcoming barriers related to making energy improvements. Such barriers include confusion on which products are right for their home, product cost and payback period, and finding qualified installers.

The main product offerings include:

- Electric conservation measures:
  - LED bulbs of various types and wattages
  - Installation of a new, or temperature setback of an existing, programmable thermostat (primarily leading to cooling electric savings in summer months)
- Electric conservation measures, available for customer purchase:
  - Power control timers for TVs & electronic accessories
  - Installation of additional programmable thermostats
  - Installation of a smart thermostat (primarily leading to cooling electric savings in summer months)
- Natural gas conservation measures:
  - High efficiency showerheads
  - Low flow sink aerators for the kitchen and bathroom
  - Installation of a new, or temperature setback of an existing, programmable thermostat (primarily leading to natural gas heating savings in winter months)
  - Weather-stripping of one exterior door
  - Insulation blanket for the water heater
  - Temperature assessment and setback of the water heater
- Natural gas conservation measures, available for customer purchase:
  - Weather-stripping of additional doors
  - Installation of additional programmable thermostats
  - Installation of a smart thermostat (primarily leading to natural gas heating savings in winter months)

This product offers the delivery and installation of energy conservation measures bundled within one package with flat pricing. The price contributes toward the technician trip charge; the Company pays for the cost of the base measures and installation. Customers may purchase additional measures that are priced individually.

The introduction of interval meter data will help educate customers on how and when they use energy. This will pair nicely with smart thermostats and will allow customers to better

understand and appreciate the savings they can achieve through this program by providing more timely feedback.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The product participation and savings targets were developed based on Colorado residential market size, historical participation, and experience with similar products in the Company's other jurisdictions.

### Budgets

Budgets were determined by evaluating vendor cost estimates and potential participation levels in Colorado. A marketing budget is included for advertising, promotion and outreach to generate awareness and drive participation in targeted areas. Primary budget drivers are:

- *Administration* – administration costs for the third-party implementer; internal labor and administrative costs; and the labor costs associated with installing energy efficient measures in customer homes.
- *Advertising and Promotion* – print, radio, broadcast, direct mail, interactive media and event promotion.
- *Incentives* – cost of the energy efficient measures installed in customer homes.

## **C. Application Process**

During an in-home visit, the Home Energy Squad technician will work directly with the customer to determine which energy-saving measures will make their home more energy efficient. The customer pays a trip charge and receives a suite of energy-saving items such as LED light bulbs, high efficiency showerheads and aerators, etc. The installation labor and materials cost is paid to the third-party implementer by the Company. The third-party implementer reports the installation of energy-saving measures to the Company, therefore the customer does not need to submit a post-project rebate application.

## **D. Marketing Objectives & Strategies**

Marketing objectives will focus on building awareness and product interest, in addition to driving customer participation. The Company will utilize several marketing channels for this product, including bill inserts, newsletters/blogs, radio, social media, and the Company website. Additional tactics may include door hangers, sweepstakes or promotional incentives, depending on participation rates. Targeted direct mail and telemarketing tactics may also be used. Call Center agents will direct any customers inquiring about this product to contact the third-party implementer using their toll-free number or website.

Local outreach programs, such as Partners in Energy, are an important channel for building awareness and driving participation. Participating trade partners from other products are another important channel.

Cross-marketing opportunities exist with other products such as Home Performance with Energy Star, Refrigerator Recycling, and School Education Kits. Concurrent appointments with a Home Energy Audit program technician are another opportunity for cross-promoting multiple products in order to increase awareness and drive stronger customer participation.

This product will also explore Spanish-language marketing collateral and channels in order to reach a significant portion of the Company's customers who might not otherwise be aware of the product.

## **E. Product-Specific Policies**

A Home Energy Squad participant must be a combination gas and electric, or electric-only, customer. The Company will connect customers with the third-party implementer to begin the product engagement.

The technical assumptions will largely reflect those of other residential products such as Home Lighting & Recycling and Energy Efficient Showerhead to consistently report measure costs and energy savings.

## **F. Stakeholder Involvement**

The Company will partner with its existing array of customer and trade stakeholders regarding product design and implementation, awareness building and ongoing product feedback. This may include partnering with other utilities where the Company is the electric-only or gas-only provider.

## **G. Rebates & Incentives**

A customer co-pay will be required to receive the direct-installed energy-saving items such as LEDs, high efficiency showerheads, etc. This process differs from most prescriptive rebate programs where the customer submits a rebate application after equipment is installed and operational. The third-party implementer will report the installed measures to the Company, and the Company pays the implementer directly for the installation labor and materials cost. Therefore the customer does not need to submit a post-project rebate application.

## ➤ Home Lighting & Recycling

### A. Description

The Home Lighting & Recycling product provides resources for customers to purchase energy efficient light bulbs and dispose of them in an environmentally-friendly manner. Using energy efficient bulbs is an easy and inexpensive way for customers to save electricity. Public Service provides an avenue for customers to purchase discounted energy-efficient bulbs through local retailers. Customers can also recycle CFLs free of charge through the product at Ace Hardware.

#### Bulb Discounts

The Company motivates customers to purchase LEDs by offering in-store retail discounts. An instant rebate is provided through Company collaboration with bulb manufacturers and retailers, enabling customers to purchase a variety of energy-efficient bulb models at a discounted price. The Company partners with retailers such as Home Depot, Walmart, Costco, Ace Hardware, and Dollar Tree. Customers receive the discounted price at the register; there is no mail-in rebate form.

#### CFL Recycling

The CFL Recycling component of the product provides an environmentally-friendly method for customers to dispose of CFLs. Public Service maintains a partnership with Ace Hardware to serve as the retail arm for CFL recycling. Customers can bring spent CFLs to any Ace Hardware store throughout the state and recycle them free of charge. The retailer then stores the bulbs in a covered bin until it is full. Then they ship the bulbs to the recycler in the postage paid bin. The Company covers the cost to ship and recycle the bulbs that are submitted for recycling at participating retailers within the Company's service territory.

### B. Targets, Participants & Budgets

#### Targets and Participants

The energy savings target for the product was derived by analyzing the market potential and historical sales data, while considering new technologies, available retail channels and participating customer segments. All Public Service electric customers are eligible to participate in the Home Lighting & Recycling product.

#### Budgets

The Home Lighting & Recycling budgets have decreased from the previous filing due to decreased costs of LED incentives as a result of lower incremental costs. LED incentives make up the majority of the budget costs.

### C. Application Process

Customers do not need to apply to participate in the Home Lighting & Recycling product. Public Service works with retailers and manufacturers to provide a discounted price on bulbs through

upstream incentives. The incentive varies depending on the type of bulb and the manufacturer/retailer partner. The customer receives the discounted price at the cash register. Incentives are paid upstream and the discounts are passed on to the customer.

## **D. Marketing Objectives & Strategies**

The objective of the Home Lighting & Recycling product is to motivate customers to purchase energy efficient bulbs, and encourage them to recycle CFLs when they burn out. Public Service will focus marketing dollars building awareness and sales of LED bulbs, in addition to helping educate customers about the product benefits in this changing marketplace. The Company will use various media channels to reach customers including television, radio, in-store signage, publications, bill inserts, social media, internet and sponsorship of local events. The peak sales period for energy efficient bulbs is in the fall and winter, as such, promotions are focused during these buying time periods.

Public Service uses an RFP process each year to select participating retailers and endeavors to enable partnership with a variety of retailers (including big box, mass merchandiser, and hardware and grocery outlets) to ensure optimal pricing and to help reduce free-ridership.

CFL Recycling is marketed locally through the local retail partner, Ace Hardware. The Company also markets recycling through the Company's website.

## **E. Product-Specific Policies**

Public Service selects retailers within its electric service territory and assumes that the customers purchasing the discounted bulbs live within the given area.

The third-party implementer will be responsible for delivering the calculated savings, actual high efficiency product sales details, including the location, types and quantities of bulbs sold each year to be used in the DSM Annual Status Report.

Public Service currently uses a third-party implementer for CFL recycling. The selected implementer is known to be the best in industry because they separate the CFL components by hand to ensure that hazardous materials do not end up in the ground soil or water. The third-party implementer also provides bins made of recycled material and recycles the bins that the bulbs are shipped in. In addition, they provide certificates of proper recycling.

## **F. Stakeholder Involvement**

The Company collaborates with several organizations to monitor and incorporate best practices into lighting product design. These activities include: member of the Consortium for Energy Efficiency, annually attending the national ENERGY STAR Lighting Partner meeting, and monitoring information published by lighting manufacturers, E-Source, the American Council

for an Energy-Efficient Economy (ACEEE), the U.S. Environmental Protection Agency and the U.S. Department of Energy.

## **G. Rebates & Incentives**

The upstream markdown incentives typically account for up to 75% of the incremental cost, depending on the bulb. The cost savings are passed on to the customer as an instant rebate.

## ➤ Home Performance with ENERGY STAR®

### A. Description

The Home Performance with ENERGY STAR (HPwES) product is targeted toward existing single-family homes in need of multiple energy efficiency improvements. By providing these customers with rebate incentives, Public Service is able to incorporate a bundled, whole home approach to energy efficiency. To participate in the product, customers must be combination electric and gas customers or have electric-resistance heat.

Home Performance was developed using principles from the nationally recognized ENERGY STAR® “Home Performance with ENERGY STAR” product.<sup>55</sup> The concept of the product is to provide the customer with one-stop for all of their home efficiency needs. This comprehensive approach requires an energy audit as a prerequisite which is then used to generate a list of recommendations. The contractor, who may also be the auditor, reviews the recommended improvements and completes the work. Some projects may receive an independent verification of the improvements after completion if a Quality Control Inspection (QC) is performed. The contractor and homeowner may also request advice on recommended upgrades and rebates from the Energy Advising service offered through the Home Energy Audit product. Since this product requires an audit and deeper engagement from the customer, AMI interval data would greatly enhance the conversation and allow auditors to give customers an even better analysis of the energy usage within their home.

Trade partner companies interested in performing installations must have a technician on staff that is currently certified in one of the following:

- Building Performance Institute (BPI) Building Analyst;
- BPI Envelope;
- BPI Heating;
- BPI Residential Building Envelope Whole House Air Leakage Control Installer or Crew Chief;
- Quality Control Inspector (QCI);
- Advanced Energy Auditor; or
- North American Technician Excellence (NATE) Gas Heating plus approved Combustion Appliance Zone (CAZ) training, NATE AC or NATE ASHP or GSHP certification (with the exception of evaporative cooling and water heaters, which don't require a certified contractor).

Each trade partner company must have one technician in each certification area that they are participating in. A technician's certification may not be used by another trade partner company

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<sup>55</sup> Learn more about EPA's Home Performance with ENERGY STAR:  
[https://www.energystar.gov/index.cfm?fuseaction=hpwes\\_profiles.showSplash&s=footer](https://www.energystar.gov/index.cfm?fuseaction=hpwes_profiles.showSplash&s=footer)

to meet the program requirements. Additionally, trade contractors must complete the appropriate Home Performance contractor training depending on the services they offer.

These trainings provide contractors with information on the product components, process, and diagnostic testing required as part of the efficient measure installations. All participating contractors must sign the corresponding contractor agreement before providing installations for participants in the product. A random sample of 10% of the contractor's jobs will be inspected and verified. Once contractors have completed all necessary trainings and signed the agreement, they will be included on the approved contractor list, which is included in the customer packets and on the Company's website.<sup>56</sup>

## **B. Targets, Participants & Budgets**

### Targets and Participants

The product targets were developed based on the 2017 product results and the Company's forecasted assumptions for increased participation as the Company works to streamline the HPwES process throughout 2019.

### Budgets

The budget for this product is based on the 2016 and 2017 expenditures and includes costs for third-party implementation, software, measurement and verification inspections, and minimal product promotion. Trade incentive rebates are also budgeted for cooling and attic insulation measures.

## **C. Application Process**

Customers interested in participating in HPwES must first complete a Home Energy Audit with blower door test. The auditor will provide information on the Home Performance product during the audit, tying the specific product requirements into the audit recommendations. The customer may then sign up for Home Performance through their auditor at the time of the audit or any time thereafter using the online signup form.

Once a customer has signed up for the product, they have one year to complete the required equipment installs and work with their contractor to submit their application. If they complete this, they may then complete optional equipment installs over the next three years and still receive the higher Home Performance rebates.

The Home Performance product information, approved contractor list, and signup form are on the Company's website.<sup>57</sup> Customers can only receive applications through their registered and approved contractor. Customers may also contact the Residential Customer Care center (1-800-895-4999) to request product information or guidance on how to obtain rebates.

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<sup>56</sup> [www.xcelenergy.com/cotrades](http://www.xcelenergy.com/cotrades)

<sup>57</sup> [www.xcelenergy.com/homerebates](http://www.xcelenergy.com/homerebates)

## **D. Marketing Objectives & Strategies**

Public Service will provide product information through the website, and implement low-cost marketing tactics when available. The Company will also provide Home Performance information to the Customer Education team to promote at several “green” community events throughout the year. Trade partners may also be incentivized to identify participants that may not be aware of the “whole house option” through Home Performance.

Other products such as the Company’s Home Energy Audit product and Enhanced Home Energy Squad offering will offer information on Home Performance. Public Service will monitor product participation on a monthly basis and implement additional marketing tactics if necessary to achieve the year-end target.

In addition, Public Service will attempt to utilize the trade partners who have been trained and contracted to deliver this product to customers. This is viewed as the most important marketing channel for building awareness and participation in the product. As a result, Public Service is offering incentives to participating installation contractors designed to increase the number of projects performed. These incentives provide contractors with additional motivation to promote the Home Performance product.

## **E. Product-Specific Policies**

The HPwES product leverages the Company’s Home Energy Audit offering, requiring an advanced in-home blower door audit as a prerequisite to product participation. Customers are eligible for a Home Energy Audit every two years. Public Service will provide the customer a list of contractors participating in the product; however, the Company does not guarantee the contractor’s expertise or warrant any of the products or services, nor is one contractor promoted over another. Public Service shall have no liability for contractor work or negligence. After the customer completes the audit and meets the product eligibility requirements, the customer may sign up to participate in Home Performance.

If the customer’s audit recommends air sealing or attic insulation, these upgrades, plus one Supplemental Upgrade, become pre-requisites for Home Performance participation. Supplemental upgrades require the customer to provide proof of purchase, such as a receipt, on one of the following items: LED bulbs or water saving faucet aerators and/or shower heads. Customers who have participated in the Company’s Home Energy Squad or Showerheads product will be considered to have met the Supplemental Upgrade requirements. Several equipment rebates, including the required air sealing and insulation measures, are higher under the HPwES product to encourage customers to do more bundled upgrades. To receive the higher rebates, the customer must complete any required air sealing or insulation within one year of signing up for the product. If completed, the customer may then complete optional improvements

and receive the higher HPwES rebates for three years after their original signup date.<sup>58</sup> The Company will not rebate pre-existing efficient equipment.

## F. Stakeholder Involvement

Public Service periodically meets with the Cities of Boulder, Fort Collins, Greeley, and Colorado Springs, the Center for Resource Conservation, the Platte River Valley Authority, the Colorado Energy Office, the U.S. Environmental Protection Agency, the U.S. Department of Energy, Electric & Gas Industries Association, and the Energy Efficiency Business Coalition (EEBC) for product feedback. The Company plans to continue meeting with these organizations, and other stakeholders, for feedback to improve the product.

Additionally, Public Service is an active member of Affordable Comfort, Inc. (ACI)—a leading educational resource for the Home Performance industry; and has an active partnership with the BPI — a national standards development and credentialing organization for residential energy efficiency retrofit work.

## G. Rebates & Incentives

Home Performance product rebates are prescriptive and based on the specific measures installed. Rebate levels are higher for Home Performance participants compared to rebates offered for the same measures in the Company’s related DSM products. This offset is to encourage customers to pursue whole-home, bundled improvements instead of individual upgrades. The rebate levels are as follows.

<b>Home Improvement Measures</b>	<b>Prescriptive Rebates</b>		
<b>Top Three Required Improvements</b> (If listed as a recommendation in the customer’s audit report)	Rebate for Natural Gas Heated Home w/o Cooling	Rebate for Natural Gas Heated, AC Cooled Home	Rebate for Electric Resistance- Heated Homes
Attic Insulation* (30% up to cap)	\$400	\$600	\$700
Air Sealing, Bypass Sealing & Weather-stripping* (60% up to cap. See insulation application for tier-level requirements)	Bottom Tier	\$250	\$400
	Top Tier	\$325	\$500
Supplemental Upgrades (choose one)* -Home Energy Squad -LED bulbs -Water saving showerheads or aerators	Visit <a href="http://Xcelenergystore.com">Xcelenergystore.com</a> for instant rebates on LED bulbs, water savings measures or to sign up for the Home Energy Squad**		

<sup>58</sup> Qualifying equipment is subject to change and customer must participate under current programs rules designated by the current year in which the install the additional measures.

<b>Optional Improvements</b>	Rebate for Natural Gas Heated Home w/o Cooling	Rebate for Natural Gas Heated, AC Cooled Home	Rebate for Electric Resistance-Heated Homes
Wall Insulation (above grade)	\$400	\$600	\$700
Evaporative Cooling – Standard System (1 <sup>st</sup> )			\$325
Evaporative Cooling – Standard System (Replace)			\$225
Evaporative Cooling – Premium System (1 <sup>st</sup> )			\$725
Evaporative Cooling – Premium System (Replace)			\$625
Evaporative Cooling – Whole House System			\$1200
Central AC 15 SEER, EER 12.5			\$400
Central AC 16 SEER, EER 13			\$550
Central AC 17 SEER, EER 13			\$700
Central AC Trade-in			\$550
Ground Source Heat Pump		\$300 per ton	
Electric Heat Pump			\$550
Programmable Set Back Thermostat			\$25
95% AFUE or higher High Efficiency Furnace			\$200
Electronically Commutated Motor			\$125
Tankless Water Heater .90 EF or higher			\$200
Water Heater .67 EF or higher			\$100
ENERGY STAR Refrigerator/Primary			\$15
ENERGY STAR Clothes Washer			\$30
ENERGY STAR Smart Thermostat			\$50

\*These measures must be completed in order to participate in Home Performance with ENERGY STAR unless auditor rules the home exempt meaning the air-sealing and/or attic insulation is sufficient from an energy efficiency perspective.

\*\*Instant rebates on LED bulbs can also be found at participating retailers

## ➤ Insulation and Air Sealing Rebate

### A. Description

The Insulation and Air Sealing Rebate product offers rebates for installing insulation and air sealing, and cellular shade measures in existing single-family homes or properties with four units or fewer. Eligible customers must be those customers with a combination of residential electric and natural gas service, gas-only service, or electric-only service who are electrically-heating their residences.

Public Service will rebate the following qualifying measures:

- Air sealing, bypass sealing and weather stripping (required with insulation applications unless the home is 0.50 NACH (Natural Air Changes per Hour) or better). If air sealing is required, a minimum of a 20% reduction in air leakage must be achieved to qualify for insulation rebates;
- Attic insulation (where existing insulation is R-15 or less) to a minimum R-value of R-49 and R-60 maximum; and
- Wall insulation to an R-value of R-13 (existing exterior wall cavities must be empty).
- Cellular shades in place of vinyl or metal blinds. Qualifying products must meet applicable AERC standards.

### B. Targets, Participants & Budgets

#### Targets and Participants

The Company anticipates approximately 85% of participating homes will require air sealing. The Company has split the air sealing measure into two tiers based on the percent of air leakage reduction achieved and associated savings. The savings for air sealing measures are calculated using the same baseline home compared against the anticipated average savings within each tier:

	Estimated Therm Savings per home	Estimated kWh Savings per home
20-29% reduction	9.77 therms	306 kWh
30% reduction and higher	19.81 therms	663 kWh

Residential customers who can expect the most return from air sealing and insulation improvements are, electrically heated homes, natural gas heated and AC cooled, and natural gas heated with no AC cooling. Participation targets and rebate amounts are aligned with marketing and trade partner education plans to encourage participation from customer-types who will benefit the most. Advanced meter interval data would also help target high use customers and provide support to trade partners as they work to educate customers on the unseen benefits of insulation. Residential customers who can expect the most return from cellular shades are electrically heated homes with AC.

## Budgets

Budgets for the insulation and air sealing measures are based on 2016 and 2017 product performance. The air sealing incremental costs include the costs to the customer for bypass attic air sealing, weatherization and envelope, and additional costs of blower door testing. M&V costs are based on a percentage of the installations to ensure they meet quality installation standards and achieve the expected energy savings.

Budgets for the cellular shade measure are based on external projected sales numbers and rebate budgets are the single largest expense component.

Typically, this product is promoted through the Company's website, communications to local area insulation and air sealing contractors, community events and by the Xcel Energy consumer education team. For that reason, the product has required little budget for promotion and marketing purposes but the Company has allocated some budget for contractor trainings and educational opportunities for the trade community.

## **C. Application Process**

For insulation and air sealing measures, the application process requires customers to use a participating trade partner, to qualify for the rebate; customers can only receive the rebate application from those trade partners. Air sealing and weather-stripping are required for each install, unless the home meets the 0.50 NACH threshold. Pre and post-blower door results in CFM 50 are required for all projects, with the exception of homes that meet the 0.50 NACH value.

The Company must receive a copy of the dated invoice reflecting the qualified installation work performed. Applications will be reviewed and processed accordingly by the rebate operations team and checks issued within six to eight weeks. The Company will issue the rebate directly to the customer, or the alternate rebate recipient if designated on the rebate application form.

Participating trade partner companies must have a technician on staff that is currently certified in one of the following: BPI Analyst, Envelope or Residential Whole House Air Leakage Control Installer or Crew Chief. A technician's certification may not be used by another trade partner company to meet the program requirements. All registered contractor companies must also be listed on the Company's trade partner website.<sup>59</sup> These contractors have agreed to the terms of the Company's trade partner agreement and meet the requirements related to quality installation practices per BPI.

Starting in 2019, the Company will offer a prescriptive rebate for cellular shades. A prescriptive rebate application will be developed and be available on the Company's website.

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<sup>59</sup> [www.xcelenergy.com/cotrades](http://www.xcelenergy.com/cotrades)

## **D. Marketing Objectives & Strategies**

The Company will market the Insulation and Air Sealing product through a variety of channels such as the Home Energy Audit product, the Company's website, direct mailings to local area BPI-certified insulation contractors, and environmentally-focused community events. The Company will support this overall marketing strategy with seasonal bundled direct mail and email efforts, and social media to targeted customers. Historically, this strategy has worked well when implemented during the key heating months of December, January, and February, and during the summer months to highlight cooling benefits.

Additionally, the Company will incorporate communications activities to local insulation contractors so they can educate qualified customers on how they can benefit from this rebate. By collaborating with the Company on outreach to our customers, local contractors may be able to drive more customers to commit to quality assured insulation installations.

Finally, the Company may initiate cross-marketing efforts with our other natural gas rebate products. An example of this could be a winter bill insert that outlines existing rebate and energy efficiency products available to natural gas customers of Public Service. This strategy has proved successful in the past. Other, emerging strategies may also be incorporated.

## **E. Product-Specific Policies**

The customer must use a trade partner company who employs an employee or subcontractor who holds a BPI Analyst, Envelope, Residential Whole House Air Leakage Control, Quality Control Inspector, or Advanced Energy Auditor certification. This person's certification can only be used by one trade partner company to qualify them for participation. All participating contractors in good standing will be listed on the Company's trade partner website.<sup>60</sup> These contractors have agreed to the terms of the Company's trade partner agreement and meet the requirements related to quality installation practices per BPI.

Air sealing and weather-stripping are required for each installation, unless the home meets the 0.50 NACH (Natural Air Changes per Hour) threshold, using the Company's modified NACH formula. A pre-improvement blower door test, measured in CFM 50, is required for all projects that have not had a recent Home Energy Audit that included a blower door test. If the home's results show the home is already "tight enough" (.50 NACH value) then no further air sealing work is required will not be rebated; in that instance, a post-improvement blower door test is unnecessary. The customer may then qualify for attic and/or external wall insulation improvements. If the pre-improvement NACH reveals the house is not already "tight enough," meeting the air sealing improvement criteria is a pre-qualification for the attic and/or wall insulation measure rebates.

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Most homes have a NACH higher than the threshold and will require air sealing improvements, and a post-improvement blower door test must be done and show a minimum improvement of 20% air leakage reduction, before insulation improvements can qualify for the rebate.

Self-installations, or installations done by contractors without the BPI certifications listed above, do not qualify for rebates.

This product excludes new residential construction, new residential additions, insulation of doors, garages, sheds, workshops, below-ground basements, mobile homes, projects with pre-improvement R-values of R-16 or greater, and residential properties with more than four units. To qualify for a rebate, all insulation must be installed to the manufacturer's specifications and meet all state and local codes and federal regulations. Air sealing and weather stripping must follow industry-accepted practices for mitigating air leakage. For safety reasons, residences with asbestos and/or vermiculite cannot receive a blower door test and are disqualified from the product until they can prove mitigation work has been done to remove all asbestos and/or vermiculite from the residence.

A combustion appliance zone (CAZ) test check box is included on the rebate application—contractors are required to acknowledge that testing was completed and/or note a recommendation for CAZ testing to be performed by an HVAC contractor. The Company reserves the right to inspect installations before or after issuing a rebate. Rebates will not be issued if the same purchase has already been rebated through other Public Service rebate products, such as through the Home Performance with ENERGY STAR Product. Customers are eligible for one rebate per calendar year.

Starting in 2019, qualifying cellular shades that are purchased and installed by customers will be eligible for a prescriptive rebate.

## **F. Stakeholder Involvement**

The quarterly DSM Roundtable Meetings provide a forum for stakeholder involvement and feedback regarding this product. The Company continues to conduct meetings with interested trade partners and stakeholders to improve and implement this product, particularly around the issues of quality assurance and air sealing requirements. The Company will continue to engage stakeholders in garnering product feedback.

## **G. Rebates & Incentives**

For insulation and air sealing, the rebate structure aligns with the anticipated energy savings a customer can expect, based on the way the customer's home is heated and cooled. Air sealing rebates are 60% of the actual incremental costs, up to the maximums allowed, based on the type of the heating and cooling of the Company's individual residential customers. Attic and wall insulation rebates are 30% of the actual incremental costs, up to the maximums allowed, based on the type of the heating and cooling of the residential customer's home.

Rebate measure category	Rebate for natural gas-heated home, no central AC	Rebate for natural gas heated homes with central AC	Rebate for electric resistance-heated homes with or without central AC
Air-sealing, 20-29% improvement	\$175	\$300	\$350
Air-sealing, 30% improvement or greater	\$250	\$400	\$450
Attic Insulation	\$350	\$500	\$600
Exterior wall insulation	\$350	\$500	\$600

If a customer does multiple measure improvements, the measure rebates are added together. For example, if a qualified customer in a natural gas heated home with central AC gets a 32% reduction in the air sealing, and has the attic and wall insulation as well, the rebates would be  $\$400 + \$500 + \$500 = \$1400$  total. A customer may submit a rebate application one time per calendar year. The Company will not provide additional rebates for the same improvement type at the same address unless the customer has experienced a catastrophic loss, such as a fire.

Starting in 2019, the Company will offer a prescriptive rebate on cellular shades. The cellular shade rebate is 71% of the actual incremental costs based on the type of the heating and cooling of the residential customer's home.

Measure	Rebate
Cellular shade	\$1.33 per square foot

## ➤ Refrigerator and Freezer Recycling

### A. Description

The Refrigerator and Freezer Recycling product strives to decrease the number of inefficient refrigerators, freezers, and room air conditioners in use, and by doing so, deliver electric energy savings and peak demand reduction. The product is designed to encourage customers to upgrade to a more-efficient unit, and/or choose to decommission their operable, inefficient unit rather than give it to the second-hand market, by providing a convenient way to dispose of their units in an environmentally safe and compliant manner. Eligible customers include residential electric customers in the Company's service territory. Customers with qualifying refrigerators and/or freezers will receive an incentive for their participation. Customers will not be directly responsible for any costs associated with pick-up, transportation, disposal, and proper recycling of their unit(s). The Company will use the services of a qualified third-party implementer to perform the following:

- Refrigerator/Freezer/Room air conditioner collection, transportation and storage;
- Verification of eligibility of the appliance at time of scheduled pick-up;
- Appliance processing and materials recycling;
- Issuing the customer incentive payment;
- All customer service aspects related to above activities;
- Product tracking and reporting; and,
- Supporting M&V requirements.

The implementer will be required to comply with all local, state and federal requirements. This includes maintaining all permits and licenses required for any facilities, equipment and personnel used for this product. Adherence to this process will ensure that recycled units will not re-enter the secondary or primary market and be placed back on the Company's grid.

### B. Targets, Participants & Budgets

#### Targets and Participants

Participation and energy savings levels for this product were developed based on historical product performance, as well as projections using annual harvest rates, which is a unit of measurement to determine a segment of the population that would qualify for the recycling product, projected by the Company's third-party implementer using program modeling.

#### Budgets

The 2019 and 2020 budgets were developed based on forecast participation and recycling costs. Recycling-related expenditures account for approximately 45% of the overall budget. The projected rebates account for 26% of the budget. Marketing, M&V and administrative expenses make up the remaining budget.

## **C. Application Process**

Customers will either call-in to the third-party implementer's toll-free service number or schedule this service online.<sup>61</sup> The third-party implementer will ask qualifying questions in order to minimize costs and maximize customer satisfaction. The implementer will schedule an appointment and will be required to pick up the unit no later than 10 business days after the customer's requested pick-up date. Customers will be called one to two days prior to their scheduled pick-up date in order to confirm their appointment and remind them to turn on their unit and make sure it is empty. Customers will receive their incentive check within six to eight weeks after their unit has been picked up by the implementer.

## **D. Marketing Objectives & Strategies**

The target market consists of customers who are disposing of their primary (usually located in the main kitchen) or secondary refrigerator (usually located in a garage or basement area), or freezer units (usually located in a garage or basement). Generally these customers have single-family homes with two or more individuals in the household. Customer interest in this type of product is seasonal, usually occurring in the spring, summer and early fall seasons (prior to the Thanksgiving holiday). Product demand often peaks in the summer months, which is associated with customer home improvement periods. Deployment of promotional tactics will coincide with these seasonal time periods.

The Company will utilize several marketing channels for this product, including bill inserts, newsletters/blogs, radio, social media, and the Company website. Additional tactics may include door hangers, sweepstakes or promotional incentives, depending on participation rates. Cross-marketing opportunities exist with other products such as Home Energy Squad, Multi-Family Buildings, and School Education Kits. Targeted direct mail and telemarketing tactics may also be used. Call Center agents will direct any customers inquiring about this product to contact the third-party implementer using their toll-free number or website.

This product will also explore Spanish-language marketing collateral and channels in order to reach a significant portion of the Company's customers who might not otherwise be aware of the product.

## **E. Product-Specific Policies**

All refrigerator, freezer, and room air conditioner units must meet the following requirements to qualify for this product:

- Must be operational. "Operational" is defined as in working order. Refrigerators must be capable of freezing water; freezers must be capable of freezing.

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<sup>61</sup> <http://www.xcelenergy.com/fridge>

- Appliances will be categorized as follows for reporting purposes:
  - *Secondary*: Used as a secondary unit for at least two months prior to pick up
  - *Primary*: Used as the primary unit in the home at the present time
  - *Freezer*: Used separately from the primary refrigerator and is a standalone unit.
- Refrigerator/Freezer must be plugged in the night before the pick-up date (customer will receive a call from the implementer, reminding them to do this). This is to ensure full operation (cooling/freezing water for a refrigerator; freezing capability for a freezer) when inspected at the time of pick-up.
- Refrigerator/Freezer must be no smaller than 10 cubic feet or no larger than 30 cubic feet.
- There will be a limit of two refrigerators and/or freezers per household per year.
- Room air conditioners may be picked up if the third-party implementer is already at a customer's home to collect a refrigerator or freezer.

## **F. Stakeholder Involvement**

The Company is a proud partner of the U.S. Environmental Protection Agency's (EPA's) Responsible Appliance Disposal (RAD) Program. This voluntary partnership program began in 2006 to help protect the ozone layer and reduce emissions of greenhouse gases through the responsible disposal of appliances.

The Company has been responsibly recycling appliances for many years. The Company's voluntary participation in the RAD Program further underscores its commitment to helping customers make responsible technology and appliance choices. The Company has been published within the RAD annual report and recognized at annual events for product accomplishments.

## **G. Rebates & Incentives**

Participants will receive an incentive to remove their inefficient primary and/or secondary refrigerators and freezers. The primary and secondary refrigerator or freezer will be removed and properly recycled at no cost to the customer. An incentive check will be mailed to the customer within four weeks following their pick-up date.

In addition to the incentive, customers will receive the benefit of energy savings, which could exceed \$50 per year for replacing an old refrigerator with an ENERGY STAR® certified model<sup>62</sup>; and may receive two LED bulbs at the time of unit collection.

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<sup>62</sup> [https://www.energystar.gov/products/appliances/nows\\_time\\_flip\\_your\\_fridge\\_and\\_save](https://www.energystar.gov/products/appliances/nows_time_flip_your_fridge_and_save)

## ➤ Residential Heating

### A. Description

The Residential Heating product provides an incentive in the form of a cash rebate to Public Service's customers who purchase high-efficiency heating equipment, including furnaces, and electronically commutated motor (EC Motor) furnace fans for residential use. Residential customers who purchase their natural gas from the Company may qualify for the furnace rebate. Residential customers who purchase their electricity from the Company may qualify for the EC Motor rebate.

Public Service customers benefit by receiving a reduced cost for energy efficient units, in addition to experiencing energy savings throughout the lifetime of the equipment. In making a purchase decision, consumers can check with Public Service or a registered Heating, Ventilating and Air Conditioning (HVAC) contractor participating in the product to ensure all minimum qualifications exist with the chosen system to obtain a rebate. Public Service allows customers to choose a registered heating system contractor or installer. These contractors have agreed to the terms of the product and meet the requirements related to quality installation practices. A list of registered contractors can be found on the Xcel Energy website<sup>63</sup>; however, the customer may choose to work with a contractor not on the list of participating contractors.

The product is applicable only for the purchase of qualifying new furnaces and EC Motor furnace fans installed in existing or new residential homes. Furnace rebates are offered for a minimum furnace efficiency of 95% Annual Fuel Utilization Efficiency (AFUE). EC Motor rebates are offered only when the EC Motor is installed as part of a new furnace only.

### B. Targets, Participants & Budgets

#### Targets and Participants

Targets were developed based on 2017-2018 participation and energy savings trends, and experience with similar products in the Company's other jurisdictions. Total participant and savings targets for 95%+ AFUE furnaces will remain consistent from 2019 to 2020. Participant and savings targets for EC Motors will decline sharply for 2020, because EC Motors are expected to become standard technology in mid-2019.

#### Budgets

Budgets were developed based on the cost per participant from past product results. Budget dollars are focused on rebates for residential furnaces and EC Motors. The budget also contains contingency funding, to be used if needed, to further incentivize product participation on a fixed reward basis per rebate application. In the recent past, bonus incentives have helped to increase

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customer participation during months where heating systems sales are slower; this tactic has been utilized in other Xcel Energy service territories.

### **C. Application Process**

The typical sales cycle begins with a customer hiring a contractor, learning about energy efficient models, and purchasing and installing the unit. Following installation, the customer or trade partner submits a completed Public Service rebate application and equipment invoice. Invoices must reflect the same information provided on the application form, specifically the model number, serial number, installation address, and purchase date. Other information gathered on the application form includes the customer's Public Service account number, mailing address if different from installation address, customer signature, trade partner signature and the unit's efficiency level.

Furnace equipment eligibility is determined by using the Air Conditioning and Refrigeration Institute (AHRI) Directory of Certified Product Performance,<sup>64</sup> EC Motor eligibility can be determined in a similar manner, or an OEM spec sheet, submitted with the rebate application, may be used. The Company reviews each application and verifies that all the required data has been provided as well as the unit's energy efficiency level. Rebates are typically mailed within eight weeks.

### **D. Marketing Objectives & Strategies**

The Residential Heating product's primary objective is to increase demand for high efficiency heating equipment among Public Service customers, and through consumer demand, assist the overall effort to increase the availability of high-efficiency heating units in the marketplace. Another objective is to help Public Service customers save energy with their heating needs and understand the immediate and long-term value of purchasing and installing high efficiency equipment.

Residential heating and residential HVAC systems typically have a short- to medium-term sales cycle. Public Service uses the following marketing communications strategies to make customers aware of the Product:

- Print and online advertising (radio on contingency basis). Advertising is an effective way to reach a broad audience. Banner advertising will be strategically placed on local popular news and weather sites, in addition to local larger print newspaper sites. Print advertising media plans will include the larger print papers serving the metropolitan areas, and print papers in smaller cities and other parts of the state.
- Public Service bill messaging. Bill messaging is timed according to appropriate seasons for the equipment. Typically, heating season promotion begins as early as June to coincide with the busy summer trade season when heating and cooling equipment is being replaced or installed simultaneously in customer homes. Bill messaging for high

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<sup>64</sup> <http://www.ahridirectory.org>

efficiency heating equipment has also proven to be effective in the spring, when winter has ended and customers have had recent experience with high heating bills.

- Xcel Energy website<sup>65</sup>. The website contains heating-related pages targeted to both customers and energy partners—installers, contractors and distributors. The pages are updated according to equipment efficiency changes and available promotions. The rebate schedule is always available on these pages, along with links to related pages or to forms and collateral.
- Trade Relations Manager. The Company utilizes a trade relations manager to communicate product details to the contractor and distributor channels (i.e. trade community) and conduct training sessions on product specifics. The Company will also participate in appropriate tradeshow and presentations related to heating.
- Trade Community. The primary promotional channel is the trade community. Training, meetings, telephone calls, letters and newsletters keep the HVAC trade informed about the product and help to increase awareness among new contractors. Contractors are required to register with Public Service as a product participant and obtain a contractor ID number for their company; this number is a unique identifier and helps with trade management internally.

## **E. Product-Specific Policies**

Eligibility requirements for participation include having a residential natural gas account with Public Service for the gas furnace rebate, and a residential electric account with Public Service for the ECM furnace fan rebate. The product is applicable only for the purchase of qualifying new furnaces, with or without EC Motors.

HVAC contractors and installers must follow all product guidelines, and be approved by Public Service to participate.

## **F. Stakeholder Involvement**

Public Service considers its stakeholders for the Residential Heating product to be the HVAC contractors and distributors, Southwest Energy Efficiency Project (SWEEP), the Energy Efficiency Business Coalition (EEBC), the Colorado Energy Office (CEO), local municipalities within the service area, and other environmental organizations. Stakeholders are able to share their product suggestions during the Company's quarterly DSM Roundtable Meetings. In addition, the Company is a member of the Consortium for Energy Efficiency (CEE), and monitors its initiatives related to residential HVAC equipment.

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<sup>65</sup> [www.xcelenergy.com/residentialheating](http://www.xcelenergy.com/residentialheating)

## **G. Rebates & Incentives**

The Residential Heating product offers three different rebate levels, depending on the type and efficiency of the equipment purchased:

- Furnaces at or above 95% AFUE qualify for a rebate of \$300
- EC Motor furnace fans installed in new furnaces qualify for a rebate of \$100 if central air conditioning is used for cooling the home.
- EC Motor furnaces installed in new furnaces qualify for a rebate of \$65 if central air conditioning is not used for cooling the home.



## ➤ School Education Kits

### A. Description

School Education Kits offer a turnkey product that combines a set of classroom activities with projects in the home to install energy efficiency and water conservation measures. The product is targeted for fifth or sixth grade students in Public Service's electric and natural gas service territory. The Company works with a third-party implementer to implement this product. The third-party implementer will recruit and train teachers, provide associated educational materials, and track participation by the students and teachers.

Along with various classroom materials, each participant receives a kit containing the following:

- Two (2) LED bulbs (11 Watt);
- Four (4) LED bulbs (9 Watt);
- One (1) 1.5 gpm High Efficiency Showerhead;
- One (1) 1.5 gpm Kitchen Faucet Aerator;
- One (1) 1.0 gpm Bathroom Faucet Aerator;
- LED Night Light;
- Furnace Filter Whistle;
- Digital Water / Air Thermometer; and
- Parent Evaluation Card.

An evaluation of the K-12 schools in Colorado indicates that there are approximately 70,000 students in the fifth and sixth grades in a given year. The fifth and sixth grades were chosen for participation to align with Colorado State learning requirements. Specifically, the topics covered in Science Standard 4, Earth Sciences call for discussion of renewable/non-renewable natural resources, solar heat in the environment, and water circulation through the hydrologic cycle.

In Colorado, individual school districts have the ability to establish their own standards, which supersede state requirements, so there may be some local areas where kit participation is moved to another grade level to accommodate these local preferences. The same materials and kit measures are provided to those districts.

This product has many advantages – it enables an educational program to have direct impacts on energy conservation, it helps build awareness of energy conservation among children, and it can impact customers at all income levels. Similar products are offered in Xcel Energy's New Mexico and Minnesota service territories.

The Company is considering educational and behavioral modifications to the offering that would be enabled by interval data provided from AMI.

The Company will work with the third-party implementer to provide a number of "bonus" kits. These bonus kits will contain a variety of specialty LED light bulbs, which will provide customers an opportunity to conserve more energy in additional rooms in their homes, and will

also allow the Company to evaluate new items for potential inclusion in School Kits in the future.

## **B. Targets, Participants & Budgets**

### Targets and Participants

School enrollment data has identified approximately 70,000 students in the service territory served by the Company. Historical data indicated that approximately 80% of teachers offered participation in the program choose to participate. School districts within the electric and gas territory served by the Company are eligible to participate.

### Budgets

The kit cost is all-inclusive, made up of not only the kit items but also the curriculum support materials for the teacher, the pre- and post-surveys, teacher incentives, marketing and outreach to teachers, and third-party implementer administrative cost and website support. The product budget was developed based on participation targets and the cost per kit. Internal labor and administration costs have been added to the budget. M&V of installation will be conducted by the third-party implementer and those costs are included in the kit cost as well.

## **C. Application Process**

Teachers may enroll through various means (i.e. phone, email, mail, or via the website). If the response to enrollment calls is insufficient, the third-party implementer will redesign the marketing materials and/or offer incentives to teachers to participate. Examples of incentives may be gift cards to select retailers.

Upon enrollment, the teachers indicate to the third-party implementer the time during the school year at which they would like to use the product materials and will subsequently provide enrollment/participant numbers. The third-party implementer will send the teachers the School Education Kit materials in advance of the selected program date. Third-party implementer staff will remain in contact with the teachers via phone, email and mail at various times throughout the program to provide support for the teachers and to request return of audit forms. Participants are provided with a toll-free number to call if they need help.

The Company receives the results from participating schools in a summary report from the third-party implementer at the end of each school semester.

## **D. Marketing Objectives & Strategies**

The third-party implementer will manage all aspects of marketing and outreach for the product, including:

- Identifying the schools that are within the Company's service territory and determining the approximate number of eligible teachers and students;

- Sending out customized marketing materials to help enroll the classrooms. These materials explain the program, and the fact that it is offered free of charge to their classroom thanks to the sponsoring agency (the Company); and
- The third-party implementer will work with the Company to confirm the eligibility of interested schools.

## **E. Product-Specific Policies**

Only those schools that participate in the product are able to distribute the School Education Kits. All kits must come directly from the Company's third-party implementer.

## **F. Stakeholder Involvement**

In the past the Company has worked with the third-party implementer to conduct focus groups to gather feedback around the kits and the associated classroom materials. The Company has also presented the product to the Colorado Associate of School District Energy Managers.

## **G. Rebates & Incentives**

The Company will fund 100% of the cost of the School Education Kits. Teachers may be offered an incentive to participate if enrollment is slow, or an incentive may be offered to encourage completion of student installation surveys. Examples of incentives include gift cards to select retailers for teachers, or energy-themed toys for students.

## ➤ **Water Heating**

### **A. Description**

The Water Heating product is designed to encourage Colorado customers to purchase and install high-efficiency natural gas or electric water heating equipment for residential use. The product's objectives are to increase demand for high-efficiency water heating equipment among Public Service residential customers, increase the availability in the marketplace, capture energy savings with customers' water heating needs and help them understand the immediate and long-term value of purchasing and installing high efficiency equipment. In addition to providing a cash incentive and long-term operational savings to customers, this product promotes market transformation through increasing customer demand. Participants receive a rebate for the purchase and installation of qualifying water heaters.

Customers may choose their own independent residential water heating contractor or installer, or install the unit themselves. Eligibility requirements for participation include being either a residential natural gas or electric customer. The product is applicable only for the purchase of qualifying new natural gas standard storage tank water heaters, natural gas tankless water heaters or electric heat pump water heaters installed in new or replacement applications. Qualification for an incentive is a minimum efficiency of 0.64 Uniform Energy Factor (UEF) for medium draw standard tanks, 0.68 UEF high draw standard tanks, 0.87 UEF tankless natural gas water heaters. Electric heat pump water heaters also qualify for an incentive. In recognition of future demand response opportunities, heat pump water heaters that are CEA/ANSI enabled will receive a higher incentive.

The Water Heater product is included in the portfolio to encourage the purchase of high-efficiency water heaters as a common replacement item in customers' homes. Alternate product design and delivery to Public Service customers will be considered in an effort to reduce costs and improve cost-effectiveness. Additionally, the Company is investigating the energy storage potential of electric water heaters, which in conjunction with the future availability of interval meter data, will help better identify strategies to shift energy use from peak to off-peak periods.

### **B. Targets, Participants & Budgets**

#### Targets and Participants

The energy savings and participation targets were developed based on historical participant data, current market conditions, and projected sales of water heaters. Proposed savings were estimated on a per-unit basis using the projected number of participants.

#### Budgets

Budgets for the Water Heating product were developed based on the expected costs per participant, and include costs associated with engaging heating, ventilation, and air conditioning (HVAC) installers in the Colorado service territory. Specifically, this includes newsletters and email to the contractor community. An internal Trade Relations Manager will also reach out to

trade allies and develop key relationships to ensure product success. The overall marketing budget for consumers was determined by the number of marketing communications necessary to continue education and awareness of the product and to encourage participation. This product is often cross-marketed with the Residential Heating product to offer customers yet another way to save on natural gas and electric costs in the home.

### **C. Application Process**

Customers can expect to receive a rebate six to eight weeks after submitting an application. The product does not require preapproval. Rebates for new home construction are negotiated between the builder and resident/new homebuyer to determine who will receive the cash rebate.

The customer will learn about the Water Heating rebate product through bill messaging, retailers that sell water heaters on site, the HVAC community and advertising and promotions such as newsletters and email. The typical sales cycle starts with a customer either purchasing and installing a water heater on their own or hiring an HVAC technician to install it. In either case, the water heater could be purchased through the contractor or a retailer. Following installation, a completed rebate application form and invoice are submitted to Public Service. Forms are mailed or emailed to the utility by either the contractor or the customer. Invoices must reflect the same information provided on the rebate application form, specifically manufacturer and model number, size or capacity (gallons), BTU, Uniform Energy Factor, equipment type, serial number and installation and purchase dates. Other information gathered on the rebate application form includes the unit size, draw pattern, efficiency level, the customer's account number, mailing address (if different from the installation address), customer signature, and contractor signature, unless the equipment was self-installed.

### **D. Marketing Objectives & Strategies**

Marketing tactics may include the following: email, communications on the Company's website, tradeshow, trade communications, trainings, direct mail, newsletters, and HVAC community relationship building.

Specifically:

- Public Service contractor communications are timed according to appropriate seasons for the equipment. Since water heating demand is year-round, this provides flexibility with marketing seasonality. To maximize the value of messaging, the Water Heating product is often cross-marketed with the Residential Heating product.
- Internet pages for Water Heating are developed for customers and the pages are updated according to equipment efficiency changes and available promotions.
- The Company will participate in tradeshow related to water heating to provide information about the product, and/or make a formal presentation. The Trade Relations Manager also presents product details, objectives and policies to trade partners at various contractor meetings.
- Trade partners also support Water Heating promotions. Training, meetings, telephone calls, letters and newsletters with biannual frequency keep the trade informed about the

product and help increase awareness among new contractors as well as ensure proper application rules are followed. Customers can obtain information on contractors from the Company's website.<sup>66</sup> Contractors are encouraged to register with the Company as a registered contractor and obtain a contractor ID number.

As an important marketing channel, the HVAC community helps ensure product guidelines, eligibility requirements and processes are clearly communicated. This product relies heavily upon HVAC installers; they are on the frontline with customers as trusted individuals hired to perform service installation projects in their homes.

## **E. Product-Specific Policies**

Customers and installers must adhere to all product rules listed on the reverse side of the rebate application form. An invoice for the equipment is required along with the rebate application form. Invoices must reflect the same information provided on the rebate application form, specifically manufacturer and model number, size or capacity in gallons, BTU, Uniform Energy Factor, equipment type, serial number and installation and purchase dates.

Equipment eligibility is determined using the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Directory of Certified Product Performance<sup>67</sup> or ENERGY STAR<sup>®</sup> Qualified Products on the ENERGY STAR website.<sup>68</sup> The Company's Rebate Operations team reviews each application for accuracy and qualifications prior to mailing a rebate check. In the event of insufficient information, the rebate application and invoice are returned to the customer with a letter requesting additional information.

Customers applying for a water heater rebate will be rebated at the level indicated in that calendar year's approved DSM Plan. Customers are allowed to submit a rebate application for more than one water heater at a time, as some larger homes may require more than one; however, if more than one unit is installed at an address one application per unit is required to receive a rebate for each unit.

## **F. Stakeholder Involvement**

Ongoing consumer awareness and usability research studies are used to identify potential product modifications and enhancements. Product-specific studies are conducted every few years, allowing past participants and contractors to provide feedback about their experiences with the product. Public Service staff also engages with stakeholders for best practice sharing via the

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<sup>66</sup>

[http://www.xcelenergy.com/Save\\_Money\\_&\\_Energy/Residential/Supplemental\\_Information/Contract\\_or\\_Legal\\_Disclosure](http://www.xcelenergy.com/Save_Money_&_Energy/Residential/Supplemental_Information/Contract_or_Legal_Disclosure)

<sup>67</sup> <https://www.ahridirectory.org/ahridirectory/pages/home.aspx>

<sup>68</sup> <https://www.energystar.gov/>

Consortium for Energy Efficiency's (CEE) High Efficiency Residential Gas Water Heating Initiative.<sup>69</sup>

## G. Rebates & Incentives

Rebates for qualifying equipment are as follows.

<b>Water Heater Type</b>	<b>Rebate</b>
.64 UEF Storage Water Heater (Medium Draw)	\$50
.68 UEF Storage Water Heater (High Draw)	\$50
.87 UEF Tankless Water Heater	\$100
Electric Heat Pump Water Heater	\$400
Electric Heat Pump Water Heater (Enabled)	\$500

Rebate applications must be submitted by July 31 of the following year after purchase and installation to qualify for a rebate.

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<sup>69</sup> CEE Energy Efficiency Program Library: <http://library.cce1.org/content/cee-high-efficiency-residential-natural-gas-water-heating-initiative>.

## ➤ Thermostat Optimization

### A. Description

The Thermostat Optimization product is a multi-tiered product designed to provide residential customers year-round savings through the use of smart thermostat technology. The first tier incentivizes residential customers to purchase and install smart thermostats that have earned the ENERGY STAR® Connected Thermostat certification, resulting in year-round electric and natural gas savings. The second tier of the Thermostat Optimization product aims to leverage available software and customer experience tools that optimize smart thermostat operations to deliver additional savings that may also improve customers' comfort and overall user experience.

ENERGY STAR lists the following key product criteria as requirements for certified smart thermostats<sup>70</sup>:

- Work as a basic thermostat in absence of connectivity to the service provider;
- Give residents some form of feedback about the energy consequences of their settings;
- Provide information about heating, ventilating and air conditioning (“HVAC”) energy use, such as monthly run time;
- Provide the ability to set a schedule; and
- Provide the ability to work with utility programs to prevent brownouts and blackouts, while preserving consumers' ability to override those grid requests.

#### Tier 1 – Purchase & Install ENERGY STAR Smart Thermostat

The concept of realizing energy savings by programming a thermostat is straight-forward: scheduling temperature setting changes (setbacks) during times when home occupants are away or asleep ensures no energy is wasted when no one is home or awake. Thermostats meeting the ENERGY STAR Connected Thermostat specification have demonstrated the ability to achieve energy savings through HVAC equipment runtime reductions, specifically an 8% or higher reduction in heating equipment runtime and a 10% or higher reduction for cooling equipment runtime.

These runtime reductions are achieved by smart thermostats through a variety of methods, starting with the ease of scheduling. These devices make it easier to program efficient setback schedules compared to their non-communicating predecessors. Additionally, customers can make temporary or daily changes to setback schedules without having to reprogram the device, and devices can automatically return customers to their normal setback schedule to avoid wasted energy from an inefficient set point. There are other advanced features available from certain devices, such as motion sensors that can direct thermostats to go into a more efficient mode when no motion is detected in the home, or allowing customers to enter temporary vacation schedules which take advantage of additional savings opportunities without having to completely

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<sup>70</sup> [https://www.energystar.gov/products/heating\\_cooling/smart\\_thermostats/key\\_product\\_criteria](https://www.energystar.gov/products/heating_cooling/smart_thermostats/key_product_criteria)

reprogram the thermostat. The smart thermostat market is relatively young and these advanced features are expected to grow as manufacturers continue to innovate.

## Tier 2 – Optimize ENERGY STAR Smart Thermostat

In addition to ongoing product innovations by thermostat manufacturers, third-party software firms have begun to provide additional optimization functionality that promises to proactively manage consumer thermostats for deeper energy efficiency and demand management functionality without negatively impacting customer comfort.

Thermostat optimization products vary in capabilities and methodologies. Advanced software offerings analyze a volume of data points – e.g. outdoor temperatures, indoor temperature gains and losses, HVAC equipment runtimes, desired temperature set points, and other public and proprietary datasets – and use advanced algorithms to provide individual, premise-optimized energy efficiency and demand management opportunities through more efficient operation of HVAC equipment operation. Optimization algorithms can be tuned to optimize based on customer and/or utility priorities, such as efficiency savings, maximizing Demand Response capacity, or cost savings using time-of-use or demand pricing (among other priorities). Optimization can also be achieved by customers opting into a seasonal program that evaluates their setback schedules and activity in the home through motion sensor data, then deploys more efficient temperature set points and schedule changes to increase energy savings.

The Company began piloting thermostat optimization products in 2017 and preliminary results show energy savings and support additional efficiency and demand management achievements, while further reinforcing high customer satisfaction related to smart thermostat technology. The first pilot deployment during the summer of 2017 tested an advanced software tool that provides optimized thermostat schedules for each participant based on their individual characteristics; including data from their existing thermostat schedule; their home's thermal model calculated from outdoor temperature, indoor temperature set points, indoor temperature gains, and HVAC equipment runtime; and occupancy schedules based on motion sensor data, etc. The results showed a significant reduction in equipment runtime, resulting in energy savings for participants. The 2017 pilot has continued during summer 2018 to build upon the 2017 results.

The second optimization deployment occurred during the winter of 2018. The Company tested a different optimization algorithm that's typically deployed seasonally and evaluates participants' setback schedules, then gradually deploys more efficient temperature set points and schedules during an initial adjustment period of approximately three weeks. Once that initial period is over, the new efficient schedule remains on each participant's thermostat for the remainder of that season. Results from this deployment to nearly 12,500 participants showed an average temperature set point change of 0.81 degrees Fahrenheit, and an average heating equipment runtime reduction of 4.4%. The Company is continuing the testing for this optimization tool during the summer of 2018 to study savings potential during the cooling season.

Both pilot deployments showed encouraging results and the potential to increase energy efficiency and demand management savings from smart thermostats on top of savings inherent to the ENERGY STAR certification. The Company will continue to test optimization technologies

and approaches as this market is expected to evolve and grow similar to the consumer smart thermostat market. Further, thermostat optimization represents an appealing choice to customers as variable rate designs enter the market and more advanced demand management programs become available to residential customers.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Tier 1 participation targets are based on past performance of the Smart Thermostat Pilot and AC Rewards products. The Tier 1 offering will be available to all residential customers in single-family homes with central air-conditioners. The Company will continue evaluating potential for customers in other dwelling types or cooling systems, such as multifamily buildings or customers with heat pumps, for potential eligibility in the future.

Tier 2 participation is based on leveraging the installed base of smart thermostats within the Company's service territory.

Savings will be determined based on actual participation within each Tier offering.

### Budgets

Program costs are driven primarily by two categories: participant rebates and product administration. The majority of participant rebates are attributable to the Tier 1 offer which provides up to a \$50 rebate to each approved participant. Program administration costs include internal labor to manage the day-to-day operations of the program and third-party fees such as software licenses, annual device fees, data access and marketing support. There are minimal costs included in the Marketing and Evaluation categories.

## **C. Application Process**

The Company also plans to make the Thermostat Optimization product available through other channels and programs, for example the Xcel Energy Store Online Marketplace and Home Energy Squad® and other products. The Thermostat Optimization product will leverage existing application processes when other channels are used to streamline customers' application experience.

## **D. Marketing Objectives & Strategies**

The Company plans to directly promote the Thermostat Optimization product to customers using a variety of marketing strategies, including but not limited to:

- e-mail;
- A web-page for interested customers to explain how to apply and the benefits of participating;
- Bill inserts;

- Co-marketing with other DSM products;
- In-store materials at participating retail stores; and
- Engaging contractors who install smart thermostats.

The Company also plans to work with thermostat manufacturers to co-market eligible products and the customer incentive. This includes manufacturers providing online promotion of the program's rebates, marketing materials to existing smart thermostat owners for the Tier 2 offerings, and in-store materials at participating retail locations.

## **E. Product-Specific Policies**

To be eligible for the Thermostat Optimization offering, participants must be a residential customer of Public Service in single-family homes. For customers with electric service, participants must have central air conditioning; for gas-only customers, participants must have central gas heating.

Devices must be certified as ENERGY STAR Connected Thermostat products and meet all product criteria to be eligible for the Thermostat Optimization product offering.

The Tier 2 offering will also require ENERGY STAR certified thermostats. Customers can participate in the Tier 2 offering without having been a Tier 1 participant. The Company will work with manufacturers and vendors to confirm device eligibility for Tier 2 offerings. The Company may work with multiple third parties to deliver Tier 2 offerings should there be differentiated products and services to offer customers that meet product requirements.

## **F. Stakeholder Involvement**

Public Service has worked closely with a number of external stakeholders since the inception of the Smart Thermostat Pilot in 2014. The Company maintains active relationships with leading smart thermostat manufacturers, software vendors, consultants, and evaluators, and will continue to interact frequently with all parties as the product, technology, and product market grows.

## **G. Rebates & Incentives**

The Thermostat Optimization product will offer up to a \$50 rebate to Tier 1 participants upon purchase and installation of an eligible smart thermostat. Tier 2 participant incentives will vary based on the specific approach and products chosen, with the possibility of no rebate offered to participants.

## Low-Income Program

### A. Description

The Low-Income Program includes Public Service’s energy efficiency and education products targeted at income-qualified customers. Public Service continues to make a substantial commitment to both low-income gas and electric energy efficiency in 2019 and 2020. The Company recognizes that low-income products offer a unique opportunity to both substantially improve the efficiency with which customers use energy and to directly improve their quality of life. Energy efficiency products likely provide other non-energy related benefits to low-income customers in the form of health, safety, comfort, and other improvements. Reductions in low-income customers’ utility bills can have a disproportionately beneficial effect on household income as compared to non-low-income customers because a larger percentage of a low-income customer’s income is spent on energy.

With these factors in mind, Public Service will continue to offer the same four products included in the 2017/2018 DSM Plan intended to reach a large percentage of the low-income community while leveraging resources already in place to serve this customer group.

The Low-Income Program consists of the following four products:

- Energy Savings Kit
- Multifamily Weatherization
- Non-Profit
- Single-Family Weatherization

#### Low-Income Product Rankings

All products in the DSM portfolio were ranked through the same process<sup>71</sup> and the results for low-income products are shown in Table 12 below. Criteria used to rank the products included: market segments, customer classes, natural gas energy savings, electric energy savings, number of participants, participant rate (percent of the entire customer class), and MTRC test ratio results.

**Table 12: Low-Income Program Product Rankings**

2019-2020	Rank
Energy Savings Kit	9
Single-Family Weatherization	28

<sup>71</sup> The entire DSM product ranking can be found in [Appendix C](#) of this Plan.

Non-Profit	32
Multifamily Weatherization	34

## B. Targets, Participants & Budgets

### Targets and Participants

The Company developed participation and energy savings targets based on historical experience with these products. Participation rates were established in partnership with CEO, EOC, low-income agencies, and vendors to further refine the goals and budgets.

Public Service relies on customers who request and qualify for energy assistance on their energy bills to determine eligibility and is rapidly exhausting this list of prospects to market these offerings to.

### Budgets

Budgets for low income DSM products have increased compared to the 2017/2018 Plan, consistent with Commission guidance received in Decision No. C14-0731.<sup>72</sup>

**Table 13a: 2019 Electric Low-Income Program Budgets and Goals**

2019	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Low-Income Program</b>				
Energy Savings Kit	\$490,368	329	2,600,605	1.36
Multifamily Weatherization	\$1,081,511	407	1,889,123	0.89
Non-Profit	\$1,119,608	383	1,701,178	0.99
Single-Family Weatherization	\$1,430,268	226	1,778,524	0.70
<b>Low-Income Program Total</b>	<b>\$4,121,754</b>	<b>1,344</b>	<b>7,969,430</b>	<b>0.90</b>

<sup>72</sup> Decision No. C14-0731, page 27 paragraph 76.

**Table 13b: 2020 Electric Low-Income Program Budgets and Goals**

2020	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Low-Income Program</b>				
Energy Savings Kit	\$251,424	164	1,300,302	1.23
Multifamily Weatherization	\$1,081,511	407	1,889,123	0.90
Non-Profit	\$1,119,608	383	1,701,178	1.02
Single-Family Weatherization	\$1,420,268	226	1,778,524	0.71
<b>Low-Income Program Total</b>	<b>\$3,872,811</b>	<b>1,180</b>	<b>6,669,128</b>	<b>0.90</b>

**Table 13c: 2019 Natural Gas Low-Income Program Budgets and Goals**

2019	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Low-Income Program</b>					
Energy Savings Kit	\$178,948	20,911	116,854	\$2,849,669	12.71
Multifamily Weatherization	\$773,681	10,693	13,821	-\$337,376	0.78
Non-Profit	\$431,913	3,999	9,260	-\$220,373	0.74
Single-Family Weatherization	\$2,913,101	47,617	16,346	-\$749,595	0.88
<b>Low-Income Program Total</b>	<b>\$4,297,643</b>	<b>83,220</b>	<b>19,364</b>	<b>\$1,542,325</b>	<b>1.17</b>

**Table 13d: 2020 Natural Gas Low-Income Program Budgets and Goals**

2020	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Low-Income Program</b>					
Energy Savings Kit	\$150,441	10,455	69,498	\$1,390,728	8.61
Multifamily Weatherization	\$773,681	10,693	13,821	-\$311,370	0.80
Non-Profit	\$431,913	3,999	9,260	-\$208,482	0.75
Single-Family Weatherization	\$2,913,101	47,617	16,346	-\$623,414	0.90
<b>Low-Income Program Total</b>	<b>\$4,269,136</b>	<b>72,765</b>	<b>17,044</b>	<b>\$247,462</b>	<b>1.03</b>

### C. Marketing Objectives & Strategies

The Low-Income Program aims to educate low-income customers on the importance of and value provided by energy efficiency. The Company will work with low-income providers, cities/counties and other community organizations to promote all available services. Marketing and promotion activities will occur primarily through partners with collateral material developed by Public Service. This tends to be the most effective way to target the low-income customers, as other targeting methods are limited. Xcel Energy's call center agents are also trained to provide

useful information with which to direct potentially eligible customers to participate in the Program's products.

#### **D. Program-Level Policies**

Customers participating in the Energy Savings Kit and Single-Family Weatherization products must purchase retail electricity or gas from Public Service on a residential tariff. Participants in the Multifamily Weatherization product must be a residential customer or own multi-family buildings whose rental units are a minimum 66% occupied by customers certified as low-income per product guidelines. Non-Profit Weatherization participants must electric and gas service on a non-residential rate from Public Service. Specific products within the Program may have different eligibility requirements depending on the services offered, funding partners or customers served.

#### **E. Stakeholder Involvement**

Public Service received significant input and assistance in originally developing and modifying products for the Low-Income Program and will rely heavily on stakeholders to deliver successful products. Perhaps more than any other Program, the Low-Income Program depends on outside expertise in the form of government agencies and non-profits to provide product benefits to customers. In this sense, Public Service is the facilitator that provides financial and energy efficiency resources to complement the services provided by state and local organizations.

The Company will continue to work with the EOC, vendors, outside consultants, Commission Staff, and local weatherization organizations to ensure that its Low-Income Program products are delivering promised benefits and producing effective results. These interactions will also guide mid-year performance adjustments that may be necessary to keep products on track.

#### **F. Rebates & Incentives**

Low-income rebates are unique in that the incentive level assigned for the measures offered under these four DSM products covers 100% of the incremental capital cost.

#### **G. Evaluation, Measurement & Verification**

The specific product measurement and verification plans are included in the EM&V section of this Plan.

## ➤ Energy Savings Kits

### A. Description

The Energy Savings Kit provides home energy efficiency measures bundled and distributed to income-qualified customers through email and direct mail campaigns and partnerships. The kits offer electricity and natural gas saving measures and customer education materials to help lower customer bills and improve the comfort and safety of their dwellings.

Income-qualified customers will receive an offer through email or the mail informing them of their eligibility to receive a free Energy Savings Kit. The offer details the contents of the kit and how much money they could save on their energy bill if they install all the measures provided. If the customer chooses to receive a kit, they will send their response to the third-party implementer. Customers will receive a kit within six to eight weeks.

The Energy Savings Kits will include the following electric and natural gas efficiency measures:

- Eight (8) LED bulbs (10 Watt)
- One (1) 1.5 gpm High Efficiency Showerhead
- One (1) 1.5 gpm Kitchen Faucet Aerator
- One (1) 1.0 gpm Bathroom Faucet Aerator

Interval data will help the Company gain insight into customer's daily energy use, and inform better measures that can be added to these kits to maximize savings for these hard to reach customers.

### B. Targets, Participants & Budgets

#### Targets and Participants

The Company set the participation target (number of kits to be sent out) based on historical product performance and participation projections for 2019 and 2020. Energy savings targets were developed based on the installation rate of the kit measures in 2018.

#### Budgets

The budget is based on the number of forecasted kits. The budget includes the costs of kit contents, and production, distribution, and fees from the third-party implementer. The budget also includes costs for labor, marketing materials and M&V.

### C. Application Process

Customers who have received Low Income Home Energy Assistance Program (LIHEAP) funding, any energy assistance funding (including county assistance and fuel fund assistance), Low-Income Energy Assistance Program (LEAP) funding, or other state assistance programs and live the Public Service electric and/or natural gas service territory will be sent an offer to receive

the kit. The third-party implementer will track customer participation so that customers do not receive more than one kit. This tracking information will also be provided to the Company on a regular basis. Income-qualified customers are eligible to receive a kit once every ten years.

#### **D. Marketing Objectives & Strategies**

The overall objective of the product is to increase and expand education among the income-qualified customers on the importance of energy efficiency and the value of taking action to improve efficiency in their homes. The Company will work with local and state agencies to obtain customer mailing lists to reach more customers annually.

#### **E. Product-Specific Policies**

In order to participate, customers must receive LIHEAP, LEAP, or any energy assistance funding (including county assistance and fuel fund assistance) or other state assistance programs.

#### **F. Stakeholder Involvement**

The Company will continue to work with local and state agencies to identify eligible customers and determine additional kit content needs.

#### **G. Rebates & Incentives**

The Company will fund 100% of the cost of the Energy Savings Kits. There will be no rebate provided to customers.

## ➤ Multifamily Weatherization

### A. Description

The Multifamily Weatherization product is designed to provide funding for a wide variety of equipment and process improvements for electric and natural gas efficiency measures in income qualified multifamily buildings. This offering differs from the Single-Family Weatherization product in that these dwellings have common areas, greater overall square footage, more appliances and other potential energy-saving measures.

The product will be implemented in partnership with Energy Outreach Colorado (EOC). EOC works jointly with a number of government and non-profit partners to identify and qualify multifamily units for participation. Details of measures, rebates, reporting processes, and M&V procedures will be evaluated on a per-project basis using a detailed engineering analysis.

In addition to these measures, customer education is offered with this product. EOC staff provides educational materials, historical energy usage information, and bill analysis to these customers during the weatherization process to help them identify additional changes they can make in their day-to-day lives to further reduce energy use in their building. Currently, the Company does not claim any energy savings associated with the educational component of this product; however, with the introduction of AMI interval data this may become a more viable option for behavioral savings or, at a minimum, enhance the existing education component.

### B. Targets, Participants & Budgets

#### Targets and Participants

Participation and energy savings targets were developed by evaluating 2016 and 2017 project completions and information provided by EOC on anticipated participants. Participation can vary from building to building as many properties are master metered.

#### Budgets

Historical project costs and participation information were tracked and analyzed to develop a budget estimate. The majority of the budget is allocated to electric and natural gas rebates benefiting tenants in low-income multifamily buildings. Other external variables contributing to costs, such as outreach, material costs and staffing, were also evaluated.

### C. Application Process

To participate in the product, customers must submit an application to EOC. Applications are reviewed by EOC and once approved; a comprehensive audit is performed on the building. Income qualified households must comprise at least 66% of the building's total households for the building to be eligible to apply. EOC will determine which applicant locations have the

greatest need for weatherization services. In some cases, if the need is very high, the application may be approved for buildings that are occupied by 50% low-income households.

## **D. Marketing Objectives & Strategies**

The overall marketing objective is to increase education among income qualified customers and building owners on the importance of energy efficiency, thereby driving product participation. Public Service will also work to educate customers on the value of taking further actions to improve efficiency in their homes in conjunction with EOC and other low-income customer advocates.

## **E. Product-Specific Policies**

Eligible customers for this product are building owners or property managers of multifamily housing complexes with at least 66% of the rental units occupied by income qualified customers whose income is below 80% of the local area median as defined by the Colorado Housing and Finance Authority. Customers meeting the U.S. Department of Energy Weatherization Assistance Program funding guidelines,<sup>73</sup> as determined by the Colorado Energy Office (CEO), EOC, local governments, or their agencies, are automatically deemed income eligible.

## **F. Stakeholder Involvement**

When designing the product, Public Service worked with external consultants to determine which measures would ensure customer comfort while saving money on energy costs. Public Service will continue to evaluate historical projects with EOC to determine measure implementation and needs trending.

## **G. Rebates & Incentives**

The product does not provide a rebate to customers, but rather provides project funding in the form of grants. The estimated average incentive amounts for electric and natural gas energy improvements can be found in [Appendix H](#): Technical Reference Manual.

Public Service will evaluate each project on a custom basis to determine funding levels using a detailed engineering analysis. Engineers review the project information to determine the projected energy savings, benefit/cost ratio and payback. Projects will be bundled in order to pass the MTRC test ratio for the product. Testing, study, engineering and project management fees may be included in the project costs.

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<sup>73</sup> <http://energy.gov/eere/wipo/where-apply-weatherization-assistance>

## ➤ Non-Profit

### A. Description

The Non-Profit product is designed to provide funding on a wide variety of equipment and process improvements for electric and natural gas efficiency measures to qualified non-profit organizations within the Company's Electric and Natural Gas service territory. The product's focus is on helping organizations that serve income qualified individuals, such as shelters, safe houses, and residential treatment centers.

The product will be implemented in partnership with Energy Outreach Colorado (EOC). EOC utilizes funding through their existing Non-Profit Energy Efficiency Program (NEEP) grants targeting non-profits. EOC works to identify and qualify non-profit facilities for the product. Details of energy-saving measures, rebates, reporting processes, M&V procedures will be evaluated on a per project basis using a detailed engineering analysis.

In addition to these measures, customer education is included with this product. EOC staff provides educational materials, historical energy usage information, and bill analysis to these customers during the weatherization process to help them identify additional changes they can make in their day-to-day lives to further reduce energy use in their facility. Currently, the Company does not claim any energy savings associated with the educational component of this product; however, with the introduction of AMI interval data this may become a more viable option for behavioral savings or, at a minimum, enhance the existing education component.

### B. Targets, Participants & Budgets

#### Targets and Participants

Participation and energy savings targets were developed by evaluating 2016 and 2017 project completions and information provided by EOC on anticipated participants.

#### Budgets

Historical costs and participation information were tracked and analyzed to develop a budget estimate. The majority of the budget is allocated to electric and natural gas rebates benefiting non-profit facilities. Other external variables contributing to costs, such as outreach, material costs, and staffing were also evaluated.

## **C. Application Process**

Customers can learn about the product through information that is available on EOC's website<sup>74</sup> and also Xcel Energy's website<sup>75</sup>. EOC reaches out to those customers who may not be aware of funding and educates them on the benefits of an energy-efficient retrofit improvement. Customers who are interested in the product can apply online through the EOC website. The online application must be completed, and includes a description of existing equipment in the facility, confirmation of building ownership/facility usage, proof that the building is registered with the Colorado Secretary of State as a 501(c)3 and documentation showing the financial stability of the organization. A committee made up of non-profit industry leaders then determines the applicant's needs and how EOC and Public Service funding can help.

## **D. Marketing Objectives & Strategies**

The overall marketing objective is to increase and expand education among the income-qualified customers and building owners on the importance of energy efficiency, thereby driving product participation. Public Service will also work to educate customers on the value of taking further actions to improve efficiency at the facility. EOC markets the product through various channels, including communications through non-profit association literature, community resource center announcements, and local income qualified foundations.

## **E. Product-Specific Policies**

To receive funding, the following customer and facility eligibility requirements must be met:

- Customers must receive electricity and/or natural gas from Public Service;
- Customer must operate the non-profit facility on a property they own and for which they pay energy bills, or have a long-term lease that requires only non-profits to occupy the space with plans to be in current location for at least the next ten years; and
- The property must provide services to vulnerable populations including but not limited to: transitional housing, homeless shelters, affordable housing, domestic violence shelters and day shelters, organizations that provide services (substance abuse, health and mental health services, child care, education and/or emergency services) for special needs populations, including income qualified families, the disabled, senior, and youth communities.

In addition, the following project requirements must be met:

- Be recommended by an independent energy auditor based on energy conservation calculations that are available for review; and

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<sup>74</sup> <https://www.energyoutreach.org/programs-for-organizations/non-profit-energy-efficiency/>

<sup>75</sup> [https://www.xcelenergy.com/programs\\_and\\_rebates/business\\_programs\\_and\\_rebates/income\\_qualified\\_rebate\\_programs\\_for\\_buildings](https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/income_qualified_rebate_programs_for_buildings)

- Reduce the use of energy (electricity, natural gas, or both) provided by Public Service to the facility.

Participating low income agencies must agree to the following:

- Installation of an energy use monitoring and reporting system;
- A comprehensive energy audit by a qualified entity;
- Set target energy use goals for each facility;
- Consider installation of all qualifying efficiency measures;
- Engage appropriate contractors and manage the installation and completion of efficiency measures;
- Provide a summary project report at the completion of the installations;
- Provide all insurance and legal protections requested by Public Service; and
- Annually review the energy use of the retrofitted facility and formulate a plan for further improvement using available and appropriate assistance.

## **F. Stakeholder Involvement**

When designing the product, Public Service worked with external consultants to determine which measures would ensure customer comfort while saving money on energy costs. Public Service will continue to evaluate historical projects with EOC to determine specific measure trends.

## **G. Rebates & Incentives**

The product does not provide a rebate to customers, but rather provides project funding in the form of grants. The estimated average incentive amounts for the energy improvements can be found in [Appendix H: Technical Reference Manual](#).

Public Service will evaluate each project on a custom basis to determine funding levels using a detailed engineering analysis. Engineers review the project information to determine the projected energy savings, benefit/cost ratio and payback. Projects will be bundled in order to ensure that the product passes the MTRC test ratio. Testing, engineering and project management fees may be included in the project costs.

## ➤ Single-Family Weatherization

### A. Description

The Single Family Weatherization product targets income qualified customers who are receiving assistance on their energy bills. The product works with weatherization agencies and contractors around the state to provide this at-risk customer segment with free or low-cost home audits and electric and/or natural gas efficiency measures. Public Service offers significant rebates toward the incremental cost of these upgrades which include things like:

#### Natural Gas Measures

- Furnace efficiency upgrades
- Wall insulation
- Attic insulation
- Crawl space insulation
- Attic insulation for manufactured homes
- Water heaters
- Storm windows
- 1.5 GPM showerheads
- 1.5 GPM aerators
- 0.5 GPM aerators
- Air Sealing
- Thermostat Installation and Programming

#### Electric Measures

- Refrigerator replacements
- Electrically Commutated Motors (ECMs)
- LEDs (A-19 and BR-30 bulbs)
- Cooling savings for building shell measures
- Water heater blanket
- Evaporative Coolers

In addition to these measures, a major focus of this product is customer education. Low-income auditors will provide educational materials, historical energy usage information, and bill analysis to these customers during the weatherization process to help them identify additional changes they can make in their day-to-day lives to further reduce energy use in their home. Furthermore, the implementer will offer educational workshops in collaboration with local housing authorities, and other engaged community organizations. Currently, the Company does not claim any energy savings associated with the educational component of this product; however, with the introduction of advanced meter interval data this may become a more viable option for behavioral savings or, at a minimum, enhance the existing workshops.

The Single-Family Weatherization product is delivered in partnership with a third-party implementer. The third-party implementer will work to secure public grants and private funds to

match with Public Service funds. They will also develop annual contracts with weatherization agencies in the Public Service electric and gas service territories. Processes for reporting measure detail, rebates, and measurement and verification (M&V) are managed by the third-party implementer.

## **B. Targets, Participants & Budgets**

### Targets & Participants

Energy savings and participation targets were established in partnership with the third-party implementer using historical product participation in 2016 and 2017 as a guide. Recommendations from the third-party implementer on expected workflow were also considered when developing energy savings targets and participation rates.

### Budgets

Budgets for the product were developed based on the incremental cost of measures installed in low-income homes. The Company also allocated funds for necessary health and safety upgrades in special situations; these funds will be used at the discretion of the third-party implementer with proper documentation.

## **C. Application Process**

Participating customers must receive residential electricity and/or natural gas from the Company and have a household income below 80% of the area median income (AMI), which varies by county. Customers will be informed of the Single-Family Weatherization product when they sign up for Colorado Low-Income Energy Assistance Program (LEAP), among other outreach avenues. LEAP qualification is, currently, at 165% below the Federal Poverty Level (FPL), while the Department of Energy's (DOE) Weatherization Assistance Program (WAP) allows for 200% FPL.

Once the customer's income and energy assistance status is verified, they will be qualified by their local weatherization agency, and the third-party implementer, to receive weatherization services.

## **D. Marketing Objectives & Strategies**

The primary marketing objective of this product is to deliver energy savings which help low-income customers reduce energy costs and increase comfort in their homes. A secondary objective is to provide low income customers with access to materials and workshops educating them on the importance of energy efficiency and the value of taking action to improve efficiency in their homes. The Company will work with low-income providers, such as local weatherization

agencies and community organizations, to promote available services. Customers can find information on local weatherization agencies on Xcel Energy's website.<sup>76</sup>

## **E. Product-Specific Policies**

The third-party implementer will contract with subcontracted agencies to perform weatherization services. All contractors will be trained to follow BPI installation requirements for weatherization services. These contractors receive funding from the third-party product implementer and other state funding and have agreed to weatherize homes following state regulations and guidelines.

## **F. Stakeholder Involvement**

When designing the product, the Company worked with external consultants to define energy savings measures to help customers save money on their energy bills, while also improving the comfort of their home. The product is delivered in partnership with federal, state, and nonprofit low-income weatherization organizations.

## **G. Rebates & Incentives**

The Company will pay rebates toward the equipment and installation costs of predetermined electric and natural gas energy efficiency measures available to low-income, single-family customers. The Company will also pay for necessary health and safety upgrades associated with the installation of these weatherization measures which may include, fixing gas leaks, updating electrical or adding ventilation.

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<sup>76</sup> [http://www.xcelenergy.com/Save\\_Money\\_&\\_Energy/Rebates/Income\\_Qualified\\_Weatherization\\_-\\_CO](http://www.xcelenergy.com/Save_Money_&_Energy/Rebates/Income_Qualified_Weatherization_-_CO)

## Indirect Products & Services

### A. Description

Indirect Products and Services support planning, analysis, administration, and evaluation of products with direct savings impacts as well as development and implementation of the Plan. Most of these indirect products and services are not independently evaluated for cost-effectiveness, with the exception of pilots with measured savings impacts that are being assessed for potential future transition to a product—those do undergo a cost-benefit evaluation. Pilot implementation and evaluation approaches are fully discussed in each written pilot summary, following the Product Development description. All of the Indirect Products and Services costs are included in the overall DSM portfolio cost-benefit analysis.

Indirect Products and Services play a critical role in ensuring that the overall DSM portfolio is effectively researched, managed, and operated. These products and services provide valuable information and support for the direct impact products and offer innovative approaches for inciting change in the DSM marketplace. These innovative approaches, manifested in education and market transformation products, may not produce readily quantifiable energy and demand savings, but still play a very important role in shifting markets and attitudes to be more energy efficiency and demand reduction oriented.

There are two main areas of Indirect Products & Services:

1. Education/Market Transformation and
2. Planning and Research.

#### Education/Market Transformation

The Company offers five customer-facing education and market transformation products, including: Business Education, Business Energy Analysis, Consumer Education, Energy Efficiency Financing, and the Home Energy Audit. The definition of market transformation in the Public Service gas DSM Rulemaking is:

*...a strategy for influencing the adoption of new techniques or technologies by consumers. The objective is to overcome barriers within a market through coordinating tactics such as education, training, product demonstration and marketing, often conducted in concert with rebates or other financial incentives.<sup>77</sup>*

#### Planning and Research

The Company will operate five internal DSM services: Evaluations, Market Research, Measurement & Verification, Planning & Administration, and Product Development.

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<sup>77</sup> 4 CCR 723-4-4751(n)

## B. Targets, Participants & Budgets

### Targets and Participants

Most indirect products and services do not have savings or participation targets, with the exception of some pilots, whose energy savings and participation targets are described within each pilot's written summary which follows this section.

### Budgets

Because the majority of Indirect Products and Services do not directly produce energy and demand savings and, therefore, may reduce the overall cost-effectiveness of the DSM portfolio, there is a natural tendency to limit activity and spending in this area to only the most essential elements. The Company will not limit its spending in this area to a specific percentage of the overall portfolio, but will remain vigilant about limiting the Indirect Products and Services overall size.

The budget consists primarily of labor, educational material, and study costs. Most studies are conducted by outside experts, generally selected through a competitive bid process. Tables 14a through 14d provide the overall Indirect products and services energy savings and participation targets, if applicable, and budgets, broken out by each product / service.

**Table 14a: 2019 Electric Indirect Products & Services Goals & Budgets**

2019	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Indirect Products &amp; Services</b>				
<b>Education/Market Transformation</b>				
Business Education	\$176,739	0	0	
Business Energy Analysis	\$760,350	0	0	
Consumer Education	\$899,908	0	0	
Energy Benchmarking	\$94,407	0	0	
Energy Efficiency Financing	\$60,000	0	0	
ENERGY STAR Retail Products Platform	\$509,271	0	0	
Home Energy Audit	\$444,675	0	0	
Partners in Energy	\$799,000	0	0	
<b>Education/Market Transformation Total</b>	<b>\$3,744,350</b>	<b>0</b>	<b>0</b>	
<b>Planning and Research</b>				
EE Market Research	\$350,791	0	0	
EE Measurement & Verification	\$12,000	0	0	
EE Planning & Administration	\$522,162	0	0	
EE Program Evaluations	\$404,005	0	0	
EE Product Development	\$1,840,082	0	0	
Geo-targeting Pilot - EE	\$14,116	0	0	0.81
<b>EE Product Development Total</b>	<b>\$1,854,198</b>	<b>0</b>	<b>0</b>	
<b>EE Planning and Research Total</b>	<b>\$3,143,157</b>	<b>0</b>	<b>0</b>	
<b>EE Indirect Products &amp; Services Total</b>	<b>\$6,887,507</b>	<b>0</b>	<b>0</b>	

**Table 14b: 2020 Electric Indirect Products & Services Goals & Budgets**

2020	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Indirect Products &amp; Services</b>				
<b>Education/Market Transformation</b>				
Business Education	\$176,739	0	0	
Business Energy Analysis	\$760,350	0	0	
Consumer Education	\$899,908	0	0	
Energy Benchmarking	\$97,240	0	0	
Energy Efficiency Financing	\$60,000	0	0	
ENERGY STAR Retail Products Platform	\$509,271	0	0	
Home Energy Audit	\$444,675	0	0	
Partners in Energy	\$836,000	0	0	
<b>Education/Market Transformation Total</b>	<b>\$3,784,183</b>	<b>0</b>	<b>0</b>	
<b>Planning and Research</b>				
EE Market Research	\$382,134	0	0	
EE Measurement & Verification	\$12,000	0	0	
EE Planning & Administration	\$522,162	0	0	
EE Program Evaluations	\$378,737	0	0	
EE Product Development	\$1,854,964	0	0	
Geo-targeting Pilot - EE	\$75,544	0	0	0.93
<b>EE Product Development Total</b>	<b>\$1,930,508</b>	<b>0</b>	<b>0</b>	
<b>EE Planning and Research Total</b>	<b>\$3,225,541</b>	<b>0</b>	<b>0</b>	
<b>EE Indirect Products &amp; Services Total</b>	<b>\$7,009,724</b>	<b>0</b>	<b>0</b>	

**Table 14c: 2019 Natural Gas Indirect Products & Services Goals & Budgets**

2019	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Indirect Products &amp; Services</b>					
<b>Education/Market Transformation</b>					
Business Education	\$19,638	0	0		
Business Energy Analysis	\$78,000	0	0		
Consumer Education	\$133,323	0	0		
Energy Benchmarking	\$34,491	0	0		
Energy Efficiency Financing	\$60,000	0	0		
ENERGY STAR Retail Products Platform	\$7,121	0	0		
Home Energy Audit	\$561,795	0	0		
Partners in Energy	\$89,000	0	0		
<b>Education/Market Transformation Total</b>	<b>\$983,367</b>	<b>0</b>	<b>0</b>		
<b>Planning and Research</b>					
EE Market Research	\$111,942	0	0		
EE Measurement & Verification	\$6,000	0	0		
EE Planning & Administration	\$116,920	0	0		
EE Program Evaluations	\$178,835	0	0		
EE Product Development	\$195,000	0	0		
Geo-targeting Pilot - EE	\$0	0	0		
<b>EE Product Development Total</b>	<b>\$195,000</b>	<b>0</b>	<b>0</b>		
<b>EE Planning and Research Total</b>	<b>\$608,698</b>	<b>0</b>	<b>0</b>		
<b>EE Indirect Products &amp; Services Total</b>	<b>\$1,592,065</b>	<b>0</b>	<b>0</b>		

**Table 14d: 2020 Natural Gas Indirect Products & Services Goals & Budgets**

2020	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio
<b>Indirect Products &amp; Services</b>					
<b>Education/Market Transformation</b>					
Business Education	\$19,638	0	0		
Business Energy Analysis	\$78,000	0	0		
Consumer Education	\$133,323	0	0		
Energy Benchmarking	\$35,525	0	0		
Energy Efficiency Financing	\$60,000	0	0		
ENERGY STAR Retail Products Platform	\$7,121	0	0		
Home Energy Audit	\$561,795	0	0		
Partners in Energy	\$93,000	0	0		
<b>Education/Market Transformation Total</b>	<b>\$988,402</b>	<b>0</b>	<b>0</b>		
<b>Planning and Research</b>					
EE Market Research	\$118,187	0	0		
EE Measurement & Verification	\$6,000	0	0		
EE Planning & Administration	\$116,920	0	0		
EE Program Evaluations	\$160,602	0	0		
EE Product Development	\$197,000	0	0		
Geo-targeting Pilot - EE	\$0	0	0		
<b>EE Product Development Total</b>	<b>\$197,000</b>	<b>0</b>	<b>0</b>		
<b>EE Planning and Research Total</b>	<b>\$598,708</b>	<b>0</b>	<b>0</b>		
<b>EE Indirect Products &amp; Services Total</b>	<b>\$1,587,110</b>	<b>0</b>	<b>0</b>		

## **C. Application Process**

Most indirect products and services do not have rebate applications, with the exception of some pilots, whose rebate applications and/or participation parameters are described within each pilot's written summary which follows this section.

## **D. Marketing Objectives & Strategies**

Indirect Products & Services serve all markets addressed by Public Service's direct impact products. During 2017 and 2018, market research activities will be focused on customer and market characterization. Each process evaluation conducted by Market Research includes: the quantification of product penetration, provides segment and target market information, determines trends and barriers affecting participation, and investigates best practices observed by peer utility programs. This information provides a basis from which product and program decisions can be made.

Through membership in consultative organizations such as E Source, Market Research receives vendor-neutral and reliable market intelligence overall, and specific to a product/program or by targeted segments. Other general research provides demographic and firmographic data about the characteristics of our customer base, attitudinal and awareness information which informs market strategy, and levels of customer satisfaction which address program vitality.

Marketing, advertising, and promotion activities under Indirect Products and Services are primarily focused on the Education/Market Transformation area. The very nature of these products suggests that they will use customer contacts in the form of newsletters, bill inserts, community events, energy efficiency workshops, direct mail and email campaigns, and communications to new residents, and advertising through radio, television and print to educate customers and transform markets. Promotional costs are also budgeted to create awareness and generate enrollments in the Home Energy Audit and Business Energy Analysis products.

## **E. Program-Specific Policies**

The Company will make every effort to focus its Education and Market Transformation messages and promotions on Public Service customers, yet there will likely be spillover benefits to non-Public Service customers particularly with those activities that convey information to general audiences (like the Company website, partnerships with regional agencies, and community-based events).

## **F. Stakeholder Involvement**

Indirect Products and Services rely heavily on input from internal and external stakeholders, and, as such, manage the Company's interaction with "official" stakeholder groups such as the DSM Roundtable. Market Research and Education/Market Transformation activities actively engage

internal and external stakeholders including employees, customers, trade allies, and vendors to ensure that product objectives are met.

## **G. Rebates & Incentives**

Most indirect products and services do not have energy savings targets or offer rebates, with the exception of some pilots, whose rebates and incentives are described within each pilot's written summary which follows this section.

## **H. Evaluation, Measurement and Verification**

The Indirect offering includes the Company's Evaluation, Measurement and Verification (EM&V) plan for 2019 and 2020, which describes the EM&V approach for all of the DSM products included in the Plan. The majority of Planning and Research services themselves are not subject to EM&V, with the exception of pilots, where their EM&V is described within each pilot's written summary which follows this section.

The DSM Planning & Administration group is responsible for developing the EM&V methodologies, while the Market Research group will oversee third parties conducting the research. These efforts are described in more detail within the EM&V and Market Research sections below.

## ➤ **Business Education**

### **A. Description**

The goal of Business Education is to improve public knowledge concerning the benefits of energy efficiency and conservation. The Company views this as an important part of a long-term effort to create educated, engaged customers who are ready to act on energy efficiency opportunities. The following key messages will be incorporated into all of the product's marketing efforts:

- DSM is a more cost-effective resource than building new generation resources.
- DSM costs incurred today are an investment that defers incurring higher costs for new generation equipment later.

Further, the purpose of Business Education is to induce permanent changes in customers' energy usage through long-term education and proactive customer interactions. A key to the success of market transformation is creating sophisticated consumers who have information that allows them to make more informed and effective decisions. Among the changes that will affect market transformation are shifts in conventional thinking, heightened awareness, and increased knowledge. Specifically, the Company will educate customers about how to use energy wisely, how to change energy usage behaviors, and how to buy energy efficient appliances, such as those that are ENERGY STAR-rated. Going beyond the initial education, the true intent of this product is to engage customers about energy conservation and efficiency and motivate them to reduce their energy usage.

Primary emphasis is placed on:

- Energy efficiency and conservation messaging through email and print newsletters;
- Face-to-face interaction via customer events and sponsorships through business and trade associations;
- Digital tools for customers to utilize in their business
- Utilizing mass market advertising such as radio, print and digital to create awareness in energy efficiency;

### **B. Targets, Participants & Budgets**

#### Targets and Participants

Business Education is targeted to all Colorado natural gas and electric business customers, with strong emphasis on small- to mid-sized customers.

#### Budgets

Public Service's budget for this product was determined through estimates of material, labor, and past activities in Colorado and other states. The majority of the budget is driven by customer education, conservation promotion, and internal labor.

### **C. Application Process**

This product does not include an application process.

### **D. Marketing Objectives & Strategies**

The primary objective of Business Education is to heighten business customers' awareness about energy efficiency and conservation resulting in engaged customers who will proactively take steps to reduce energy consumption by upgrading to high efficiency measures.

### **E. Product-Specific Policies**

This indirect program has no specific policies.

### **F. Stakeholder Involvement**

Public Service will create and leverage strategic partnerships and alliances with governmental, non-governmental, and trade partners to reach target businesses in Colorado.

### **G. Rebates & Incentives**

This indirect program does not offer customer rebates.

## ➤ Business Energy Analysis

### A. Description

The Business Energy Analysis product is an indirect impact product that offers analysis services to identify energy saving opportunities for Colorado business and industrial customers. The goals of this product are to provide a method and entry way for commercial and industrial customers to learn how their businesses use energy today and to identify measures that will help them save energy and reduce operating costs in the future. This service is a first step for customers to uncover energy saving opportunities with little capital investment and risk. Audits have the capability to use interval usage data to identify opportunities where customers can shift their energy usage from peak to off-peak periods. Public Service representatives have and continue to use this as a selling point for engagement in other energy efficiency products. Participation is heavily dependent on promotion by internal Public Service representatives, as well as the trade partners and outside business customer assistance programs.

The Business Energy Analysis product offers two types of assessments: onsite audits and engineering assistance studies, which vary in customer involvement and capital investment. The reports in both assessments provide detailed information about costs and paybacks, which will assist in creating a business case to make energy efficiency upgrades.

- *Onsite energy audit:* Public Service sends an energy advisor from a contracted third-party vendor to a customer's facility to conduct an onsite energy audit, which is a comprehensive audit of the facility and its energy use. The customer receives a detailed report including energy conservation opportunities with the associated payback, savings, cost, and available rebates. Qualified third-party contractors are selected through an RFP process to perform the onsite energy audits.

Customers with an annual peak demand of less than 100 kW will qualify for participation in the direct-install component of the product. While onsite for the audit, the third-party implementer will perform free installation of the following energy savings measures, where applicable:

- Select screw-in LED lamps; and
- Aerators in public restrooms and kitchen sinks
- Pipe insulation
- Water conservation showerheads
- Water conservation kitchen spray valves

Savings for these measures will be claimed and paid for in their respective products.

- *Engineering assistance studies:* Provides guidance when the customer is seeking to replace or upgrade a major process or system. The customer will hire a trade partner of their choice to analyze the facility and develop recommendations for the most energy efficient equipment options. The analysis targets customers who are focused on analyzing their refrigeration, cooling, custom, or space and processing heating systems.

### B. Targets, Participants & Budgets

### Targets and Participants

The targets were developed by analyzing historical participation data, and the commercial and industrial customer market segment.

### Budgets

The budget was developed based on historical data, auditor pricing, forecasted participation and the presumed size and location of participating buildings, to estimate an average assessment cost.

Labor, promotions, and consulting drive the budget level:

- *Consulting*: Developed using average auditor pricing and participation goal.
- *Labor Charges*: Estimated costs for program management, execution of the marketing strategy, and rebate processing.
- *Promotions and Advertising*: The estimated promotional budget anticipates several customer and trade communications during the year and support for general energy efficiency advertising campaigns.

## **C. Application Process**

Customers may become aware of this product through their Account Manager or the Business Solutions Center, contracted trade allies, external customer assistance products, and/or marketing efforts including mailings, emails, newsletters, and the Company's website. All avenues are essential for increasing product awareness in conjunction with marketing efforts.

Onsite energy audits and engineering assistance studies require preapproval prior to project initiation. Customers may access the onsite audit preapproval application on the Company's website<sup>78</sup> and work with Public Service to complete the process by collecting their billing history information. Once the application is complete with customer and building information, an auditor will be assigned to assess the building. The customer will typically receive their final report from the engineer within three months of applying for preapproval. This time allows for internal processing, onsite engineer walkthrough of the facility, creation of the report, and a final review by Public Service internal engineering staff, as needed. The customer must select a trade partner prior to preapproval, because a project proposal including the scope of work must be included with the preapproval application to determine funding levels. Engineering assistance studies typically take three months to complete and will be reviewed and approved by Public Service internal engineering staff.

## **D. Marketing Objectives & Strategies**

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[https://www.xcelenergy.com/Programs\\_and\\_Rebates/Business\\_Programs\\_and\\_Rebates/Energy\\_Audits\\_and\\_Studies/Energy\\_Analysis](https://www.xcelenergy.com/Programs_and_Rebates/Business_Programs_and_Rebates/Energy_Audits_and_Studies/Energy_Analysis)

The main goal of the Business Energy Analysis product is to raise awareness and knowledge of Public Service's other energy efficiency products. The Company will rely heavily on trade partners and stakeholder resources, such as city- and county-driven projects throughout Colorado, to increase awareness in the Business Energy Analysis product and partner in the audit process. Though the target markets will differ by assessment type, onsite audits are popular with small business customers. Methods used to reach and educate customers include:

- *Company website*: Provides a description of the product offering, and links product collateral and study brochures;
- *Collateral*: Product brochure, case studies, applications, frequently asked questions, and study templates that give the customer an idea of the resources they will receive by participating;
- *Direct mailings*: Informational piece to gain awareness and understanding of the product offerings;
- *Email campaigns*: Brief email from Public Service representatives to gain interest in the product from customers;
- *Newsletters*: Another medium to gain customer awareness and participation in the product; and
- *Customer seminars*: Educate customers about the product offering and benefits.

## **E. Product-Specific Policies**

Products in the Company's Indirect Program, such as Business Energy Analysis, have no immediate savings attributed to them. Business Energy Analysis is meant to open the door for customers to participate in Public Service's other energy efficiency offerings and rebates that have direct impacts that contribute to achievement of goals. Once an onsite audit or engineering report is complete, the customer will receive a summary of energy efficiency opportunities available in their facility. When a customer moves forward with implementation, they follow the guidelines of the specific product in which they participate (i.e. Motor & Drive Efficiency), based on the opportunities identified in the report.

## **F. Stakeholder Involvement**

Public Service worked closely with the contracted audit trade partners to develop and streamline the audit process. The Company also receives recommendations and feedback from stakeholders via the DSM Roundtable.

## **G. Rebates & Incentives**

Customers do not receive a rebate for participation in the Business Energy Analysis product, but they do receive study funding assistance. Business Energy Analysis offers two types of study funding based on whether an onsite audit or engineering assistance study was completed. Onsite audit participants with facilities under 50,000 square feet receive the audit free of cost, while larger square footages will be responsible for paying a small fee dependent on square footage

and location. Public Service will pay up to 75% of the engineering study cost, up to \$25,000; funding is based on the potential energy savings of the project and the cost of the study.

## ➤ Consumer Education

### A. Description

The Consumer Education product focuses on creating awareness of energy conservation while providing residential customers with information on what they can do in their daily lives to reduce energy usage. The residential market segment in Colorado is demographically varied; thus, the Company will employ a wide variety of marketing channels to communicate key energy efficiency messaging.

Communication strategies include:

- Annual community and conservation events, and outreach;
- Social media (Facebook, Twitter, blogs, etc.);
- Online and social media messaging through local media, community and partner digital channels;
- Digital kiosks featuring “One-handed” energy efficiency videos;
- Power Check/Draft Check meters and materials placed in public libraries;
- Direct mail marketing to address seasonal usage challenges;
- Sponsorship of local Earth Day events;
- Conservation messaging through seasonal bill messaging;
- Sponsorship of community events supporting residential conservation and energy efficiency; and
- Customer feedback surveys and customized post-event emails following outreach events.

Participating in direct customer outreach events creates an opportunity for meaningful conversations with customers. Outreach and participation in these events is valuable for creating active engagement with residential customers. Public Service will continue to focus on renewing existing community partnerships that have provided consistent customer participation and engagement. Maintaining diversity in our communication channels will continue to increase our customers’ knowledge of energy efficiency, drive to direct program signups and provide them with access to a variety of resource options and services.

### B. Targets, Participants & Budgets

#### Targets and Participants

Consumer Education is widely targeted to all Colorado natural gas and electric residential customers. Targets are established through targeted outreach to customer segments and use of multiple channels for delivery of energy efficiency messaging.

#### Budgets

Public Service’s budget for this product was determined through estimates of material, labor, identification of customer growth patterns, and past activities in Colorado and other states. Budgets reflect the expansive reach and impact of digital media and sponsorships—with the Company’s premier partnerships and community partnerships yielding direct product

participation leads. The majority of the budget is driven by customer education, conservation, promotion, community partnerships, and internal labor.

### **C. Application Process**

This product does not include an application process.

### **D. Marketing Objectives & Strategies**

The primary objective of the Consumer Education product is to initially heighten residential customers' awareness about energy efficiency and conservation and then develop engaged customers who will proactively take steps to reduce energy consumption. The goal of the product is to get customers to conserve and consider upgrading to high-efficiency measures, when possible, thereby reducing energy consumption. The product will deliver communications that provide behavior-altering strategies that customers can implement in their daily lives to conserve energy (e.g. move customers from awareness to action). Another focus of the Consumer Education product is to drive to direct impact product signups where able to help support the portfolio. Customized post-event emails will continue to be implemented as a way to follow-up with customers showing interest in specific programs to provide additional information.

Our strategy will continue to utilize a wide variety of communications channels including social media, print and event outreach. While messaging will continue to align with the overall portfolio strategy of seasonal energy-saving tips and information for residential customers focused on reducing their energy usage, active engagement through outreach events and premier partnerships with key community partners will also be. Historically, seasonal messaging has been effective in the residential market. The Company's residential customer education strategy will continue to promote the financial and environmental benefits of energy conservation and the ease of measure implementation. To engage the customer in energy efficiency there will be a focus on expansion of existing channels such as the digital kiosks with "How to" videos and Power Check/Draft Check meters, which provide residential customers with energy efficiency tips and resources for reducing their energy usage. These digital kiosks will continue to be placed in public libraries and at community partnership locations. Additional channel expansion and integration will also likely include digital and social media channels. The channels that are utilized will continue to be focused on targeted segments and will continue to align with the overall residential communication strategy.

### **E. Product-Specific Policies**

This product has no specific policies.

### **F. Stakeholder Involvement**

Public Service will create and leverage strategic partnerships and alliances with governmental, non-governmental, and trade partners to reach residential customers in Colorado.

## **G. Rebates & Incentives**

This product does not offer customer rebates.

## ➤ Energy Efficiency Financing

### A. Description

Energy Efficiency Financing is an indirect impact product offering aimed at increasing the availability of financing to overcome economic barriers to customer participation in the Company's other energy efficiency products. As an indirect impact product no direct attributable energy or demand savings are recorded, but the product plays an important role in shifting markets and attitudes toward greater energy efficiency implementation.

The Energy Efficiency Financing product encourages residential and small commercial customers to participate in existing direct impact rebate products by making sure financing options are available to reduce monetary barriers. The Company facilitates the financing of these projects through partnerships with existing financial institutions and financing programs and by assisting in the creation, by existing lenders, of financing options in areas where such programs don't exist. The Company is not providing capital for these loans, offering a loss reserve, servicing loans, or offering on-bill financing in connection with this product.

The Company conducted extensive interviews with parties who currently offer energy efficiency loans in Colorado including private-sector lenders, non-profit lenders, and government entities throughout the state. In all cases these parties have access to capital to fund loans or leases, a credit enhancement to provide a loan loss reserve, or both. The gap that these entities have identified is not a lack of capital, but a need for assistance in marketing to drive volume. These existing lenders appreciate the fact that the Company is not confusing the marketplace by offering a competing loan product, but is enhancing the existing marketplace by driving business to these lenders for financing energy efficiency.

The Company will actively market selected loan products to targeted customer segments, including by leveraging lender relationships, using the following channels:

- Contractor Training;
- Direct Outreach and Marketing;
- Bill Inserts;
- Web Links;
- Rebate Integration; and
- Loan Customer Case Studies.

The Company has identified loan products that best match the financing needs of customers, including:

1. *Residential Unsecured Loans* – These loans are appropriate for short-term, reactive needs as well as long-term, proactive investments. Participants in the Home Performance with ENERGY STAR, High Efficiency Air Conditioning, Residential Heating, Insulation and Air Sealing, or Evaporative Cooling products would be ideal for this product.

2. *Business Loans or Leases* – This type of financing requires a quick turnaround from the lender. Having the loan or lease available may drive the customer to make the improvement immediately. Participants in the Lighting Efficiency, Lighting – Small Business, or Motors and Drives products could be interested in this type of loan or lease.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The primary goal of this product is to drive incremental participation in existing direct impact energy efficiency products that include:

- Business Program:
  - Lighting Efficiency;
  - Lighting – Small Business;
  - Motor & Drive Efficiency; and
  - Custom Efficiency.
- Residential Program:
  - Evaporative Cooling;
  - Residential Heating;
  - High Efficiency Air Conditioning;
  - Insulation and Air Sealing; and
  - Home Performance with ENERGY STAR.

The product's achievements are measured by the number of participants rather than direct energy savings. The target for each year is 150 participants, including 25 business loans and 125 residential loans. These targets have been developed through research of similar programs, review of participation factors for the direct impact products, historical participation, and discussions with industry experts.

For planning purposes, the Company estimates that approximately 10% of these loans might be “incremental” in that the resulting energy savings would have not occurred had the Energy Efficiency Financing product not been available.

### Budgets

Public Service's 2019 and 2020 budgets for this product were determined through estimates of material, labor and past activities in Colorado.

## **C. Application Process**

Customers are made aware of financing options at the same time they become aware of rebates. Awareness may be driven by Account Managers, the Business Solution Center (BSC), trade allies, external customer assistance programs, and/or marketing efforts including mailings, newsletters, and the Company's website.

Customers will be directed to one or more lending allies suited to their needs. Loan applications will be completed by the customer and submitted directly to the participating lender. Billing and payment processing will also be between the customer and the participating lender without the Company's involvement.

## **D. Marketing Objectives & Strategies**

The product's marketing objective is to identify customers that want to implement more energy efficiency but require financial assistance, linking those customers with the most appropriate rebates and loan products.

Direct and indirect marketing strategies will be employed. Direct marketing will be done in partnership with the Product Managers of the targeted direct impact products. Indirect Marketing involves broad communication that spans multiple (or all) direct impact products. The best example is contractor training and education. Understanding that many customers interact primarily or exclusively with a contractor, the Company will ensure that interested trade allies are armed with the knowledge, expertise, and collateral to educate customers about the best available financing option for their situation.

The Company will use a consultant who is knowledgeable about financial loan offerings to assist with additional partnerships, as needed.

## **E. Product-Specific Policies**

This product has no product specific policies.

## **F. Stakeholder Involvement**

Public Service worked closely with stakeholders to develop this product. Channels for this involvement have included the following:

- *Political Engagement* – Public Service's Government Affairs group has been actively involved in liaising with legislative interests related to energy and energy efficiency.
- *Stakeholder Communication* – A stakeholder meeting was held in 2012 to gather and incorporate stakeholder input into the product design. More recently, the 2015-2016 product evaluation includes stakeholder input, and ongoing communication with stakeholders will continue.
- *Consultant Services* -- The Company has used consultant services to expand/refine partnerships with various financial allies as well as refining product specific details, and will continue to do so as needed.
- *DSM Roundtable Meetings* – Product updates have been presented and discussed at quarterly DSM Roundtable Meetings.

## **G. Rebates & Incentives**

No customer rebates are offered through this product. Trade ally incentives were offered in 2015 and 2016 to help drive their participation and could be used again in the future.

## **H. Evaluation, Measurement, & Verification**

Basic product operations will be monitored and reported regularly. Metrics reported in preparation for the quarterly DSM Roundtable Meetings include loan participation and product expenditures.

## ➤ Energy Star Retail Products Platform

### A. Description

The ENERGY STAR<sup>®</sup> Retail Products Platform (“ESRPP”) will engage retailers through midstream incentive payments to increase the supply and ultimately demand for energy efficient residential plug-load and appliance products, driving greater sales of select ENERGY STAR certified products to customers. With a combination of incentives and engagement, retailers will assort, stock, and promote more energy-efficient models than they would have absent the program.

Eligible products are expected to include refrigerators, freezers, clothes washers, clothes dryers, room air cleaners, room air conditioners, and sound bars. Future changes to eligible products will be made as the Company successfully transforms the market in the Company’s service territory to more efficient products. This transition will be triggered by changes in market share, the development of new products, changes to ENERGY STAR or minimum efficiency standards, or other factors. The goal will be to stay ahead of the market and closely monitor changes in energy efficient products.

The Company will engage national retailers through the ESRPP product, an initiative facilitated by the U.S. Environmental Protection Agency (“EPA”). ESRPP is based on the concept of developing a national-level structure for the delivery and engagement with retailers and gives sponsors new access to a low-cost retail program with national coordination. The goal of ESRPP is to transform the market for residential plug-load and appliance products by streamlining and harmonizing energy efficiency programs with retailers, making them less complex and more cost-effective.

#### Target Market

Market intervention strategies are aimed at a highly concentrated group of retail decision makers. In many energy consuming product categories, a small group of retail merchants and marketers decide which products consumers see on the retail floor, are promoted in-store, advertised in marketing materials and featured on the web. These same retail merchants and marketers purchase millions, and sometimes billions, of dollars of products from global manufacturers which earns retailers significant influence in determining market price and features (such as those contributing to energy performance) of products most prevalent in the market.

## B. Targets, Participants & Budgets

### Targets and Participants

The Company will work through a partnership framework facilitated by EPA to partner with national retailers involved with the ESRPP. Only retail partners located within Public Service's service territory will be able to participate.

### Budgets

The forecasted expenditures for 2019 and 2020 are based on projected participation levels, promotion, and administration expenses. The majority of the product costs are for administration, promotions, and vendor incentives.

## C. Application Process

The Company will work with its retail partners to establish qualifying retail locations that are located within Public Service's service territory. Additional methods to address the spillover effect related to purchases by consumers not served by the Company will be explored and evaluated through the course of the program. No application forms are necessary for customers, given the midstream approach of this product.

## D. Marketing Objectives & Strategies

The Company faces increased challenges in claiming energy savings from consumer products programs as market share and per-unit efficiency increases for consumer products. The higher efficiency of average units decreases the incremental savings available from more efficient units, which reduces the cost-effectiveness of traditional consumer rebate approaches. With shrinking sales volume and smaller per-unit rebates available, national retailers are also having increasing difficulty justifying participation in traditional efficiency programs which vary from region to region with different utilities and their associated disparate rules and offerings. The Company faces higher implementation costs as easy-to-implement program opportunities decline or disappear from the market. Current market barriers and ESRPP elements that address these barriers are:

<i>Traditional Market Barriers</i>	<i>ESRPP Approach</i>
<ul style="list-style-type: none"><li>Increasing market share of efficient units and dwindling per-unit energy savings of higher-efficient units render traditional consumer rebates less cost-effective.</li></ul>	<ul style="list-style-type: none"><li>Smaller per-unit incentive payments are directed toward the retailer rather than the customer to affect increased stocking and sales of targeted measures.</li></ul>
<ul style="list-style-type: none"><li>Retailers are becoming less interested in participating in utility energy efficiency programs, because they are not core to</li></ul>	<ul style="list-style-type: none"><li>ESRPP, as a national platform, reduces complexity of multiple program approaches and requirements while</li></ul>

<b><i>Traditional Market Barriers</i></b>	<b><i>ESRPP Approach</i></b>
<p>their business; they introduce cost and complexity; and consumer incentives offered by the utility may not be perceived as offering value and efficacy as a tool for driving sales.</p>	<p>allowing retailers the flexibility to determine the best path toward reaching sales goals.</p> <ul style="list-style-type: none"> <li>• Incentive payments to retailers help to engage and encourage them to offer ENERGY STAR products to their customers.</li> </ul>
<ul style="list-style-type: none"> <li>• Administrative costs as a percentage of program costs for retailer-based program implementation are on the rise.</li> <li>• Costs for rebate administration may prohibit some products whose incremental costs would yield small rebates from being delivered as cost-effective downstream programs.</li> </ul>	<ul style="list-style-type: none"> <li>• Nationally-facilitated relationships with retailers and a uniform program structure will increase operational efficiencies and reduce administrative costs for both Public Service and retailer partners.</li> </ul>
<ul style="list-style-type: none"> <li>• Customers may not always follow through on rebate/incentive applications regardless of their purchase of an ENERGY STAR certified product due to low per-unit rebates or the ease of online purchasing.</li> </ul>	<ul style="list-style-type: none"> <li>• ESRPP eliminates the customer responsibility for submitting rebate forms and instead relies on facilitated access to data from participating retailers.</li> </ul>
<ul style="list-style-type: none"> <li>• Obtaining high quality and detailed sales data from retailers to verify savings.</li> </ul>	<ul style="list-style-type: none"> <li>• Retailer partners in ESRPP have already agreed to provide unprecedented access to category-level sales data required for EM&amp;V activities.</li> </ul>
<ul style="list-style-type: none"> <li>• Quickly evolving retail industry and small per-unit energy savings make it difficult to successfully engage consumers in the traditional retail environment due to varying rules and program offerings from region to region across the country.</li> </ul>	<ul style="list-style-type: none"> <li>• Collaboration of utility program administrators through ESRPP creates opportunities to develop cost-effective platforms to engage customers.</li> </ul>

## **E. Product-Specific Policies**

Only retail partners located within Public Service's service territory are eligible to participate.

## **F. Stakeholder Involvement**

Through involvement in the ESRPP product, the Company will work closely with EPA and its affiliates, as well as other Program Sponsors across the country. The Company will utilize a third-party implementer, selected through a competitive process, to conduct field visits and engage closely with retail partners.

## **G. Rebates & Incentives**

The Company will provide incentives to participating retailers in Public Service's service territory to increase sales of ENERGY STAR-certified products. These products include refrigerators, freezers, clothes washers, clothes dryers, room air cleaners, room air conditioners, and sound bars. Examples of retailer strategies may be increased stocking and promotion of qualifying ENERGY STAR models or marketing campaigns focusing on core products, as well as sales associate training. If retailers feel it would effectively increase sales, they may choose to use incentive funds to reduce the sales price for products, but this is not a requirement or an expectation of the program.

The following list of measures is the initial set of offerings; however, the offerings are expected to change as new products are added and new versions of ENERGY STAR qualifications are created by the EPA.

<b><i>ENERGY STAR Certified Product</i></b>	<b><i>Specification</i></b>	<b><i>Initial Unit Incentive Level</i></b>
Refrigerators	ENERGY STAR Most Efficient 2018	\$15
Freezers (Basic)	ENERGY STAR Version 5.0	\$15
Freezers (Advanced)	ENERGY STAR Version 5.0 + 5%	\$20
Clothes Washers	ENERGY STAR Most Efficient 2018 + 5%	\$20
Clothes Dryers	ENERGY STAR Most Efficient 2018	\$40
Room Air Cleaners (Basic)	ENERGY STAR Version 1.2 + 30%	\$15
Room Air Cleaners (Advanced)	ENERGY STAR Version 1.2 + 50%	\$20
Room Air Conditioners	ENERGY STAR Version 4.0	\$10
Sound Bars (Basic)	ENERGY STAR Version 3.0 + 15%	\$10
Sound Bars (Advanced)	ENERGY STAR Version 3.0 + 50%	\$15

To motivate retailers to transform the market towards efficient products, the specifications for qualified products are common among sponsors.

Incentive payments will be made to retailers on a per-unit-sold basis, within a predetermined budget, paid on a regular basis during the program cycle. Individual incentive levels for specific product categories may be adjusted throughout the program to reflect new cost information or market needs.

## **H. Evaluation, Measurement, & Verification**

EM&V recommendations are being collaboratively developed for this program by ESRPP national collaborators; including EPA, program implementers, evaluators, and participating utility program administrators.

The following activities are representative of the mixed-methods approach contemplated by the ESRPP team. Under this approach, evaluation will rely on systematically gathering and analyzing data from multiple sources using a variety of techniques relevant to the program implementation logic model to triangulate savings estimates. The following activities are expected to be included in the EM&V approach:

- Surveys and/or interviews of retailers, contractors, and service providers who participate in and/or promote the program;
- Collection and analysis of in-store associate training, customer education, promotional and marketing efforts by retailer for qualifying measures sold as well as how the rebate dollars are utilized;
- Interviews with the implementation team and Company staff;
- Interviews with manufacturers;
- Review analysis of historical and program-period sales data for each product category from participating retailers (including category-level historical data, as well as program-year categorical-level sales data);
- For participating retailers, compare participating stores to non-participating stores with respect to sales of qualified products and market share;
- Visual data inspection to establish trend of program influence; and
- Comparison of forecasted higher efficiency unit sales prior to ESRPP implementation to post-implementation actual sales using segmented regression techniques.

### Tracking and Reporting

Retailers will help Public Service establish a sales baseline by providing sales data for the 12 months preceding program launch for products sold for each product category in participating stores in Public Service's service territory. On a monthly basis, participating retailers will provide sales and model information at the store level. This will be uploaded into a tracking tool with ENERGY STAR product information to identify category-level (qualified and non-qualified) sales and to capture accurate measure-level gross energy consumption and savings for units sold. However, it is important to note that while Public Service will capture energy savings, the company will NOT be claiming savings for this Market Transformation program.

The Company's implementation team, with the assistance of Retail Partners, will also:

- Verify the reporting of measures for a statistical sample of projects to maintain quality assurance;
- Supply tracking database extracts on an as-needed basis, to be determined by EM&V contractors, to properly measure and verify the program savings and ensure accuracy in quarterly reports; and/or
- Track other short-term and mid-term indicators over time to make sure that the program is on track to achieve its ultimate objective, which is market transformation.

## ➤ Energy Benchmarking Product

### A. Description

Energy benchmarking of commercial and multi-family buildings is an established and growing trend in the energy efficiency sector. Through the city of Denver's City Energy Project and several local efforts, building owners in CO are especially engaged in the practice, which allows building owners, policy makers, and product administrators to more effectively target buildings with the highest energy efficiency potential by identifying those properties that are performing below a portfolio average, or benchmark. According to the U.S. Department of Energy:

*“Energy benchmarking is a standardized process of measuring building energy efficiency. Benchmarking helps building owners identify cost-effective energy upgrades, realize the energy and cost savings benefits from those upgrades, document the savings achieved, and communicate these accomplishments to stakeholders. A 2012 study found that energy performance benchmarking prompted energy efficiency investments through improved energy management processes (62% of those who participated in a benchmarking product) or building upgrades and behavioral efficiency projects (84% of benchmarking participants).*

*To date, more than a quarter-million buildings representing almost 30 billion square feet have been benchmarked. This number continues to grow thanks to multiple drivers, including the private sector adoption of benchmarking, state and local voluntary benchmarking initiatives, utility energy efficiency products incorporating benchmarking, and state and local legislation requiring that buildings be benchmarked and that the results be disclosed to the public.*

*As more building owners begin benchmarking, these building owners seek streamlined, consistent processes for obtaining whole building energy usage data. Building owners and managers want easy, automated ways to get utility data into their benchmarking software. In addition, many owners of multi-tenant commercial buildings and multifamily buildings cannot access energy consumption data for their entire building due to separately metered tenant spaces.”<sup>79</sup>*

In response to this need, the Company has created an Energy Benchmarking product.

#### *Product Design*

Xcel Energy participated in a Department of Energy effort under the Better Buildings Initiative titled the Energy Data Accelerator<sup>80</sup> which is designed to bring utilities and municipal leaders together to “demonstrate streamlined, best-practice approaches for building owners to access

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<sup>79</sup> Factsheet associated with the Company's participation in the DOE Energy Data Accelerator

<sup>80</sup> For more information, visit

<http://www1.eere.energy.gov/buildings/betterbuildings/accelerators/energy.html>

whole-building energy usage data—with a specific focus on providing building owners with aggregated energy usage information across multiple tenants.” The Company learned valuable insights from both its municipal partner, the City of Minneapolis, as well as from DOE Facilitators and Utility collaborators across the country. The design implemented by the Company is a product of these accumulated insights and is representative of best practices identified through this effort.

Key features of the Energy Benchmarking product include Building Owner Authorization, Tenant Identification, Data Privacy Rule Implementation, Consumption Data Aggregation and Normalization, and Automated Data Transfer to the ENERGY STAR Portfolio Manager (ESPM). Each of these elements is discussed in more detail below.

#### Building owner authorization

Upon registration to an online portal, building owners or their contracted agents will be verified using publicly available records as well as information available within the Company’s Customer Information System

#### Tenant Identification

Using the property address, the company will return a list of tenants (meters or premises) that appear to be associated with the building. If verified as accurate by the building owner, this list will be used to permanently associate those premises to the property in the Company’s customer information systems.

#### Data Privacy Rule Implementation

The system is designed to implement thresholds based on either the tenant count, individual tenant usage percentage, or both, as is currently the cast under Electric Rule 3034. No energy data will be shared with the building owner until these rules have been satisfied.

#### Consumption Data Aggregation and Normalization

Acknowledging that most building owners seek whole-building aggregate data, the company will automatically combine data across meter readings and normalize those readings to a common calendar month cycle. Building owners will also have the ability to request data for individual tenants, or sub-sets of tenants as desired; however, these requests will be subject to aggregation methodologies outlined in Rule 3034 and will be more likely to require individual tenant consent.

#### Automated Data Transfer to ENERGY STAR Portfolio Manager (ESPM)

The service relies upon ESPM to standardize the transfer of energy data from the company’s systems. This decision was made primarily from the fact that ESPM is well-established as the industry standard tool to perform energy benchmarking, and that this standard further allows a consistent, free, robust option for building owners to gain valuable information about their buildings.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The Benchmarking product does not have any specific participation, energy, or demand savings goals because this product does not measure direct savings. The Company plans to promote this offering to building owners in the Commercial and Multi-Family sectors. The Company will coordinate with local stakeholders to ensure training materials and Energy Efficiency product offerings are communicated to building owners as they complete the task of Benchmarking. Building owners subject to local Benchmarking ordinances make up a majority of product participants.

### Budgets

The budget is used to support marketing, promotion, and the administrative activities required to facilitate building owners in setting up data transfer as well as interpreting and using the results to identify cost-effective energy-saving measures.

## **C. Application Process**

Any building owner or contracted agent of the building owner is eligible for participation in the product. Users will register via the Company's web portal and be granted access to property-specific information once their status has been verified.

## **D. Marketing Objectives & Strategies**

The Company will employ a variety of strategies to promote the new product. Many municipalities and corporations encourage the practice of energy benchmarking to their constituents. The Company plans to work closely with these entities to ensure appropriate training and promotional materials are shared. More broadly, the company will market the product via its public website and through participants or interested participants in its existing Energy Efficiency products. Through the practice of Benchmarking, the Company plans to promote its existing Commercial and Multi-Family building products.

## **E. Product-Specific Policies**

The product will follow the regulations identified in Rule 3034.

## **F. Stakeholder Involvement**

Throughout development of the product as well as during the formal hearing process which resulted in Rule 3034, the Company solicited and received input to inform the design of the system.

## **G. Rebates & Incentives**

As an indirect impact product, no rebates are proposed. Rebates for projects resulting from the product will be delivered through the established direct impact products.

## ➤ Home Energy Audit

### A. Description

The Home Energy Audit product offers Public Service residential customers a rebate on three types of auditing services: a Standard Audit, a Standard Audit with Blower Door Test, and an Infrared Audit. The purpose of this product is to educate homeowners and renters about their homes and identify energy saving opportunities and equipment upgrades that will help them save money on their energy bills. For each type of audit, customers pay the auditor directly and receive a cash rebate from Public Service. This product would greatly benefit from advanced meter enabled interval data because customers who are receiving an audit are engaged at the time. If the auditor could speak to their real-time energy use it would greatly enhance the conversation.

#### *Standard Audit*

The essential elements of the in-home Standard Audit are:

- Customer energy bill analysis;
- Client assessment and education;
- Shell assessment;
- Mechanical and electrical equipment review; and
- Energy savings recommendations derived from energy modeling software.

Typically, the audit begins with the auditor's review and analysis of billing history since this is often an indication of what the customer may need to address first. The auditor also takes this opportunity to discuss any concerns or questions the customer may have regarding their home's energy usage and related comfort. Once the areas of concern are identified, the auditor initiates the onsite inspection. This process begins with a shell assessment of the exterior of the home, identifying cracks, exterior signs of air leakage or maintenance needs. The auditor then begins the interior evaluation with inspection of the attic or crawl space. This determines what insulation has been installed prior to the audit, and any upgrades the customer should consider. Suggested upgrades could include items such as additional insulation and sealing bypass areas.

Next, the auditor reviews the home's heating and/or air conditioning systems for efficiency ratings and discusses monthly maintenance tips. The auditor will also show the customer how to implement suggested maintenance options — like changing air filters — on a regular basis. As the auditor moves through the home, they will continue to educate the customer on how they can implement energy efficiency measures. The auditor will inspect and provide information on the efficiency of their appliances, as well as on possible replacement options that are ENERGY STAR-qualified.

Finally, the Standard Audit ends with a review of the top three to five recommendations to the homeowner and a final review of the customer's questions and concerns. The auditor will email the completed report and scope of work to the customer and leave behind efficiency product collateral on relevant rebate products. The entire Standard Audit process takes about two hours to complete and can vary depending on size of home.

### *Standard Audit with Blower Door Test*

The Standard Audit with Blower Door Testing includes all components listed above, as well as a blower door test and a combustion appliance zone (CAZ) test. The blower door test will be conducted in every home and the CAZ test will be performed only if atmospherically vented appliances are present.

The blower door test is a diagnostic tool designed to measure the air tightness of a home and identify air leakage locations. A blower door includes use of a calibrated fan for measuring the airflow rate and a pressure-sensing device to measure the pressure created by the fan's airflow. The combination of this pressure and the fan's airflow measurements are used to determine a home's air tightness. Before the test is performed, customers must go through their home closing and locking all exterior windows. Once the fan is turned on, a vacuum effect is created and customers can then check windows and interior bypasses by holding up their hands and feeling the airflow created. Because this test provides such a visual image for customers, they are often motivated to address air sealing opportunities they may have overlooked prior to the testing. This tool can also identify potential venting issues around a home's heating system.

### *Infrared Audit*

The Infrared Audit includes all Standard Audit components as well as an infrared scan. The infrared scan evaluates internal structures such as drywall and insulation, and determines temperature differences where insulation is present, missing, or not working effectively. Blower door testing is also a mandatory part of the Infrared Audit. Benefits of infrared testing include: identifying insulation needs, air leakage pathways within walls, attics, windows and doors; it also provides a quality check on existing insulation. Infrared testing, along with the required blower door test, gives customers a visual understanding and detailed list of structural conservation improvements available to them through non-invasive testing — thus identifying additional savings potential. The Infrared Audit is available to all natural gas customers and electric customers with electrically-heated homes. Electric-only customers with gas provided by another utility or customers who use propane as a heat source, are not eligible for the Infrared Audit because it is primarily used as an inspection to detect where the home is losing heat.

The Company uses the Home Energy Audit product to support and drive participation in the Home Performance with ENERGY STAR (Home Performance) product. Customers must begin the Home Performance process with a home audit to identify areas for improvement and to educate them as to whether or not their house is a good candidate for participation. If they are a good candidate, customers may sign up for the Home Performance product through their auditor. The audit also assists in developing a scope of work for their project, and encourages completion of the recommended improvements.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The Home Energy Audit product includes a participant goal, but no energy or demand savings goals because this product does not measure direct savings.

### Budgets

The Home Energy Audit budget was developed based upon the desired participation level, associated product software, and administration costs. Using the product's previous years' performance and marketing needs as a proxy, the cost of the rebate, product collateral, and all necessary marketing efforts are included.

## **C. Application Process**

The customer will contact the third-party implementer and speak with an Energy Advisor or visit the Company's website<sup>81</sup> to find a qualified and participating auditor. The customer calls the auditor to schedule the appointment. Once the audit is complete and the customer has received the audit report, the customer or the auditor submits the rebate paperwork to the Company with proof of purchase. A rebate takes at least six to eight weeks to process once the application is received. Customers are limited to one audit per two-year period, unless they move to a new address.

The customer may also choose to schedule their audit in tandem with a visit from the Home Energy Squad which can be scheduled through the third-party implementer at the customer's request.

## **D. Marketing Objectives & Strategies**

This product will be marketed primarily through seasonal bill inserts, social media, trade partners, media relations, and bundled residential campaigns. Further, Public Service will market this product through general customer inquiries regarding their energy bill and cross-marketing efforts with other Public Service residential energy efficiency products, especially the Home Energy Squad product. In addition, the Company will identify "green event" opportunities within the community and provide product collateral. Product activity will be monitored on a monthly basis to quickly implement the above strategies, if warranted.

Public Service will offer customers Energy Advising as additional support toward completing retrofits. The purpose of the advising is to encourage customers to complete and implement findings within their Home Energy Audit reports, regardless of the DSM product they participate in (e.g., Home Performance, Saver's Switch, Refrigerator & Freezer Recycling, etc.). The Energy Advising service has achieved a consistent 50% conversion rate in helping homeowners make upgrades and homeowners rate this service very highly. By necessity, the Energy Advising service provides rebate assistance to Standalone as well as Home Performance rebates.

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<sup>81</sup> [http://www.xcelenergy.com/Save\\_Money\\_&\\_Energy/Residential/Energy\\_Audits/Home\\_Energy\\_Audit\\_-\\_CO](http://www.xcelenergy.com/Save_Money_&_Energy/Residential/Energy_Audits/Home_Energy_Audit_-_CO)

## **E. Product-Specific Policies**

To qualify for the product, participants must be residential customers living in the Company's Colorado service territory. Infrared Audit customers must be residential customers that receive natural gas or electric-only service with electric heat from Public Service to qualify for participation. Qualifying customers may receive an audit once every two years.

Participating trade partner companies must have a technician on staff with a minimum of a Building Performance Institute (BPI) or certification and training/in-field experience to provide audit services for this product. All auditors are also required to attend product training, which includes training on the product modeling software. There will be a \$150 per auditor membership fee which is allocated to costs associated with software and quality assurance provided by the third-party; this one-time fee will be paid directly to the software vendor. An auditor's certification may not be used by another trade partner company to meet the product requirements. All registered contractor companies must also be listed on the Company's trade partner website.<sup>82</sup> These contractors have agreed to the terms of the Company's trade partner agreement and meet the requirements related to quality installation practices per BPI.

Auditors will be required to utilize the scope of work tool within the software to deliver actionable recommendations to the customer. This is a critical part of the product as the third-party administrator will be tracking the conversion rate of audit-to-improvements. To maintain consistency, training, audit quality, and overall quality assurance between the auditors, the Company will require auditors to use a specific energy modeling software package.

## **F. Stakeholder Involvement**

Public Service collaborates with trade allies such as the Energy Efficiency Business Coalition (EEBC), Colorado Energy Office (CEO), other utilities, local communities, and contractors. The Company also provides updates to interested parties at the quarterly DSM Roundtable Meetings.

## **G. Rebates & Incentives**

To simplify product participation for homeowners, the Company offers the following audit rebate schedule:

<b>Audit type</b>	<b>% of cost</b>
Infrared Audit	60% up to \$200 rebate
Blower Door Audit	60% up to \$160 rebate
Standard Audit	60% up to \$100 rebate

\*Rebate amounts determined by the average audit cost for the Colorado market.

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<sup>82</sup> [www.xcelenergy.com/cotrades](http://www.xcelenergy.com/cotrades)

The Company understands the actual price for an in-home audit will vary based on the location and complexity of the residence, but the purpose of this product is to provide customers with a straight-forward process to improve their knowledge on energy efficiency and options they have within their home.

## ➤ Partners in Energy

### A. Description

Partners in Energy is an indirect product offering community leaders and stakeholders the opportunity to jointly develop and implement energy conservation goals and action plans for municipal, commercial & industrial facilities and homes within the community's boundaries, track energy efficiency product participation and related activities. The Company works with a third-party consultant to provide tools and resources to enable community-driven energy planning and implementation.

Partners in Energy staff team up with community workgroups to develop an individualized plan to engage commercial and residential constituents in energy efficiency activities, and help identify project funding via rebates, financing and other sources.

Delivery of Partners in Energy to participating communities includes:

1. Establishing a baseline of community-specific energy information including Company-provided municipal, commercial, industrial and residential data and decision-making tools to
  - a) Profile existing energy use;
  - b) Benchmark against other communities;
  - c) Set goals;
  - d) Identify and prioritize opportunities; and
  - e) Forecast potential energy and money savings to the community.
2. Facilitating stakeholder workshops to
  - a) Help community workgroups identify and develop short- and long-term energy reduction targets; and
  - b) Prioritize energy conservation activities – for example, best return-on-investments first.
3. Supporting the communities as they develop plans, build consensus among community stakeholders and implement energy efficiency initiatives.
4. Measuring, tracking and reporting results to the community workgroups and facilitating communications to the community's key constituents.

### B. Targets, Participants & Budgets

#### Targets and Participants

The Company will target up to three new participating Partners in Energy communities in a twice-per-year application process. In the 2019 and 2020 Plan years, the Company will onboard and commence the planning phase of Partners in Energy for new communities as well as follow through with plan implementation for the various cohorts of Partners in Energy communities who began the process in prior years.

The product's target market consists of communities that have not initiated a comprehensive energy planning process or those who have stalled in their past planning and implementation efforts – both groups can benefit from the structured and facilitated Partners in Energy process.

## Budgets

The product's budget is primarily administration and program delivery – community facilitation, planning, implementation, measurement and reporting including third-party consulting services – with a smaller proportion dedicated to customer education and promotion. Some Partners in Energy projects may involve higher rebate and incentive levels on a promotional basis to drive targeted, increased energy efficiency participation. 2019 and 2020 budgets are determined based on the number of communities participating and the level of time, effort and resources necessary to deliver the product to new communities as well as follow through with the implementation phase of previous cohorts.

## **C. Application Process**

Community leaders interested in working with Partners in Energy submit an application detailing:

1. Community profile
  - a) Population, counts of businesses and homes
  - b) Geographic boundaries and area
2. Utility providers including Public Service Company and others, if applicable
3. Energy-related issues facing the community (e.g. population growth, aging housing stock or infrastructure)
4. Community approvals needed to begin the planning process (examples: City Council, economic development, City departments or committees)
5. Past or presently-active energy action plans, initiatives or policies
6. Community resources, including paid staff, who would be involved in energy initiatives and could act as the main point person during the planning and implementation phases
7. Other potential community representatives such as city or town staff members, local businesses, non-profits, schools, government officials and citizens

## **D. Marketing Objectives & Strategies**

The product's primary marketing objective is to drive increased levels of DSM participation, energy savings, demand reduction and societal benefits through community-driven energy planning and implementation.

Once the Partners in Energy communities are established through a twice-per-year application process, marketing efforts including personalized municipal and business customer outreach, residential mailings, email, social media outreach and community events designed to raise awareness of and participation in DSM.

Past Partners in Energy community workgroups have identified opportunities to partner with a community's existing communication channels and planned events to get the word out about rebates, studies and other services available to municipal, business and residential customers.

Marketing approaches that have been effective are:

1. Presentations to local business development organizations, trade groups, chambers of commerce or other networking opportunities;
2. Incorporating Partners in Energy goals, available rebates & incentives and timing in community newsletters and news releases to increase awareness and interest;
3. Including product messaging in the community's existing social media networks, outreach and forums;
4. Personalized direct mailings and email campaigns to increase DSM awareness and participation;
5. In-person tabling events, demonstrations, giveaways and special offers coordinated with the community's calendar of events and meetings;
6. Developing local business recognition for increased DSM participation; and
7. Facilitating conference calls and online forums for participating Partners in Energy communities to exchange useful information and share best practices.

## **E. Stakeholder Involvement**

Current and potential communities participating in Partners in Energy choose their key decision makers to give input and help facilitate energy planning and implementation.

Examples of key decision makers and key community points of contact include:

1. Economic Development & Business Services;
2. Representatives of large local businesses and employers;
3. Community Development;
4. Public Works;
5. City Manager's or Mayor's office;
6. Interested and engaged citizens; and
7. Community members of boards & commissions.

## **F. Rebates & Incentives**

Generally rebates and incentives for the product's participating communities are paid by the Business, Residential and/or Low-Income products that are targeted for increased participation via Partners in Energy's planning and implementation process. Some community-targeted projects may involve higher rebate and incentive levels on a promotional basis to drive targeted, increased DSM participation.

## ➤ Market Research

### A. Description

The Company conducts market research and analysis to support effective design and implementation of DSM products and services. This enhances understanding of current and potential customers, market segmentation, and engagement drivers. Additional research is conducted through procurement of third-party consultants who review primary and secondary data. Market research subscriptions that offer energy efficiency and/or marketing resources are also purchased. Research projects are selected and completed, providing strategic information regarding customers, DSM products, and business direction for DSM efforts.

In 2018 and 2019, the Company plans to continue procurement of the following market research resources:

- *E Source* membership provides unbiased, objective research and advisory services that help advance efficiency programs, improve the customer experience, and use energy more efficiently.
- *Dun & Bradstreet* list purchase provides specific demographic information helpful in effectively identifying potential business customers capable of benefiting from existing and planned DSM programs.
- *Consortium for Energy Efficiency (CEE)* membership assists in defining market approaches aimed at more efficient use of regulated energy sources.
- *Home Use Study* provides valuable information regarding saturation of various home appliances and technologies in residential homes.
- *NTG Survey for Prescriptive Products* provides insight into business customer decision making processes shortly after receiving prescriptive rebates.
- *Residential and Business Advertising Tracking* data ensures the effectiveness and reach of DSM advertising efforts by asking customers reactions and recall of specific campaigns.

The list of research projects will be reviewed at the beginning of each year and may be adjusted to align with current information needs.

### B. Targets, Participants & Budgets

#### Targets and Participants

This indirect impact product does not have participants or energy savings.

#### Budgets

The budget reflects annual internal research costs and third-party vendor costs for market research to execute surveys, collect data from research participants, and analyze and interpret data, ensuring representative samples of the study populations, to support research results and findings. Respondents may include peer utility contacts with similar programs, customer

participants and non-participants, vendor partners and internal staff involved with the programs of interest. Research is often bid competitively among a list of approved vendors.

### **C. Application Process**

This indirect impact product does not have a rebate / participation application.

### **D. Marketing Objectives & Strategies**

Research is focused to identify opportunities that will maximize existing DSM product impacts and identify new marketing opportunities. Market trends are reviewed to identify market potential for DSM products and gauge customer understanding and satisfaction with program implementation.

### **E. Product-Specific Policies**

This indirect impact product does not have any product-specific policies.

### **F. Stakeholder Involvement**

Trade allies and vendors help enable successful execution of market research with integrity and cost-effectiveness.

### **G. Rebates & Incentives**

This indirect impact product does not deliver customer rebates or incentives.

## ➤ **DSM Planning & Administration**

### **A. Description**

DSM Planning & Administration is an indirect service that manages all energy efficiency-related compliance filings, including this Plan, the annual DSM Status Report, and other regulatory filings. This group performs the benefit-cost analyses of all of the energy efficiency and load management products, provides tracking of the energy and demand savings achievements, and collaborates with the Resource Planning group to develop inputs for the resource plans. The DSM Planning and Administration group also provides management and oversight of all evaluation, measurement, and verification planning and internal policy guidance, hosts the quarterly DSM Roundtable meetings and correspondence with the Roundtable members, and works with outside consultants, when needed, to bring additional expertise to our product planning. These functions are needed to ensure a cohesive and high quality DSM portfolio that meets all legal requirements as well as the expectations of Public Service's customers, regulators, and staff.

This service is administrative in nature and is not open to customer participation. However, because this group operates in all of the states where Xcel Energy offers energy efficiency products, the Company is able to lend consistency and share best practices across all of the jurisdictions.

### **B. Targets, Participants & Budgets**

#### Targets and Participants

As an indirect service, DSM Planning & Administration does not have savings or participation targets.

#### Budgets

The DSM Planning and Administration budget is made up primarily of internal labor required to manage DSM filings, regulatory proceedings, stakeholder meetings, and cost-effectiveness analysis. Employee expenses, consulting and contracting services are a very small portion of the total budget. Actual expenditures in recent years were used as a guide for development of the 2019 and 2020 budgets.

### **C. Application Process**

DSM Planning & Administration is not customer-facing, and therefore, has no associated application.

## **D. Marketing Objectives & Strategies**

The DSM Planning and Administration services are not customer-facing, and therefore, have no associated marketing objectives or strategy.

## **E. Product-Specific Policies**

The DSM Planning and Administration services ensure DSM compliance with internal policies and Commission directives.

## **F. Stakeholder Involvement**

Public Service considers its stakeholders for DSM Planning and Administration to be both the internal groups who manage the DSM products and require DSM data, as well as the external governmental agencies, environmental, and customer groups who express interest in the design of and strategy for the Company's future DSM products. The DSM Planning and Administration group meets with its external stakeholders regularly through the DSM Roundtable, but also meets with parties at other times as needed.

## **G. Rebates & Incentives**

There are no customer rebates associated with this service.

## ➤ Evaluation, Measurement & Verification

### A. Description

The Company's Evaluation, Measurement & Verification (EM&V) plan was developed to evaluate, measure, and verify direct savings for electric and natural gas DSM products. The Company's EM&V approach is separated into performance year and post-performance year activities. Performance year activities are conducted during the reporting year, as products are in operation, and may include rebate application validation, field inspections, verification of equipment installation, and engineering calculation review. Post-performance year activities include verified savings calculation and reporting; comprehensive product evaluations; and portfolio-wide technical assumption evaluations. Section I of this document describes our performance year EM&V activities in greater detail. Section II of this document describes our post-performance year EM&V activities further. Table 15 at the end of the EM&V Plan summarizes each product's planned EM&V. The Company will report any modifications to this EM&V plan in a 60-Day Notice posted to the Xcel Energy website. Notifications of new DSM products (or pilots that will claim savings), launched via 60-Day Notice, will include a detailed EM&V process consistent with the approach described herein.

#### I. *Performance Year M&V*

M&V is conducted on an ongoing basis on measures implemented throughout the product performance year. These ongoing M&V activities ensure that rebate application forms contain complete and correct information, the specified equipment is installed, and the claimed gross energy savings are accurate. These performance year activities include:

##### Rebate Application Validation

This validation procedure applies to all residential and business products (electric and gas) offered in Colorado. The procedure is comprised of the following two steps, both performed by Rebate Operations:

*Step 1: Front-End Validation* – Rebate Operations reviews all prescriptive business and residential product rebate applications and vendor invoices, including those for indirect impact products. They check the customer information, equipment eligibility, and proper rebate amounts. If information is missing or incorrect, the application is sent back to the account representative or customer. For custom products, engineering staff reviews the project documentation to verify customer information, equipment eligibility, and proper rebate amounts, and then delivers final numbers to Rebate Operations.

*Step 2: Daily Audit* – Rebate Operations then audits all business and residential applications to verify that the information was correctly entered. This is the final review prior to issuing the rebate. If errors or issues are found, they are corrected. The daily audit report is re-run after the problems are corrected and filed for permanent storage.

##### Ongoing M&V of Savings

Ongoing M&V of savings differs between prescriptive products, custom products, upstream/midstream approaches, behavioral approaches, and pilots. The following sections describe the general M&V methods that will be used for each. (In addition, products having characteristics requiring unique M&V approaches are detailed below).

#### *1. Prescriptive DSM Product M&V*

For direct impact prescriptive products, the Company contracts with third-party verification contractors (VCs) and third-party implementers to perform M&V. VCs will use the onsite verification information gathered between November 1 and October 31 to confirm energy efficiency measure installation rates for each calendar year (reported in the DSM Annual Status Reports). Using an offset calendar will allow the VC to provide the required information in sufficient time for it to be incorporated into the DSM Annual Status Report each year.

Prescriptive products use stipulated or deemed technical assumptions assigned to each measure in order to calculate gross energy and demand savings. The VCs will follow a deemed savings approach when conducting verification activities for prescriptive products, where the primary goal of M&V is to use field inspections to sample projects to determine that the measures are properly installed and have the potential to generate savings. This approach corresponds to the basic rigor method outlined in the International Performance Measurement and Verification Protocol (IPMVP) – *Option A: Retrofit Isolation: Key Parameter Measurement*.

Information gathered at customer sites will vary based on the product and sector, but will generally confirm that the installed equipment matches equipment listed on rebate application. For example, as applicable, the contractor may confirm the manufacturer, model number, efficiency rating, equipment size, capacity or output, application of measure (e.g. motors that run fans versus pumps, versus other mechanical systems), business sector (e.g. restaurant versus college, versus office building), quantity (e.g. number of light bulbs), or any concerns regarding the operation of the fixtures or deviations from the customer application.

For most prescriptive products, the VC will select a statistically valid number of projects to verify through field inspections or phone surveys. The sample size is designed to achieve accuracy levels of between 10% and 20% given a confidence level of 90% around the “realization rate,” and is weighted to select larger projects. The number of randomly selected participants in the sample may increase or decrease during the year in order to ensure that the realization rate accuracy exceeds the accuracy goal for the product. Sampling bias will be reduced using a random selection of sample points. Rebate forms notify all customers that their respective premises and measures are subject to verification inspections.

The “realization rate” for a project is the ratio of the verified savings to the savings reported on the rebate application. The realization rate for the product as a whole is the ratio of the product’s total verified savings to the total rebate reported savings. The product realization rate is applied to gross savings to determine gross product impacts. The net-to-gross (NTG) factor is then

applied to the verified gross savings to yield net product impacts. The following products, or prescriptive components of these products, adhere to the prescriptive M&V process:<sup>83</sup>

#### **Business Products**

- Commercial Refrigeration Efficiency
- Compressed Air Efficiency
- Cooling
- Data Center Efficiency
- Heating Efficiency
- Lighting Efficiency
- Lighting – Small Business
- Multifamily Buildings
- Motor & Drive Efficiency
- Strategic Energy Management

#### **Residential Products**

- Evaporative Cooling
- High Efficiency Air Conditioning
- Insulation and Air Sealing
- Residential Heating
- Water Heating
- Thermostat Optimization

The general M&V process for the following prescriptive products, or prescriptive components of products, is outlined below.

#### ***1(a). General Prescriptive DSM Project M&V Process***

General prescriptive M&V includes validation of individual rebate applications as well as ongoing M&V.

##### Rebate Application Validation

1. Customer submits rebate application and required documentation to Public Service after measure is installed.
2. Rebate Operations reviews each business and residential product rebate application and associated vendor invoices, checking the customer information, equipment eligibility and proper rebate amounts. If information is missing or incorrect, the application is sent back to the account representative or customer to make changes.
3. If the project qualifies for rebate, Rebate Operations enters rebate application data into Salesforce (customer relationship management system) and authorizes rebate payment. Prior to authorizing rebates, all applications are verified in a daily audit.

##### Ongoing M&V

4. Public Service will send the VC a list of projects completed to-date on an agreed to schedule.
5. The VC will select a statistically valid sample of projects to inspect, weighted towards the larger projects. The sample size is designed to achieve 90% confidence with 10-20% precision.

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<sup>83</sup>These products may have both prescriptive and custom components, in which case they will be subject to both prescriptive and custom M&V.

6. The VC will contact each customer to schedule the inspection or complete the phone survey.
7. The VC will visit or phones each customer site and verify the savings factors or checkpoints for that measure.
8. The VC will use the verified savings factors to calculate the project's verified energy savings and realization rate (RR), which is calculated by dividing the recalculated or verified savings by the reported or rebated savings. At 1.0 or 100%, the verified and rebated savings are equal.
9. The VC will calculate the product's RR, which is the sum of all verified savings divided by the sum of all rebated savings for all projects in the product sample. The product's RR is applied to the rebate application savings captured in Salesforce to determine gross verified savings.
10. NTG factors are applied to the gross verified savings to determine net savings.

***1(b). Exceptions to the Prescriptive Product M&V Process***

Certain prescriptive products have special design elements that require verification processes unique to those particular products. The following products, or components of these products, require exceptions to the prescriptive M&V process:<sup>84</sup>

**Business Products**

- Data Center Efficiency
- Multifamily Buildings

**Residential Products**

- Energy Efficient Showerhead
- ENERGY STAR New Homes
- Home Energy Squad
- High Efficiency Air Conditioning
- Home Performance with ENERGY STAR
- Refrigerator & Freezer Recycling
- School Education Kits

**Low-Income Products**

- Energy Savings Kits
- Multifamily Weatherization
- Non-Profit
- Single-Family Weatherization

The unique M&V processes for these products are described below:

Data Center Efficiency

For verification of the EC plug fan measure installation, the VC will maintain a log of any refusals for site entry for M&V, and subsequently seek out, and document, verbal confirmation of installation from the customer and/or installer.

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<sup>84</sup> These products may have both prescriptive and custom components, in which case they will be subject to both prescriptive and custom M&V.

### Energy Efficient Showerhead

The third-party implementer will report on the quantity of showerheads distributed. Xcel Energy will utilize the third-party survey platform under contract for customer satisfaction measurement or another independently contracted company to survey customers for the purpose of determining the installation rate of each kit component.

### ENERGY STAR New Homes

The ENERGY STAR New Homes product utilizes the HERS raters' report outputs as the basis for product M&V. The third-party implementer conducts Quality Assurance/Quality Control (QA/QC) of the HERS raters' results. Each project is verified by a HERS rater and the third-party product implementer prior to issuing a rebate to the builder using the following process:

1. Builder contacts HERS rater to express interest in building an energy efficient home and participating in the ENERGY STAR New Homes product.
2. HERS rater works with builder to construct the home to meet or exceed the ENERGY STAR New Homes product requirements. The HERS rater visits the home during construction to inspect the building method used and the equipment installed.
3. Once the home is completed, the HERS rater performs a blower door test on the house and then calculates the final HERS Index. The HERS rater models the home by entering the individual home characteristics into the RESNET accredited REM/Rate modeling software or a RESNET accredited modeling software approved by the Company. When the rating of the home is completed, the REM/Rate files for the modeled house are submitted to the rater's HERS provider. RESNET sets forth the role of the provider, provides accreditation and requires that HERS providers perform quality assurance on 10% of each rater's building files and fully replicate 1% of the home ratings annually. The HERS provider performing the QA must not be the same individual that rated the home.
4. The rater submits the specific REM/Rate reports and the final HERS Index to the Company's third-party product implementer, at which point the implementer performs QA/QC. The builder's rebate is calculated based on the percent by which the new home exceeds the local building jurisdictions energy code requirements, which has a direct correlation to gas and electric savings. There is no rebate application for this product. The rater, acting on behalf of their builder client, submits the required REM/Rate files, reports and other supporting information to the third-party product implementer. The submitted data is used to determine each individual home's rebate amount. The third-party product implementer ensures that all the information entered by the HERS rater into their database system is correctly entered and tracked. The third-party product implementer then enters the required information into Salesforce, including the key REM/Rate output data. The REM/Rate data is used by the Company to calculate the energy savings achieved for each home.
5. Public Service tracks and stores key parameters in Salesforce such as the home address, square footage, builder name and address, HERS Index, blower door test score, gas and electric energy saved, date completed, and rebate amount paid to the builder. Additional data for each home such as a photograph of the installed gas meter and the submitted REM/Rate files are retained by the third-party implementer.

### Home Energy Squad

The third-party implementer will verify and report implemented measures (and baseline equipment being replaced, where applicable) to the Company. The Company will track this information in Salesforce. Due to the direct installation nature of this product, the realization and installation rates are set at 100%.

### High Efficiency Air Conditioning

The High Efficiency Air Conditioning (HEAC) product has three energy saving components that are calculated and rebated separately, including:

- New Equipment – Purchase of high efficiency equipment.
- Quality Installation – The proper installation of new standard or high efficiency residential air-conditioning equipment.
- Trade-Ins – Replacement of low efficiency units with high efficiency units.

The M&V process for the New Equipment and trade-in components will follow the standard prescriptive product M&V process above.

The Quality Installation component requires slight deviations from the standard prescriptive process. To verify a quality installation, the VC will verify that a Public Service-approved load calculation was performed, that the unit is sized properly, and that refrigeration charge, airflow, and duct leakage are within acceptable ranges. Each component of the savings calculation for Quality Installation will be verified independently. The process includes the following steps:

1. Public Service will send the VC a list of projects completed to-date on an agreed to schedule.
2. The VC will select a statistically valid sample of projects to inspect. The sample size is designed to achieve 90% confidence with 10-20% precision.
3. The VC will contact each customer to schedule the inspection.
4. The VC will verify that a Company-approved load calculation was used to size the equipment.
5. The VC will visit the customer site and test the loaded, equilibrium performance of installed air conditioning equipment for proper refrigerant charge and air flows.
6. The VC will verify duct sealing by observation of sealing mastic or other Air Conditioning Contractors of America (ACCA)-approved sealing means on accessible joints.
7. The VC will compare airflow, refrigerant charge, and duct leakage results to the range of values deemed acceptable for the specified equipment. If the actual values are within the acceptable range, the verified savings are considered to be 100% of the rebated values. If the actual values are outside of the acceptable range, the savings will be reduced according to the deviation from the acceptable range. Details on the savings reductions are provided in the Deemed Savings Technical Assumptions sheets within the Technical Reference Manual (see Appendix H).
8. The VC will input the verified savings factors into an M&V calculator spreadsheet to calculate the project's verified energy savings.

9. The VC will calculate the project's RR by dividing the recalculated or verified savings by the reported or rebated savings. At one or 100%, the verified and rebated savings are equal.
10. The VC then will calculate the product's RR, which is the weighted average RR of all projects in the product sample. The product's RR is applied to the rebate application savings captured in Salesforce to determine gross verified savings. For purposes of determining and applying the RR, the M&V calendar year will run from November 1 to October 30 of each product year. The realization rate determined for this 12 month period will be applied to the product values for the calendar year corresponding to the September 30th date (as described above).
11. NTG factors will be applied to the gross verified savings to determine net savings.

#### Home Performance with ENERGY STAR

The Home Performance with ENERGY STAR product is designed to take a whole house approach to improving the energy efficiency of existing single-family homes. Contractors will have their first five completed projects inspected and then 10% of their completed projects thereafter. The M&V process for Home Performance with ENERGY STAR is as follows:

1. Customer receives a Home Energy Audit with blower door test.
2. Customer submits product application form.
3. Within one year of enrollment in the product, the customer installs the required measures. As required depending on the number of the projects completed by the contractor, the contractor schedules a final verification inspection with our selected third-party implementer.
4. During the verification inspection, the VC performs a blower door test and a Combustion Appliance Zone (CAZ) test and verifies that the homeowner has performed all of their planned energy efficiency improvements. If the contractor tests out of this requirement (for their first five projects), a random inspection of 10% of projects completed thereafter will be conducted by the third-party implementer.
5. When the inspection is completed, the third-party implementer and/or contractor submit a rebate form to the Company, along with copies of invoices for all of the completed improvements.

#### Multifamily Buildings

The third-party implementer of the Multifamily Buildings product will report the number of direct installation measures completed to the Company. This information will be entered and tracked in Salesforce.

#### Refrigerator and Freezer Recycling

The Refrigerator & Freezer Recycling third-party implementer will send monthly reports to Public Service of all customers who participated in the product. The VC will conduct phone surveys to verify removal of each unit and that the refrigerator/freezer was operable at time of removal.

### School Education Kits

The School Education Kits third-party implementer will send follow-up surveys to a sample of the participants to determine the equipment installation rates which are then applied to the gross savings for the calendar year.

### Energy Savings Kit (Low-Income)

The Company will use the platform under contract for customer satisfaction measurement or another third-party partner to conduct phone and/or web surveys with a sample of participants for the purpose of determining the installation rate of each kit component. .

### Single-Family Weatherization (Low-Income)

The Single-Family Weatherization product offers standard payments to the product's third-party implementer for the installation of specific, predetermined prescriptive energy efficiency measures. Verification is built into the product design, as the third-party implementer and its subcontracted agencies actually install the measures. The specific product process, including verification, is outlined below.

1. The third-party implementer guides income-qualified customer to sign up for weatherization services.
2. The third-party implementer arranges for an energy auditor to visit the customer's home to identify savings opportunities.
3. The crew returns to the home within 14 days to implement the identified measures.
4. The third-party implementer submits documentation of the measures that were installed to the Company, along with a request for payment for the installed measures.
5. Public Service reviews the documentation and issues payment for the installed measures.

### Multifamily Weatherization (Low-Income)

The Multi-Family Weatherization product offers payments to the third-party implementer for the installation of custom energy efficiency measures. Verification is built into the product design, as the contracted weatherization agency actually installs the measures. The specific product process, including verification, is outlined below.

1. Income-qualified customer (multi-family building owner) signs up for weatherization services through the third-party implementer.
2. The third-party implementer arranges for the contracted consultant to visit the building and identify savings opportunities.
3. Consultant produces an audit report outlining savings opportunities and potential savings.
4. Public Service engineer reviews project specifications as provided by the consultant.
5. The third-party implementer arranges for the weatherization crew to install measures approved by Public Service.
6. The third-party implementer arranges for the contracted consultant to visit the building to verify measure installation and calculate final savings.
7. Contracted consultant submits completed audit report with final savings to the third-party implementer.
8. The third-party implementer submits this documentation to Public Service, along with a request for payment for the installed measures.

9. Public Service reviews the documentation and issues payment for the installed measures.

#### Non-Profit (Low-Income)

The Non-Profit Energy Efficiency product provides funding for energy efficiency retrofit improvements to qualified non-profit organizations within the Company's service territory. Verification is built into the product design, as the contracted weatherization agency actually installs the measures. The specific product process, including verification, is outlined below:

1. Income-qualified customer signs up for weatherization services through third-party implementer.
2. The third-party implementer arranges for the contracted consultant to visit the building and identify savings opportunities.
3. Consultant produces an audit report outlining savings opportunities and potential savings.
4. Public Service engineer reviews project specifications as provided by the consultant.
5. The third-party implementer arranges for the weatherization crew to install measures approved by Public Service.
6. The third-party implementer arranges for the contracted consultant to visit the building to verify measure installation and calculate final savings.
7. Contracted consultant submits completed audit report with final savings to the implementer.
8. The implementer submits this documentation to Public Service along with a request for payment for the installed measures.
9. Public Service reviews the documentation and issues payment for the installed measures.

#### 2. *Custom DSM Product M&V*

Custom products use technical assumptions that are specific to each project in order to calculate the energy and demand savings. For all Custom projects, the Company's energy efficiency engineers will calculate the demand and energy savings at the pre-approval stage. Senior and managing engineers will audit the pre-approval calculations for all projects, as outlined in Step 3 of the General Custom Project M&V Process below. In addition, a random sample of all pre-approved projects will be sent to an outside engineering firm for review, as shown in Step 4 below.

All measures with anticipated savings greater than or equal to 1 GWh or 20,000 Dth require a project-level M&V plan, outlining the scope and methods of the M&V activities at the specific facility. The methods, such as pre- and post-metering, will be aligned with the appropriate IPMVP options. The duration of the metering will vary depending upon the load variability or project complexity, but typically, these projects will be metered for a minimum of two weeks pre- and post-installation. If metering is too costly or physically impossible, engineering modeling or building simulation modeling may be substituted.

Metering also may be used to verify savings of smaller projects at the discretion of the engineer. Typically metering is performed on smaller projects with new or uncommon technologies, or

where the calculated energy savings or rebate is significantly impacted by assumptions for which there is not ample supporting information at the time of pre-approval.

The general Custom project approval process is described below and applies to the following products, or certain custom components of these products:

**Business Products**

- Commercial Refrigeration Efficiency
- Compressed Air Efficiency
- Cooling
- Custom Efficiency
- Data Center Efficiency
- Energy Management Systems
- Heating Efficiency
- Lighting Efficiency
- Motor & Drive Efficiency
- Multifamily Buildings
- Strategic Energy Management

**Low-Income Products**

- Multifamily Weatherization
- Non-Profit

**2(a). *General Custom Project M&V Process:***

The general custom project M&V process includes pre-approval, M&V site verification, and rebate approval and payment.

Pre-Approval Process:

1. Customer submits custom application describing the proposed project, purpose, and potential for energy savings.
2. A Public Service energy efficiency engineer or outside engineering firm will review the application and calculate the anticipated energy and demand savings based on the technical assumptions specific to that measure and the potential rebate. Calculations on small projects completed by Public Service energy efficiency engineers may proceed to Step 4 without review from a senior energy efficiency engineer if the engineer conducting this step has been approved by Public Service for direct sign-off for the particular type and size of project in question.
3. Public Service senior energy efficiency engineer reviews the calculations completed by external engineers.
4. Public Service randomly selects a sample of all projects to send to an outside engineering firm (if Public Service engineer performed Step 2) to review the calculations.
5. If the outside engineering firm disagrees with the Public Service engineer's analysis, they discuss the project and reach consensus on the calculations.
6. Public Service sends out a pre-approval or rejection letter stating the pre-approved demand and energy savings along with the rebate amount.

### Monitoring & Site Verification:

7. If monitoring is required, a Public Service energy efficiency engineer will draft a project-specific M&V plan, which is sent out for customer review and signature.
8. If the customer does not have the appropriate meter structure, an outside engineering firm will install metering equipment and collect the pre-data as set forth in the project-specific M&V Plan and forward the data to Public Service.
9. After the designated pre-monitoring period, the customer will complete the project installation and submits all required documents.
10. Outside engineering firm collects post-installation monitoring data and sends post data to Public Service.
11. For managed accounts, the customer's account manager confirms project installation, which may include visiting the site or reviewing invoices and other project documentation. The project documentation is then submitted to Public Service.
12. For non-managed customers completing custom projects, the Company's Business Solutions Center and Program Manager will review project documentation.

### Savings Reconciliation:

1. For non-metered projects, final documents are reviewed for compliance with the initial pre-approval. If the project costs or the project savings vary by greater than 10%, the project is reevaluated.
2. For metered projects, Public Service's energy efficiency engineer, or outside engineering firm, determines actual savings based on metering results. All metered projects previously reviewed only by internal engineers will be sent to an outside engineering firm for review. If the outside engineering firm disagrees with Public Service engineer's analysis, they will discuss the project and reach consensus on the calculations.
3. If the post-project kW and kWh savings and incremental cost are within 10% of the pre-approved values, values, the preapproved rebate will be paid. If the post-project quantities are not within 10% of the pre-approved values, then the rebate will be based on the post-M&V results. In all cases, the post M&V results for kW, kWh, Dth, and incremental cost will be booked for the project.

### **2(b). *Exceptions to Custom DSM Product M&V***

The following Business products, having special design elements, are verified using processes unique to the product or component:

- New Construction
- Recommissioning
- Self-Direct
- Strategic Energy Management

The M&V process for each of these products is described below:

#### New Construction

The New Construction product is comprised of two components: Energy Design Assistance and Energy Efficient Buildings.

The Energy Design Assistance component provides design assistance to the architects and engineers designing new buildings. Public Service contracts with a third-party product implementer to complete the energy modeling and measurement and verification. The rebate is not paid until project savings are verified. The specific product process, including verification, is outlined below.

1. Customer submits an application describing the proposed project.
2. The third-party implementer conducts an introductory meeting with the design team/customer.
3. The third-party implementer completes energy modeling to identify efficiency opportunities.
4. The third-party implementer reviews construction documents for qualifying energy efficiency measures identified through the energy model. The design team and customer are notified whether or not these measures were found within these documents.
5. The third-party implementer provides Public Service with a verification plan for each project.
6. The third-party implementer visits site and verifies that specified measures were installed. Equipment and systems are monitored for a two-week timeframe, as appropriate, to evaluate performance variables against modeling assumptions.
7. For projects with individual measures that have savings greater than or equal to 1.0 GWh or 20,000 Dth per year, data logging is required for a time period of four weeks.
8. The actual results are compared to the estimated savings to determine the final rebate. If the actual results are not within 15% of the energy savings identified within the previous model, the consultant completes an as-built model to determine final energy savings.
9. Rebate is issued to customer based on final savings.

The Energy Efficient Buildings component provides customers a review of their new construction, major renovation or additions for potential energy efficiency measure opportunities before the building is built. The specific product process, including verification, is outlined below.

1. Customer submits an application describing the proposed project.
2. Third-party implementer conducts an introductory meeting with the design team/customer.
3. Customer applies for rebates based on the energy efficiency measures they have incorporated into their design plans.
4. Third-party implementer reviews construction documents compared to application submitted.
5. Third-party implementer visits site and verifies that specified measures were installed.
6. For projects with individual measures that have savings greater than or equal to 1.0 GWh or 20,000 Dth per year, data logging is required for a time period of four weeks.

7. Third-party implementer determines final savings based on data logging and verification.
8. Rebates are issued to customer based on final savings.

### Recommissioning

The Recommissioning product identifies existing functional systems that can be “tuned up” to run as efficiently as possible through low- or no-cost improvements. Because Recommissioning projects are difficult to meter, a combination of metering and calculations may be used. The specific product process, including verification, is outlined below.

#### *Study Pre-Approval*

1. Customer hires an engineering firm (Recommissioning provider) to draft a proposal to conduct a study.
2. Customer submits application and proposal from Recommissioning provider to Public Service for study pre-approval.
3. After pre-approval, Recommissioning provider or customer can begin study of the building to identify savings opportunities and determine energy savings for each measure. Approved customers may perform their own measure analysis and/or use our Recommissioning calculator tool with standard savings calculations.

#### *Study Approval*

4. Completed study is submitted to Public Service for review.
5. If study is approved, the provider will present study to customer and Public Service issues study rebate. If study is not approved, Public Service will follow up with provider or customer to reconcile issues.
6. Public Service follows up (generally within seven business days) with a detailed M&V plan that the customer must sign. Public Service engineer reviews all savings calculations and identifies if any individual measures will require metering (measure savings > 1 GWh or 20,000 Dth). If metering is needed, Public Service will send out a letter alerting customer that one or more measures will require metering.

#### *Implementation*

7. Customer notifies Public Service of measures to be improved. For those measures > 1 GWh or 20,000 Dth, Public Service notifies the VC that pre-installation metering is needed. Pre-metering must be completed prior to measure recommissioning in accordance with the M&V plan.
8. Customer implements selected measures and notifies their Public Service account manager of their completion. For measure savings > 1 GWh or 20,000 Dth, Public Service notifies the VC that the customer is ready for post-metering.
9. Post-monitoring data is submitted to Public Service engineer for analysis and determination of final savings and rebate amount.

#### *Approval & Rebate Payment*

10. Account manager collects invoices and signed rebate form identifying which measures were installed.

11. The invoices are reviewed and if the invoice details match what was submitted on the rebate form, then the pre-approved rebate is awarded. If there are discrepancies, the account manager works with the customer to provide additional detail and reconcile differences.
12. Rebate is issued to the customer based on final savings.

#### Self-Directed Custom Efficiency

The Self-Directed Custom Efficiency product provides rebates to customers who identify, scope, and verify the energy savings for qualifying projects to offset their costs to implement energy efficiency projects. The specific product process, including verification, is outlined below.

1. Public Service pre-qualifies customers who are eligible for participation in the Self-Directed Product.
2. Once pre-qualified, a customer identifies the opportunity, then develops and submits a project application. For projects over 250,000 kWh, the customer is required to develop a project-level M&V plan and submit it with their application. Specific components of the plan will be determined by the customer, and agreed upon by Public Service. At a minimum, the plan should employ sound engineering judgment and follow standard industry practices such as the IPMVP.
3. Public Service provides confirmation of application receipt, reviews the application, and asks for additional information if necessary. Public Service notifies the customer of approval or denial of the application, expected rebate, and mutually agreed on M&V plan.
4. If the customer chooses to implement the pre-approved project, they must follow the requirements detailed in their M&V plan and conduct all necessary steps in order to verify energy savings. Any data required for pre-installation monitoring detailed in their M&V plan should be submitted to the Company and approved before the customer implements the efficiency measures. Upon acceptance of the data, the customer can then implement the measures and perform any follow-up monitoring as described in their M&V plan.
5. The customer then submits a project completion report. Public Service reviews the report, requests any additional data, and calculates the final rebate. The rebate is paid upon completion of project and Public Service's approval of project completion report.
6. A random sample of all pre-approved projects will be selected by the Company and sent to an outside engineering firm for metering and verification.

#### Strategic Energy Management (SEM) Custom Efficiency

The SEM product, which offers visualization and analysis of real-time energy data from across a customer's facility to capture low-cost recommissioning opportunities as well as behavioral and operational energy savings, will use the following unique Custom M&V processes:

### M&V for SEM Measures

Measure Categories	Description	M&V Protocol
New system or process automation	Measures that consist of equipment and processes whose automation capabilities don't currently exist or are underutilized. By identifying and applying appropriate control measures, incremental energy savings can be achieved.	Follow General Custom M&V Process
Low cost / no cost Recommissioning	Measures that address failure or underperformance of installed systems and equipment that can be fixed by making small adjustments, typically not requiring new equipment.	Follow the Unique Custom M&V Process used for the Recommissioning product.
Systemic O&M	New system or process automation measures that consist of equipment and processes whose automation capabilities don't currently exist or are underutilized.	EIS tracking mechanisms or Process path re-measurements will be established to check the ongoing performance of the measures. Annually, the third-party implementer, with review by the Company's engineers, will analyze the data in accordance with IPMVP criteria and the Company's custom M&V process, to ensure persistence of the measure's savings. These savings will be reported annually for the duration of the customer's involvement in the SEM product.
Behavioral	Measures that require manual intervention with repeated decision-making to achieve energy savings. Behavioral measures rely on the choice of individuals to change the way they use equipment. Savings is the reduction in energy use by customer personnel that is statistically attributable to measures conducted as part of the product.	EIS tracking mechanisms or Process path re-measurements will be established to check the ongoing performance of the measures. Annually, the third-party implementer, with review by Xcel Energy engineers, will analyze the data in accordance with IPMVP criteria and the Company's custom M&V process, to ensure persistence of the measure's savings. These savings will be reported annually for the duration of the customer's involvement in SEM.

### 3. *M&V Process for Products Delivering Upstream/Midstream Incentives*

The Home Lighting & Recycling product was launched from the outset as an upstream product. Beginning in 2015, the Company started offering midstream incentives to distributors for Cooling and Lighting Efficiency measures. The rebate treatment (administration vs. participant incentive) and NTG are based on actual, verified participant costs and market penetration rates observed through the products. The rebate will only be recorded as a participant incentive if the verified Net Participant Costs (based on invoices) are equal to the sum of the incremental capital costs and baseline capital costs, less the rebate; otherwise the rebate will be recorded as an administration cost. M&V for these approaches will be conducted as follows:

### Cooling

Distributors will be offered incentives in return for increasing their stock and promotion of high efficiency HVAC equipment. The NTG for this approach will be deemed within the DSM Plan and verified through periodic product evaluations. The M&V process for the midstream component of the Cooling product is as follows:

1. Participating distributors provide biweekly reports of products sold, including the manufacturer, model, number of units installed, unit serial numbers, address where equipment was installed, contact information (for the customer, contractor, or installer), and distributor invoice number and date.
2. The third-party implementer enters the information into a tracking system and submits weekly reports containing the data to be uploaded into Sales Force.

The VC will include the midstream projects within the sample of Cooling projects that receive M&V throughout the year, in order to calculate realization rates for net energy and demand savings.

### Lighting Efficiency and Small Business Lighting

Within the Lighting Efficiency and Small Business Lighting products, LED lamp incentives will be offered to distributors as the Business LED Instant Rebate. The NTG for this approach will be deemed within the DSM Plan and verified through periodic third-party product evaluations. A fraction of the rebate may be treated as a Vendor Incentive (administration cost) and the remainder as a participant incentive if the fraction of Net Participant costs are greater than the sum of the incremental capital and baseline capital costs, and there is evidence that a portion of the rebate is passed on to program participants. If there is no evidence that a portion of the rebate is passed on to program participants, then the full rebate cost will be captured as an administrative cost. The M&V process for the midstream component of the Lighting Efficiency/Small Business Lighting products is as follows:

1. Participating distributors provide sales reports listing the model, wattage, type, and number of bulbs sold.
2. The distributor enters the information into a tracking system and submits monthly reports to the third-party implementer containing the data and the third-party implementer calculates the demand and energy savings using technical assumptions provided by the Company.
3. The third-party implementer audits the database output by examining and comparing against retailer sales reports. The VC conducts a field verification of 10% of completed projects; and subsequently the third-party implementer adjusts the wattage and number of bulbs if errors are found and provides the final verified savings for all bulbs for year-end.

Public Service compares the net costs paid by program participants to the deemed incremental capital and baseline capital costs to determine the amount of instant rebate passed on to participants as a reduction in product cost. This amount is used in calculating the portion of the presumed participant incentive that is treated as a rebate in the cost-benefit analysis completed for the status report following the program year.

### Home Lighting & Recycling

To deliver the Home Lighting & Recycling product, the Company partners with manufacturers and retailers to reduce the retail price of qualifying bulbs and promote them to the retailers' customers. Public Service tracks the manufacturer, model number, quantity, wattage, cost, and type of the bulbs sold through a third-party implementer and pays incentives to the manufacturer. The M&V process for the Home Lighting component of the product is as follows:

1. Participating retailers provide weekly or monthly sales reports listing the model, wattage, cost, type, and number of bulbs sold.
2. A third-party implementer enters the information into a tracking system and submits monthly reports containing the data and calculation of the demand and energy savings using technical assumptions provided by The Company. Higher bulb costs may be forecasted in the Plan based on estimated costs at the time, observed costs will be captured throughout the year and used to calculate the actual average incremental capital cost which will be reported in the DSM Annual Status Report. The baseline bulb costs will be deemed within the Plan and also used within DSM Annual Status Report.
3. The VC audits the database output by examining and comparing against retailer sales reports. The validation contractor adjusts the wattage and/or number/type of bulbs if errors are found and provides the final verified total savings for all bulbs for year-end.

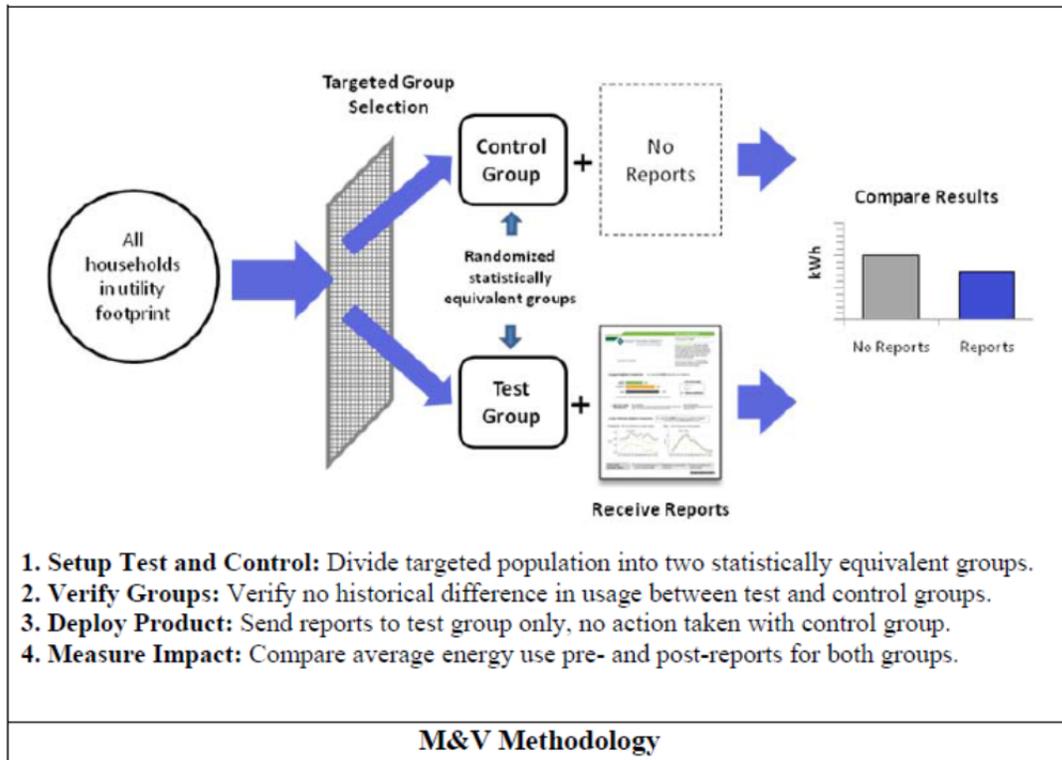
#### *4. M&V Process for Energy Feedback Behavioral Products*

Behavioral products present unique challenges related to measuring resulting savings. M&V is critical for understanding the savings delivered and fine-tuning the product's effectiveness. The M&V protocol for the Energy Feedback products is described below.

#### Energy Feedback – Residential Product

The Energy Feedback opt-out product provides targeted communication of energy-use comparisons and information to our residential customers, providing specific recommendations and feedback to motivate and teach customers how to reduce their energy consumption. Actual consumption in the form of meter data is used to M&V this program. Meter data for all participants, comparison homes, and control homes are provided to the third-party implementer for continuous analysis and performance reporting. The third-party implementer compares the consumption of participants (Treatment Group) to those of the Control Group to determine the savings resulting from the product. Savings for the print/email product will be measured compared to an appropriately sized Control Group of non-participant customers that are uninformed by any direct action of this product. In addition to determining the savings resulting from the product, the third-party implementer will track and adjust for participant's incremental participation in other energy efficiency products.

This M&V methodology is recommended by the State and Local Energy Efficiency Action Network (SEE Action). The following figure depicts the M&V methodology.



Moreover, the M&V methodology incorporates recommendations made by the Center for Energy and Environment (CEE) in their evaluation of the Minnesota Residential Energy Feedback pilot. Specifically, the following recommendations were incorporated:

- Opt-out customers are included in total savings. While opt-out customers were previously included in the calculation of savings per household (i.e. in the regression), the aggregation of savings did not include the count of opt-out customers
- Negative “savings” estimates are included in total savings. Previously, zero savings were reported in months with negative savings estimates. The updated method includes negative “savings” that occur in any month.
- Duplicate records are eliminated. Data preparation steps now remove (if present) duplicate billing records along with records from multiple meters at a customer’s home that may have been added during the course of the program. The total number of records removed are noted in a logfile and stored.
- Model is robust to varying monthly imbalances between treatment and control. The regression model below controls for any remaining overall and seasonal differences between treatment and control. This update achieves the intent of the evaluation’s recommendation to take care in adjusting estimates for any residual overall or seasonal imbalance between the treatment and control group.

The following regression model is used to estimate  $\widehat{\beta}$ , the average energy saved per day per household/business. The model is estimated separately for electricity and gas.

Where:

Variables:

- $usage_{it}$  is average daily usage for meter read  $t$  for household/business  $i$  in the post-treatment period
- $treatment_i$  is an indicator for assignment of household/business  $i$  to the treatment group
- $pre\_usage_i$  is average daily usage across household/business  $i$ 's available pre-treatment meter reads
- $pre\_winter_i$  is average daily usage over the months of Dec, Jan, Feb, and Mar across household/business  $i$ 's available pre-treatment meter reads. This value is imputed, if missing, with household/business  $i$ 's value for  $pre\_usage_i$ .
- $pre\_summer_i$  is average daily usage over the months of Jun, Jul, Aug, and Sep across household/business  $i$ 's available pre-treatment meter reads. This value is imputed, if missing, with household/business  $i$ 's value for  $pre\_usage_i$ .
- $mm_t$  is a vector of month-year dummies

Parameters

- $\beta$  is the average treatment effect of interest
- $\alpha_0$  is a common intercept term
- $\alpha_1$ ,  $\alpha_2$ , and  $\alpha_3$  are the effect of the control variables  $pre\_usage_i$ ,  $pre\_winter_i$ , and  $pre\_summer_i$  on  $usage_{it}$  in the reference month.
- $\gamma$  is a vector of parameters capturing the average effect of each month-year dummy on  $usage_{it}$
- $\delta_1$ ,  $\delta_2$ , and  $\delta_3$  capture the effect of the control variables  $pre\_usage_i$ ,  $pre\_winter_i$ , and  $pre\_summer_i$  on  $usage_{it}$  in each month-year ( $mm_t$ ) of the post-period
- $\varepsilon_{it}$  is an error term
- $i$  is notation for the  $i$ th customer
- $t$  is notation for the first, second, third, etc.. month of the post-treatment period

kWh/Dth saved by Treatment Group =  $-\hat{\beta}$  \* total\_treatment\_days – kWh/Dth saved by rebated equipment for the same time period and same customers

Kilowatt (kW) demand reduction will be determined by first estimating the daily energy savings from the monthly energy savings, then apportioning the daily energy savings over the system peak hour.

#### Online Energy Feedback (My Energy) Opt-in Product

Residential customers in the print or email product who opt-in to participate in the My Energy tools will remain in the Home Energy Report Treatment Group and their savings will be included in the print/email product savings calculation.

Because login to the My Energy tools is a self-selected, opt-in action and therefore not easily subject to random assignment in a Randomized Controlled Trial, savings for Online Energy Feedback are performed using the Propensity Score Matching methodology. This analysis employs a quasi-experimental matching method which seeks to match customers who log in to My Energy (“treatment customers”) to very similar customers who did not log in to My Energy (“matched control customers”). Matched controls are drawn from a larger set of candidate control customers. Not all customers who log in are successfully matched largely due to not having 12 months of pre-login usage data. These customers are not matched due to the concern that they cannot be matched well. As a result, the analysis measures the average treatment effect on the treated for those customers who visited the web and who could be matched well; it is not a measurement of the effect of web on all customers who visited My Energy.

The algorithm follows Imbens and Rubin (2015) and begins by selecting customer characteristics for estimation of a propensity score. The propensity score is the predicted probability of receiving the treatment (i.e. logging in to My Energy). Matching customers based on nearly identical propensity scores serves to balance the distribution of the included customer characteristics among the treatment and matched control populations. An important limitation of this method is that treatment customers may still differ from matched control customers along unobserved dimensions (e.g. attitudes toward energy efficiency) which could bias results. Despite this limitation, propensity score matching is an accepted method in the Department of Energy SEE Action guidelines and widely used in other disciplines.

Energy savings will have a one-year life, with ongoing treatment and information exposure necessary to continue the full energy-savings benefits. To address this unique situation with treatment-driven behavior programs, Public Service will discount the annual savings so that 1/3 of the total savings measured are claimed each year during a three-year cycle. This is different than the standard conservation product, where a measure gets installed and credit is taken for the multi-year life of that installed measure. The third-party implementer will calculate savings throughout 2017 and 2018 using a comparison of the Treatment Group and the Control Group as savings occur and only if they occur.

Public Service will track rebates by customer and account and will subtract the energy saved through these product participations from the Energy Feedback results to prevent double counting.

##### 5. *Pilot Products*

EM&V for pilot products can differ from the EM&V for prescriptive and custom products since the pilots are being evaluated for market viability. Therefore, additional testing may be necessary, and, in some cases, specifically designed for a particular pilot. For these reasons, the detailed EM&V Plan for each pilot is included in the pilot’s product description, which can be found in the Indirect Products and Services section of the Plan under Product Development.

## II. *Post-Performance Year Product EM&V*

The purpose of the post-performance year EM&V is to ensure that all technical assumptions, including the NTG ratios, are accurate and that the product is operating as effectively as possible. Post-performance year activities take place in the years following the performance year and include comprehensive product evaluations, a portfolio-wide technical assumptions evaluation, and calculation of outcomes for the annual status report.

### a) Verified Savings Calculation and Reporting

At year-end, net verified generator savings are calculated from gross customer (meter) savings using the approved line losses, measured or assumed installation and realization rates, and NTG values and reported in the EM&V Results section of each DSM Annual Status Report, according to the following formulas:

Net verified kW savings =

$$\text{Peak customer kW} * \text{Line Loss} * \text{Installation Rate} * \text{Realization Rate} * \text{NTG}$$

Net verified kWh savings =

$$\text{Customer kWh} * \text{Line Loss} * \text{Installation Rate} * \text{Realization Rate} * \text{NTG}$$

Net verified Dth savings =

$$\text{Gross Dth} * \text{Line Loss} * \text{Installation Rate} * \text{Realization Rate} * \text{NTG}$$

Where,

- peak customer kW, customer kWh, and gross Dth are reported from Salesforce and/or provided by the third-party implementers;
- line losses are 6.51% for business products and 7.69% for residential products;
- installation rates are assumed to be 100% for all of the products within the Business, Residential, and Low-Income Programs, and for pilots, with the exception of the Home Lighting & Recycling, School Education Kits, Energy Efficient Showerhead, and Energy Savings Kits products. For each of the exceptions, the third-party implementer measures the installation rate and reports it, along with gross savings, to the Company.
- realization rates are assumed to be 100% for custom products, Low-Income products, and pilots, and are measured and reported by the M&V contractor or the third-party implementer for the prescriptive products; and
- NTG values are as filed in the Technical Reference Manual of the DSM Plan, unless modifications were adopted resulting from a product evaluation, as described below.

Note that:

- Installation and realization rates, as well as NTG values, are applied at the measure and end-use levels within each product.
- Either an installation rate or a realization rate, but not both, are typically applied to calculations of net verified savings.

- Comprehensive products that claim prescriptive or custom savings from other end-uses, will apply the installation rates, realization rates, and NTG ratios specific to each end-use when calculating net verified savings.
- Products that offer studies (such as Compressed Air Efficiency, Data Center Efficiency, or Recommissioning, for example) may distinguish study-driven savings from non-study-driven savings and apply different installation rates, realization rates, or NTG values to the various categories of savings, as described in the Technical Reference Manual of the DSM Plan.

b) Product Evaluations

In addition to the performance-year M&V described above, Public Service will contract with an independent third-party consultant to complete evaluations for specific products each year. Product evaluations are conducted on a staggered schedule so that all products receive comprehensive evaluations at least once every eight years. The principal objective of the product evaluation is to determine the role of the product in customer decision-making. This includes specific research that assesses customer satisfaction with the DSM product and implementation processes, conducts a thorough review of industry-wide approaches, and/or to assess changes that should be made to NTG ratios or savings baselines based on the evaluator's primary research. When considering the evaluation recommendations, Public Service will follow the guidance from Decision No. C11-0465, which gives Public Service the discretion to make changes to its DSM products that are reasonable, cost-effective, and timely; as well as to reject suggested changes that are flawed.<sup>85</sup>

Factors that are taken into consideration in determining the priority and schedule of product evaluations include, but are not limited to: product tenure in Colorado, savings achieved per participant and relative to total goals, product expenditures compared to total budgets, uncertainty and/or risk associated with savings or technical assumptions, duration since a significant product redesign, and availability of other studies regarding the particular measures. Discussions with portfolio managers, product developers, and technical consultants are used to finalize the priority and schedule of evaluations.

In 2019 and 2020 the Company plans to conduct evaluations under two separate contracts due to the need for evaluation of Demand Response products that require a significantly different scope and skill set when compared to the other products in the portfolio. Between these two contracts, the Company will evaluate five programs in 2019 and six in 2020 in addition to a lighting baseline study in 2019.<sup>86</sup> In 2019 the Company proposes a full process and impact evaluation (also known as a comprehensive evaluation) of Motor and Drive Efficiency, a lighting baseline study for all residential and business segments,<sup>87</sup> and process-

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<sup>85</sup> Order Addressing Application for Rehearing, Reargument, or Reconsideration & Motion for Extension of Time to File 2012-2013 Plan. Proceeding No. 10A-554EG, Order No. C11-0465, Pages 6 – 7.

<sup>86</sup> The Company agreed to conduct four comprehensive product evaluations each year, starting in 2016 under the 2015/16 DSM Plan Settlement Agreement (Proceeding No. 14A-1057EG).

<sup>87</sup> Under the 2015/16 DSM Plan Settlement Agreement (Proceeding No. 14A-1057EG), the Company also agreed to evaluate each of its lighting products (Home Lighting & Recycling, Lighting Efficiency, and Lighting – Small Business) on a three year rotation. As part of a previous Settlement Agreement, the Company evaluated both the

only evaluations of Heating Efficiency and Low Income Weatherization in the Business and Low Income programs. The lighting baseline study is proposed to provide a more nuanced understanding of market influences and opportunities for different customer segments and lighting applications than a traditional NTG analysis. In 2020 the Company will perform comprehensive evaluations of Energy Efficiency Showerheads, Refrigerator & Freezer Recycling, Home Lighting and Recycling, Lighting Efficiency, and Lighting – Small Business.

In the DR program, the Company will conduct modified comprehensive evaluations of Saver's Switch and Peak Partner Rewards in 2019 and AC Rewards in 2020. Due to the nature of the DR program, it is expected that NTG is not broadly applicable because events would not be called in the absence of the Company's efforts to reduce demand. However, instead of completing process-only evaluations the Company expects that the vendor will identify how to qualitatively evaluate the Company's influence on how the customers elect to reduce demand through the DR products.

This schedule will be reviewed at the beginning of each year and may be adjusted based on costs, scope, and need.

### *III. EM&V Best Practices*

Public Service's ongoing M&V procedures are aligned with utility industry best practices for measuring product results. The Company requires that its contractors follow standard protocols, such as the IPMVP and the California Evaluation Framework. The following links are to some of the common reference materials describe these protocols in more detail:

California Evaluation Framework:

[http://www.calmac.org/publications/California\\_Evaluation\\_Framework\\_June\\_2004.pdf](http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf)

National Action Plan:

<http://www.epa.gov/cleanenergy/energy-programs/suca/resources.html>

SEE Action EM&V Resource Portal:

<https://www4.eere.energy.gov/seeaction/topic-category/evaluation-measurement-and-verification>

The International Performance Measurement and Verification Protocol can be found in the Products & Services section of the Efficiency Valuation Organization's website at

<http://www.evo-world.org>.

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Home Lighting and Lighting Efficiency products in 2015 and the Lighting – Small Business in 2016. The Lighting baseline study conducted in 2019 will affect all lighting programs, and additionally all three lighting programs, Home Lighting and Recycling, Lighting – Small Business and Lighting Efficiency (the latter on recommendation from the 2018 evaluation) will receive a comprehensive evaluation in 2020.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Not applicable.

### Budgets

The robustness of Public Service's EM&V plan is balanced against its costs; we continue to be mindful of the objectives of ensuring accurate savings while keeping expenditures prudent and maintaining the cost-effectiveness of products. The budgets for the various EM&V components are included within this DSM Plan in the following ways:

- *Rebate validation*: Internal labor is charged as an Administration and Product Delivery cost to individual DSM product budgets.
- *Ongoing M&V*: Most outside contractor costs, including database development, data tracking, and reporting, are charged as an M&V cost to individual DSM product budgets and are not included in the general Measurement & Verification budget under the Indirect Products and Services section of the Plan. Budgets for these activities were forecasted based upon historical experience or followed a more general budgeting plan at between 3 to 5% of the respective DSM products' total budgets.
- *Comprehensive Product Evaluations*: Outside consultant costs are included within the "Program Evaluations" budget under the Indirect Products and Services section of the Plan. These costs were developed based on previous evaluation costs.
- Internal Xcel Energy labor that supports administration and oversight of ongoing M&V and comprehensive product evaluations is charged to "Measurement & Verification" or "Program Evaluation" budgets, respectively, under the Indirect Products and Services section of the Plan.

## **C. Application Process**

Not applicable.

## **D. Marketing Objectives & Strategies**

Not applicable.

## **E. Product-Specific Policies**

EM&V does not have any specific policies.

## **F. Stakeholder Involvement**

EM&V does not have any unique stakeholder involvement.

**G. Rebates & Incentives**

Not applicable.

**H. Evaluation, Measurement, & Verification**

As described in section (A) above and in Table 15 below.

## Measurement and Verification Summary by Product

Program Component	M&V Protocol	2019/2020 M&V Plan
Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors from implemented measures.
Direct Install	Unique Prescriptive	Xcel Energy's program implementer documents equipment installed onsite, no further verification is required.
Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Prescriptive	General Prescriptive	Prescriptive rebates available for Variable Frequency Drive Compressors that are less than 50 hp and have no air loss drain valves. Verification Contractor selects random sample and performs field inspections of deemed savings factors -- e.g. size of compressor and number of drains.
Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Custom - Study Driven Credit	Unique Custom	Studies may yield direct energy savings from leak fixes. The study provider will identify the location and size of leaks. The study provider and/or the customer will fix the identified leaks. The customer must verify all leak fixes, as 50% or more of the fixes must be completed in order to qualify for the study rebate. A realization rate of 100% is applied to the calculated savings from leak fixes.
Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors; e.g. equipment type, size, efficiency, climate zone and building type.

	Upstream/Midstream	Unique Prescriptive	Participating distributors will enter sales data into an online application administered by a third-party, listing the make, model, serial number, quantity, installation address and zip code. The third-party administrator will verify customer eligibility and provide periodic sales reports. Verification Contractor selects random sample and performs field inspections of deemed savings; e.g. equipment type, size, efficiency, climate zone and building type.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Custom Efficiency	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Data Center Efficiency	Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors; e.g. equipment type, number of equipment.
	Prescriptive	Unique Prescriptive	For verification of the EC plug fan measure installation, the VC will maintain a log of any refusals for site entry for M&V, and subsequently seek out, and document, verbal confirmation of installation from the customer and/or installer.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).

Energy Management Systems	Custom	General (EMS) & Unique Custom (EIS)	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
	Behavioral	Behavioral Custom	The third-party implementer, with review by Xcel Energy engineers, will analyze data from energy information systems (EIS) in accordance with IPMVP criteria and the Company's custom M&V process, to ensure persistence of the behavioral measure's savings. These savings will be reported annually for the duration of the customer's involvement in the EIS measure.
Lighting Efficiency <sup>2,3</sup>	Upstream / Midstream	Unique Prescriptive	Participating distributors provide sales reports listing the model, wattage, type, and number of bulbs sold. The third-party implementer enters the information into a tracking system and submits monthly reports containing the data and calculation of the demand and energy savings using technical assumptions provided by The Company. The VC audits the database output by examining and comparing against retailer sales reports. The VC adjusts the wattage and number of bulbs if errors are found and provides the final verified savings for all bulbs for year-end.
	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors -- e.g. number of fixtures, equipment type, building type, existence of air conditioning. Information gathered for a sample of lamps/fixtures and extrapolated to total population.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Lighting - Small Business <sup>2,3</sup>	Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors -- e.g. number of fixtures, equipment type, building type, existence of air conditioning. Information gathered for a sample lamp/fixtures.
	Direct Install	Unique Prescriptive	Xcel Energy's program implementer documents equipment installed onsite, no further verification is required.

	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects $\geq$ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Motor & Drive Efficiency <sup>1</sup>	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors -- e.g. horsepower, efficiency, type, speed, application, building type, and use of motor. For VFDs, size, speed, type, application and use of motor drive, and building type. If more than 10 motors, information will be gathered for a sample.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects $\geq$ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Multifamily Buildings	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects $\geq$ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
New Construction	Custom - Energy Efficient Buildings	Unique Custom	Consultant visits site and verifies that specified measures were installed. Projects with individual measure savings $\geq$ 1 GWh savings: Four weeks of data logging verifies savings.
	Custom - Energy Design Assistance	Unique Custom	Consultant visits site and verifies that specified measures were installed. Equipment and systems are monitored for a two week timeframe, as appropriate, to evaluate performance variables against modeling assumptions. Projects with individual measure savings $\geq$ 1 GWh savings: Four weeks of data logging verifies savings. All projects verified with actual results not within 15% of the energy savings identified in the original model will have an as-built model completed for rebate calculations.
Strategic Energy Management	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors specified for applicable end use product.

	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if The Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Recommissioning	Custom	Unique Custom	Customer hires an engineering firm to conduct study of building and to determine energy savings for each measure. Internal energy efficiency engineers reviews and verifies that savings calculations are accurate for 100% of projects. For measures over 1 GWh of savings, pre and post metering is required to verify savings, if feasible. For projects that are very difficult to meter, a combination of metering and calculation may be used.
Self-Direct	Custom	Unique Custom	Customer will calculate savings and Company will verify calculations. Customer will develop and implement M&V plan specific to project. Company will review M&V plan and results. Pre- and post-installation metering and verification will be required for all projects with predicted energy savings greater than 0.25 GWh, unless the Company and customer agree upon another methodology. The Company reserves the right to require data measurement and verification for projects of any size.
<b>Business Gas:</b>			
Commercial Refrigeration Efficiency	Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors from direct installed measures and implemented measures
	Direct Install	Unique Prescriptive	Xcel Energy's program implementer documents equipment installed onsite, no further verification is required.
Heating Efficiency	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors. For boilers -- size and efficiency. For steam traps -- high or low pressure. For all other -- size and implemented measure.
	Custom	General Custom	Projects <20,000 Dth savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification. Account Manager or Business Solutions Center verifies project installation, collects equipment invoices. Projects ≥ 20,000 Dth savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).

Custom Efficiency	Custom	General Custom	Projects <20,000 Dth savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification. Account Manager or Business Solutions Center verifies project installation, collects equipment invoices. Projects ≥ 20,000 Dth savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Energy Management Systems	Custom	General Custom & Unique Custom (EIS)	Projects <20,000 Dth savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification. Account Manager or Business Solutions Center verifies project installation, collects equipment invoices. Projects ≥ 20,000 Dth savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
	Behavioral	Behavioral Custom	The third-party implementer, with review by Xcel Energy engineers, will analyze data from energy information systems (EIS) in accordance with IPMVP criteria and the Company's custom M&V process, to ensure persistence of the behavioral measure's savings. These savings will be reported annually for the duration of the customer's involvement in the EIS measure.
Lighting – Small Business <sup>2,3</sup>	Direct Install	Unique Prescriptive	Xcel Energy's program implementer documents equipment installed onsite, no further verification is required.
New Construction	Custom - Energy Efficiency Buildings	Unique Custom	Consultant visits site and verifies that specified measures were installed. Projects with individual measure savings ≥ 20,000 Dth savings: Four weeks of data logging verifies savings.
	Custom - Energy Design Assistance	Unique Custom	Consultant visits site and verifies that specified measures were installed. Equipment and systems are monitored for a two week timeframe, as appropriate, to evaluate performance variables against modeling assumptions. Projects with individual measure savings ≥ 20,000 Dth savings: Four weeks of data logging verifies savings. All projects verified with actual results not within 15% of the energy savings identified in the original model, will have an as-built model completed for rebate calculations.
Recommissioning	Custom	Unique Custom and Study-Drive Credit	Customer hires an engineering firm to conduct study of building and to determine energy savings for each measure. Internal engineer reviews and verifies that savings calculations are accurate for 100% of projects. For measures >1 GWh savings or over 20,000 Dth of savings, pre and post metering is required to verify savings, if feasible. For projects that are very difficult to meter, a combination of metering and calculation may be used.

<b>Residential Electric:</b>			
Energy Feedback Residential	Behavioral	Behavioral Prescriptive	Actual consumption in the form of meter data is used to M&V this program. Meter data for all participants, comparison homes, and control homes are provided to the third-party implementer for continuous analysis and performance reporting. The third-party implementer compares the consumption of participants (Treatment Group) to those of the Control Group to determine the savings resulting from the product.
ENERGY STAR New Homes	Prescriptive	Unique Prescriptive	RESNET Certified HERS rater performs multiple site walk-throughs and at the end of construction determines final HERS rating - 100% site verification. Rebate amount is determined by the modeled energy consumption (as-built home) percent better than local code requirement (reference home). Home size information, measures installed, and HERS rating are verified by third party product implementer and then submitted to Public Service.
Evaporative Cooling	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors; e.g. type of unit (tier 1, 2 or 3), and type of unit if previously installed and if registers and ducting are complete (if applicable to tier).
Home Energy Squad	Prescriptive	Unique Prescriptive	Third-party implementer verifies installation of measures.
Home Lighting & Recycling <sup>2, 3</sup>	Prescriptive	Unique Prescriptive	Third party administrator provides tracking data and manufacturer sales reports for bulbs sold. Verification contractor audits the data and compares to manufacturer sales reports. Verification contractor corrects any errors and calculates energy savings based on Public Service assumptions.
High Efficiency Air Conditioning	Prescriptive	Unique Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors using a defined process. This includes verifying load calc was performed, unit sized properly and that refrigerant charge, air flow, and duct leakage are within acceptable ranges.
Home Performance with ENERGY STAR	Prescriptive	Unique Prescriptive	Third-party product implementer performs a walk through inspection after the homeowner has performed all of their planned energy efficiency improvements. The work conducted by a participating installation contractor will be inspected through this method. Contractors will have first five completed projects inspected followed by a ten percent sample of homes. The product has this permanently built into the product as a requirement to ensure all stated improvements have been made prior to issuing the rebate. THE COMPANY will also implement a market research survey with customers to gauge satisfaction with the product, auditors, and installation contractors that were used.
Refrigerator & Freezer Recycling <sup>2</sup>		Unique Prescriptive	Verification contractor conducts phone surveys of random sample of participants to verify removal of refrigerator and that refrigerator was operable at time of removal.

School Education Kits	Prescriptive	Unique Prescriptive	Third-party product implementer conducts surveys to teachers/students to confirm what was installed at students home.
Thermostat Optimization	Prescriptive	General Prescriptive	Third-party product implementer conducts surveys to confirm what was installed at home.
	Custom	General Custom	Company verification of third-party saving calculations and algorithms.
<b>Residential Gas:</b>			
Energy Efficient Showerheads <sup>2</sup>	Prescriptive	Unique Prescriptive	Verification Contractor selects random sample & performs phone survey of deemed savings factors -- e.g. did the customer receive the product and was it installed.
Energy Feedback Residential	Behavioral	Behavioral Prescriptive	Actual consumption in the form of meter data is used to M&V this program. Meter data for all participants, comparison homes, and control homes are provided to the third-party implementer for continuous analysis and performance reporting. The third-party implementer compares the consumption of participants (Treatment Group) to those of the Control Group to determine the savings resulting from the product.
ENERGY STAR New Homes	Prescriptive	Unique Prescriptive	Third-party implementer manages certified energy raters who consult directly with builders during construction phase and then assign a HERS rating (with blower door testing) at end of construction prior to rebating for product - 100% site verification. Home size information, measures installed, and HERS rating are verified by product implementer.
Residential Heating	Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors; e.g. manufacturer, model, serial number
Home Energy Squad	Prescriptive	Unique Prescriptive	Third-party implementer verifies installation of measures.
Home Performance with ENERGY STAR	Prescriptive	Unique Prescriptive	Third-party product implementer performs a walk through inspection after the homeowner has performed all of their planned energy efficiency improvements. The work conducted by a participating installation contractor will be inspected through this method. Contractors will have first five completed projects inspected followed by a ten percent sample of homes. The product has this permanently built into the product as a requirement to ensure all stated improvements have been made prior to issuing the rebate. THE COMPANY will also implement a market research survey with customers to gauge satisfaction with the product, auditors, and installation contractors that were used.

Insulation & Air Sealing	Prescriptive	General Prescriptive	Verification Contractor selects random sample & conducts onsite verification to confirm measure(s) were installed. VC conducts post blower door test for accuracy of air leakage reduction and confirms that the contractor is certified under Building Performance Institute (BPI), registered under Xcel Energy's program and licensed in Colorado.
School Education Kits	Prescriptive	Unique Prescriptive	Third-party product implementer conducts mail surveys to teachers/students to confirm what was installed at students home.
Water Heating	Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors -- e.g. type of unit installed.
<b>Low-Income Electric:</b>			
Energy Savings Kits	Prescriptive	Unique Prescriptive	Verification Contractor selects random sample & conducts phone surveys to confirm what was installed at recipient's home.
Multi-Family Weatherization	Prescriptive	Unique Prescriptive	Consultant visits building and completes energy audit. The Company engineer reviews audit report and approves or denies report. Consultant visits site to verify that approved measures were installed and submits final savings in verification report.
Non-Profit Energy Efficiency	Prescriptive	Unique Prescriptive	Consultant visits building and completes energy audit. The Company engineer reviews audit report and approves or denies report. Consultant visits site to verify that approved measures were installed and submits final savings in verification report.
Single Family Weatherization	Prescriptive	Unique Prescriptive	Contracted weatherization agency visits home, identifies savings opportunities and then installs measures. Weatherization agency provides documentation of completed measures to third-party product implementer, who submits information to The Company.
<b>Low-Income Gas:</b>			
Energy Savings Kits	Prescriptive	Unique Prescriptive	Verification Contractor selects random sample & conducts phone surveys to confirm what was installed at recipient's home.
Multi-Family Weatherization	Prescriptive	Unique Prescriptive	Consultant visits building and completes energy audit. The Company engineer reviews audit report and approves or denies report. Consultant visits site to verify that approved measures were installed and submits final savings in verification report.
Non-Profit Energy Efficiency	Prescriptive	Unique Prescriptive	Consultant visits building and completes energy audit. The Company engineer reviews audit report and approves or denies report. Consultant visits site to verify that approved measures were installed and submits final savings in verification report.
Single Family Weatherization	Prescriptive	Unique Prescriptive	Contracted weatherization agency visits home, identifies savings opportunities and then installs measures. Weatherization agency provides documentation of completed measures to third-party product implementer, who submits information to The Company.

<sup>1</sup>Comprehensive Evaluation will be conducted in 2019.

<sup>2</sup>Comprehensive Evaluation will be conducted in 2020.

<sup>3</sup>Baseline Evaluation will be conducted in 2019.

## ➤ Product Development

### A. Description

The Product Development team identifies, assesses, and develops new conservation and load management products and services for potential addition to the DSM portfolio. The product development process begins when customers, regulators, vendors, or energy professionals submit ideas through an Opportunity Identification Form or when Public Service staff or the Product Development team identifies potential opportunities for new products or measures. The Product Development team works on both energy-efficiency and load-management products.

#### *Opportunity Identification*

The Product Development team will screen, research, evaluate, and prioritize ideas for potential inclusion in the DSM portfolio. New items may be added to the portfolio in the form of a new measure within an existing product, launched as a pilot in need of further testing, or as a stand-alone new product. This work enables Public Service to periodically update its portfolio with promising new energy-saving opportunities for customers. The Company reports on its analysis and next steps for concepts submitted via the Product Development Opportunity Identification Form<sup>88</sup> at quarterly DSM Roundtable Meetings.

#### *Custom Efficiency Analyses*

The team will review measures being rebated within the Custom Efficiency product on a periodic basis. As emerging technologies become more commonly rebated as custom measures, the Company will evaluate the potential for transitioning them to prescriptive rebates, if cost-effective.

#### *Advanced Energy Communities*

Product Development plans to support a growing number of commercial, industrial, and mixed use buildings and neighborhood developments striving to incorporate strategies across multiple distributed energy resources technologies in order to minimize net energy consumption at the site. These projects require additional assistance beyond that offered in the current Energy Design Assistance offering, including earlier consulting and energy modeling as well as enhanced monitoring and verification once the project is completed and in operation. The focus of Product Development efforts in these projects will be to identify strategies that would enable a streamlined, cost-effective approach to serving these projects through the New Construction product in the future.

#### *Emerging Technologies Research*

Product Development also conducts research on emerging technologies.<sup>89</sup> Product Development works with other utilities, program administrators and research organizations<sup>3</sup> to identify new

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<sup>88</sup> [www.xcelenergy.com/productideas](http://www.xcelenergy.com/productideas)

technologies that have the potential for consistent and measurable energy savings, and are close to commercialization. Promising new technologies are then evaluated through the Opportunity Identification process described above.

### *Pilots*

Pilot product will continue to contribute to the Company's efforts to innovate and explore new approaches to cost-effectively achieve its energy-efficiency goals. The Company selects measures or products to pilot based on a variety of criteria, including: potential energy savings, cost of savings, customer interest, market dynamics, feasibility to be developed and brought to market quickly and at a reasonable cost, potential longevity of the offering, level of market barriers and risk. In addition to researching new product offerings and emerging technologies, Product Development also explores and investigates new energy-efficiency concepts, market transformation opportunities and market approaches as part of our long-term DSM strategy.

The Product Development team will support implementation and evaluation of the following energy efficiency and demand response pilots during 2019 and 2020:

- Electric Vehicle Smart Charging
- Residential Behavioral Demand Response
- Multifamily Thermostat Demand Response
- Residential Battery Demand Response
- Geo-Targeting

The Company will offer to hold at least two meetings with interested stakeholders, to discuss any new pilots that the Company decides to pursue, prior to 60-Day Notice.

## **B. Targets, Participants & Budgets**

### Targets and Participants

This is an indirect program and as such, has no estimated energy or participation targets.

### Budgets

The budget was estimated based on the historical costs and expected costs. Product Development spending can fluctuate significantly from year to year depending on the products in development and the funding needed to research and develop those products. Due to the nature of the emergence of new technologies within the market, it is not always possible to predict steady expenditures from one year to the next.

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<sup>89</sup> First added in the 2009/10 Biennial DSM Plan (Proceeding No. 08A-366EG) as part of the Stipulation and Settlement Agreement, Appendix A, Paragraph f, pg. 4; which stated: "The Company agrees to increase the budget for research on emerging technologies and new program development."

<sup>3</sup> Examples of research organizations include Western Cooling Efficiency Center (WCEC), E Source, Emerging Technologies Coordinating Council (ETCC), Consortium for Energy Efficiency (CEE), and the American Council for an Energy-Efficient Economy (ACEEE).

## **C. Application Process**

This indirect product does not include a customer application process.

Ideas for new products or measures can be submitted for consideration to the Company by following the detailed instructions included on the forms listed under ‘Product Development Idea Submissions’ on the Company’s website.<sup>90</sup>

## **D. Marketing Objectives & Strategies**

This indirect product does not have marketing objectives.

## **E. Product-Specific Policies**

Product Development utilizes the following criteria to consider whether a DSM technology/approach warrants exploration via a pilot:

- Does the market assessment indicate broader deployment is possible? Or are additional learnings needed?
  - Does the preliminary assessment sufficiently answer all technical assumptions?
  - Does sufficient market attractiveness exist for a wide-scale deployment?
- Is additional testing necessary to understand/define the true capabilities of the concept?
  - Has the chosen technology solution been widely deployed elsewhere in a comparable program with comparable learnings?
- Does the enterprise infrastructure support a full deployment or do significant manual processes still exist?
- Do the market, technical and functional requirements meet the needs of all impacted groups (e.g. technical, legal, regulatory, etc.) or are additional learnings needed?

## **F. Stakeholder Involvement**

Public Service will rely heavily on the active participation of employees, customers, trade allies and vendors to successfully identify and develop new products with a high level of integrity, timeliness, and cost-effectiveness. Representatives of the energy-efficiency industry and other stakeholder groups are engaged in the development process through such channels as the quarterly DSM Roundtable Meetings and the use of Opportunity Identification Forms found on the Company’s DSM Website.

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<sup>90</sup> [http://www.xcelenergy.com/Company/Rates\\_&\\_Regulations/Filings/Colorado\\_Demand-Side\\_Management](http://www.xcelenergy.com/Company/Rates_&_Regulations/Filings/Colorado_Demand-Side_Management)

## **G. Rebates & Incentives**

This indirect product does not provide customer rebates.

## ➤ Geo-targeting Pilot

### A. Description

#### Background

The objective of the Company's Geo-Targeting pilot is to demonstrate that the targeted deployment of DSM resources can defer the need for investment in a new distribution transformer and associated feeder upgrades. To accomplish this, the Company will need to show how its traditional DSM and DR resources can be adapted to address localized system constraints. Each of the following three areas is key to fulfilling the pilot objective.

#### Drive High levels of Local Adoption

The Company believes the successful execution of geo-targeting projects will require that it is able to drive adoption of energy efficiency and demand response in concentrated locations faster and at higher levels of participation than normal. The Company will need to explore new delivery models and promotional methods to achieve this goal. This pilot presents an opportunity to identify successful approaches and learn about any additional savings or costs associated with attracting greater levels of customer participation.

#### Coordinate and Dispatch Demand Response

Traditionally, the Company utilizes demand response as a system resource that reduces total system load during emergency, contingency, or economic events. These events are informed by the needs of the bulk power system, and there is an established process for how and when these resources are activated. In contrast, the Company has less experience and fewer processes for using demand response for distribution purposes. This pilot will give the Company an opportunity to explore how DR can be used in a distribution context.

#### Validate Concept Costs and Effectiveness

In order to substitute proven infrastructure upgrades for geo-targeting solutions, the Company needs to be confident that it can deliver cost-effective and reliable solutions. The pilot will provide detailed information about cost-effectiveness and whether a portfolio of DSM and DR solutions can work to reduce load sufficiently and consistently during targeted times.

#### Pilot Description

The Company selected the Lakewood/Rooney Valley area as the location of its geo-targeting pilot. The Company reviewed several geo-targeting project opportunities, and determined this location represented the best opportunity for a pilot for several reasons: the deferred benefit is large enough to justify incremental DSM spending; there is enough lead time before the infrastructure investment to procure additional DSM and DR; and there is additional flexibility in this location to use traditional distribution operations approaches such as switching to protect reliability during the pilot.

The Rooney Valley is an area located to the Southwest of Denver, and it sits South of Green Mountain and adjacent to C-470. Planning efforts by Morrison and Lakewood have suggested as much as 700 acres of land could open up to new development. A number of developers with ownership interest in the Rooney Valley are at various stages of the design, permitting, and construction process.<sup>91</sup>

Part of Lakewood and the Rooney Valley are served by the Company's Kendrick substation and a feeder that extends from Kendrick. In addition to Rooney Valley, this feeder also serves a part of Lakewood moving eastward from C-470 between West Alameda Avenue and West Yale Avenue. On very hot summer days, this feeder, which serves mostly residential dwellings, has approached its thermal limit—requiring active switching to move some demand to nearby feeders. If a significant share of the planned development in the Rooney Valley occurs, demand will begin to regularly exceed the thermal capacity of the feeder thereby requiring system upgrades.

The Company's Distribution Planning team, based on the most current information, expects demand growth will result in the need for both a new transformer and feeder in 2023. The cost of these upgrades could total \$10.1 million. The timeline for this infrastructure investment is likely to evolve from year-to-year, as construction timelines from developers and builders change. However, the pilot filing and analysis discussed below focuses on a base case that matches this 2023 projected investment need.

In order to defer the planned distribution system upgrades, a combination of demand side management and demand response would need to work together to keep the feeder load below its thermal limits as new load from development comes online. The Company projects that it needs to acquire three MW of load reduction. The Company would rely on or activate this load reduction multiple times per year for up to 44 hours. As Table 16 shows the load reduction need starts small and grows over time as new construction occurs.

Through its existing Residential Demand Response product, the Company already has one MW of load reduction available for participation in this pilot. Although these resources may still operate a few times a year for system-wide demand response, the Company can test their use for the deferral pilot. After accounting for these resources, the Company still has a need for load reduction during the deferral period.

Although the Company forecasts it would not need this additional load reduction until 2023, it is pursuing these reductions in the 2019/2020 timeframe for several reasons. First, the demand forecast is uncertain and load growth could occur faster than expected, thereby requiring more load reduction sooner than expected. Second, acting earlier in the window will allow the Company to test its approach to procuring and utilizing load reduction before

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<sup>91</sup> For background on the Rooney Valley and on-going planning efforts, see Lakewood and Town of Morrison. (2016). *Plan Rooney Valley*. For more on development plans, see the Rooney Valley Commission website at <http://lakewood-colorado.org/RVC/>.

load reduction is required. And third, if the Company waits until 2021 or beyond, it will miss its window to affect the new construction that may be built in 2019 and 2020.

**Table 16: Estimated load reduction, duration, and frequency, 2019-2026**

	2019	2020	2021	2022	2023	2024	2025	2026
Maximum Load Reduction in Single Hour Required to Keep Demand Below Thermal Limit (MW)	0	0	0.4	0.9	1.4	1.9	2.5	3.0
Total Estimated Hours Above Thermal Limit	0	0	2	5	14	23	34	44
Maximum Duration of Load Reduction for Single Day (Hours)	0	0	2	3	4	4	5	6
Thermal Limit (MW)	16.5							

The

Company evaluated a number of different customer segments and measure types to meet the remaining load reduction need. Based on its current evaluation, the Company expects it will focus on achieving the load reduction through air-conditioning-related measures and by targeting new construction in the area. This project focus has the advantage of targeting the primary end-use, air conditioning, that is aligned with and driving the late afternoon/early evening feeder peak. In addition, its emphasis on new construction in the area will allow the Company to concentrate its efforts on a few builders rather than hundreds or thousands of residential customers.

Based on planning documents and conversations with developers working in the area, the Company expects the new demand in the 2019 and 2020 timeframe to come from townhomes and light industrial commercial buildings. The Company plans to focus on residential new construction, since peak demand from this segment is highly coincident with the feeder's peak and this segment represents the majority of new load beyond 2020.

Several measures in the Company's existing DSM portfolio already target residential new construction. The Company currently believes these existing measures offer the right load reduction opportunities, but they may need to be marketed through different channels. Relevant products and measures that could be part of the pilot effort include:

- Targeting the adoption of specific measures within ENERGY STAR® New Homes for builders interested in participating and
- Specific measures targeted at builders outside ENERGY STAR New Homes, including air conditioning rebates, insulation rebates, and smart thermostats.

For these measures, the Company may rebate at levels above existing incentives. For example, the AC Rewards offering, part of the Residential Demand Response product, could increase rebates to cover the full incremental cost of a smart thermostat, so the builder makes DR-enabled smart thermostats part of their base heating, ventilation, and air conditioning package to customers. By modifying products to engage with builders, the Company believes it could secure substantial builder and therefore customer participation.

To complement its efforts with builders and to better understand how to generate lift in existing neighborhoods, the Company will implement a one-year campaign focused on existing homes. This effort, as described in Section B and D, will test new local and community marketing approaches to sell products with load reduction benefits.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The new development in the Rooney Valley creates an opportunity to influence the efficiency and peak power consumption of a large amount of new load. In order to meet the deferral requirements, the Company will focus on engaging directly with builders and developers.

In addition, the Company will perform a one-year campaign to target its efforts at growing participation in the existing neighborhoods on the feeder. These neighborhoods are predominately composed of single family homes, but also include a small number of multifamily low-rise dwellings.

### Budgets

The Company has developed a budget with expenses based on two project strategies. The first strategy focuses on paying increased rebates to drive installation of efficient equipment inside new homes. For this strategy, the timing of expenses is based on the Company's current knowledge of when the builders will construct these new homes. The second strategy focuses on driving adoption of measures into existing homes. The Company plans to hire a third-party implementer to run a local campaign to increase lift. The primary expense for this strategy is the cost of the third-party implementer. The implementer will focus on awareness and marketing through local channels.

The administration costs for this project reflect that it is a first-of-a-kind project. Administration costs cover labor to manage the third-party implementer, engage with builders and developers, establish and manage the process for using DR, and provide general pilot management.

It is important to note that the budget for this pilot only reflects incremental costs associated with the project. Thus all or a portion of rebates and marketing expenses for measures included in the 2019/2020 DSM Plan that the project leverages will accrue to each product budget outside of this pilot. For example, if the Company were to offer builders a free smart

thermostat in exchange for the home buyer's enrollment in the Residential Demand Response product, then the expenses would be allocated as shown below:

- Full incremental cost of smart thermostat: \$249<sup>92</sup>;
- Portion of cost that accrues to Residential Demand Response product: \$75 (based on current rebate structure); and
- Portion of bonus rebate that accrues to Geo-targeting Pilot: \$174.

### **C. Application Process**

The application process will be contingent upon the measures that are implemented and the application process specific to the associated product will be applied. For example, the application process for ENERGY STAR New Homes would apply to any new home construction project targets as part of the pilot.

### **D. Marketing Objectives & Strategies**

The Company is already in contact with developers in the Rooney Valley. It will continue to engage directly with these developers, while also looking to reach out to builders to discuss how they can participate in relevant energy efficiency and demand response products.

For the portion of the project that emphasizes existing neighborhoods, it will look to market its offerings using a tailored, community-based approach.

The Company plans to work with a third-party to support any community-based marketing efforts. These efforts could use budget for a range of activities that would be customized for the community and extend beyond the Company's normal marketing efforts. Examples include:

- Hosting awareness events through local organizations, such as Homeowners' Associations;
- Use of local citizens as program champions to spread the word about their experience with energy efficiency and demand response products;
- Door-to-door selling in communities; and
- School, church, or neighborhood group-level prizes and awards associated with achieving adoption targets.

### **E. Product-Specific Policies**

The Geo-targeting pilot is focused on a particular feeder in the Company's distribution system. If additional incentives are offered, a customer or builder/developer must prove that the equipment they are seeking a rebate for is being placed in a location on the targeted feeder. The Company

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<sup>92</sup> Price estimate for smart thermostat based on Ecobee for list price on the Xcel Energy store (<https://www.xcelenergystore.com/collections/rebated-smart-thermostats>).

can verify location based on the building or home location and/or the customer's account number.

## **F. Stakeholder Involvement**

Depending on the Company's marketing and outreach tactics, it may seek to engage with a range of local non-profit, government, home developers and builders, and trade partners – including low-income advocates - to drive customer adoption. Example approaches are discussed in Section D.

## **G. Rebates & Incentives**

Rebates and incentives may be used in two principal ways.

1. Additional offset of incremental costs for builders: In order to attract builder participation, the Company may significantly offset the incremental cost for equipment such as smart thermostats or air conditioners. The Company would pursue additional rebates if it believes this practice would result in large-scale adoption in new construction.
2. Organizational prizes for participation: As described in section D, the Company plans to work with established community organizations to drive adoption. If it takes this approach, it may establish incentives for these local organizations based on the amount of participation the Company measures from the organization's member-base. The Company will seek to make incentives relevant to the mission and purpose of the organization, and it will size the awards in a way that compel both engagement from the organization and participation and adoption from its member-base.

Exclusive of these uses, the Company plans to rely on existing rebates and incentives that are already part of on-going products.

## **H. Evaluation, Measurement, & Verification**

The Company's measurement and verification (M&V) efforts will seek to validate that products used for distribution purposes provide the same load reduction effects as is highlighted in each product's technical assumptions. The M&V analysis will do this by verifying that the participating neighborhoods look similar to the rest of the Company's service territory and that the load reduction is occurring in a similar timeframe to what has been used in filed demand response and energy efficiency measures.

The Company may also decide to conduct additional M&V to clearly show that the dispatchable demand response is delivering the intended effect at the substation transformer during a DR event. This analysis will provide greater internal assurance to the Company's distribution operators that the project is delivering what it forecasts.

## Demand Response Program

### A. Description

Demand Response (“DR”) provides utilities with a valuable tool for managing peak demand on the electric system. The utility must maintain adequate generation reserve margins to fulfill its obligation to deliver power at all times, even when unforeseen factors impact generation supply. DR offers a lower cost alternative to meet this need as compared to building or acquiring additional generation capacity. The Company’s DR portfolio provides customers with an economic incentive, in the form of rebates or bill credits, in return for their commitment to reduce load when called upon. DR benefits all customers by helping create a more reliable electric system at a lower cost.

*Demand response* differs from *energy efficiency* in that demand response reduces load only during times of peak demand on the electric system and results in relatively little reduction in overall electric consumption. Energy efficiency, in comparison, provides a permanent reduction in overall electric consumption through equipment replacement, or process or behavior change, only a portion of which may be coincident with system peak demand.

Generally speaking, there are three DR program constructs that the Company intends to leverage:

- *Direct Load Control (“DLC”)* – The Company directly controls a customer’s load, remotely, during periods of high demand creating a dispatchable resource. Saver’s Switch is an example of a DLC.
- *Interruptible Tariffs* – Customers agree to reduce consumption at a pre-qualified discount. These products are also dispatchable. There is a fee associated with non-compliance with a control event. The Interruptible Service Credit Option (“ISOC”) is an interruptible tariff.
- *Other Demand Response* – Products that would fall into this category include capacity bidding, demand bidding, and other aggregator offers, as well as offerings that are non-dispatchable, or those that are directly controlled by customers, such as pricing structures. The Smart Thermostats are an example.

The Company’s DR portfolio includes all three types of demand response; however, the majority of customer load is from DLC and interruptible tariffs.

#### Products

The Company is deploying, as part of this DSM Plan, five demand response choices. The originating filing and customer targets for each product / pilot are identified in the table below.

**Table 17: The Company’s Demand Response Program**

<b>Product / Pilot</b>	<b>Customers</b>	<b>Filing Source</b>
Critical Peak Pricing	Commercial/Industrial	DSM Plan
ISOC	Commercial/Industrial	07S-521E

Peak Partner Rewards	Commercial/Industrial	DSM Plan
Residential Demand Response	Residential	DSM Plan
Residential Battery Demand Response	Residential	DSM Plan
Geo-targeting	All classes	DSM Plan

DR products and pilots will contribute to both energy and demand savings. Demand savings will count towards total controllable load goals.

The intent of these products and pilots is to (1) minimize increased load adjustments until such time as there is an identified resource need and (2) pilot new approaches so that they could be in place as a need is realized. Pilot products in 2017 and 2018 are aimed to define the magnitude of potential peak capacity available during specific intervals.

## **B. Targets, Participants & Budgets**

### Targets and Participants

DR targets are forecasted differently than energy efficiency, as such, the tables below represent the incremental demand reduction estimates for the years 2019 and 2020. Tables 18a and 18b summarize the incremental controllable load expected from ISOC. Tables 19a and 19b, summarize DSM products and pilots that will contribute to demand reduction, as shown in the Plan's Executive Summary.

**Table 18a: 2019 Demand Response Incremental Load for Non-DSM Programs**

<b>2019</b>	<b>Marketing &amp; Admin. Budget</b>	<b>Net Gen. MW</b>
ISOC	\$500,000	1.00
<b>Total</b>	<b>\$500,000</b>	<b>1.00</b>

**Table 18b: 2020 Demand Response Incremental Load for Non-DSM Programs**

<b>2020</b>	<b>Marketing &amp; Admin. Budget</b>	<b>Net Gen. MW</b>
ISOC	\$500,000	0.00
<b>Total</b>	<b>\$500,000</b>	<b>0.00</b>

**Table 19a: 2019 Demand Response Incremental Load for DSM Products & Pilots**

2019	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Demand Response Program</b>				
Critical Peak Pricing Pilot	\$58,400	5,588	0	
Geo-targeting Pilot - DR	\$78,189	0	0	12.37
Peak Partner Rewards	\$1,725,420	12,000	0	
Residential Battery Demand Response	\$323,500	389	-16,752	1.55
Residential Demand Response	\$13,133,000	14,517	53,834	1.83
<b>DR Program Total</b>	<b>\$15,318,509</b>	<b>32,494</b>	<b>37,082</b>	<b>1.75</b>

**Table 19b: 2020 Demand Response Incremental Load for DSM Products & Pilots**

2020	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio
<b>Demand Response Program</b>				
Critical Peak Pricing Pilot	\$66,000	5,588	0	
Geo-targeting Pilot - DR	\$309,067	0	0	0.83
Peak Partner Rewards	\$1,725,420	20,000	0	
Residential Battery Demand Response	\$365,500	389	-16,752	1.51
Residential Demand Response	\$13,339,940	14,517	53,834	1.83
<b>DR Program Total</b>	<b>\$15,805,927</b>	<b>40,494</b>	<b>37,082</b>	<b>1.68</b>

The Commission-approved demand response goals<sup>93</sup> are cumulative (total controllable load) demonstrating the total peak capacity the Company could make available during a control event (as shown in the Table 20). The Commission-approved demand response goals will be used to inform the Company’s next Electric Resource Plan.

**Table 20: Demand Response Goals – Total System Controllable Load**

2019	2020
465 MW	476 MW

Budgets

Budgets for demand response efforts are anticipated to fall outside of our energy efficiency budget. The budget is a small increase from expenditures on existing DR products, however, an overall increase in budget for DR overall due to piloting opportunities. For 2019/2020, DR budgets were developed using the same well-defined process as all other energy efficiency

<sup>93</sup> DR goals were established by the Commission in Decision No. C14-0731 (Proceeding No. 13A-0686EG), Paragraph 60.

products. Budgets are based on incremental program load, with the exception of Residential Demand Response and Residential Battery Demand Response, which includes ongoing incentives.

### **C. Application Process**

Application processes vary by product. See individual product summaries following this overall for more information.

### **D. Marketing Objectives & Strategies**

For commercial and industrial offerings, outreach and marketing efforts are primarily conducted through internal teams such as the Account Management team. However, in 2019, the Company expects to retain the services of a third-party to aid in the recruitment of customers for its demand response offerings. This implementer will focus on underserved areas and those customers that do not have a managed account.

For residential offerings, marketing and outreach is primarily conducted through direct contact such as emails or direct mail. In addition, the Company has been working with manufacturers, such as thermostat and battery manufacturers, to further encourage customers to enroll in demand response products.

### **E. Program-Specific Policies**

There are no DR Program-specific policies. Individual DR products may have unique policies as noted in each of the product summaries that follow.

### **F. Stakeholder Involvement**

Demand Response efforts will follow the same process for stakeholder engagement as energy efficiency products, within the DSM Roundtable when filed originally within the DSM Plan.<sup>94</sup> DR efforts are also discussed with stakeholders during other proceedings such as our Energy Resource Plan. Beyond the DSM Roundtable and various proceedings, program managers individually involve trade allies, manufacturers and other groups in the development of products.

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<sup>94</sup> The ISOC product was originally filed outside of the DSM Plan, and therefore will not be included in the DSM Roundtable process.

## **G. Rebates & Incentives**

DR products offer annual or event-oriented incentive payments to participating customers rather than traditional one-time rebate payments. Incentive structures vary by product.

## **H. Evaluation, Measurement, & Verification**

The impacts from the Company's Demand Response programs are analyzed annually. Public Service's load research organization leads an annual research project to evaluate the controllable system load available from our Saver's Switch and ISOC programs. This analysis includes all program participants still active in each program. For the Saver's Switch program the team hires a consultant—that specializes in load research—to conduct the data gathering and most of the analysis on a sample of program participants. For the ISOC program, data is recorded. The results are used to document the extent of load relief achieved during each actual control event occurring within the year. The amount of available total controllable system load is determined by this analysis twice annually in early spring and late summer.

The amount of available total controllable system load is made up from the cumulative historical achievement of incremental participation reported in past Status Reports. This available total controllable system load will differ from the sum of the incremental generator kW achievements reported in past Status Reports due to various reasons, as mentioned above, including but not limited to:

- *Load Loss:* Within DR programs there are factors we define as a “load loss pool.” This pool includes customers who choose to discontinue participation as well as those who adjust their commitment to a lower load reduction in the ISOC program.
- *Regulation:* EPA rules, historically, can have an impact on the participation within the ISOC program. Recently, backup generation rules resulted in a significant drop of load from this program.
- *Savings Estimates:* The Saver's Switch component of the Residential Demand Response product assumes a deemed controllable system load per switch estimate in Status Reports. The actual controllable system load can vary over time. The Company uses data logging on a sample of installed Saver's Switches to identify the available system controllable load per switch. These data loggers record the actual load of the air-conditioning units controlled by the installed switches. This recorded load is used to estimate the available system controllable load at typical system peaking conditions. This estimated available system controllable load can vary over time due to changes in air conditioner efficiencies and residential conservation efforts. Additionally, performance of the switches varies over time due to the disconnection or mechanical failure of switches.

The results of the annual analysis of the impacts from the Company's Demand Response program is combined with a forecast of the future participation in each DR product to produce a forecast of the total controllable system load expected in the future, referred to as the Load Management Forecast. The Company uses this annual analysis, combined with the actual

participation in each DR product, to determine the achievement of total system controllable load goals in annual Status Reports.

Pilot programs include their own M&V procedures and are discussed in detail within the individual pilot write-ups.

## ➤ Critical Peak Pricing (CPP) Pilot

### A. Description

The Critical Peak Pricing (CPP) pilot product is a tariff rate that was introduced through Public Service's 2016 Phase II rate case.<sup>95</sup> Price signals can be used to provide an incentive to reduce system costs, including reducing system peak, ultimately reducing costs for all customers. Tariffs focused on the reduction of system peak.

Critical Peak Pricing programs attempt to strongly encourage – rather than require – customers to reduce their usage during periods when forecasts indicate the electric grid will experience high system loads as a percentage of available generation capacity. The nomenclature “critical peak” is a reference to such periods. The term “pricing” indicates that, rather than requiring load reductions, the Company will charge a high price for usage during these hours that will encourage customers to reduce their usage. During all other hours customers are assessed much lower charges.

The CPP tariff would be available to commercial and industrial (C&I) customers who have existing interval metering. The CPP offering will; provide an additional customer choice, provide customers an opportunity to reduce their bill by managing their energy usage, and contribute to reducing system costs by reducing system peak via the response price signals. This pilot provides an alternative for customers who cannot, or chose not to participate in the Company's other DR programs such as ISOC.

Participating customers will receive day-ahead notification of when “critical peak” days will occur. Critical peak events will be no more than four hours in duration. These events will always occur on non-holiday weekdays between the hours on noon and eight p.m. A maximum of 15 events can be called in any calendar year.

To better manage their energy usage during peak events participants will be provided with access to their electric load profile data in near real time. Access to this data will not only allow participants to monitor their performance during events, but also provide insight into their energy use throughout the year.

The CPP tariff is designed to be “revenue neutral” for the class average customer. That means a customer with the average load profile within a given rate class would pay the same amount for electricity on an annual basis whether they were on the standard rate or the CPP rate if they do not modify their consumption during peak days. This design provides a strong incentive for reducing usage with little inherent risk of an overall increase in electric bills.

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<sup>95</sup> See Proceeding No. 16AL-0048E.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The CPP rate will be targeted to larger C & I customers with the sophistication to manage or ability to curtail their energy consumption. Customers would be recruited by the Company. Market segments which may be interested in this pilot include:

- Manufacturing – ability to curtail a line or process during an event;
- Office (commercial, institutional, etc.) – ability to pre-cool, adjust HVAC settings and shed discretionary loads; and
- Water/wastewater treatment – ability to shift process times.

As this is a pilot enrollment will be limited to 30 MW of capacity as measured by totaling the participant's annual peak demand. For the 2019/2020 Plan the Company anticipates approximately 30 participants for demand reduction of 5 MW.

### Budgets

All administrative and implementation costs are included in the annual budget. Unlike other DSM products there is no monetary incentive associated with this pilot. Pilot costs are attributed to the following areas:

Administration – This category covers costs associated with day-to day operations of the pilot as well as monitoring equipment at the participant's facility.

Advertising & Promotion – This category is for marketing campaigns and associated collateral.

M & V – Measurement and verification of pilot performance will largely be automated through the Company's Demand Response Management System (DRMS). Periodic sampling of participant's data will be done to insure automated processes are performing correctly.

## **C. Application Process**

Account Management will act as the primary channel for delivering this pilot to market. Account Managers will discuss the CPP tariff option with customers. Those customers wishing to participate will request to be placed on the new tariff. After verifying with the Program Manager whether there is available capacity remaining, the Account Manager will initiate the tariff change for the customer.

Once a customer has elected to be on the CPP tariff, monitoring equipment will be installed to provide the participant with near real time access to their load profile data. Though each participant's configuration may vary depending on their unique circumstance, in general this equipment will consist of a "pulse" device to transmit data pulse outputs from the customer's revenue meter and a data logger to record and translate the pulse outputs and communicate this data back to the Company's DRMS. This process is estimated to take 60 days.

## **D. Marketing Objectives & Strategies**

A critical part of the pilot's success will be the Company's ability to locate potentially eligible customers, assist them in becoming a part of the pilot. A qualification of this pilot is the existence of interval metering. This customer base is made up primarily of "managed accounts". Potential customers will be contacted by the Company to discuss the pilot. The objective of the meeting is to introduce the customer to the pilot, discuss tariff requirements, and assist the customer in identifying controllable loads which could be shed during a critical peak event.

Marketing and communication materials will be created to communicate the features and benefits of the pilot. These will include a rate evaluation tool which Account Managers can use to help customers evaluate whether the CPP rate offers them potential savings opportunities.

A key asset enabling this pilot is the Company's DRMS. This system provides the platform from which all its demand response products are managed. In addition to managing events and providing customer notification the system will provide pilot participants with near real time access to their load profile data. Having this data will allow participants to manage their energy use during events to help them maximize their savings.

Overall pilot success will be tracked and managed by a designated program manager. This individual will work with account managers to insure pilot participation and demand response capacity forecasts are being met. The program manager will work with additional internal employees including product developers, marketers, technicians, and other Program Managers to track the progress of the pilot and meet the pilot's goals and objectives. This goal measurement process consists of monitoring several indicators, including the number of customers participating, event load reduction data, forecasting demand response capacity expected during events, and calculating rate savings being achieved by participants.

The CPP pilot will require the need for ongoing customer support and communication to insure the pilot delivers reliable results year over year. Therefore marketing is a continuous process—not a single event—which includes initial discussion to recruit participants, then ongoing communication to ensure customers know and can continue to evaluate the benefits of the pilot in order to retain these customers, and ongoing communication/education about how the pilot works.

## **E. Product-Specific Policies**

### *Qualification:*

CPP is available to all Colorado business customers receiving electric service under Schedule SG, PG, or TG with the following qualifiers:

- Customers must have existing interval metering;
- Customer's load factor for the previous 12 months is 30% or greater. Load factor (LF) is calculated as the customer's total annual usage in kWh divided by the product of the

customer's annual peak demand in kW times 8,760. ( $LF = kWh_{\text{annual}} / (kW_{\text{peak}} \times 8,760)$ ); and

- Customer's average monthly peak demand in the summer (June through September) is equal to or greater than the customer's average monthly peak demand in non-summer months (October through May).

The pilot will be limited to a total capacity of 30 MW as measured by aggregating the annual peak demand of each participant. Limiting the pilot in this manner provides the Company the opportunity to study the impact of CPP on system peak demands and base revenues before extending it more broadly.

*Contract Term:*

There are no contracts associated with this pilot other than the associated tariff. A minimum period of one year participation is stipulated within the tariff. The customer may elect to leave the tariff for after 12 months and revert to their original rate plan.

*Events:*

Critical Peak Pricing events are triggered whenever forecasts indicate the electric grid will experience high system loads as a percentage of available generation capacity. Based on historical system peaking conditions, events are most likely to be called during the summer months of June through September, but events may occur in any month throughout the year.

Events may be called between the hours of noon and 8:00 p.m. MST. Events will be no less than one hour duration and no more than four hours duration within this time period. Customers will be subject to no more than one event in any 24 hour period. No individual customer will experience more than 15 events per calendar year, for a maximum of 60 critical peak hours per year.

*Load Reductions:*

Load reduction will be determined by dividing the total energy reduced during the event period as measured in kWh by the number of hours in the event. Energy reduction will be calculated by subtracting the customer's actual usage during an event from the customer's baseline consumption for the same time period. The aggregate of participant's load reductions during critical peak events will be used to determine the amount of demand response provided by the pilot. Initially this amount has been estimated at 20% of the participant's peak demand based on the Company's investigation of similar programs from other utilities. As results from actual events become available the DR estimates can be adjusted to align with actual expected performance. The Company will create a seasonal DR forecast for the pilot to account for differences in participant's savings throughout the year.

*Baseline Consumption:*

For purposes of determining a participant's load reduction the customer's load during an event will be compared to the customer's baseline load. The baseline methodology being proposed for this pilot is an adaptation of baseline calculations the Company has used in other products. Public Service updated its historical approaches by reviewing "Measurement and Verification for Demand Response" (2013). This document, commissioned by the National Action Plan on

Demand Response Measurement and Verification Working Group, focuses on providing “best DR M&V practices in various market and program contexts.” This report provided valuable context on different baseline approaches, and a number of recommendations contained within the report have been incorporated into the baseline.

Specifically for this pilot, the baseline usage for any 15 minute interval during an event will be calculated as the average of the measured demand during the same interval of the customer’s five (5) highest energy consumption days within the last ten (10) non-holiday, non-weekend, non-event days.

An event day correction will be made to each 15 minute interval during the event to reflect the impact of weather or other operational changes which could cause substantive differences between the event day and the baseline calculation. This event day correction will be the average 15 minute kW difference between the baseline calculation and the participant’s actual load during the hour prior to event notification.

As customer baselines are inherently unobservable, one cannot measure usage which never took place, a poor baseline methodology can lead a systematic bias. To help mitigate this problem, Public Service will regularly evaluate baseline calculations. This can be done by selecting sample participants, calculating their baseline consumption for a simulated event day, and evaluating the difference between the calculated baseline and actual loads. Should these simulations show significant bias that is leading to inaccurate baseline assumptions, then Public Service will develop and recommend changes to the baseline methodology. It is proposed that such an evaluation may be done annually prior to the summer event season. Should any changes be warranted, updates to the pilot would be made through a 60-Day Notice.

*Incentives:*

CPP participant’s “incentive” is the opportunity to save money by reducing usage during high priced critical peak events. Additionally, participants will receive the benefit of having access to their electric load profile data in near real time. Access to this data will not only allow participants to monitor their performance during events, but also provide insight into their energy use throughout the year. Data will be provided in “near real time” with updates occurring at least every fifteen minutes through a customer portal feature of the Demand Response Management System (DRMS). Performance data will be available to individual participants through the customer portal feature of the DRMS. Customers can view their usage at any time using their unique username and password to log into the system.

*Notification:*

Participating customers will receive advance notice of events. Notifications will be delivered a minimum of 22 hours prior to an event and always during normal business hours between 8:00 a.m. and 5:00 p.m. MST. Notifications will be sent to the customer’s designated contact(s) via e-mail, text, voice message, or combination thereof as specified by the customer. Customers are responsible for insuring contact information is kept current and notifying the Program Manager if any changes are necessary.

## **F. Stakeholder Involvement**

Pilot development outreach included representatives from the Southwest Energy Efficiency Project (SWEET), Western Resource Advocates (WRA), Office of Consumer Council (OCC), and Colorado Public Utilities Commission Staff. The Company will continue to meet and interact frequently with these stakeholders at forums such as the quarterly DSM Roundtable and encourages their input.

## **G. Rebates & Incentives**

As previously mentioned there are no rebates or incentives associated with this pilot comparable to other DSM products. The CPP pilot participant's incentive is avoiding high priced energy charges during critical peak periods. These charges were established through the CPP tariffs approved as part of the Company's 2016 Phase II rate case. During critical peak periods participating customers will be charged the following based on their respective rate class:

SG-CPP	\$1.50/kWh
PG-CPP	\$1.35/kWh
TG-CPP	\$1.25/kWh

These rates were established in order to provide a strong incentive for customers to reduce their usage during these critical periods. Additionally the Company believes customers must see the opportunity to make a substantial impact on their annual electric bill to entice their participation. As CPP events are limited to 60 hours a year the effective price per kWh was set quite high to present an opportunity for substantial bill savings. At these price points, with an estimated usage reduction of 20% during peak periods, annual bill savings of between 5%-10% could be obtained.

Furthermore, participants face limited risk of increased electric bills as compared to the standard tariff as the CPP rates are designed to be revenue neutral on an annual basis.

## **H. Evaluation, Measurement, & Verification**

The Company will collect interval data from each participant in the pilot from monitoring equipment installed as part of enrollment and/or interval data metering installed as part of their regular electric service. This data will be stored and analyzed within the DRMS. Pilot performance for each event will be calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window. The amount of demand reduction supplied for a given event is calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window. This calculation, both on the portfolio level and for individual customers, will be automated through the functionality of the Company's DRMS.

## ➤ **Interruptible Service Option Credit**

### **A. Description**

The Interruptible Service Option Credit (ISOC) product offers significant savings opportunities for Public Service's business customers who can reduce their electric demand when notified. In return for participating, customers receive a monthly credit based on the notification option and total interruption hours they select.

During periods of peak demand, such as hot summer days, the system may require more power than is normally available. By participating in this program, ISOC customers help reduce the amount of electricity needed, which helps Public Service meet electric system requirements at critical times.

The product is a tariff rate approved by the Colorado Public Utilities Commission,<sup>96</sup> and is available to commercial customers in Public Service's electric service territory. To qualify, customers must have an interruptible demand of at least 300 kilowatts (kW) during the months of June, July, August, and September. In addition, the customer must have a Contract Interruptible Load (CIL) of 300 kW or more.

The customer's contracted interruptible load is the median of their maximum daily 1-hour integrated demands, which occurred between noon and 8 p.m. on Monday through Friday (excluding holidays); from June 1 through September 30 of the previous year. In addition, their interruptible demand is the maximum daily integrated demand used during the month that occurred each day between noon and 8 p.m., less any firm demand. Customers must install a phone line that is connected to their meter - this will allow Public Service to provide near real-time usage information.

The participating customer signs a contract that includes their selected firm demand, the hours of interruption per year, and their advance-notice requirement. Customers can use electricity as usual until Public Service notifies them of a control period. The Company will give advanced notice before requiring the customer to curtail electricity use. Then, during the interruption period, customers cut their electricity use down to the firm demand chosen in their program agreement.

Customers choose the amount of interruption appropriate for their facility. The credit they receive is tied to the number of hours they contract to be interrupted each year and their advance notice option.

Interruption periods are triggered as a result of capacity, contingency and/or economic constraints. Economic interruptions are the only interruptions that offer the customer a buy-

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<sup>96</sup> Proceeding No. 07S-521E.

through option. All interruptions (events) last a minimum of 4 hours, unless the customer has chosen to waive the 4-hour minimum interruption timeframe.

The *Within-10-Minute Notice* option gives the Company the ability to reduce the amount of electricity available to the customer's facility; during economic events, it's up to the customer to take steps to reduce their load during control periods or buy through. If customers do not meet their agreed-upon load reduction, they will be charged penalties.

## **B. Targets, Participants & Budgets**

ISOC is available to all customers that qualify for the tariff. From a total demand credit budget perspective, dollars allocated for this initiative are based on the number of hours they contract to be controlled each year, and the amount of controllable load they have available.

As of June 1, 2018, there were 88 Public Service customers participating in the ISOC product. The Company anticipates the same business customers on the Within-10-minute notice option will continue to participate in the program in 2019 (the 1-hour notice option will be eliminated in 2019).

ISOC budget items include labor, equipment, and the development of marketing materials, such as customer ISOC User Guides (described in Section D below), as well as an annual training for customers and Account Managers to share updates on any enhancements or revisions to the product.

## **C. Application Process**

Account Managers play a vital role in communicating the benefits of this product to potential customers. They spend a great deal of time with the customer throughout the application process to ensure that the customer meets all the requirements of the product, and that all product information is understood. When customers decide to join the product, they will work with their Account Manager to determine the following:

### *Qualification:*

ISOC is available to all customers that qualify for the tariff rate. Prior to completing a contract, the customer must have a minimum of 300 kW of Interruptible Demand in each of the summer months of June, July, August, and September. Additionally, the customer's CIL for Planning Reserves must be greater than 300 kW. The Interruptible Demand and CIL figures must be reduced by any Contract Firm Demand the customer chooses.

### *New Within 10 Minute Notice contract term:*

The initial contract term for customers joining the program in 2019 and beyond shall be five years, with an 18-month termination notice requirement. Early termination penalties will be equal to 18 months of credits.

Trial Period Provision: There is a first-year trial period provision provided in the tariff (*for example:* If the customer signs-up for ISOC in April, the trial period will run from April through December of that year). If the customer chooses to cancel their agreement in the first year they can do so by returning all credits paid. Subsequently, the Company will return any capacity/contingency penalties and cancel the contract. This provision is only available to participants during the year in which the contract is signed.

*Grandfathered Within 10 Minute Notice contract term:*

Those customers enrolled by December 31, 2018, that commit the same kW load shed commitment for a period of ten years will receive a grandfathered credit rate but no additional application process is necessary. If grandfathered customers wish to leave the product, they will be required to provide the Company with three years' notice. If these customers wish to leave the product prior to the termination of their ten-year commitment, they will be subject to an early termination penalty that amounts to 36 months of credits.

*Contract Authorization:*

Once it is determined that the customer will qualify for the ISOC, an Interruptible Service Option Agreement will be executed. The Agreement must be approved by the customer and by an authorized representative of Public Service prior to May 31 for the customer to receive credits in that year.

## **D. Marketing Objectives & Strategies**

A critical part of the ISOC program's success is the Company's ability to locate potentially eligible customers, assist them in becoming a part of the product, and provide service according to the tariff. That process begins by running a query on the customer information system to locate business customers in the electric service territory that meet eligibility requirements for the ISOC product.

Potential customers that meet product eligibility requirements are contacted by an Account Manager, and a meeting is scheduled with interested businesses. The objective of the meeting is to introduce the customer to the various ISOC product options, and discuss product requirements and responsibilities.

In addition to this customer prospecting process, marketing and communication materials are created, and these materials are used to communicate the features and benefits of the program. These marketing materials include:

- The Interruptible Service Option Credit (ISOC) User Guide – Provided to customers as a valuable reference to navigating the Demand Response Management System (DRMS).
- ISOC Info Sheet – Summarizes the product's features and benefits, helps potential customers determine their qualification status, and outlines various control options and assists customers in understanding the savings they could realize by participating.

- ISOC Website – Extensive information is also included on the Xcel Energy website for current and potential customers.<sup>97</sup> The website is reviewed on a consistent basis to ensure the information is current.

Account Managers conduct outreach to potential customers utilizing the marketing and communications materials referenced above. The Account Managers play a crucial role by interacting with customers on a regular basis to ensure customer satisfaction.

A group of internal employees including analysts, Account Managers, product developers, marketers, technicians, and product managers are also continually working to track the progress of the program to meet the program goals and objectives. This goal measurement process consists of monitoring several indicators, including the number of customers participating, interruption data, MW available for control, and credit dollars.

Much of the effort for future ISOC marketing initiatives will involve working to target qualified customers and increase the level of communications to current and potential customers.

For a product of this nature, it is not only important to promote the product up-front, but customers also need ongoing support and communication. It should also be noted that we view marketing as a continuous process—not a single event—which includes initial discussion to recruit participants, then ongoing communication to ensure customers know and can continue to evaluate the benefits of the product in order to retain these customers, and ongoing communication/education about how the product works.

This effort includes pre-season communication and training, as well as during and post-control event communications and support. Marketing staff work to understand the various stages of any particular customer's interpretation of the product and provide materials and support necessary to ensure consistent and positive customer experience.

Marketing encompasses both solicitation communications and education, and also on-going product communication, including training to retain participant customers in support of achieving the capacity deferral benefit potential of the product, as captured in the Company's ISOC forecast.

## **E. Product-Specific Policies**

Beginning in 2019, all new contracts for service under this schedule shall be for an initial five-year term. New customers as of January 1, 2019, must provide the Company an eighteen-month advance notice in writing to cancel service under this schedule.

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[http://www.xcelenergy.com/Programs\\_and\\_Rebates/Business\\_Programs\\_and\\_Rebates/Rates/Interruptible\\_Service\\_Option\\_Credit](http://www.xcelenergy.com/Programs_and_Rebates/Business_Programs_and_Rebates/Rates/Interruptible_Service_Option_Credit)

Any time during the first year of service under the contract a customer may opt to cancel by returning all monthly credits received to date. No additional payment will be assessed.

Any customer who cancels service without complying with the Service Period requirements under this schedule shall be required to pay Public Service, as a penalty, an amount equal to the product of 110% times the customer's CIL times the customer's Monthly Credit Rate for each of the remaining months of the unexpired contract term.

In addition, the customer shall reimburse Public Service for the direct cost incurred for equipment to measure the customer's interruptible demand and to interrupt the customer.

## **F. Stakeholder Involvement**

Colorado business customers have played a major role in the on-going dynamics of this product. The Company continues to meet frequently and interact with these business customers to encourage their input.

## **G. Rebates & Incentives**

The monthly kW credit paid to customers as part of the ISOC product is calculated by multiplying the Monthly Credit Rate by the lesser of the customer's CIL or the actual Interruptible Demand during the billing month. The credits are a monthly credit to the customer's energy bill.

The Monthly Credit Rate is revised effective January 1 each year, and shall remain in effect for the calendar year. The Monthly Credit Rate will vary by season. The summer season runs from June 1 through September 30, and the winter season is October 1 through May 31.

The number of hours in the year that each customer elects as interruptible is set in the ISOC Agreement. The options include 40 hours, 80 hours, or 160 hours.

## **H. Evaluation, Measurement, & Verification**

The Company will collect interval data from each participant in the ISOC Program from monitoring equipment installed as part of product enrollment and/or interval data metering installed as part of their regular electric service. This data will be stored and analyzed within the DRMS. Performance data will be available to individual participants through the customer portal feature of the DRMS. Customers can view their usage at any time using their unique username and password to log into the system.

## ➤ Peak Partner Rewards

### A. Description

The Peak Partner Rewards product is a Demand Response product designed to provide Public Service's business customers an incentive for agreeing to reduce their electrical loads when the electric grid experiences peak demand periods. The product is similar in concept to the ISOC product, but is designed to be more flexible and target customers who are not currently eligible for ISOC. Customer incentives are outlined within a tariff which may be updated annually, allowing the Company to balance product cost effectiveness and customer participation.

Participating customers will sign a contract agreeing to reduce load at their facility during peak demand periods. This load will be determined by the customer based on their ability to manage operations within their facility, but must be at least 25 kW during summer months. Customers will receive a monthly credit (reservation incentive) based on this committed load reduction. During peak periods, customers will receive an additional incentive based on their total load reduction, measured in kWh, during the event (performance incentive). Customers who participate in the product will receive an additional benefit of having access to their electric load profile data in near real time. Access to this data will not only allow participants to insure they are complying with their contractual obligations, but also provide insight into their energy use throughout the year.

Peak periods (events) are triggered as a result of capacity, contingency and/or economic constraints upon the electrical system. All interruptions will last a maximum of 4 hours. Participating customers will receive at least one hour notice prior to an event. If customers do not meet agreed upon load reduction they will not receive their event payment and may be removed from the product.

Peak Partner Rewards is designed to price capacity at or below the cost of avoided capacity as defined within the 2019/2020 DSM Plan Cost Benefit assumptions. This means that purely on a capacity basis, the product should yield positive net benefits.

### B. Goals, Participants & Budgets

#### Targets and Participants

Peak Partner Rewards is available to all commercial customers who can commit to reducing their electric load by a minimum of 25 kW during summer months. Marketing of the product covers a diverse spectrum of commercial and industrial customers, ranging in size from greater than 1 MW to less than 100 kW.

For the 2019/2020 Plan the Company anticipates demand reduction of 32 MW.

## Budgets

Product costs are attributed to two primary categories; Marketing & Administration, and Participant Incentives:

Marketing & Administration – Administration costs cover several different activities as detailed below.

- Administration – This category covers costs associated with day-to day operations of the product. Included in this category are expenses for the third party implementer assisting with the product.
- Equipment & Installation – This category reflects the cost to purchase and install monitoring equipment at each participant’s facility. Expenditure is expected to be greatest in the early years of the product as the participant base is built. Future expenditures will reflect costs of growing the product incrementally and any ongoing equipment maintenance for current participants.
- Advertising & Promotion – This category is for marketing campaigns and associated collateral.

Participant Incentives – Participant incentives account for the majority of the product budget and include both a reservation incentive for contracted load reduction and a performance incentive for actual load reduction during event days.

## **C. Application Process**

Peak Partner Rewards is offered to business customers of all sizes. Therefore product marketing will be delivered through several channels; Account Managers for larger C&I customers (Managed Accounts), the Business Solutions Center for non-managed customers making inbound inquiries, and a third party implementer who will provide an additional resource to Account Managers and Business Solutions Center staff. Through these channels customers interested in the product will be guided through the following application details:

### *Qualification:*

Peak Partner Rewards is available to all business customers who can agree to reduce usage during the summer months, June through September, between the hours of 2:00 p.m. and 6:00 p.m. by a minimum of 25 kW.

### *Contract Term:*

The initial contract term shall be 24 months followed by an annual term that is automatically renewed each year. A sixty day written notice is required from the customer in order to cancel their participation. If the customer chooses to cancel their agreement in the first year they can do so by returning all credits paid. This provision is only available to participants during the year in which the contract is signed.

### *Contract Authorization:*

Once it is determined that the customer will qualify for Peak Partner Rewards, Peak Partner Rewards Product Agreement will be executed.

## **D. Marketing Objectives, Goals, & Strategy**

A critical part of the Peak Partner Rewards product's success is the Company's ability to locate potentially eligible customers, assist them in becoming a part of the product, and provide service according to the tariff.

Potential customers are contacted by an Account Manager or the implementation provider to discuss the product. The objective of the meeting is to introduce the customer to the product, discuss product requirements and responsibilities, and assist the customer in identifying controllable loads which could be shed during an interruption.

Marketing materials include a product guide summarizing key features and benefits and a Peak Partner Rewards website accessible on the Company's website to provide more extensive product information.

A key asset enabling this product is the Company's Demand Response Management System (DRMS). This system provides the platform from which all of the Company's demand response products are managed. In addition to managing events and providing customer notification, the system provides product participants with near real time access to their load profile data. Having this data allows participants to manage their energy use during events to ensure they comply with their contractual requirements as well as maximize their potential incentive.

The Peak Partner Rewards product requires the need for ongoing customer support and communication to ensure the product delivers reliable results year over year. Therefore marketing is a continuous process—not a single event—which includes initial discussion to recruit participants, then ongoing communication to ensure customers know and can continue to evaluate the benefits of the product in order to retain these customers, and ongoing communication/education about how the product works.

## **E. Product-Specific Policies**

### ***Qualification:***

Peak Partner Rewards is available to Public Service's firm rate Commercial and Industrial customers who are not currently under an existing interruptible contract (ISOC), Critical Peak Pricing tariff, or on a Standby Tariff. Participants must agree to reduce usage by a minimum of 25 kW during the summer months, June through September, between the hours of 2:00 p.m. and 6:00 p.m. Although no minimum or maximum customer size is required, the product is focused on providing an option to customers with smaller loads who do not qualify for the ISOC tariff.

### ***Events:***

Demand response event periods are triggered as a result of capacity, contingency and/or economic constraints upon the electrical system. Based on historical system peaking conditions, events are most likely to be called during the summer months of June through September, but events may occur in any month throughout the year.

Events will be no less than one hour in duration and no more than four hours in duration. Customers will be subject to no more than one event in any 24 hour period. No more than 15 events would be called for any one customer during a given year (60 total event hours).

In addition to events called for a specific need, each customer may be subject to up to two test events each calendar year. The purpose of test events is to insure participants are able to deliver the load reductions committed. Participants will receive the same incentive for test events as for actual events.

Should a capacity or contingency situation arise outside of the prescribed hours of 2:00 p.m. to 6:00 p.m., product participants may be notified and asked to curtail load on a “best effort” basis. The customer will be under no obligation to reduce load, but those able to participate will be compensated for energy reductions at the tariffed incentive level.

***Contracts:***

*Term* - All contracts for service under this schedule shall be for an initial two-year term, with automatic one-year renewal terms. A customer must provide Public Service a sixty day advance notice in writing to cancel.

*Load Reduction Obligation* – Each participating customer will be responsible for reducing their facilities load during an event by an amount equal to or greater than that designated within their contract. Participants will designate their load reduction obligations, in terms of kW, by calendar month. The kW commitment can vary each month and may be a zero kW commitment, however during the summer months of June through September the participants commitment cannot be less than 25 kW.

Load reduction during an event will be determined by taking the total energy reduction during the event period as measured in kWh and dividing by the number of hours in the event. Energy reduction will be calculated by subtracting the participant’s actual usage during an event from the participant’s baseline consumption for the same time period. The customers minimum hourly load reduction must be no less than the kW stipulated within the participant’s contract.

*Baseline* – For purposes of determining a participants load reduction the customers load during an event will be compared to the customers baseline load. A description of the baseline methodology is provided later in this document.

*Penalties* - If a participant does not meet or exceed their contractual obligation they will not receive payment of their performance incentive. If a participant fails to meet their contractual obligation during two events within the same calendar year they will be dropped from the product. Should a participant elect to leave the product during their initial two-year contract term, a one-time fee of \$500 will be assessed to cover costs associated with decommissioning hardware supplied to the participant for this product.

***Incentives:***

Customers will receive three distinct incentives for their participation:

*Reservation Incentive* – The customer will receive a credit on their monthly bill for the capacity they have agreed to supply within their contract. This incentive is designed to keep customers committed to the product over the long term.

*Performance Incentive* – Participants will receive an additional incentive based on actual performance during events. This is designed to help insure customers meet their obligation during actual events. The incentive is based on a participants total energy reduction during the event period.

*Load Profile Data Access* – Customers who participate in the product will receive an additional benefit of having access to their electric load profile data in near real time. Access to this data will not only allow participants to insure they are complying with their contractual obligations, but also provide insight into their energy use throughout the year. Data will be provided in “near real time” with updates occurring at least every fifteen minutes through a customer portal feature of the DRMS. Performance data will be available to individual participants through the customer portal feature of the DRMS. Customers can view their usage at any time using their unique username and password to log into the system.

***Notification:***

Participating customers will receive advance notice of events. Notifications will be delivered a minimum of one hour prior to an event and will include the event start time, duration of event, and event end time. Notifications will be sent to the participating customer’s designated contact(s) via e-mail, text, voice message, or combination thereof as specified by the customer. Customers are responsible for ensuring contact information is kept current and notifying the Product Manager if any changes are necessary.

***Baselines:***

For purposes of determining a participants load reduction the customers load during an event will be compared to the customers baseline load. The baseline methodology being proposed for this product is an adaptation of baseline calculations the Company has used in past products. Public Service updated its historical approaches by reviewing “Measurement and Verification for Demand Response” (2013).<sup>98</sup> This document, commissioned by the National Action Plan on Demand Response Measurement and Verification Working Group, focuses on providing “best DR M&V practices in various market and product contexts.” This report provided valuable context on different baseline approaches, and a number of recommendations contained within the report have been incorporated into the baseline.

Specifically for this product, the baseline usage for any 15 minute interval during an event will be calculated as the average of the measured demand during the same interval of the customer’s

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<sup>98</sup> <https://www.ferc.gov/industries/electric/indus-act/demand-response/dr-potential/napdr-mv.pdf>

five (5) highest energy consumption days within the last ten (10) non-holiday, non-weekend, nonevent days.

An event day correction will be made to each 15 minute interval during the event to reflect the impact of weather or other operational changes which could cause substantive differences between the event day and the baseline calculation. This event day correction will be the average 15 minute kW difference between the baseline calculation and the participant's actual load during the hour prior to event notification.

As customer baselines are inherently unobservable, one cannot measure usage which never took place, a poor baseline methodology can lead a systematic bias. To help mitigate this problem, Public Service will regularly evaluate baseline calculations. This can be done by selecting sample participants, calculating their baseline consumption for a simulated event day, and evaluating the difference between the calculated baseline and actual loads. Should these simulations show significant bias that is leading to inaccurate baseline assumptions, then Public Service will develop and recommend changes to the baseline methodology. Such an evaluation may be done annually prior to the summer event season and should any changes be warranted updates to the product would be made through 60-Day Notice.

## **F. Stakeholder Involvement**

The Company has consulted with representatives from the Southwest Energy Efficiency Project (SWEEP), Western Resource Advocates (WRA), Office of Consumer Council (OCC), and Commission Staff. The Company will continue to meet and interact frequently with these stakeholders at forums such as the quarterly DSM Roundtable and encourages their input.

## **G. Rebates & Incentives**

The Peak Partner Rewards product was designed to price capacity at or below the avoided costs used within this DSM Plan. This results in a product that, on a capacity basis, always yields positive net benefits. Incentive values are to be identified within the Peak Partner Rewards tariff which will be filed separately.

**Reservation Incentive** – The Reservation Incentive is a monthly kW credit calculated by multiplying a capacity payment by the participant's contractual summer load reduction obligation.

**Performance Incentive** – The performance incentive is calculated by multiplying an energy payment by the participants total energy reduction during the event period. The energy payment does not necessarily reflect the anticipated marginal cost of energy during event periods. Its value is established to provide participants a compelling incentive to perform during demand response events.

## **H. Evaluation, Measurement, & Verification**

The Company will collect interval data from each participant in the Peak Partner Rewards Product from monitoring equipment installed as part of product enrollment and/or interval data metering installed as part of their regular electric service. This data will be stored and analyzed within the DRMS. Product performance for each event will be calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window. The amount of demand reduction supplied for a given event is calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window. This calculation, both on the portfolio level and for individual customers, will be automated through the functionality of the Company's DRMS.

## ➤ Residential Battery Demand Response Pilot

### A. Description

#### Background

Batteries are quickly emerging as an important component of the electricity system. A growing number of utilities have signaled their interest in batteries through pilots and resource solicitations. The Company, for example, recently proposed the acquisition of 275 MW of batteries through its latest resource solicitation.<sup>99</sup> Similarly, customers are beginning to make investments. California customers have led the way with nearly 100 MW of installations since the beginning of 2016.<sup>100</sup> The Colorado market is also showing signs of growth. In 2017 and 2018, residential Public Service customers installed nearly 100 batteries (approximately 500 kW of capacity) and there are 200 more applications in the interconnection process.

Batteries can perform multiple functions for the customer and the grid. A battery can provide back-up power to a customer's critical energy uses during a grid outage, while also helping to manage energy costs when paired with time-of-use or demand rates. From the grid perspective, a battery sited at a customer location could deliver system peak load reduction, support local voltage management, and/or provide renewable integration to name just a few.<sup>101</sup>

The Company proposes the Residential Battery Demand Response pilot to test how battery technology could contribute to the grid. In the pilot, the Company partners with early adopters that are already installing battery technology. These early adopters afford the Company a unique opportunity to leverage ongoing customer and third-party investment to test batteries more quickly, and at a lower cost, in order to build the expertise and experience necessary to develop scalable products in the coming years.

#### Pilot Description

The Residential Battery Demand Response pilot seeks to address three research areas: (1) integration of batteries into utility systems, (2) battery performance, and (3) customer preferences.

*Integration of batteries into utility systems:* The pilot seeks to integrate a set of batteries from two or more technology vendors<sup>102</sup> into its Demand Response Management System

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<sup>99</sup> See Proceeding No. 16A-0396E.

<sup>100</sup> GTM Research and Energy Storage Association. (2018). *U.S. Energy Storage Monitor: Q2 2018 Full Report*.

<sup>101</sup> Several organizations have provided a comprehensive accounting of the potential functions a battery can provide, for examples see: National Renewable Energy Laboratory. (2016). *Batteries 101 Series: Use Cases and Value Streams for Energy Storage*. Retrieved from <https://www.nrel.gov/technical-assistance/blog/posts/batteries-101-series-use-cases-and-value-streams-for-energy-storage.html> and Rocky Mountain Institute. (2015). *The Economics of Battery Energy Storage*.

<sup>102</sup> The Company uses "Technology Vendor" to refer to the entity that either pre-sets the battery equipment to participate in the pilot or operates and maintains software and communications that

(DRMS). The DRMS can streamline the integration and use of batteries by making it easier to gather data from individual batteries and send DR instructions back to the batteries.

*Battery performance:* The Company will assess the availability of batteries for demand response. In addition, the pilot will evaluate the quantity of demand response offered from a battery and the response speed during a series of year-round demand response events. The Company's assessment of availability and performance is critical in determining expected performance of the technology and ultimately assessing the level of compensation to be offered to future customers.

*Customer preferences:* Customers can choose to use their battery in ways that provide benefits solely to the battery customer (e.g., back-up power), to the grid, or both. The pilot will explore customer interest in allocating a portion of their battery to support the grid.

To achieve these objectives, the pilot will focus on a simple incentive structure. Customers who agree to participate in the pilot will receive an upfront rebate along with an ongoing monthly bill credit during the pilot. In exchange for those incentive payments, a customer will agree to allow the utility to use 50% of the battery's available capacity for up to 100 events per year. To manage pilot costs, the Company will select a small number of technology vendors for participation.

The Company will use participant batteries to test how a battery performs as a (DR) resource. The Company will call events that will result in the discharge of the battery over the duration of the event. The amount of DR from each battery will be governed by the customer's interconnection agreement<sup>103</sup>—with some customers able to discharge all available capacity and other customers limited to discharging an amount not to exceed their onsite electricity demands.

This pilot expands on common residential DR practices. Existing products, such as AC Rewards and Saver's Switch®, only operate during the summer months when there is air conditioning load. As a result, the Company's period to call events is limited. Unlike air conditioning-based control strategies, batteries can provide demand response year round, and the regular use of a battery does not have the potential to affect the customer's comfort in any way. As a result of these differences, a battery can be used more frequently and for more purposes.

Approximately half of the proposed DR events will provide regular peak-load reduction during the summer months. The remainder of events will be spread across non-summer months to

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directly control the battery on behalf of the Company. Examples of Technology Vendors include Sonnen, SolarEdge, Sunrun, and Tesla.

<sup>103</sup> The Company offers several interconnection options for customers seeking to connect a battery to the grid behind their meter. Some of these options allow a customer to export energy from the battery to the grid. Other options do not allow for export. To review these interconnection standards, see Storage Guidance 1, Storage Guidance 2, and Storage Guidance 3 on Xcel Energy's "How to Interconnect" webpage ([https://www.xcelenergy.com/working\\_with\\_us/how\\_to\\_interconnect](https://www.xcelenergy.com/working_with_us/how_to_interconnect)).

provide afternoon capacity during days when wind production is below average. In addition, in non-summer months, the Company may reserve one spring or fall month to perform a solar time-shifting function, where the battery charges with solar in the middle of the day and discharges in early evening. The solar time-shifting function is aimed at the distribution system, and could become useful in the future as rooftop solar adoption continues to grow.<sup>104</sup>

To execute these events, the Company's DRMS will send a secure signal to a participating vendor's network operating center. The vendor will then communicate instructions to each battery through the internet or the vendor's preferred communications path to the battery.

## **B. Targets, Participants & Budgets**

### Targets and Participants

The Company will target existing residential customers with batteries that have interconnected in a way that allows the battery to operate in parallel with the grid. This pool of customers is limited to systems interconnected after January 1, 2017, since any systems interconnected before that time were not permitted to operate in parallel with the grid. In addition to existing battery customers, the Company will also partner with installers<sup>105</sup> to inform new customers that are considering battery purchases. Any customer that purchases or leases a system using an approved vendor technology, regardless of who installs their system, will be eligible to participate in the pilot.

The pilot will target participation from up to 500 residential customers. This number is based on forecasts of total residential market size in Colorado from Greentech Media.<sup>106</sup> A pilot of this scale will have a better chance of attracting interest and participation from vendors and yielding more diverse information about customers and different battery types. The Company's achievement of this level of customer participation in the pilot will be partly determined by whether installers are able to continue to sell battery systems in the volumes achieved since the beginning of 2017.

### Budgets

The largest share of the budget is for rebates and incentives. Administrative expenditures are associated with vendor selection, promotion and vendor partnerships to capture participants, monitoring and management of enrolled battery systems during demand response events. The

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<sup>104</sup> The solar time shifting function is typically aimed at customer's that have both on-site solar and storage. However, it may also be deployed to stand-alone battery customers, by charging and discharging the battery at times that reflect the same dynamics that occur for customers with on-site solar (when solar on the system is peaking, charge the battery, and when residential demand peaks, discharge the battery).

<sup>105</sup> "Installers" refer to the company that is installing the hardware at the customer's home. In some instances the installer is the same as the "Technology Vendor" that operates the battery (e.g., Tesla). In other instances, an installer is using hardware and software partly or wholly supplied by a Technology Vendor (e.g., Local solar installer chooses an LG Chem battery and a SolarEdge inverter that is operated by SolarEdge software).

<sup>106</sup> GTM Research and Energy Storage Association. (2018). *U.S. Energy Storage Monitor: Q2 2018 Full Report*.

Company also has inserted costs to integrate vendor technology into its DRMS and collect data from vendors and customers necessary to perform measurement and verification (M&V) of battery system performance.

### **C. Application Process**

A customer that would like to participate in the pilot will enroll through an online or paper-based enrollment process. The Company will ask for information necessary to validate that the customer and their technology is eligible to participate in the pilot. At this time, the customer would agree to terms and conditions associated with the pilot, including agreement to share data necessary for calling DR events and performing M&V. The Company will confirm a customer is eligible by verifying customer equipment has been installed and connected to a participating technology vendor's cloud service.

After eligibility is confirmed, the Company will mail a rebate check to the customer. In addition, the Company will set up its systems to provide the customer with a monthly credit for the duration of the pilot.

### **D. Marketing Objectives & Strategies**

The Company will use a targeted marketing approach that attracts existing battery customers into the pilot, while also informing prospective customers that are engaging with installers. The Company will prepare and use promotional materials through direct mail, email, and/or phone campaigns to existing battery customers. It will also seek to engage the small community of existing battery customers in more non-traditional marketing forms, such as meet-ups to discuss batteries and the pilot. In addition, the Company will develop a program webpage to explain the pilot and promote it to interested customers. To target prospective customers, the Company plans to educate installation partners and provide them with promotional materials.

The Company also intends to further collaborate and coordinate with technology vendors and installation partners to consider how they may directly promote the pilot to customers.

The Company will adapt its marketing tactics over the course of the pilot depending on pilot participation results.

### **E. Product-Specific Policies**

Batteries: Participation is open to customers that have onsite solar and battery storage or standalone battery storage. As of the end of the first quarter of 2018, combination solar and battery customers made up 84% of the customer-sited battery storage market in the Company's service territory. The emphasis on solar and battery storage customers allow the Company to focus its testing efforts on the largest part of the battery storage market in the state and test the interaction between solar and batteries.

Interconnection Agreement: Each customer participating in the pilot must have an interconnection agreement with Public Service that allows their system to operate in parallel with the grid. These interconnection agreements will dictate how the Company utilizes each customer’s battery in the pilot. For example, some agreements only permit a customer to use their battery to offset onsite electricity demand. For these customers, the Company will work with participating technology vendors to ensure a customer’s participation in the pilot does not violate the interconnection standard they have chosen to operate within.

Eligible Technology: The Company will select one or several approved technology vendors for participation in the pilot. The vendor selection process will primarily focus on the vendor’s capability to execute a demand response signal, whether the vendor is ready to integrate with the Company’s DRMS, and the number of existing or forecasted systems that the technology vendor expects to see installed in Colorado.

System Size: There is a wide range of battery sizes in the residential market today that range from one kWh up to tens of kWh. For this initial pilot, the Company is limiting participation to those customers that have batteries equal to or greater than five kWh.

Early Termination: The Company will include an early termination fee to discourage customers from accepting an upfront rebate and leaving the pilot before the Company is able to achieve its learning objectives. If a customer leaves the pilot before they have participated for a full year, the customer will be required to pay back the \$500 upfront rebate.<sup>107</sup> If a customer chooses to leave after one year of participation, there will be no early termination fee.

## F. Stakeholder Involvement

During the pilot development process the Company engaged numerous stakeholders to gather feedback and refine the pilot including the following events:

<b>Stakeholder Type/Group</b>	<b>Date</b>	<b>Description</b>
Demand Side Management Roundtable	February 15, 2018	<ul style="list-style-type: none"> <li>• Introduced pilot</li> <li>• Requested interested parties attend Existing/Future Programs and Grid Stakeholder Group for detailed pilot description</li> </ul>
Existing/Future Programs and Grid Stakeholder Group	February 23, 2018	<ul style="list-style-type: none"> <li>• Description of initial pilot concept</li> <li>• Feedback and discussion</li> </ul>
Existing/Future Programs	June 15, 2018	<ul style="list-style-type: none"> <li>• Further details on pilot</li> </ul>

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<sup>107</sup> The Company will consider a year of participation as one year from the date the Company verifies the Customer has an eligible system and approves a customer’s enrollment in the pilot.

and Grid Stakeholder Group		<p>concept, including initial plan for participation options and customer incentive levels</p> <ul style="list-style-type: none"> <li>• Feedback and discussion</li> <li>• Shared contact information and offered further discussions with any interested stakeholders</li> </ul>
Installers	Numerous	<ul style="list-style-type: none"> <li>• Multiple conversations with installers throughout the pilot design process covering program objectives and attributes</li> </ul>
Technology Vendors	Numerous	<ul style="list-style-type: none"> <li>• Multiple conversations with installers throughout the pilot design process covering program objectives, attributes, technical battery and software capabilities, and integration approaches</li> </ul>
Battery Customers	Numerous	<ul style="list-style-type: none"> <li>• Prior to product launch, the Company plans to discuss motivation for battery investment and feedback and interest in the pilot concept</li> </ul>

**G. Rebates & Incentives**

The Company will offer a combination of rebates and credits to participating customers. Upon signing up for the pilot, each customer will receive a rebate of \$500. During each month the customer participates in the pilot, they will also receive a \$10 credit on their bill.

The combination of an upfront incentive and an ongoing bill credit is meant to draw customers into the pilot, while providing ongoing value that keeps them invested in participating for the full pilot. The Company selected a total compensation that it thought could attract a customer who had made a multi-thousand dollar investment in their battery. The Company also considered

typical customer compensation in Company demand response products and the range of state and utility incentives for battery storage that exist nationally.<sup>108</sup>

The rebates and incentives are designed to attract participation for this particular pilot, and do not necessarily reflect the compensation level or structure for any future product.

## **H. Evaluation, Measurement, & Verification**

There are four components to the Evaluation, Measurement, and Verification plan for this pilot.

At and immediately after the time of enrollment in the pilot, the Company will perform the following three activities to better understand the customer's motivations for participating in the pilot and to validate their equipment:

- Desktop review: The Company reviews the installation to ensure that the installation matches the Company's expectation for the performance of the system.
- Sampling of onsite reviews: The Company performs site visits to make sure the physical interconnection is capable of performing the desired function. The number of site visits will scale up based on the number of participating customers and is based on achieving 90% confidence in battery installations. For example, if there are 100 pilot participants, the Company will visit between 20 and 40 sites.
- Enrollment survey: At the time of enrollment, the customer will complete a short survey explaining the customer's reasons for participating in the pilot.

During and at completion of the two-year pilot, the Company will estimate the demand response availability and performance of each battery system and compare the performance to initial estimates. The analysis will utilize data supplied by participating installers and vendors and taken from a combination of the inverter, current transformers, and utility metering.

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<sup>108</sup> The Company reviewed several battery incentive programs that included California's Self Generation Incentive Program, Maryland's Energy Storage Tax Credit Program, Jacksonville Electric Authority's Battery Incentive Program, and Green Mountain Power's Tesla program.

## ➤ Residential Demand Response

### A. Description

The Company's Residential Demand Response product contains two offerings:

- Saver's Switch
- AC Rewards

Both products seek to reduce system load by curtailing central air conditioners and are generally utilized on hot summer days when Public Service's load is expected to reach near-peak capacity.

#### Saver's Switch®

Saver's Switch offers residential participants a \$40 annual bill credit as an incentive for allowing the Company to control operation of their central air conditioners. Since the launch of Saver's Switch in 2000, Public Service has declared an average of seven control events per year. When a customer enrolls, a switch device is installed near the AC unit that can interrupt the operations of the compressor.

When activated, a control signal is sent to interrupt the customer's central air conditioning load during peak periods, typically between the hours of 2:00 p.m. and 7:00 p.m. on weekdays. The product has deployed switches with varying load control strategies:

- Switches installed prior to 2004 are cycled 15 minutes out of every 30 minutes (a 50% cycling strategy) during the control period.
- Switches installed after 2004 have utilized an "adaptive algorithm" cycling strategy. This strategy allows the switches to "learn" how a customer's air conditioning is being operated in order to achieve a 50% reduction in load. The newer switches generally provide greater load reduction per unit. Approximately 98% of the approximately 203,000 switches in the field (as of December 31, 2017) use the adaptive algorithm strategy.

Control events, normally last for about four hours on a control day and take place in the late afternoon or early evening. With the expanding participant population, Public Service has created sub groups of participants to enable the activation of less than the entire population at a time. This gives the Company flexibility to better manage peak demands on the system.

#### AC Rewards

Following a pilot in 2015 and 2016, Public Service launched the AC Rewards offering in July 2017. Like Saver's Switch, AC Rewards seeks to reduce AC load at peak times. But the methodology is different.

Customers can join AC Rewards by installing and enrolling a Wi-Fi enabled thermostat. Currently, certain devices from ecobee and Honeywell are eligible for enrollment. There are two channels for customers to join:

- Bring Your Own Thermostat (BYOT) – customers that already have a qualifying thermostat installed at their home can enroll it at a company provided portal. BYOT participants receive a one-time bill credit upon joining AC Rewards.
- Direct Install – for customers not comfortable installing their own device, the company can provide and install one free of charge.

In addition to discounts, bill credits and devices, customers receive an annual bill credit of \$25 for their participation.

In a control event, the Company communicates with the thermostat over the customer's Wi-Fi system and adjusts the set point by a few degrees. Customers have the ability to override control events by returning the device to a different set point. Currently, customers are not penalized for opting out of control events. However, the Company will monitor program performance over time and may make adjustments to incentives depending on how often events are overridden. The Company expects to experiment with different control approaches including event pre-cooling in the coming years to determine optimal operations.

## **B. Targets, Participants & Budgets**

### Targets and Participants

Both Saver's Switch and AC Rewards are aimed at single family home owners with central air conditioning. Between the two, the Company aims to install/enroll 12,000 devices per year. This will be quite challenging as Saver's Switch has been an offering for almost two decades. As a result it has an installed base of participants that accounts for an estimated half of the eligible customers in the state. To the extent possible, the Company aims to promote AC Rewards in ways that minimize cannibalization of existing Saver's Switch participants.

### Budgets

The primary costs in operating Saver's Switch are: the cost of switches, switch installation, rebates for participating customers, and promotional expenses for recruiting participants. For AC Rewards, the primary costs are incentives (bill credits and device discounts) and promotional expenses. Over time, as Residential Demand Response has been a focus of the Company, advertising and promotional expenses have been escalating with increasing product penetration.

## **C. Application Process**

Customers may sign up for Saver's Switch via mail-in forms, over the phone, or at the Company website <http://www.xcelenergy.com/saversswitch>. Applications are generally processed and switches installed within six to eight weeks. Due to variations in air conditioner age, code compliance, and where the AC unit is located (next to the house), the installer will make the final on site determination as to whether the customer qualifies for the product. The installation work normally takes place entirely outside, allowing customers not to be home for the installation.

Customers wanting to join AC Rewards can do so at the Company's enrollment portal <http://smarththermostat.xcelenergy.com>.

## **D. Marketing Objectives & Strategies**

Saver's Switch and AC Rewards are promoted to residential customers using a variety of channels including bill inserts, company newsletters, print and radio advertising, direct mail and email.

Based on an analysis of customer energy usage during the summer months and market research, Public Service estimates that approximately 325,000-375,000 residential electric customers in Colorado have central air conditioning. Of those, about 193,000 were signed up for the product at the end of 2017. Where possible (i.e. in direct mail and telemarketing), the Company directs its promotional efforts to customers identified as likely to have central air conditioning.

In 2019 and 2020, Public Service expects to continue an intense promotional effort with activities including:

- Direct mail, including up-front incentives to new participants;
- E-mail marketing;
- Bill inserts;
- Radio advertising; and
- Print advertising.

## **E. Product-Specific Policies**

Saver's Switch has the following additional requirements:

- The product does not offer customers the choice of opting out of individual control days. The one exception is in the case of medical emergencies where customers can be removed from the product on very short notice.
- When a customer moves into a premise with a pre-existing switch, they are automatically enrolled in the product, but notified that they may opt-out.
- Upon request for a Saver's Switch from a customer, a third-party implementer installs the switch. The third-party makes the determination in the field as to whether or not a switch can be successfully deployed, depending on the age of the A/C unit, electrical code compliance, etc.

AC Rewards has the following additional requirements:

- Participants must have central AC to join AC Rewards. As there, in most cases, is no contractor at the premise to validate this, we assume participants have central AC. The Company reserves the right to remove customers from the product who are deemed to not have central AC.

- The Company also reserves the right to remove participants from AC Rewards if the device goes ‘offline’ for too long or if the customer opts out of most or all control events.

## **F. Stakeholder Involvement**

Public Service recognizes that the HVAC community and homebuilders are in a position to influence customer attitudes towards the product. The HVAC community may also have lingering misconceptions about Saver’s Switch being harmful to customers’ air conditioners. Public Service is planning to increase its efforts to educate the HVAC / builder community about the benefits of Saver’s Switch to customers.

## **G. Rebates & Incentives**

Saver’s Switch participants will receive a \$40 discount on their October energy bills following participation in the preceding summer control season. AC Rewards participants receive a \$25 discount on their October bills. AC Rewards participants that enroll an existing qualifying thermostat receive a one-time \$75 bill credit. Customers without a qualifying thermostat can get a discount when purchasing one at <https://www.xcelenergystore.com>.

## **H. Evaluation, Measurement, & Verification**

Public Service’s load research organization leads an annual research project to evaluate the load relief achieved from installed Saver’s Switch and AC Rewards units. The team hires a consultant—that specializes in load research—to conduct the data gathering and most of the analysis. A sample of participants is included in the research, undertaken annually. This is done with data loggers deployed onsite to monitor A/C run time and device operations during the cooling season. The results are used to document the extent of load relief achieved during a control day.

## **Cost-Benefit Analyses**

The cost-benefit analyses (CBAs) for the portfolio and each program included in this DSM Plan are displayed on the following pages, with the 2019 electric and gas CBAs, followed by the 2020 electric and gas CBAs.

<b>PORTFOLIO TOTAL</b>					<b>2019 ELECTRIC</b>			<b>GOAL</b>
<b>2019 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>			
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A		12 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B		8760
<b>Benefits</b>					Gross Customer kW	C		1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D		40.22%
Generation Capacity	N/A	\$85,826,122	\$85,826,122	\$85,826,122	Gross Load Factor at Customer	E		22.49%
Trans. & Dist. Capacity	N/A	\$11,549,338	\$11,549,338	\$11,549,338	Net-to-Gross (Energy)	F		81.2%
Marginal Energy	N/A	\$110,367,342	\$110,367,342	\$110,367,342	Net-to-Gross (Demand)	G		85.4%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H		5.666%
Subtotal				\$207,742,801	Transmission Loss Factor (Demand)	I		8.647%
Non-Energy Benefits Adder (20.4%)				\$42,278,578	<b>Installation Rate (Energy)</b>	<b>J</b>		<b>99.0%</b>
Subtotal	N/A	\$207,742,801	\$207,742,801	\$250,021,379	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>99.5%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>		\$292
Bill Reduction - Electric	\$433,232,454	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>		\$141
Participant Rebates and Incentives	\$63,422,693	N/A	N/A	\$63,422,693	Gross Annual kWh Saved at Customer	( B x E x C )		1,970 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x C x J ) )		1,584 kWh
Incremental O&M Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Generator	( F x ( B x E x C x J ) ) / ( 1 - H )		1,679 kWh
Subtotal	\$496,655,148	N/A	N/A	\$63,422,693				
<b>Total Benefits</b>	<b>\$496,655,148</b>	<b>\$207,742,801</b>	<b>\$207,742,801</b>	<b>\$313,444,072</b>				
<b>Utility Project Costs</b>					<b>Program Summary All Participants</b>			
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total Budget</b>	<b>N</b>		<b>\$109,484,943</b>
Administration & Program Delivery	N/A	\$35,974,422	\$35,974,422	\$35,974,422	<b>Net coincident kW Saved at Generator</b>	( G x O x K ) x D / ( 1 - I )		111,751 kW
Advertising/Promotion/Customer Ed	N/A	\$7,548,001	\$7,548,001	\$7,548,001	Net Annual kWh Saved at Customer	( F x ( B x E x O x J ) )		473,623,158 kWh
Participant Rebates and Incentives	N/A	\$63,422,693	\$63,422,693	\$63,422,693	<b>Net Annual kWh Saved at Generator</b>	( F x ( B x E x O x J ) ) / ( 1 - H )		502,070,169 kWh
Equipment & Installation	N/A	\$219,118	\$219,118	\$219,118	<b>TRC Net Benefits with Adder</b>	( O x L )		\$87,154,992
Measurement and Verification	N/A	\$2,320,708	\$2,320,708	\$2,320,708	<b>TRC Net Benefits without Adder</b>	( O x ( L - M ) )		\$44,876,414
Subtotal	N/A	\$109,484,943	\$109,484,943	\$109,484,943				
<b>Utility Revenue Reduction</b>					<b>Utility Program Cost per kWh Lifetime</b>			\$0.0175
Revenue Reduction - Electric	N/A	N/A	\$349,452,966	N/A	<b>Utility Program Cost per kW at Gen</b>			\$980
Subtotal	N/A	N/A	\$349,452,966	N/A				
<b>Participant Costs</b>								
Incremental Capital Costs	\$131,863,601	N/A	N/A	\$113,128,881				
Incremental O&M Costs	\$3,759,768	N/A	N/A	\$3,675,256				
Subtotal	\$135,623,369	N/A	N/A	\$116,804,138				
<b>Total Costs</b>	<b>\$135,623,369</b>	<b>\$109,484,943</b>	<b>\$458,937,909</b>	<b>\$226,289,081</b>				
<b>Net Benefit (Cost)</b>	<b>\$361,031,778</b>	<b>\$98,257,858</b>	<b>(\$251,195,108)</b>	<b>\$87,154,992</b>				
<b>Benefit/Cost Ratio</b>	<b>3.66</b>	<b>1.90</b>	<b>0.45</b>	<b>1.39</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>PORTFOLIO TOTAL</b>					<b>2020 ELECTRIC</b>			<b>GOAL</b>
2020 Net Present Cost Benefit Summary Analysis For All Participants					Input Summary and Totals			
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified TRC Test (\$Total)	Program Inputs per Customer kW			
<b>Benefits</b>					Lifetime (Weighted on Generator kWh)	A		12 years
<b>Avoided Revenue Requirements</b>					Annual Hours	B		8760
Generation Capacity	N/A	\$88,356,240	\$88,356,240	\$88,356,240	Gross Customer kW	C		1 kW
Trans. & Dist. Capacity	N/A	\$11,431,019	\$11,431,019	\$11,431,019	Generator Peak Coincidence Factor	D		44.09%
Marginal Energy	N/A	\$116,650,475	\$116,650,475	\$116,650,475	Gross Load Factor at Customer	E		24.06%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Net-to-Gross (Energy)	F		82.6%
Subtotal				\$216,437,733	Net-to-Gross (Demand)	G		85.9%
Non-Energy Benefits Adder (20.3%)				\$43,976,545	Transmission Loss Factor (Energy)	H		5.617%
Subtotal	N/A	\$216,437,733	\$216,437,733	\$260,414,278	Transmission Loss Factor (Demand)	I		8.593%
<b>Other Benefits</b>					<b>Installation Rate (Energy)</b>	<b>J</b>		<b>99.1%</b>
Bill Reduction - Electric	\$439,136,957	N/A	N/A	N/A	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>99.5%</b>
Participant Rebates and Incentives	\$65,252,867	N/A	N/A	\$65,252,867	MTRC Net Benefit (Cost)	<b>L</b>		\$356
Incremental Capital Savings	\$0	N/A	N/A	\$0	MTRC Non-Energy Benefit Adder	<b>M</b>		\$160
Incremental O&M Savings	\$0	N/A	N/A	\$0	Gross Annual kWh Saved at Customer		( B x E x C )	2,108 kWh
Subtotal	\$504,389,825	N/A	N/A	\$65,252,867	Net Annual kWh Saved at Customer		( F x ( B x E x C x J ) )	1,726 kWh
<b>Total Benefits</b>	<b>\$504,389,825</b>	<b>\$216,437,733</b>	<b>\$216,437,733</b>	<b>\$325,667,146</b>	Net Annual kWh Saved at Generator		( F x ( B x E x C x J ) ) / ( 1 - H )	1,829 kWh
<b>Utility Project Costs</b>					<b>Program Summary All Participant</b>			
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total Budget</b>	<b>N</b>		<b>\$111,309,880</b>
Administration & Program Delivery	N/A	\$35,570,113	\$35,570,113	\$35,570,113	<b>Net coincident kW Saved at Generator</b>		( G x O x K ) x D / ( 1 - I )	113,198 kW
Advertising/Promotion/Customer Ed	N/A	\$7,622,578	\$7,622,578	\$7,622,578	Net Annual kWh Saved at Customer		( F x ( B x E x O x J ) )	473,572,881 kWh
Participant Rebates and Incentives	N/A	\$65,252,867	\$65,252,867	\$65,252,867	<b>Net Annual kWh Saved at Generator</b>		( F x ( B x E x O x J ) ) / ( 1 - H )	501,754,028 kWh
Equipment & Installation	N/A	\$325,615	\$325,615	\$325,615	<b>TRC Net Benefits with Adder</b>		( O x L )	\$97,695,276
Measurement and Verification	N/A	\$2,538,707	\$2,538,707	\$2,538,707	<b>TRC Net Benefits without Adder</b>		( O x ( L - M ) )	\$53,718,731
Subtotal	N/A	\$111,309,880	\$111,309,880	\$111,309,880	<b>Utility Program Cost per kWh Lifetime</b>			
<b>Utility Revenue Reduction</b>					<b>Utility Program Cost per kW at Gen</b>			
Revenue Reduction - Electric	N/A	N/A	\$355,752,222	N/A				\$0.0178
Subtotal	N/A	N/A	\$355,752,222	N/A				\$983
<b>Participant Costs</b>								
Incremental Capital Costs	\$130,973,412	N/A	N/A	\$112,811,033				
Incremental O&M Costs	\$4,143,036	N/A	N/A	\$3,850,956				
Subtotal	\$135,116,449	N/A	N/A	\$116,661,990				
<b>Total Costs</b>	<b>\$135,116,449</b>	<b>\$111,309,880</b>	<b>\$467,062,101</b>	<b>\$227,971,869</b>				
<b>Net Benefit (Cost)</b>	<b>\$369,273,376</b>	<b>\$105,127,853</b>	<b>(\$250,624,369)</b>	<b>\$97,695,276</b>				
<b>Benefit/Cost Ratio</b>	<b>3.73</b>	<b>1.94</b>	<b>0.46</b>	<b>1.43</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>EE PORTFOLIO TOTAL</b>					<b>2019 ELECTRIC</b>			<b>GOAL</b>
<b>2019 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>			
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A		12 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B		8760
<b>Benefits</b>					Gross Customer kW	C		1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D		39.23%
Generation Capacity	N/A	\$73,813,485	\$73,813,485	\$73,813,485	Gross Load Factor at Customer	E		26.25%
Trans. & Dist. Capacity	N/A	\$9,247,750	\$9,247,750	\$9,247,750	Net-to-Gross (Energy)	F		81.2%
Marginal Energy	N/A	\$110,357,488	\$110,357,488	\$110,357,488	Net-to-Gross (Demand)	G		82.5%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H		5.666%
Subtotal				\$193,418,723	Transmission Loss Factor (Demand)	I		8.595%
Non-Energy Benefits Adder (20.4%)				\$39,413,762	<b>Installation Rate (Energy)</b>	<b>J</b>		<b>99.0%</b>
Subtotal	N/A	\$193,418,723	\$193,418,723	\$232,832,485	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>99.3%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>		\$302
Bill Reduction - Electric	\$433,188,148	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>		\$154
Participant Rebates and Incentives	\$53,379,296	N/A	N/A	\$53,379,296	Gross Annual kWh Saved at Customer	( B x E x C )		2,299 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x C x J ) )		1,849 kWh
Incremental O&M Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Generator	( F x ( B x E x C x J ) ) / ( 1 - H )		1,960 kWh
Subtotal	\$486,567,444	N/A	N/A	\$53,379,296				
<b>Total Benefits</b>	<b>\$486,567,444</b>	<b>\$193,418,723</b>	<b>\$193,418,723</b>	<b>\$286,211,781</b>				
<b>Utility Project Costs</b>					<b>Program Summary All Participants</b>			
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total Budget</b>	N		<b>\$92,408,762</b>
Administration & Program Delivery	N/A	\$30,683,088	\$30,683,088	\$30,683,088	<b>Net coincident kW Saved at Generator</b>	( G x O x K ) x D / ( 1 - I )		<b>90,062 kW</b>
Advertising/Promotion/Customer Ed	N/A	\$6,245,751	\$6,245,751	\$6,245,751	Net Annual kWh Saved at Customer	( F x ( B x E x O x J ) )		473,583,775 kWh
Participant Rebates and Incentives	N/A	\$53,379,296	\$53,379,296	\$53,379,296	<b>Net Annual kWh Saved at Generator</b>	( F x ( B x E x O x J ) ) / ( 1 - H )		<b>502,028,166 kWh</b>
Equipment & Installation	N/A	\$211,918	\$211,918	\$211,918	<b>TRC Net Benefits with Adder</b>	( O x L )		<b>\$77,235,132</b>
Measurement and Verification	N/A	\$1,888,708	\$1,888,708	\$1,888,708	<b>TRC Net Benefits without Adder</b>	( O x ( L - M ) )		<b>\$37,821,370</b>
Subtotal	N/A	\$92,408,762	\$92,408,762	\$92,408,762	<b>Utility Program Cost per kWh Lifetime</b>			<b>\$0.0148</b>
<b>Utility Revenue Reduction</b>					<b>Utility Program Cost per kW at Gen</b>			<b>\$1,026</b>
Revenue Reduction - Electric	N/A	N/A	\$349,408,659	N/A				
Subtotal	N/A	N/A	\$349,408,659	N/A				
<b>Participant Costs</b>								
Incremental Capital Costs	\$131,627,351	N/A	N/A	\$112,892,631				
Incremental O&M Costs	\$3,759,768	N/A	N/A	\$3,675,256				
Subtotal	\$135,387,119	N/A	N/A	\$116,567,888				
<b>Total Costs</b>	<b>\$135,387,119</b>	<b>\$92,408,762</b>	<b>\$441,817,421</b>	<b>\$208,976,649</b>				
<b>Net Benefit (Cost)</b>	<b>\$351,180,325</b>	<b>\$101,009,961</b>	<b>(\$248,398,698)</b>	<b>\$77,235,132</b>				
<b>Benefit/Cost Ratio</b>	<b>3.59</b>	<b>2.09</b>	<b>0.44</b>	<b>1.37</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>EE PORTFOLIO TOTAL</b>					<b>2020 ELECTRIC</b>			<b>GOAL</b>
<b>2020 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>			
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A		12 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B		8760
<b>Benefits</b>					Gross Customer kW	C		1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D		43.60%
Generation Capacity	N/A	\$76,103,345	\$76,103,345	\$76,103,345	Gross Load Factor at Customer	E		28.23%
Trans. & Dist. Capacity	N/A	\$9,699,248	\$9,699,248	\$9,699,248	Net-to-Gross (Energy)	F		82.6%
Marginal Energy	N/A	\$116,639,998	\$116,639,998	\$116,639,998	Net-to-Gross (Demand)	G		83.3%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H		5.61%
Subtotal				\$202,442,591	Transmission Loss Factor (Demand)	I		8.530%
Non-Energy Benefits Adder (20.3%)				\$41,177,517	<b>Installation Rate (Energy)</b>	<b>J</b>		<b>99.1%</b>
Subtotal	N/A	\$202,442,591	\$202,442,591	\$243,620,108	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>99.4%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>		\$380
Bill Reduction - Electric	\$439,091,606	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>		\$176
Participant Rebates and Incentives	\$55,030,073	N/A	N/A	\$55,030,073	Gross Annual kWh Saved at Customer		( B x E x C )	2,473 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer		( F x ( B x E x C x J ) )	2,025 kWh
Incremental O&M Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Generator		( F x ( B x E x C x J ) ) / ( 1 - H )	2,145 kWh
Subtotal	\$494,121,679	N/A	N/A	\$55,030,073	<b>Program Summary All Participant</b>			
<b>Total Benefits</b>	<b>\$494,121,679</b>	<b>\$202,442,591</b>	<b>\$202,442,591</b>	<b>\$298,650,181</b>	<b>Total Budget</b>	<b>N</b>		<b>\$93,384,033</b>
<b>Utility Project Costs</b>					<b>Net coincident kW Saved at Generator</b>		( G x O x K ) x D / ( 1 - I )	<b>92,317 kW</b>
Program Planning & Design	N/A	\$0	\$0	\$0	Net Annual kWh Saved at Customer		( F x ( B x E x O x J ) )	473,536,904 kWh
Administration & Program Delivery	N/A	\$29,819,382	\$29,819,382	\$29,819,382	<b>Net Annual kWh Saved at Generator</b>		( F x ( B x E x O x J ) ) / ( 1 - H )	<b>501,715,655 kWh</b>
Advertising/Promotion/Customer Ed	N/A	\$6,179,791	\$6,179,791	\$6,179,791	<b>TRC Net Benefits with Adder</b>		( O x L )	<b>\$88,840,409</b>
Participant Rebates and Incentives	N/A	\$55,030,073	\$55,030,073	\$55,030,073	<b>TRC Net Benefits without Adder</b>		( O x ( L - M ) )	<b>\$47,662,892</b>
Equipment & Installation	N/A	\$310,815	\$310,815	\$310,815	<b>Utility Program Cost per kWh Lifetime</b>			
Measurement and Verification	N/A	\$2,043,971	\$2,043,971	\$2,043,971	<b>Utility Program Cost per kW at Gen</b>			
Subtotal	N/A	\$93,384,033	\$93,384,033	\$93,384,033				<b>\$0.0149</b>
<b>Utility Revenue Reduction</b>								<b>\$1.012</b>
Revenue Reduction - Electric	N/A	N/A	\$355,706,870	N/A				
Subtotal	N/A	N/A	\$355,706,870	N/A				
<b>Participant Costs</b>								
Incremental Capital Costs	\$130,737,162	N/A	N/A	\$112,574,783				
Incremental O&M Costs	\$4,143,036	N/A	N/A	\$3,850,956				
Subtotal	\$134,880,199	N/A	N/A	\$116,425,740				
<b>Total Costs</b>	<b>\$134,880,199</b>	<b>\$93,384,033</b>	<b>\$449,090,903</b>	<b>\$209,809,772</b>				
<b>Net Benefit (Cost)</b>	<b>\$359,241,480</b>	<b>\$109,058,558</b>	<b>(\$246,648,312)</b>	<b>\$88,840,409</b>				
<b>Benefit/Cost Ratio</b>	<b>3.66</b>	<b>2.17</b>	<b>0.45</b>	<b>1.42</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>BUSINESS PROGRAM TOTAL</b>					<b>2019 ELECTRIC</b>			<b>GOAL</b>
<b>2019 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>			
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A		15 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B		8760
<b>Benefits</b>					Gross Customer kW	C		1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D		62.14%
Generation Capacity	N/A	\$52,135,310	\$52,135,310	\$52,135,310	Gross Load Factor at Customer	E		45.87%
Trans. & Dist. Capacity	N/A	\$6,529,064	\$6,529,064	\$6,529,064	Net-to-Gross (Energy)	F		86.4%
Marginal Energy	N/A	\$88,853,018	\$88,853,018	\$88,853,018	Net-to-Gross (Demand)	G		87.6%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H		5.344%
Subtotal				\$147,517,392	Transmission Loss Factor (Demand)	I		7.776%
Non-Energy Benefits Adder (20%)				\$29,503,478	<b>Installation Rate (Energy)</b>	<b>J</b>		<b>99.7%</b>
Subtotal	N/A	\$147,517,392	\$147,517,392	\$177,020,870	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>99.7%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>		\$576
Bill Reduction - Electric	\$290,583,107	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>		\$314
Participant Rebates and Incentives	\$37,624,762	N/A	N/A	\$37,624,762	Gross Annual kWh Saved at Customer		( B x E x C )	4,018 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer		( F x ( B x E x C x J ) )	3,461 kWh
Incremental O&M Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Generator		( F x ( B x E x C x J ) ) / ( 1 - H )	3,657 kWh
Subtotal	\$328,207,869	N/A	N/A	\$37,624,762	<b>Program Summary All Participants</b>			
<b>Total Benefits</b>	<b>\$328,207,869</b>	<b>\$147,517,392</b>	<b>\$147,517,392</b>	<b>\$214,645,632</b>	<b>Total Budget</b>	<b>N</b>		<b>\$57,692,446</b>
<b>Utility Project Costs</b>					<b>Net coincident kW Saved at Generator</b>		( G x O x K ) x D / ( 1 - I )	<b>55,335 kW</b>
Program Planning & Design	N/A	\$0	\$0	\$0	Net Annual kWh Saved at Customer		( F x ( B x E x O x J ) )	325,385,690 kWh
Administration & Program Delivery	N/A	\$17,018,774	\$17,018,774	\$17,018,774	<b>Net Annual kWh Saved at Generator</b>		( F x ( B x E x O x J ) ) / ( 1 - H )	<b>343,755,746 kWh</b>
Advertising/Promotion/Customer Ed	N/A	\$2,210,622	\$2,210,622	\$2,210,622	<b>TRC Net Benefits with Adder</b>		( O x L )	<b>\$54,117,036</b>
Participant Rebates and Incentives	N/A	\$37,624,762	\$37,624,762	\$37,624,762	<b>TRC Net Benefits without Adder</b>		( O x ( L - M ) )	<b>\$24,613,558</b>
Equipment & Installation	N/A	\$0	\$0	\$0	<b>Utility Program Cost per kWh Lifetime</b>			
Measurement and Verification	N/A	\$838,288	\$838,288	\$838,288	<b>Utility Program Cost per kW at Gen</b>			
Subtotal	N/A	\$57,692,446	\$57,692,446	\$57,692,446				<b>\$0.0110</b>
<b>Utility Revenue Reduction</b>								<b>\$1,043</b>
Revenue Reduction - Electric	N/A	N/A	\$247,262,314	N/A				
Subtotal	N/A	N/A	\$247,262,314	N/A				
<b>Participant Costs</b>								
Incremental Capital Costs	\$117,365,839	N/A	N/A	\$99,848,321				
Incremental O&M Costs	\$3,641,675	N/A	N/A	\$2,987,830				
Subtotal	\$121,007,514	N/A	N/A	\$102,836,150				
<b>Total Costs</b>	<b>\$121,007,514</b>	<b>\$57,692,446</b>	<b>\$304,954,760</b>	<b>\$160,528,596</b>				
<b>Net Benefit (Cost)</b>	<b>\$207,200,355</b>	<b>\$89,824,946</b>	<b>(\$157,437,368)</b>	<b>\$54,117,036</b>				
<b>Benefit/Cost Ratio</b>	<b>2.71</b>	<b>2.56</b>	<b>0.48</b>	<b>1.34</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>BUSINESS PROGRAM TOTAL</b>					<b>2020 ELECTRIC</b>			<b>GOAL</b>
<b>2020 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant Test (\$Total)</b>	<b>Utility Test (\$Total)</b>	<b>Rate Impact Test (\$Total)</b>	<b>Modified TRC Test (\$Total)</b>	<b>Program Inputs per Customer kW</b>			
<b>Benefits</b>					Lifetime (Weighted on Generator kWh)	A		15 years
<b>Avoided Revenue Requirements</b>					Annual Hours	B		8760
Generation Capacity	N/A	\$55,331,092	\$55,331,092	\$55,331,092	Gross Customer kW	C		1 kW
Trans. & Dist. Capacity	N/A	\$7,043,637	\$7,043,637	\$7,043,637	Generator Peak Coincidence Factor	D		63.92%
Marginal Energy	N/A	\$98,623,378	\$98,623,378	\$98,623,378	Gross Load Factor at Customer	E		46.98%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Net-to-Gross (Energy)	F		86.6%
Subtotal				\$160,998,107	Net-to-Gross (Demand)	G		87.3%
Non-Energy Benefits Adder (20%)				\$32,199,621	Transmission Loss Factor (Energy)	H		5.344%
Subtotal	N/A	\$160,998,107	\$160,998,107	\$193,197,728	Transmission Loss Factor (Demand)	I		7.779%
<b>Other Benefits</b>					<b>Installation Rate (Energy)</b>	<b>J</b>		<b>99.7%</b>
Bill Reduction - Electric	\$310,263,905	N/A	N/A	N/A	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>99.7%</b>
Participant Rebates and Incentives	\$39,622,974	N/A	N/A	\$39,622,974	MTRC Net Benefit (Cost)	<b>L</b>		\$704
Incremental Capital Savings	\$0	N/A	N/A	\$0	MTRC Non-Energy Benefit Adder	<b>M</b>		\$328
Incremental O&M Savings	\$0	N/A	N/A	\$0	Gross Annual kWh Saved at Customer		( B x E x C )	4,116 kWh
Subtotal	\$349,886,879	N/A	N/A	\$39,622,974	Net Annual kWh Saved at Customer		( F x ( B x E x C x J ) )	3,553 kWh
<b>Total Benefits</b>	<b>\$349,886,879</b>	<b>\$160,998,107</b>	<b>\$160,998,107</b>	<b>\$232,820,702</b>	Net Annual kWh Saved at Generator		( F x ( B x E x C x J ) ) / ( 1 - H )	3,754 kWh
<b>Utility Project Costs</b>					<b>Program Summary All Participant</b>			
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total Budget</b>	<b>N</b>		<b>\$59,115,505</b>
Administration & Program Delivery	N/A	\$16,395,741	\$16,395,741	\$16,395,741	<b>Net coincident kW Saved at Generator</b>		( G x O x K ) x D / ( 1 - I )	59,274 kW
Advertising/Promotion/Customer Ed	N/A	\$2,073,601	\$2,073,601	\$2,073,601	Net Annual kWh Saved at Customer		( F x ( B x E x O x J ) )	349,230,329 kWh
Participant Rebates and Incentives	N/A	\$39,622,974	\$39,622,974	\$39,622,974	<b>Net Annual kWh Saved at Generator</b>		( F x ( B x E x O x J ) ) / ( 1 - H )	368,947,811 kWh
Equipment & Installation	N/A	\$0	\$0	\$0	<b>TRC Net Benefits with Adder</b>		( O x L )	\$69,150,414
Measurement and Verification	N/A	\$1,023,190	\$1,023,190	\$1,023,190	<b>TRC Net Benefits without Adder</b>		( O x ( L - M ) )	\$36,950,793
Subtotal	N/A	\$59,115,505	\$59,115,505	\$59,115,505	<b>Utility Program Cost per kWh Lifetime</b>			
<b>Utility Revenue Reduction</b>					<b>Utility Program Cost per kW at Gen</b>			
Revenue Reduction - Electric	N/A	N/A	\$263,655,714	N/A				\$0.0107
Subtotal	N/A	N/A	\$263,655,714	N/A				\$997
<b>Participant Costs</b>								
Incremental Capital Costs	\$117,945,543	N/A	N/A	\$100,544,100				
Incremental O&M Costs	\$4,888,384	N/A	N/A	\$4,010,683				
Subtotal	\$122,833,927	N/A	N/A	\$104,554,783				
<b>Total Costs</b>	<b>\$122,833,927</b>	<b>\$59,115,505</b>	<b>\$322,771,220</b>	<b>\$163,670,288</b>				
<b>Net Benefit (Cost)</b>	<b>\$227,052,951</b>	<b>\$101,882,602</b>	<b>(\$161,773,113)</b>	<b>\$69,150,414</b>				
<b>Benefit/Cost Ratio</b>	<b>2.85</b>	<b>2.72</b>	<b>0.50</b>	<b>1.42</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>RESIDENTIAL PROGRAM TOTAL</b>					<b>2019 ELECTRIC</b>			<b>GOAL</b>
<b>2019 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>			
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A		7 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B		8760
<b>Benefits</b>					Gross Customer kW	C		1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D		26.22%
Generation Capacity	N/A	\$20,711,726	\$20,711,726	\$20,711,726	Gross Load Factor at Customer	E		14.80%
Trans. & Dist. Capacity	N/A	\$2,593,727	\$2,593,727	\$2,593,727	Net-to-Gross (Energy)	F		70.9%
Marginal Energy	N/A	\$20,158,557	\$20,158,557	\$20,158,557	Net-to-Gross (Demand)	G		74.7%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H		6.239%
Subtotal				\$43,464,010	Transmission Loss Factor (Demand)	I		9.065%
Non-Energy Benefits Adder (20%)				\$8,692,802	<b>Installation Rate (Energy)</b>	<b>J</b>		<b>98.0%</b>
Subtotal	N/A	\$43,464,010	\$43,464,010	\$52,156,812	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>99.0%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>		\$192
Bill Reduction - Electric	\$136,571,481	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>		\$56
Participant Rebates and Incentives	\$12,162,547	N/A	N/A	\$12,162,547	Gross Annual kWh Saved at Customer	( B x E x C )		1,296 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x C x J ) )		901 kWh
Incremental O&M Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Generator	( F x ( B x E x C x J ) ) / ( 1 - H )		960 kWh
Subtotal	\$148,734,028	N/A	N/A	\$12,162,547				
<b>Total Benefits</b>	<b>\$148,734,028</b>	<b>\$43,464,010</b>	<b>\$43,464,010</b>	<b>\$64,319,359</b>				
<b>Utility Project Costs</b>					<b>Program Summary All Participants</b>			
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total Budget</b>	N		<b>\$23,707,054</b>
Administration & Program Delivery	N/A	\$8,087,453	\$8,087,453	\$8,087,453	<b>Net coincident kW Saved at Generator</b>	( G x O x K ) x D / ( 1 - I )		<b>33,377 kW</b>
Advertising/Promotion/Customer Ed	N/A	\$2,852,344	\$2,852,344	\$2,852,344	Net Annual kWh Saved at Customer	( F x ( B x E x O x J ) )		140,920,203 kWh
Participant Rebates and Incentives	N/A	\$12,162,547	\$12,162,547	\$12,162,547	<b>Net Annual kWh Saved at Generator</b>	( F x ( B x E x O x J ) ) / ( 1 - H )		<b>150,296,541 kWh</b>
Equipment & Installation	N/A	\$211,918	\$211,918	\$211,918	<b>TRC Net Benefits with Adder</b>	( O x L )		<b>\$30,104,263</b>
Measurement and Verification	N/A	\$392,792	\$392,792	\$392,792	<b>TRC Net Benefits without Adder</b>	( O x ( L - M ) )		<b>\$21,411,461</b>
Subtotal	N/A	\$23,707,054	\$23,707,054	\$23,707,054				
<b>Utility Revenue Reduction</b>					<b>Utility Program Cost per kWh Lifetime</b>			<b>\$0.0218</b>
Revenue Reduction - Electric	N/A	N/A	\$96,594,496	N/A	<b>Utility Program Cost per kW at Gen</b>			<b>\$710</b>
Subtotal	N/A	N/A	\$96,594,496	N/A				
<b>Participant Costs</b>								
Incremental Capital Costs	\$10,847,317	N/A	N/A	\$9,627,859				
Incremental O&M Costs	\$371,428	N/A	N/A	\$880,182				
Subtotal	\$11,218,745	N/A	N/A	\$10,508,041				
<b>Total Costs</b>	<b>\$11,218,745</b>	<b>\$23,707,054</b>	<b>\$120,301,551</b>	<b>\$34,215,096</b>				
<b>Net Benefit (Cost)</b>	<b>\$137,515,283</b>	<b>\$19,756,956</b>	<b>(\$76,837,541)</b>	<b>\$30,104,263</b>				
<b>Benefit/Cost Ratio</b>	<b>13.26</b>	<b>1.83</b>	<b>0.36</b>	<b>1.88</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>RESIDENTIAL PROGRAM TOTAL</b>					<b>2020</b>	<b>ELECTRIC</b>	<b>GOAL</b>
<b>2020 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>		
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>		
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A	7 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B	8760
<b>Benefits</b>					Gross Customer kW	C	1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D	29.10%
Generation Capacity	N/A	\$19,868,670	\$19,868,670	\$19,868,670	Gross Load Factor at Customer	E	14.52%
Trans. & Dist. Capacity	N/A	\$2,494,695	\$2,494,695	\$2,494,695	Net-to-Gross (Energy)	F	72.4%
Marginal Energy	N/A	\$16,736,700	\$16,736,700	\$16,736,700	Net-to-Gross (Demand)	G	76.4%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H	6.249%
Subtotal				\$39,100,065	Transmission Loss Factor (Demand)	I	9.071%
Non-Energy Benefits Adder (20%)				\$7,820,013	<b>Installation Rate (Energy)</b>	<b>J</b>	<b>97.7%</b>
Subtotal	N/A	\$39,100,065	\$39,100,065	\$46,920,078	<b>Installation Rate (Demand)</b>	<b>K</b>	<b>99.0%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>	\$204
Bill Reduction - Electric	\$123,710,286	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>	\$60
Participant Rebates and Incentives	\$11,922,977	N/A	N/A	\$11,922,977	Gross Annual kWh Saved at Customer	( B x E x C )	1,272 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x C x J ) )	900 kWh
Incremental O&M Savings	\$587,088	N/A	N/A	\$32,492	Net Annual kWh Saved at Generator	( F x ( B x E x C x J ) ) / ( 1 - H )	960 kWh
Subtotal	\$136,220,351	N/A	N/A	\$11,955,469			
<b>Total Benefits</b>	<b>\$136,220,351</b>	<b>\$39,100,065</b>	<b>\$39,100,065</b>	<b>\$58,875,547</b>			
<b>Utility Project Costs</b>					<b>Program Summary All Participant</b>		
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total Budget</b>	N	<b>\$23,385,992</b>
Administration & Program Delivery	N/A	\$7,832,320	\$7,832,320	\$7,832,320	<b>Net coincident kW Saved at Generator</b>	( G x O x K ) x D / ( 1 - I )	31,797 kW
Advertising/Promotion/Customer Ed	N/A	\$2,953,192	\$2,953,192	\$2,953,192	Net Annual kWh Saved at Customer	( F x ( B x E x O x J ) )	118,184,928 kWh
Participant Rebates and Incentives	N/A	\$11,922,977	\$11,922,977	\$11,922,977	<b>Net Annual kWh Saved at Generator</b>	( F x ( B x E x O x J ) ) / ( 1 - H )	126,061,968 kWh
Equipment & Installation	N/A	\$310,815	\$310,815	\$310,815	<b>TRC Net Benefits with Adder</b>	( O x L )	\$26,760,799
Measurement and Verification	N/A	\$366,688	\$366,688	\$366,688	<b>TRC Net Benefits without Adder</b>	( O x ( L - M ) )	\$18,940,786
Subtotal	N/A	\$23,385,992	\$23,385,992	\$23,385,992			
<b>Utility Revenue Reduction</b>					<b>Utility Program Cost per kWh Lifetime</b>		\$0.0277
Revenue Reduction - Electric	N/A	N/A	\$87,140,885	N/A	<b>Utility Program Cost per kW at Gen</b>		\$735
Subtotal	N/A	N/A	\$87,140,885	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$9,491,948	N/A	N/A	\$8,728,756			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$9,491,948	N/A	N/A	\$8,728,756			
<b>Total Costs</b>	<b>\$9,491,948</b>	<b>\$23,385,992</b>	<b>\$110,526,877</b>	<b>\$32,114,748</b>			
<b>Net Benefit (Cost)</b>	<b>\$126,728,403</b>	<b>\$15,714,073</b>	<b>(\$71,426,812)</b>	<b>\$26,760,799</b>			
<b>Benefit/Cost Ratio</b>	<b>14.35</b>	<b>1.67</b>	<b>0.35</b>	<b>1.83</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>LOW-INCOME PROGRAM TOTAL</b>					<b>2019 ELECTRIC</b>			<b>GOAL</b>
<b>2019 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>			
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A		10 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B		8760
<b>Benefits</b>					Gross Customer kW	C		1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D		23.53%
Generation Capacity	N/A	\$966,449	\$966,449	\$966,449	Gross Load Factor at Customer	E		16.86%
Trans. & Dist. Capacity	N/A	\$121,030	\$121,030	\$121,030	Net-to-Gross (Energy)	F		100.1%
Marginal Energy	N/A	\$1,345,913	\$1,345,913	\$1,345,913	Net-to-Gross (Demand)	G		100.0%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H		6.179%
Subtotal				\$2,433,392	Transmission Loss Factor (Demand)	I		9.002%
Non-Energy Benefits Adder (50%)				\$1,216,696	<b>Installation Rate (Energy)</b>	<b>J</b>		<b>89.6%</b>
Subtotal	N/A	\$2,433,392	\$2,433,392	\$3,650,088	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>92.1%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>		<b>-127</b>
Bill Reduction - Electric	\$6,033,560	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>		<b>\$216</b>
Participant Rebates and Incentives	\$2,976,337	N/A	N/A	\$2,976,337	Gross Annual kWh Saved at Customer		( B x E x C )	1,477 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer		( F x ( B x E x C x J ) )	1,325 kWh
Incremental O&M Savings	\$253,335	N/A	N/A	\$192,755	Net Annual kWh Saved at Generator		( F x ( B x E x C x J ) ) / ( 1 - H )	1,412 kWh
Subtotal	\$9,263,232	N/A	N/A	\$3,169,092	<b>Program Summary All Participants</b>			
<b>Total Benefits</b>	<b>\$9,263,232</b>	<b>\$2,433,392</b>	<b>\$2,433,392</b>	<b>\$6,819,180</b>	<b>Total Budget</b>	<b>N</b>		<b>\$4,121,754</b>
<b>Utility Project Costs</b>					<b>Net coincident kW Saved at Generator</b>		( G x O x K ) x D / ( 1 - I )	<b>1,344 kW</b>
Program Planning & Design	N/A	\$0	\$0	\$0	Net Annual kWh Saved at Customer		( F x ( B x E x O x J ) )	7,477,001 kWh
Administration & Program Delivery	N/A	\$775,575	\$775,575	\$775,575	<b>Net Annual kWh Saved at Generator</b>		( F x ( B x E x O x J ) ) / ( 1 - H )	<b>7,969,430 kWh</b>
Advertising/Promotion/Customer Ed	N/A	\$202,504	\$202,504	\$202,504	<b>TRC Net Benefits with Adder</b>		( O x L )	<b>(\$719,026)</b>
Participant Rebates and Incentives	N/A	\$2,976,337	\$2,976,337	\$2,976,337	<b>TRC Net Benefits without Adder</b>		( O x ( L - M ) )	<b>(\$1,935,721)</b>
Equipment & Installation	N/A	\$0	\$0	\$0	<b>Utility Program Cost per kWh Lifetime</b>			
Measurement and Verification	N/A	\$167,338	\$167,338	\$167,338	<b>Utility Program Cost per kW at Gen</b>			
Subtotal	N/A	\$4,121,754	\$4,121,754	\$4,121,754				<b>\$0.0540</b>
<b>Utility Revenue Reduction</b>								<b>\$3.066</b>
Revenue Reduction - Electric	N/A	N/A	\$5,551,849	N/A				
Subtotal	N/A	N/A	\$5,551,849	N/A				
<b>Participant Costs</b>								
Incremental Capital Costs	\$3,414,195	N/A	N/A	\$3,416,451				
Incremental O&M Costs	\$0	N/A	N/A	\$0				
Subtotal	\$3,414,195	N/A	N/A	\$3,416,451				
<b>Total Costs</b>	<b>\$3,414,195</b>	<b>\$4,121,754</b>	<b>\$9,673,603</b>	<b>\$7,538,205</b>				
<b>Net Benefit (Cost)</b>	<b>\$5,849,037</b>	<b>(\$1,688,363)</b>	<b>(\$7,240,211)</b>	<b>(\$719,026)</b>				
<b>Benefit/Cost Ratio</b>	<b>2.71</b>	<b>0.59</b>	<b>0.25</b>	<b>0.90</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>LOW-INCOME PROGRAM TOTAL</b>					<b>2020 ELECTRIC</b>			<b>GOAL</b>
<b>2020 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>			
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A		10 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B		8760
<b>Benefits</b>					Gross Customer kW	C		1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D		27.05%
Generation Capacity	N/A	\$903,583	\$903,583	\$903,583	Gross Load Factor at Customer	E		18.33%
Trans. & Dist. Capacity	N/A	\$113,160	\$113,160	\$113,160	Net-to-Gross (Energy)	F		100.1%
Marginal Energy	N/A	\$1,279,920	\$1,279,920	\$1,279,920	Net-to-Gross (Demand)	G		100.1%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H		6.129%
Subtotal				\$2,296,663	Transmission Loss Factor (Demand)	I		8.957%
Non-Energy Benefits Adder (50%)				\$1,148,331	<b>Installation Rate (Energy)</b>	<b>J</b>		<b>93.5%</b>
Subtotal	N/A	\$2,296,663	\$2,296,663	\$3,444,994	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>95.3%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>		-\$178
Bill Reduction - Electric	\$5,117,414	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>		\$276
Participant Rebates and Incentives	\$2,861,814	N/A	N/A	\$2,861,814	Gross Annual kWh Saved at Customer	( B x E x C )		1,606 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x C x J ) )		1,504 kWh
Incremental O&M Savings	\$158,260	N/A	N/A	\$127,235	Net Annual kWh Saved at Generator	( F x ( B x E x C x J ) ) / ( 1 - H )		1,602 kWh
Subtotal	\$8,137,488	N/A	N/A	\$2,989,048				
<b>Total Benefits</b>	<b>\$8,137,488</b>	<b>\$2,296,663</b>	<b>\$2,296,663</b>	<b>\$6,434,042</b>				
<b>Utility Project Costs</b>					<b>Program Summary All Participant</b>			
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total Budget</b>	N		<b>\$3,872,811</b>
Administration & Program Delivery	N/A	\$701,155	\$701,155	\$701,155	<b>Net coincident kW Saved at Generator</b>	( G x O x K ) x D / ( 1 - I )		<b>1,180 kW</b>
Advertising/Promotion/Customer Ed	N/A	\$142,504	\$142,504	\$142,504	Net Annual kWh Saved at Customer	( F x ( B x E x O x J ) )		6,260,351 kWh
Participant Rebates and Incentives	N/A	\$2,861,814	\$2,861,814	\$2,861,814	<b>Net Annual kWh Saved at Generator</b>	( F x ( B x E x O x J ) ) / ( 1 - H )		<b>6,669,128 kWh</b>
Equipment & Installation	N/A	\$0	\$0	\$0	<b>TRC Net Benefits with Adder</b>	( O x L )		<b>(\$740,696)</b>
Measurement and Verification	N/A	\$167,338	\$167,338	\$167,338	<b>TRC Net Benefits without Adder</b>	( O x ( L - M ) )		<b>(\$1,889,028)</b>
Subtotal	N/A	\$3,872,811	\$3,872,811	\$3,872,811				
<b>Utility Revenue Reduction</b>					<b>Utility Program Cost per kWh Lifetime</b>			<b>\$0.0562</b>
Revenue Reduction - Electric	N/A	N/A	\$4,910,271	N/A	<b>Utility Program Cost per kW at Gen</b>			<b>\$3,283</b>
Subtotal	N/A	N/A	\$4,910,271	N/A				
<b>Participant Costs</b>								
Incremental Capital Costs	\$3,299,671	N/A	N/A	\$3,301,927				
Incremental O&M Costs	\$0	N/A	N/A	\$0				
Subtotal	\$3,299,671	N/A	N/A	\$3,301,927				
<b>Total Costs</b>	<b>\$3,299,671</b>	<b>\$3,872,811</b>	<b>\$8,783,082</b>	<b>\$7,174,738</b>				
<b>Net Benefit (Cost)</b>	<b>\$4,837,817</b>	<b>(\$1,576,148)</b>	<b>(\$6,486,419)</b>	<b>(\$740,696)</b>				
<b>Benefit/Cost Ratio</b>	<b>2.47</b>	<b>0.59</b>	<b>0.26</b>	<b>0.90</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>DR PROGRAM TOTAL</b>					<b>2019 ELECTRIC</b>			<b>GOAL</b>		
<b>2019 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>					
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>					
	<b>Test</b>	<b>Test</b>	<b>Test</b>	<b>TRC</b>						
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>						
<b>Benefits</b>					<b>Installation Rate (Energy)</b>				<b>J</b>	<b>100.0%</b>
<b>Avoided Revenue Requirements</b>					<b>Installation Rate (Demand)</b>				<b>K</b>	<b>100.0%</b>
	Generation Capacity	N/A	\$12,012,636	\$12,012,636	\$12,012,636	MTRC Net Benefit (Cost)	<b>L</b>	\$273		
	Trans. & Dist. Capacity	N/A	\$2,301,588	\$2,301,588	\$2,301,588	MTRC Non-Energy Benefit Adder	<b>M</b>	\$67		
	Marginal Energy	N/A	\$9,854	\$9,854	\$9,854	Gross Annual kWh Saved at Customer	( B x E x C )		1 kWh	
	Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x C x J ) )		1 kWh	
	Subtotal				\$14,324,078	Net Annual kWh Saved at Generator	( F x ( B x E x C x J ) ) / ( 1 - H )		1 kWh	
	Non-Energy Benefits Adder (20%)				\$2,864,816					
	Subtotal	N/A	\$14,324,078	\$14,324,078	\$17,188,894					
<b>Other Benefits</b>					<b>Program Summary All Participants</b>					
	Bill Reduction - Electric	\$44,306	N/A	N/A	N/A	<b>Total Budget</b>	N		<b>\$15,318,509</b>	
	Participant Rebates and Incentives	\$10,043,397	N/A	N/A	\$10,043,397	<b>Net coincident kW Saved at Generator</b>	( G x O x K ) x D / ( 1 - I )		<b>21,689 kW</b>	
	Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x O x J )		39,324 kWh	
	Incremental O&M Savings	\$0	N/A	N/A	\$0	<b>Net Annual kWh Saved at Generator</b>	( F x ( B x E x O x J ) ) / ( 1 - H )		<b>42,004 kWh</b>	
	Subtotal	\$10,087,703	N/A	N/A	\$10,043,397	<b>TRC Net Benefits with Adder</b>	( O x L )		<b>\$11,677,532</b>	
	<b>Total Benefits</b>	<b>\$10,087,703</b>	<b>\$14,324,078</b>	<b>\$14,324,078</b>	<b>\$27,232,291</b>	<b>TRC Net Benefits without Adder</b>	( O x ( L - M ) )		<b>\$8,812,716</b>	
<b>Utility Project Costs</b>					<b>Utility Program Cost per kWh Lifetime</b>				<b>\$26.5057</b>	
	Program Planning & Design	N/A	\$0	\$0	\$0	<b>Utility Program Cost per kW at Gen</b>				<b>\$706</b>
	Administration & Program Delivery	N/A	\$3,833,662	\$3,833,662	\$3,833,662					
	Advertising/Promotion/Customer Ed	N/A	\$1,302,250	\$1,302,250	\$1,302,250					
	Participant Rebates and Incentives	N/A	\$10,043,397	\$10,043,397	\$10,043,397					
	Equipment & Installation	N/A	\$7,200	\$7,200	\$7,200					
	Measurement and Verification	N/A	\$132,000	\$132,000	\$132,000					
	Subtotal	N/A	\$15,318,509	\$15,318,509	\$15,318,509					
<b>Utility Revenue Reduction</b>										
	Revenue Reduction - Electric	N/A	N/A	\$44,306	N/A					
	Subtotal	N/A	N/A	\$44,306	N/A					
<b>Participant Costs</b>										
	Incremental Capital Costs	\$236,250	N/A	N/A	\$236,250					
	Incremental O&M Costs	\$0	N/A	N/A	\$0					
	Subtotal	\$236,250	N/A	N/A	\$236,250					
	<b>Total Costs</b>	<b>\$236,250</b>	<b>\$15,318,509</b>	<b>\$15,362,815</b>	<b>\$15,554,759</b>					
	<b>Net Benefit (Cost)</b>	<b>\$9,851,453</b>	<b>(\$994,431)</b>	<b>(\$1,038,737)</b>	<b>\$11,677,532</b>					
	<b>Benefit/Cost Ratio</b>	<b>42.70</b>	<b>0.94</b>	<b>0.93</b>	<b>1.75</b>					

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>DR PROGRAM TOTAL</b>					<b>2020 ELECTRIC</b>			<b>GOAL</b>
<b>2020 Net Present Cost Benefit Summary Analysis For All Participants</b>					<b>Input Summary and Totals</b>			
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Inputs per Customer kW</b>			
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>	Lifetime (Weighted on Generator kWh)	A		14 years
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	Annual Hours	B		8760
<b>Benefits</b>					Gross Customer kW	C		1 kW
<b>Avoided Revenue Requirements</b>					Generator Peak Coincidence Factor	D		46.90%
Generation Capacity	N/A	\$12,252,895	\$12,252,895	\$12,252,895	Gross Load Factor at Customer	E		0.01%
Trans. & Dist. Capacity	N/A	\$1,731,770	\$1,731,770	\$1,731,770	Net-to-Gross (Energy)	F		100.0%
Marginal Energy	N/A	\$10,477	\$10,477	\$10,477	Net-to-Gross (Demand)	G		100.0%
Avoided Emissions (CO2)	N/A	N/A	N/A	\$0	Transmission Loss Factor (Energy)	H		6.380%
Subtotal				\$13,995,142	Transmission Loss Factor (Demand)	I		8.951%
Non-Energy Benefits Adder (20%)				\$2,799,028	<b>Installation Rate (Energy)</b>	<b>J</b>		<b>100.0%</b>
Subtotal	N/A	\$13,995,142	\$13,995,142	\$16,794,170	<b>Installation Rate (Demand)</b>	<b>K</b>		<b>100.0%</b>
<b>Other Benefits</b>					MTRC Net Benefit (Cost)	<b>L</b>		\$271
Bill Reduction - Electric	\$45,352	N/A	N/A	N/A	MTRC Non-Energy Benefit Adder	<b>M</b>		\$69
Participant Rebates and Incentives	\$10,222,794	N/A	N/A	\$10,222,794	Gross Annual kWh Saved at Customer	( B x E x C )		1 kWh
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x C x J ) )		1 kWh
Incremental O&M Savings	\$0	N/A	N/A	\$0	Net Annual kWh Saved at Generator	( F x ( B x E x C x J ) ) / ( 1 - H )		1 kWh
Subtotal	\$10,268,146	N/A	N/A	\$10,222,794	<b>Program Summary All Participant</b>			
<b>Total Benefits</b>	<b>\$10,268,146</b>	<b>\$13,995,142</b>	<b>\$13,995,142</b>	<b>\$27,016,964</b>	<b>Total Budget</b>	<b>N</b>		<b>\$15,805,927</b>
<b>Utility Project Costs</b>					<b>Net coincident kW Saved at Generator</b>	( G x O x K ) x D / ( 1 - I )		<b>20,881 kW</b>
Program Planning & Design	N/A	\$0	\$0	\$0	Net Annual kWh Saved at Customer	( F x ( B x E x O x J ) )		35,924 kWh
Administration & Program Delivery	N/A	\$3,810,811	\$3,810,811	\$3,810,811	<b>Net Annual kWh Saved at Generator</b>	( F x ( B x E x O x J ) ) / ( 1 - H )		<b>38,372 kWh</b>
Advertising/Promotion/Customer Ed	N/A	\$1,442,787	\$1,442,787	\$1,442,787	<b>TRC Net Benefits with Adder</b>	( O x L )		<b>\$10,974,787</b>
Participant Rebates and Incentives	N/A	\$10,222,794	\$10,222,794	\$10,222,794	<b>TRC Net Benefits without Adder</b>	( O x ( L - M ) )		<b>\$8,175,759</b>
Equipment & Installation	N/A	\$14,800	\$14,800	\$14,800	<b>Utility Program Cost per kWh Lifetime</b>			<b>\$30.4952</b>
Measurement and Verification	N/A	\$314,735	\$314,735	\$314,735	<b>Utility Program Cost per kW at Gen</b>			<b>\$757</b>
Subtotal	N/A	\$15,805,927	\$15,805,927	\$15,805,927				
<b>Utility Revenue Reduction</b>								
Revenue Reduction - Electric	N/A	N/A	\$45,352	N/A				
Subtotal	N/A	N/A	\$45,352	N/A				
<b>Participant Costs</b>								
Incremental Capital Costs	\$236,250	N/A	N/A	\$236,250				
Incremental O&M Costs	\$0	N/A	N/A	\$0				
Subtotal	\$236,250	N/A	N/A	\$236,250				
<b>Total Costs</b>	<b>\$236,250</b>	<b>\$15,805,927</b>	<b>\$15,851,279</b>	<b>\$16,042,177</b>				
<b>Net Benefit (Cost)</b>	<b>\$10,031,896</b>	<b>(\$1,810,785)</b>	<b>(\$1,856,137)</b>	<b>\$10,974,787</b>				
<b>Benefit/Cost Ratio</b>	<b>43.46</b>	<b>0.89</b>	<b>0.88</b>	<b>1.68</b>				

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

PORTFOLIO TOTAL					2019	GAS	GOAL
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified TRC Test (\$Total)	Program Assumptions:		
Benefits					Lifetime (Weighted on Dth)	A	13.38 years
<b>Avoided Revenue Requirements</b>					Net-to-Gross (Weighted on Dth)	B	95.82%
Commodity Cost Reduction	N/A	\$20,067,892	\$20,067,892	\$20,067,892	Install Rate (Weighted on Dth)	C	90.1%
Variable O&M Savings	N/A	\$292,293	\$292,293	\$292,293			
Demand Savings	N/A	\$2,047,334	\$2,047,334	\$2,047,334			
Subtotal				\$22,407,518			
Non-Energy Benefits Adder (23.6%)				\$5,297,088			
Subtotal	N/A	\$22,407,518	\$22,407,518	\$27,704,606			
<b>Other Benefits</b>					<b>Program Totals:</b>		
Bill Reduction - Gas	\$38,321,432	N/A	N/A	N/A	<b>Total Dth/Yr Saved</b>	D	<b>701,761</b>
Participant Rebates and Incentives	\$9,227,886	N/A	N/A	\$9,227,886	Utility Costs per Net Dth/Yr	E	\$21.05
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Benefit (Cost) per Gross Dth/Yr	F	\$25.04
Incremental O&M Savings	\$29,374,311	N/A	N/A	\$18,253,874	Non-Energy Benefits Adder per Gross Dth/Yr	G	\$7.55
Subtotal	\$76,923,629	N/A	N/A	\$27,481,760	<b>Annual Dth/\$M</b>	(\$1M / E)	<b>47,496</b>
<b>Total Benefits</b>	<b>\$76,923,629</b>	<b>\$22,407,518</b>	<b>\$22,407,518</b>	<b>\$55,186,366</b>	<b>Total Utility Budget</b>	( E x D )	<b>\$14,775,264</b>
<b>Utility Project Costs</b>					<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$17,573,406</b>
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$12,276,318</b>
Administration & Program Delivery	N/A	\$3,900,677	\$3,900,677	\$3,900,677			
Advertising/Promotion/Customer Ed	N/A	\$806,322	\$806,322	\$806,322	<b>Utility Program Cost per Net Dth Lifetime</b>	( E / A )	<b>\$1.57</b>
Participant Rebates and Incentives	N/A	\$9,227,886	\$9,227,886	\$9,227,886			
Equipment & Installation	N/A	\$108,150	\$108,150	\$108,150			
Measurement and Verification	N/A	\$732,230	\$732,230	\$732,230			
Subtotal	N/A	\$14,775,264	\$14,775,264	\$14,775,264			
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$36,659,333	N/A			
Subtotal	N/A	N/A	\$36,659,333	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$24,245,808	N/A	N/A	\$22,837,695			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$24,245,808	N/A	N/A	\$22,837,695			
<b>Total Costs</b>	<b>\$24,245,808</b>	<b>\$14,775,264</b>	<b>\$51,434,597</b>	<b>\$37,612,960</b>			
<b>Net Benefit (Cost)</b>	<b>\$52,677,821</b>	<b>\$7,632,254</b>	<b>(\$29,027,079)</b>	<b>\$17,573,406</b>			
<b>Benefit/Cost Ratio</b>	<b>3.17</b>	<b>1.52</b>	<b>0.44</b>	<b>1.47</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

PORTFOLIO TOTAL					2020	GAS	GOAL
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified TRC Test (\$Total)	Program Assumptions:		
Benefits					Lifetime (Weighted on Dth)	A	12.65 years
<b>Avoided Revenue Requirements</b>					Net-to-Gross (Weighted on Dth)	B	95.51%
Commodity Cost Reduction	N/A	\$19,668,855	\$19,668,855	\$19,668,855	Install Rate (Weighted on Dth)	C	89.7%
Variable O&M Savings	N/A	\$308,432	\$308,432	\$308,432			
Demand Savings	N/A	\$1,903,608	\$1,903,608	\$1,903,608			
Subtotal				\$21,880,895			
Non-Energy Benefits Adder (23.5%)				\$5,147,782			
Subtotal	N/A	\$21,880,895	\$21,880,895	\$27,028,677			
<b>Other Benefits</b>					<b>Program Totals:</b>		
Bill Reduction - Gas	\$36,097,857	N/A	N/A	N/A	<b>Total Dth/Yr Saved</b>	D	<b>681,120</b>
Participant Rebates and Incentives	\$9,058,729	N/A	N/A	\$9,058,729	Utility Costs per Net Dth/Yr	E	\$21.83
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Benefit (Cost) per Gross Dth/Yr	F	\$25.67
Incremental O&M Savings	\$28,426,959	N/A	N/A	\$17,787,308	Non-Energy Benefits Adder per Gross Dth/Yr	G	\$7.56
Subtotal	\$73,583,545	N/A	N/A	\$26,846,038	<b>Annual Dth/\$M</b>	( \$1M / E )	<b>45,814</b>
<b>Total Benefits</b>	<b>\$73,583,545</b>	<b>\$21,880,895</b>	<b>\$21,880,895</b>	<b>\$53,874,715</b>	<b>Total Utility Budget</b>	( E x D )	<b>\$14,867,096</b>
<b>Utility Project Costs</b>					<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$17,481,485</b>
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$12,333,703</b>
Administration & Program Delivery	N/A	\$4,119,041	\$4,119,041	\$4,119,041			
Advertising/Promotion/Customer Ed	N/A	\$784,163	\$784,163	\$784,163			
Participant Rebates and Incentives	N/A	\$9,058,729	\$9,058,729	\$9,058,729			
Equipment & Installation	N/A	\$157,141	\$157,141	\$157,141			
Measurement and Verification	N/A	\$748,022	\$748,022	\$748,022			
Subtotal	N/A	\$14,867,096	\$14,867,096	\$14,867,096	<b>Utility Program Cost per Net Dth Lifetime</b>	( E / A )	<b>\$1.73</b>
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$34,368,078	N/A			
Subtotal	N/A	N/A	\$34,368,078	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$22,968,168	N/A	N/A	\$21,526,133			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$22,968,168	N/A	N/A	\$21,526,133			
<b>Total Costs</b>	<b>\$22,968,168</b>	<b>\$14,867,096</b>	<b>\$49,235,174</b>	<b>\$36,393,230</b>			
<b>Net Benefit (Cost)</b>	<b>\$50,615,376</b>	<b>\$7,013,799</b>	<b>(\$27,354,279)</b>	<b>\$17,481,485</b>			
<b>Benefit/Cost Ratio</b>	<b>3.20</b>	<b>1.47</b>	<b>0.44</b>	<b>1.48</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>EE PORTFOLIO TOTAL</b>					<b>2019</b>	<b>GAS</b>	<b>GOAL</b>
	<b>Participant Test (\$Total)</b>	<b>Utility Test (\$Total)</b>	<b>Rate Impact Test (\$Total)</b>	<b>Modified TRC Test (\$Total)</b>	<b>Program Assumptions:</b>		
<b>Benefits</b>					Lifetime (Weighted on Dth)	A	13.38 years
<b>Avoided Revenue Requirements</b>					Net-to-Gross (Weighted on Dth)	B	95.82%
Commodity Cost Reduction	N/A	\$20,067,892	\$20,067,892	\$20,067,892	Install Rate (Weighted on Dth)	C	90.1%
Variable O&M Savings	N/A	\$292,293	\$292,293	\$292,293			
Demand Savings	N/A	\$2,047,334	\$2,047,334	\$2,047,334			
Subtotal				\$22,407,518			
Non-Energy Benefits Adder (23.6%)				\$5,297,088			
Subtotal	N/A	\$22,407,518	\$22,407,518	\$27,704,606			
<b>Other Benefits</b>					<b>Program Totals:</b>		
Bill Reduction - Gas	\$38,321,432	N/A	N/A	N/A	<b>Total Dth/Yr Saved</b>	D	<b>701,761</b>
Participant Rebates and Incentives	\$9,227,886	N/A	N/A	\$9,227,886	Utility Costs per Net Dth/Yr	E	\$21.05
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Benefit (Cost) per Gross Dth/Yr	F	\$25.04
Incremental O&M Savings	\$29,374,311	N/A	N/A	\$18,253,874	Non-Energy Benefits Adder per Gross Dth/Yr	G	\$7.55
Subtotal	\$76,923,629	N/A	N/A	\$27,481,760	<b>Annual Dth/\$M</b>	( \$1M / E )	<b>47,496</b>
<b>Total Benefits</b>	<b>\$76,923,629</b>	<b>\$22,407,518</b>	<b>\$22,407,518</b>	<b>\$55,186,366</b>	<b>Total Utility Budget</b>	( E x D )	<b>\$14,775,264</b>
<b>Utility Project Costs</b>					<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$17,573,406</b>
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$12,276,318</b>
Administration & Program Delivery	N/A	\$3,900,677	\$3,900,677	\$3,900,677			
Advertising/Promotion/Customer Ed	N/A	\$806,322	\$806,322	\$806,322	<b>Utility Program Cost per Net Dth Lifetime</b>	( E / A )	<b>\$1.57</b>
Participant Rebates and Incentives	N/A	\$9,227,886	\$9,227,886	\$9,227,886			
Equipment & Installation	N/A	\$108,150	\$108,150	\$108,150			
Measurement and Verification	N/A	\$732,230	\$732,230	\$732,230			
Subtotal	N/A	\$14,775,264	\$14,775,264	\$14,775,264			
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$36,659,333	N/A			
Subtotal	N/A	N/A	\$36,659,333	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$24,245,808	N/A	N/A	\$22,837,695			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$24,245,808	N/A	N/A	\$22,837,695			
<b>Total Costs</b>	<b>\$24,245,808</b>	<b>\$14,775,264</b>	<b>\$51,434,597</b>	<b>\$37,612,960</b>			
<b>Net Benefit (Cost)</b>	<b>\$52,677,821</b>	<b>\$7,632,254</b>	<b>(\$29,027,079)</b>	<b>\$17,573,406</b>			
<b>Benefit/Cost Ratio</b>	<b>3.17</b>	<b>1.52</b>	<b>0.44</b>	<b>1.47</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>EE PORTFOLIO TOTAL</b>					<b>2020</b>	<b>GAS</b>	<b>GOAL</b>
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Assumptions:</b>		
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>			
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>			
<b>Benefits</b>					<b>Program Assumptions:</b>		
<b>Avoided Revenue Requirements</b>					Lifetime (Weighted on Dth)	A	12.65 years
Commodity Cost Reduction	N/A	\$19,668,855	\$19,668,855	\$19,668,855	Net-to-Gross (Weighted on Dth)	B	95.51%
Variable O&M Savings	N/A	\$308,432	\$308,432	\$308,432	Install Rate (Weighted on Dth)	C	89.7%
Demand Savings	N/A	\$1,903,608	\$1,903,608	\$1,903,608	<b>Program Totals:</b>		
Subtotal				\$21,880,895	<b>Total Dth/Yr Saved</b>	D	<b>681,120</b>
Non-Energy Benefits Adder (23.5%)				\$5,147,782	Utility Costs per Net Dth/Yr	E	\$21.83
Subtotal	N/A	\$21,880,895	\$21,880,895	\$27,028,677	Net Benefit (Cost) per Gross Dth/Yr	F	\$25.67
					Non-Energy Benefits Adder per Gross Dth/Yr	G	\$7.56
<b>Other Benefits</b>					<b>Annual Dth/\$M</b>	( \$1M / E )	<b>45,814</b>
Bill Reduction - Gas	\$36,097,857	N/A	N/A	N/A	<b>Total Utility Budget</b>	( E x D )	<b>\$14,867,096</b>
Participant Rebates and Incentives	\$9,058,729	N/A	N/A	\$9,058,729	<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$17,481,485</b>
Incremental Capital Savings	\$0	N/A	N/A	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$12,333,703</b>
Incremental O&M Savings	\$28,426,959	N/A	N/A	\$17,787,308	<b>Utility Program Cost per Net Dth Lifetime</b> ( E / A ) <b>\$1.73</b>		
Subtotal	\$73,583,545	N/A	N/A	\$26,846,038			
<b>Total Benefits</b>	<b>\$73,583,545</b>	<b>\$21,880,895</b>	<b>\$21,880,895</b>	<b>\$53,874,715</b>			
<b>Utility Project Costs</b>							
Program Planning & Design	N/A	\$0	\$0	\$0			
Administration & Program Delivery	N/A	\$4,119,041	\$4,119,041	\$4,119,041			
Advertising/Promotion/Customer Ed	N/A	\$784,163	\$784,163	\$784,163			
Participant Rebates and Incentives	N/A	\$9,058,729	\$9,058,729	\$9,058,729			
Equipment & Installation	N/A	\$157,141	\$157,141	\$157,141			
Measurement and Verification	N/A	\$748,022	\$748,022	\$748,022			
Subtotal	N/A	\$14,867,096	\$14,867,096	\$14,867,096			
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$34,368,078	N/A			
Subtotal	N/A	N/A	\$34,368,078	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$22,968,168	N/A	N/A	\$21,526,133			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$22,968,168	N/A	N/A	\$21,526,133			
<b>Total Costs</b>	<b>\$22,968,168</b>	<b>\$14,867,096</b>	<b>\$49,235,174</b>	<b>\$36,393,230</b>			
<b>Net Benefit (Cost)</b>	<b>\$50,615,376</b>	<b>\$7,013,799</b>	<b>(\$27,354,279)</b>	<b>\$17,481,485</b>			
<b>Benefit/Cost Ratio</b>	<b>3.20</b>	<b>1.47</b>	<b>0.44</b>	<b>1.48</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>BUSINESS PROGRAM TOTAL</b>					<b>2019</b>	<b>GAS</b>	<b>GOAL</b>
	<b>Participant Test (\$Total)</b>	<b>Utility Test (\$Total)</b>	<b>Rate Impact Test (\$Total)</b>	<b>Modified TRC Test (\$Total)</b>	<b>Program Assumptions:</b>		
<b>Benefits</b>					Lifetime (Weighted on Dth)	A	16.97 years
<b>Avoided Revenue Requirements</b>					Net-to-Gross (Weighted on Dth)	B	96.79%
Commodity Cost Reduction	N/A	\$6,513,648	\$6,513,648	\$6,513,648	Install Rate (Weighted on Dth)	C	100.0%
Variable O&M Savings	N/A	\$91,015	\$91,015	\$91,015			
Demand Savings	N/A	\$637,505	\$637,505	\$637,505			
Subtotal				\$7,242,168			
Non-Energy Benefits Adder (20%)				\$1,448,434			
Subtotal	N/A	\$7,242,168	\$7,242,168	\$8,690,602			
<b>Other Benefits</b>					<b>Program Totals:</b>		
Bill Reduction - Gas	\$11,763,885	N/A	N/A	N/A	<b>Total Dth/Yr Saved</b>	D	<b>182,787</b>
Participant Rebates and Incentives	\$1,845,342	N/A	N/A	\$1,845,342	Utility Costs per Net Dth/Yr	E	\$14.83
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Benefit (Cost) per Gross Dth/Yr	F	\$32.38
Incremental O&M Savings	\$4,572,809	N/A	N/A	\$4,488,686	Non-Energy Benefits Adder per Gross Dth/Yr	G	\$7.92
Subtotal	\$18,182,036	N/A	N/A	\$6,334,028	<b>Annual Dth/\$M</b>	( \$1M / E )	<b>67,419</b>
<b>Total Benefits</b>	<b>\$18,182,036</b>	<b>\$7,242,168</b>	<b>\$7,242,168</b>	<b>\$15,024,630</b>	<b>Total Utility Budget</b>	( E x D )	<b>\$2,711,209</b>
<b>Utility Project Costs</b>					<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$5,918,484</b>
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$4,470,051</b>
Administration & Program Delivery	N/A	\$704,495	\$704,495	\$704,495			
Advertising/Promotion/Customer Ed	N/A	\$102,352	\$102,352	\$102,352	<b>Utility Program Cost per Net Dth Lifetime</b>	( E / A )	<b>\$0.87</b>
Participant Rebates and Incentives	N/A	\$1,845,342	\$1,845,342	\$1,845,342			
Equipment & Installation	N/A	\$0	\$0	\$0			
Measurement and Verification	N/A	\$59,020	\$59,020	\$59,020			
Subtotal	N/A	\$2,711,209	\$2,711,209	\$2,711,209			
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$11,383,242	N/A			
Subtotal	N/A	N/A	\$11,383,242	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$6,616,010	N/A	N/A	\$6,394,936			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$6,616,010	N/A	N/A	\$6,394,936			
<b>Total Costs</b>	<b>\$6,616,010</b>	<b>\$2,711,209</b>	<b>\$14,094,451</b>	<b>\$9,106,146</b>			
<b>Net Benefit (Cost)</b>	<b>\$11,566,026</b>	<b>\$4,530,959</b>	<b>(\$6,852,283)</b>	<b>\$5,918,484</b>			
<b>Benefit/Cost Ratio</b>	<b>2.75</b>	<b>2.67</b>	<b>0.51</b>	<b>1.65</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>BUSINESS PROGRAM TOTAL</b>					<b>2020</b>	<b>GAS</b>	<b>GOAL</b>
	<b>Participant</b>	<b>Utility</b>	<b>Rate</b>	<b>Modified</b>	<b>Program Assumptions:</b>		
	<b>Test</b>	<b>Test</b>	<b>Impact</b>	<b>TRC</b>			
	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>	<b>(\$Total)</b>			
<b>Benefits</b>					<b>Program Assumptions:</b>		
<b>Avoided Revenue Requirements</b>					Lifetime (Weighted on Dth)	A	16.16 years
Commodity Cost Reduction	N/A	\$5,668,708	\$5,668,708	\$5,668,708	Net-to-Gross (Weighted on Dth)	B	95.52%
Variable O&M Savings	N/A	\$75,712	\$75,712	\$75,712	Install Rate (Weighted on Dth)	C	100.0%
Demand Savings	N/A	\$530,316	\$530,316	\$530,316	<b>Program Totals:</b>		
Subtotal				\$6,274,736	<b>Total Dth/Yr Saved</b>	D	<b>156,603</b>
Non-Energy Benefits Adder (20%)				\$1,254,947	Utility Costs per Net Dth/Yr	E	\$17.52
Subtotal	N/A	\$6,274,736	\$6,274,736	\$7,529,683	Net Benefit (Cost) per Gross Dth/Yr	F	\$39.91
<b>Other Benefits</b>					Non-Energy Benefits Adder per Gross Dth/Yr	G	\$8.01
Bill Reduction - Gas	\$10,368,157	N/A	N/A	N/A	<b>Annual Dth/\$M</b>	( \$1M / E )	<b>57,064</b>
Participant Rebates and Incentives	\$1,815,920	N/A	N/A	\$1,815,920	<b>Total Utility Budget</b>	( E x D )	<b>\$2,744,332</b>
Incremental Capital Savings	\$0	N/A	N/A	\$0	<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$6,249,641</b>
Incremental O&M Savings	\$5,041,456	N/A	N/A	\$4,940,443	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$4,994,694</b>
Subtotal	\$17,225,532	N/A	N/A	\$6,756,362	<b>Utility Program Cost per Net Dth Lifetime</b> ( E / A ) <b>\$1.08</b>		
<b>Total Benefits</b>	<b>\$17,225,532</b>	<b>\$6,274,736</b>	<b>\$6,274,736</b>	<b>\$14,286,045</b>			
<b>Utility Project Costs</b>							
Program Planning & Design	N/A	\$0	\$0	\$0			
Administration & Program Delivery	N/A	\$787,037	\$787,037	\$787,037			
Advertising/Promotion/Customer Ed	N/A	\$82,355	\$82,355	\$82,355			
Participant Rebates and Incentives	N/A	\$1,815,920	\$1,815,920	\$1,815,920			
Equipment & Installation	N/A	\$0	\$0	\$0			
Measurement and Verification	N/A	\$59,020	\$59,020	\$59,020			
Subtotal	N/A	\$2,744,332	\$2,744,332	\$2,744,332			
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$9,903,934	N/A			
Subtotal	N/A	N/A	\$9,903,934	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$5,551,727	N/A	N/A	\$5,292,072			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$5,551,727	N/A	N/A	\$5,292,072			
<b>Total Costs</b>	<b>\$5,551,727</b>	<b>\$2,744,332</b>	<b>\$12,648,266</b>	<b>\$8,036,404</b>			
<b>Net Benefit (Cost)</b>	<b>\$11,673,805</b>	<b>\$3,530,403</b>	<b>(\$6,373,530)</b>	<b>\$6,249,641</b>			
<b>Benefit/Cost Ratio</b>	<b>3.10</b>	<b>2.29</b>	<b>0.50</b>	<b>1.78</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>RESIDENTIAL PROGRAM TOTAL</b>					<b>2019</b>	<b>GAS</b>	<b>GOAL</b>
	<b>Participant Test (\$Total)</b>	<b>Utility Test (\$Total)</b>	<b>Rate Impact Test (\$Total)</b>	<b>Modified TRC Test (\$Total)</b>	<b>Program Assumptions:</b>		
<b>Benefits</b>					Lifetime (Weighted on Dth)	A	11.87 years
<b>Avoided Revenue Requirements</b>					Net-to-Gross (Weighted on Dth)	B	94.55%
Commodity Cost Reduction	N/A	\$11,120,661	\$11,120,661	\$11,120,661	Install Rate (Weighted on Dth)	C	84.6%
Variable O&M Savings	N/A	\$165,668	\$165,668	\$165,668			
Demand Savings	N/A	\$1,160,406	\$1,160,406	\$1,160,406			
Subtotal				\$12,446,735			
Non-Energy Benefits Adder (20%)				\$2,489,347			
Subtotal	N/A	\$12,446,735	\$12,446,735	\$14,936,082			
<b>Other Benefits</b>					<b>Program Totals:</b>		
Bill Reduction - Gas	\$0	N/A	N/A	N/A	<b>Total Dth/Yr Saved</b>	D	<b>435,754</b>
Participant Rebates and Incentives	\$3,489,059	N/A	N/A	\$3,489,059	Utility Costs per Net Dth/Yr	E	\$14.17
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Benefit (Cost) per Gross Dth/Yr	F	\$26.19
Incremental O&M Savings	\$0	N/A	N/A	\$11,006,943	Non-Energy Benefits Adder per Gross Dth/Yr	G	\$5.71
Subtotal	\$3,489,059	N/A	N/A	\$14,496,002	<b>Annual Dth/\$M</b>	( \$1M / E )	<b>70,575</b>
<b>Total Benefits</b>	<b>\$3,489,059</b>	<b>\$12,446,735</b>	<b>\$12,446,735</b>	<b>\$29,432,084</b>	<b>Total Utility Budget</b>	( E x D )	<b>\$6,174,347</b>
<b>Utility Project Costs</b>					<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$11,413,662</b>
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$8,924,315</b>
Administration & Program Delivery	N/A	\$1,825,550	\$1,825,550	\$1,825,550			
Advertising/Promotion/Customer Ed	N/A	\$439,918	\$439,918	\$439,918			
Participant Rebates and Incentives	N/A	\$3,489,059	\$3,489,059	\$3,489,059			
Equipment & Installation	N/A	\$108,150	\$108,150	\$108,150			
Measurement and Verification	N/A	\$311,670	\$311,670	\$311,670			
Subtotal	N/A	\$6,174,347	\$6,174,347	\$6,174,347	<b>Utility Program Cost per Net Dth Lifetime</b>	( E / A )	<b>\$1.19</b>
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$20,352,333	N/A			
Subtotal	N/A	N/A	\$20,352,333	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$0	N/A	N/A	\$11,844,076			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$0	N/A	N/A	\$11,844,076			
<b>Total Costs</b>	<b>\$0</b>	<b>\$6,174,347</b>	<b>\$26,526,679</b>	<b>\$18,018,422</b>			
<b>Net Benefit (Cost)</b>	<b>\$3,489,059</b>	<b>\$6,272,389</b>	<b>(\$14,079,944)</b>	<b>\$11,413,662</b>			
<b>Benefit/Cost Ratio</b>	<b>INF</b>	<b>2.02</b>	<b>0.47</b>	<b>1.63</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>RESIDENTIAL PROGRAM TOTAL</b>					<b>2020</b>	<b>GAS</b>	<b>GOAL</b>
	<b>Participant Test (\$Total)</b>	<b>Utility Test (\$Total)</b>	<b>Rate Impact Test (\$Total)</b>	<b>Modified TRC Test (\$Total)</b>	<b>Program Assumptions:</b>		
<b>Benefits</b>					Lifetime (Weighted on Dth)	A	11.22 years
<b>Avoided Revenue Requirements</b>					Net-to-Gross (Weighted on Dth)	B	94.76%
Commodity Cost Reduction	N/A	\$11,683,881	\$11,683,881	\$11,683,881	Install Rate (Weighted on Dth)	C	84.3%
Variable O&M Savings	N/A	\$199,236	\$199,236	\$199,236	<b>Program Totals:</b>		
Demand Savings	N/A	\$1,151,032	\$1,151,032	\$1,151,032	<b>Total Dth/Yr Saved</b>	D	<b>451,753</b>
Subtotal				\$13,034,149	Utility Costs per Net Dth/Yr	E	\$13.87
Non-Energy Benefits Adder (20%)				\$2,606,830	Net Benefit (Cost) per Gross Dth/Yr	F	\$27.18
Subtotal	N/A	\$13,034,149	\$13,034,149	\$15,640,978	Non-Energy Benefits Adder per Gross Dth/Yr	G	\$5.77
<b>Other Benefits</b>					<b>Annual Dth/\$M</b>	( \$1M / E )	<b>72,090</b>
Bill Reduction - Gas	\$21,682,740	N/A	N/A	N/A	<b>Total Utility Budget</b>	( E x D )	<b>\$6,266,518</b>
Participant Rebates and Incentives	\$3,381,527	N/A	N/A	\$3,381,527	<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$12,280,492</b>
Incremental Capital Savings	\$0	N/A	N/A	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$9,673,663</b>
Incremental O&M Savings	\$21,232,972	N/A	N/A	\$11,192,084	<b>Utility Program Cost per Net Dth Lifetime</b> ( E / A ) <b>\$1.24</b>		
Subtotal	\$46,297,239	N/A	N/A	\$14,573,611			
<b>Total Benefits</b>	<b>\$46,297,239</b>	<b>\$13,034,149</b>	<b>\$13,034,149</b>	<b>\$30,214,589</b>			
<b>Utility Project Costs</b>							
Program Planning & Design	N/A	\$0	\$0	\$0			
Administration & Program Delivery	N/A	\$1,941,043	\$1,941,043	\$1,941,043			
Advertising/Promotion/Customer Ed	N/A	\$441,765	\$441,765	\$441,765			
Participant Rebates and Incentives	N/A	\$3,381,527	\$3,381,527	\$3,381,527			
Equipment & Installation	N/A	\$157,141	\$157,141	\$157,141			
Measurement and Verification	N/A	\$345,042	\$345,042	\$345,042			
Subtotal	N/A	\$6,266,518	\$6,266,518	\$6,266,518			
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$20,417,184	N/A			
Subtotal	N/A	N/A	\$20,417,184	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$12,849,959	N/A	N/A	\$11,667,579			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$12,849,959	N/A	N/A	\$11,667,579			
<b>Total Costs</b>	<b>\$12,849,959</b>	<b>\$6,266,518</b>	<b>\$26,683,702</b>	<b>\$17,934,097</b>			
<b>Net Benefit (Cost)</b>	<b>\$33,447,280</b>	<b>\$6,767,631</b>	<b>(\$13,649,553)</b>	<b>\$12,280,492</b>			
<b>Benefit/Cost Ratio</b>	<b>3.60</b>	<b>2.08</b>	<b>0.49</b>	<b>1.68</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>LOW-INCOME PROGRAM TOTAL</b>					<b>2019</b>	<b>GAS</b>	<b>GOAL</b>
	<b>Participant Test (\$Total)</b>	<b>Utility Test (\$Total)</b>	<b>Rate Impact Test (\$Total)</b>	<b>Modified TRC Test (\$Total)</b>	<b>Program Assumptions:</b>		
<b>Benefits</b>					Lifetime (Weighted on Dth)	A	13.42 years
<b>Avoided Revenue Requirements</b>					Net-to-Gross (Weighted on Dth)	B	100.00%
Commodity Cost Reduction	N/A	\$2,433,582	\$2,433,582	\$2,433,582	Install Rate (Weighted on Dth)	C	92.2%
Variable O&M Savings	N/A	\$35,610	\$35,610	\$35,610			
Demand Savings	N/A	\$249,423	\$249,423	\$249,423			
Subtotal				\$2,718,615			
Non-Energy Benefits Adder (50%)				\$1,359,307			
Subtotal	N/A	\$2,718,615	\$2,718,615	\$4,077,922			
<b>Other Benefits</b>					<b>Program Totals:</b>		
Bill Reduction - Gas	\$4,923,759	N/A	N/A	N/A	<b>Total Dth/Yr Saved</b>	D	<b>83,220</b>
Participant Rebates and Incentives	\$3,602,484	N/A	N/A	\$3,602,484	Utility Costs per Net Dth/Yr	E	\$51.64
Incremental Capital Savings	\$0	N/A	N/A	\$0	Net Benefit (Cost) per Gross Dth/Yr	F	\$18.53
Incremental O&M Savings	\$3,753,744	N/A	N/A	\$2,758,245	Non-Energy Benefits Adder per Gross Dth/Yr	G	\$16.33
Subtotal	\$12,279,987	N/A	N/A	\$6,360,730	<b>Annual Dth/\$M</b>	( \$1M / E )	<b>19,364</b>
<b>Total Benefits</b>	<b>\$12,279,987</b>	<b>\$2,718,615</b>	<b>\$2,718,615</b>	<b>\$10,438,652</b>	<b>Total Utility Budget</b>	( E x D )	<b>\$4,297,643</b>
<b>Utility Project Costs</b>					<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$1,542,325</b>
Program Planning & Design	N/A	\$0	\$0	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>\$183,018</b>
Administration & Program Delivery	N/A	\$470,076	\$470,076	\$470,076			
Advertising/Promotion/Customer Ed	N/A	\$76,228	\$76,228	\$76,228	<b>Utility Program Cost per Net Dth Lifetime</b>	( E / A )	<b>\$3.85</b>
Participant Rebates and Incentives	N/A	\$3,602,484	\$3,602,484	\$3,602,484			
Equipment & Installation	N/A	\$0	\$0	\$0			
Measurement and Verification	N/A	\$148,855	\$148,855	\$148,855			
Subtotal	N/A	\$4,297,643	\$4,297,643	\$4,297,643			
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$4,923,759	N/A			
Subtotal	N/A	N/A	\$4,923,759	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$4,598,683	N/A	N/A	\$4,598,683			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$4,598,683	N/A	N/A	\$4,598,683			
<b>Total Costs</b>	<b>\$4,598,683</b>	<b>\$4,297,643</b>	<b>\$9,221,402</b>	<b>\$8,896,327</b>			
<b>Net Benefit (Cost)</b>	<b>\$7,681,303</b>	<b>(\$1,579,029)</b>	<b>(\$6,502,787)</b>	<b>\$1,542,325</b>			
<b>Benefit/Cost Ratio</b>	<b>2.67</b>	<b>0.63</b>	<b>0.29</b>	<b>1.17</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

<b>LOW-INCOME PROGRAM TOTAL</b>					<b>2020</b>	<b>GAS</b>	<b>GOAL</b>
	<b>Participant Test (\$Total)</b>	<b>Utility Test (\$Total)</b>	<b>Rate Impact Test (\$Total)</b>	<b>Modified TRC Test (\$Total)</b>	<b>Program Assumptions:</b>		
<b>Benefits</b>					Lifetime (Weighted on Dth)	A	13.91 years
<b>Avoided Revenue Requirements</b>					Net-to-Gross (Weighted on Dth)	B	100.00%
Commodity Cost Reduction	N/A	\$2,316,267	\$2,316,267	\$2,316,267	Install Rate (Weighted on Dth)	C	95.5%
Variable O&M Savings	N/A	\$33,484	\$33,484	\$33,484	<b>Program Totals:</b>		
Demand Savings	N/A	\$222,260	\$222,260	\$222,260	<b>Total Dth/Yr Saved</b>	D	<b>72,765</b>
Subtotal				\$2,572,011	Utility Costs per Net Dth/Yr	E	\$58.67
Non-Energy Benefits Adder (50%)				\$1,286,005	Net Benefit (Cost) per Gross Dth/Yr	F	\$3.40
Subtotal	N/A	\$2,572,011	\$2,572,011	\$3,858,016	Non-Energy Benefits Adder per Gross Dth/Yr	G	\$17.67
<b>Other Benefits</b>					<b>Annual Dth/\$M</b>	( \$1M / E )	<b>17,044</b>
Bill Reduction - Gas	\$4,046,959	N/A	N/A	N/A	<b>Total Utility Budget</b>	( E x D )	<b>\$4,269,136</b>
Participant Rebates and Incentives	\$3,570,283	N/A	N/A	\$3,570,283	<b>Total MTRC Net Benefits with Adder</b>	( D x F )	<b>\$247,462</b>
Incremental Capital Savings	\$0	N/A	N/A	\$0	<b>Total MTRC Net Benefits without Adder</b>	( F - G ) x D	<b>-\$1,038,543</b>
Incremental O&M Savings	\$2,152,530	N/A	N/A	\$1,654,781	<b>Utility Program Cost per Net Dth Lifetime ( E / A ) \$4.22</b>		
Subtotal	\$9,769,773	N/A	N/A	\$5,225,064			
<b>Total Benefits</b>	<b>\$9,769,773</b>	<b>\$2,572,011</b>	<b>\$2,572,011</b>	<b>\$9,083,080</b>			
<b>Utility Project Costs</b>							
Program Planning & Design	N/A	\$0	\$0	\$0			
Administration & Program Delivery	N/A	\$477,780	\$477,780	\$477,780			
Advertising/Promotion/Customer Ed	N/A	\$72,218	\$72,218	\$72,218			
Participant Rebates and Incentives	N/A	\$3,570,283	\$3,570,283	\$3,570,283			
Equipment & Installation	N/A	\$0	\$0	\$0			
Measurement and Verification	N/A	\$148,855	\$148,855	\$148,855			
Subtotal	N/A	\$4,269,136	\$4,269,136	\$4,269,136			
<b>Utility Revenue Reduction</b>							
Revenue Reduction - Gas	N/A	N/A	\$4,046,959	N/A			
Subtotal	N/A	N/A	\$4,046,959	N/A			
<b>Participant Costs</b>							
Incremental Capital Costs	\$4,566,482	N/A	N/A	\$4,566,482			
Incremental O&M Costs	\$0	N/A	N/A	\$0			
Subtotal	\$4,566,482	N/A	N/A	\$4,566,482			
<b>Total Costs</b>	<b>\$4,566,482</b>	<b>\$4,269,136</b>	<b>\$8,316,096</b>	<b>\$8,835,618</b>			
<b>Net Benefit (Cost)</b>	<b>\$5,203,291</b>	<b>(\$1,697,125)</b>	<b>(\$5,744,085)</b>	<b>\$247,462</b>			
<b>Benefit/Cost Ratio</b>	<b>2.14</b>	<b>0.60</b>	<b>0.31</b>	<b>1.03</b>			

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

## Appendix A – List of Acronyms

<b>Acronym</b>	<b>Meaning</b>
ACEEE	American Council for an Energy Efficient Economy
AFUE	Annual Fuel Utilization Efficiency
ASHRAE	American Society of Heating Refrigeration & Air Conditioning Engineers
BOMA	Building Owners and Managers Association
BSC	Business Solutions Center
CEE (Minnesota)	Center for Energy and the Environment
CEE (Boston)	Consortium for Energy Efficiency
CEO	Colorado Energy Office
CFL	Compact Fluorescent Light Bulb
CFM	Cubic Feet Per Minute
CoPUC	Colorado Public Utilities Commission
DOE	U.S. Department of Energy
DSM	Demand-Side Management
DSMCA	Demand-Side Management Cost Adjustment
EEBC	Energy Efficiency Business Coalition
EER	Energy Efficiency Ratio
EF	Energy Factor
EIA	Energy Information Administration
EMS	Energy Management System
EM&V	Evaluation, Measurement & Verification
EOC	Energy Outreach Colorado
EPA	U.S. Environmental Protection Agency
ESCO	Energy Services Company
GAMA	Gas Appliance Manufacturer's Association
GPM	Gallons per Minute
HERS	Home Energy Rating System
HVAC	Heating, Ventilation, and Air Conditioning
IPMVP	International Performance Measurement and Verification Protocol
LIHEAP	Low-Income Home Energy Assistance Program
M&V	Measurement and Verification
NAIOP	National Association of Industrial and Office Properties
NEMA	National Electrical Manufacturers Association
NTG	Net-to-Gross
O&M	Operations and Maintenance
RAP	Resource Action Programs
RESNET	Residential Energy Services Network
RR	Realization Rate
SEER	Seasonal Energy Efficiency Ratio
TRC	Total Resource Cost test
VC	Verification Contractor
VFD	Variable Frequency Drive

## Appendix B – Key Terms

Plan – Gas Rule 4751(i) states that ““DSM plan” means the DSM programs, goals, and budgets over a specified DSM period, generally considered in one year increments, as may be proposed by the utility.” C.R.S. 40-3.2-103 (3)(a) dictates that “...each gas utility shall: (a) Develop and begin implementing a set of cost-effective DSM programs for its full service customers. Such programs shall be of the gas utility's choosing, taking into account the characteristics of the gas utility and its customers...” The Company submits DSM plans on an annual or biennial basis to obtain Commission approval of specific DSM programs, pilots, annual energy savings and peak demand reduction goals, and annual budgets, in accordance with Paragraph 170 of Decision No. C08-0560 which states that the Commission “concur with Public Service’s plan to file DSM plans biennially and to combine electric and gas DSM into one filing.”

Portfolio – Gas Rule 4757(e) states that, “A utility has the discretion and the responsibility of managing the portfolio of DSM programs to meet the benefit to cost ratio and the energy and savings targets. In implementing DSM programs, a utility shall use reasonable efforts to maximize energy savings consistent with the approved DSM plan.” Consistent with the use of the term portfolio in Gas Rule 4757(e), the Company uses the term DSM “portfolio” when referring to the entire group of electric or gas programs, products, and measures that the Company implements in a given plan-year.

Program – C.R.S. 40-1-102(6) states that ““Demand-side management programs” or “DSM programs” means energy efficiency, conservation, load management, and demand response programs or any combination of these programs.” Gas Rule 4751(j) states that ““DSM program” means any combination of DSM measures, information and services offered to customers to reduce natural gas usage.” Consistent with these definitions, depending on the context, the Company may use the term “program” to refer to the entire group of energy efficiency, conservation, load management, and demand response programs it offers, to only one of the described initiatives, as in the case of the Interruptible Service Option Credit program, or Third-Party Demand Response Program, or to a subset of the energy efficiency products it provides as in the case of the Residential, Business and Low-Income and Indirect gas and electric energy efficiency programs.

Product – The term “product” is used by the Company to refer to one of the approximately three dozen DSM offerings that are included as the principal components of the business, residential, and low-income programs included in the DSM plan and offered to customers.

*For example, Commercial Refrigeration Efficiency and Lighting Efficiency are individual products within the Business Program under the electric energy efficiency portfolio.*

Measure – Gas Rule 4751(g) states that ““DSM measure” means an individual component or technology, such as attic insulation or replacement of equipment.” The Company uses the term “measure” when referring to individual components or technologies offered as part of a specific product. For example, each of the energy efficient lighting technologies offered as part of the Lighting Efficiency product are considered to be individual “measures.”

Third-Party Implementer – The Company considers third-party implementers to be contracted agents that support DSM product delivery. This does not include trade partners or other consultants.

Goal – The Company refers to “goal” as the Commission-approved annual GWh savings goal for the Company’s electric portfolio, such as those ordered in Proceeding No. 17A-0462EG for years 2019 through 2023.

Targets – The Company refers to “targets” as the Company’s estimated achievements for a given year for our portfolio, programs, and products.

## **Appendix C – Product Rankings**

DSM Product rankings are established by determining market segments that could participate in the product, customer classes available, total projected savings, cost-effectiveness, and participation rates (as a number and a percent of the market). This ranking is a requirement from Gas Rules 723-4, Proceeding No. 07R-371G.

<b>2019-2020</b>	<b>Rank</b>
Home Lighting & Recycling	1
School Education Kits	2
Energy Feedback Residential	3
Lighting Efficiency	4
Energy Efficient Showerhead	5
Evaporative Cooling	6
Lighting - Small Business	7
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## **Appendix D – Budget Categories**

The Company uses the following six budget categories to track and report its annual expenditures for DSM programs and products within its portfolio:

### **1. Program Planning and Design**

Expenditures for:

- Labor for product development and product managers.
- Expenditures related to product development, planning, and design.

### **2. Administration and Program Delivery**

Expenditures for:

- Labor for product managers, sales representatives, call center, rebate processing, technical consulting, and other fulfillment activities associated with delivering a product directly to the customer.
- Labor for installation contractors, vendors, technical consultants, fulfillment contractors, and alternative providers that Xcel Energy contracts with to provide DSM services.
- Project fulfillment, implementation and program support activities associate with delivering a program directly to the customer.

### **3. Advertising / Promotion / Customer Education**

Expenditures for:

- Labor for communication staff and others.
- TV, radio, newspaper, and print media; direct promotion and sales support materials; postage, promotional events; contracted outbound telephone sales.
- Customer education through seminars, pamphlets, videos, and computer games.

### **4. Participant Rebates and Incentives**

Expenditures for:

- Customer rebates, finance interest subsidies, subsidies for engineering studies, trade incentives, and incentives given in the form of subsidized products or equipment.

### **5. Equipment and Installation**

Expenditures for:

- The costs to purchase energy efficient equipment and to install efficiency equipment at the customer site.

### **6. Measurement and Verification**

Expenditures for:

- Labor for market research and load research.
- Labor product development staff, product development, external consultants, and product development research activities.
- Customer surveys, program evaluation expenses.

## Appendix E – Avoided Cost Assumptions

The following sections summarize the avoided cost assumptions Public Service has made in order to perform the cost-effectiveness tests for electric and gas programs, and for which the Company is asking for approval of for use in the status reports and incentives calculations for 2019 and 2020 achievements.

### Electric Programs

In order to determine the cost-effectiveness of its electric energy efficiency and load management programs, Public Service must first calculate the avoided generation, transmission, distribution, and marginal energy costs these programs avoid. Below are the avoided cost assumptions used in this plan.

#### **1. Estimated Annual Avoided Generation Capacity Costs (Source: Public Service Resource Planning)**

Capacity costs reflect the generic capacity cost estimates used in Phase I and Phase II of the Public Service Company of Colorado’s 2016 Electric Resource Plan (Proceeding No. 16A-0396E) for a gas-fired combustion turbine (CT) referred to as a “Large or Generic CT” in compliance with paragraphs 33 and 34 of the filed Non-Unanimous Settlement Agreement (Proceeding No. 17A-0462EG) and as affirmed in paragraph 104 of Decision C18-0417.

	CT		CT
Year	Gen Capacity \$/kW-mo	Year	Gen Capacity \$/kW-mo
2019	\$7.37	2030	\$9.17
2020	\$7.52	2031	\$9.35
2021	\$7.67	2032	\$9.54
2022	\$7.82	2033	\$9.73
2023	\$7.98	2034	\$9.92
2024	\$8.14	2035	\$10.12
2025	\$8.30	2036	\$10.32
2026	\$8.47	2037	\$10.53
2027	\$8.64	2038	\$10.74
2028	\$8.81	2039	\$10.96
2029	\$8.99		

#### **2. Estimated Annual Avoided Transmission and Distribution (T&D) Capacity Costs (Source: Public Service Resource Planning)**

Paragraph 97 in Decision C14-0731 (Proceeding No. 13A-0686EG) required the Company to “...study the avoided transmission and distribution capacity costs and propose values in its DSM Biennial Plan for 2015 through 2016.” Consistent with the Commission’s decision in C15-0735, the Company undertook a study, specific to its own territory, utilizing the system planning approach to estimate T&D costs. The study is included as attachment SMW-6 to the Direct Testimony of Shawn M. White in Proceeding No. 16A-0512EG and affirmed in

Proceeding No. 17A-0462EG.<sup>109</sup> The results of this study represent the best estimates available and will be used for analysis of the 2019 and 2020 achievements.

Avoided Capacity \$/kW-yr				Avoided Capacity \$/kW-yr			
Year	Transmission	Distribution	T&D	Year	Transmission	Distribution	T&D
2019	\$8.71	\$2.37	\$11.08	2030	\$10.83	\$2.95	\$13.78
2020	\$8.88	\$2.42	\$11.30	2031	\$11.05	\$3.01	\$14.06
2021	\$9.06	\$2.47	\$11.53	2032	\$11.27	\$3.07	\$14.33
2022	\$9.24	\$2.51	\$11.76	2033	\$11.49	\$3.13	\$14.62
2023	\$9.43	\$2.57	\$11.99	2034	\$11.72	\$3.19	\$14.91
2024	\$9.62	\$2.62	\$12.23	2035	\$11.96	\$3.25	\$15.21
2025	\$9.81	\$2.67	\$12.48	2036	\$12.20	\$3.32	\$15.51
2026	\$10.01	\$2.72	\$12.73	2037	\$12.44	\$3.38	\$15.82
2027	\$10.21	\$2.78	\$12.98	2038	\$12.69	\$3.45	\$16.14
2028	\$10.41	\$2.83	\$13.24	2039	\$12.94	\$3.52	\$16.46
2029	\$10.62	\$2.89	\$13.51				

### 3. Estimated DSM Geo-Targeting Avoided Transmission and Distribution (T&D) Capacity Costs (*Source: Public Service Distribution Planning*)

As part of the settlement agreement in Proceeding No. 17A-0462EG a process to determine the incremental value of avoided transmission and distribution capacity costs was approved. The table below includes the value each year for this avoided cost applicable to the Geo-Targeting Pilot included in this Plan.

Geo-Targeting Incremental T&D			
Year	T&D Capacity \$/kW-yr	Year	T&D Capacity \$/kW-yr
2019	\$0.00	2030	\$0.00
2020	\$0.00	2031	\$0.00
2021	\$0.00	2032	\$0.00
2022	\$914.72	2033	\$0.00
2023	\$596.88	2034	\$0.00
2024	\$446.41	2035	\$0.00
2025	\$343.87	2036	\$0.00
2026	\$290.85	2037	\$0.00
2027	\$0.00	2038	\$0.00
2028	\$0.00	2039	\$0.00
2029	\$0.00		

<sup>109</sup> See paragraph 35 of the Non-Unanimous Comprehensive Settlement Agreement and Ordering Paragraph 104 of Decision No. C18-0417.

**4. Estimated Annual Avoided Energy Costs (Source: Public Service Generation Modelling Services)**

In order to determine avoided energy costs, the Company’s Generation Modelling Services group produced a PLEXOS run to produce hourly marginal energy estimates. These runs follow the provisions stated in the settlement agreement in Proceeding No. 17A-0462EG. For each individual measure in the Plan, an hourly load shape is assigned, as documented in Appendix G. The estimated annual avoided energy resulting from the product of hourly marginal energy estimates and the hourly load shape is used to determine the estimate annual avoided energy costs for each measure.

**5. Estimated Annual Avoided Emissions Costs (includes CO<sub>2</sub>) (Source: Public Service Generation Modelling Services)**

Public Services Company of Colorado’s 2016 Electric Resource Plan (Proceeding No. 16A-0396E) used a base-case assumed zero cost for CO<sub>2</sub> emissions. For this reason, this value is set to \$0 for all future years.

Gas Programs

In order to determine the cost-effectiveness of its gas programs, Public Service must calculate the avoided commodity cost of gas, avoided capacity costs and any avoided variable O&M costs associated with the gas energy efficiency savings. Below are the avoided cost assumptions used in this Plan.

**1. Estimated Commodity Cost of Gas (Source: Public Service Gas Resource Planning)**

The gas price forecast reflects a market snapshot for short-term prices and a quantitative average of projections from well-known forecasting services for the long-term forecast prices as of February 2018. Distinct costs are identified for Business and Residential customers with these values being applied to Business and Residential gas programs respectively.

Year	\$/Dth		Year	\$/Dth	
	Residential	Business		Residential	Business
2019	\$2.17	\$2.15	2030	\$4.44	\$4.43
2020	\$2.57	\$2.56	2031	\$4.58	\$4.57
2021	\$2.79	\$2.77	2032	\$4.79	\$4.78
2022	\$2.99	\$2.98	2033	\$4.96	\$4.95
2023	\$3.21	\$3.20	2034	\$5.10	\$5.09
2024	\$3.45	\$3.44	2035	\$5.28	\$5.26
2025	\$3.59	\$3.58	2036	\$5.48	\$5.46
2026	\$3.73	\$3.72	2037	\$5.58	\$5.56
2027	\$3.89	\$3.88	2038	\$5.75	\$5.73
2028	\$4.10	\$4.09	2039	\$5.86	\$5.84
2029	\$4.28	\$4.26			

**2. Estimated Avoided Variable O&M Costs (Source: Public Service Pricing and Planning)**

The company used the following value provided by the Company's Pricing and Planning department to determine variable O&M costs avoided with a reduction in gas usage.

Year	\$/Dth
2019-2039	\$0.05

**3. Estimated Annual Avoided Reservation Costs (used to estimate capacity savings – Peak Day Dth savings estimated as 1% of annual Dth savings) (Source: Public Service Gas Resource Planning)**

The following annual avoided reservation costs was used to determine the cost of service to transport incremental gas supplies to the metropolitan Denver area. The Company uses the CIG firm transportation rate to estimate this cost.

Year	\$/Dth
2019-2039	\$35.022

## **Appendix F – Natural Gas DSM \$/Therm and ALR Methodology**

The Company proposes the following dollar per therm values applicable to natural gas DSM programs provided to its residential and non-residential customers, respectively:

### **Proposed Dollar per Therm Values for the DSMCA factors to be effective July 1, 2016:**

DTVR =	\$0.09152
DTVNR =	\$0.10839

The dollar per therm values proposed have been used to calculate the lost revenues sought to be recovered through the Gas-Demand Side Management Cost Adjustment (G-DSMCA) filed on April 2, 2018 to be effective July 1, 2018.

The methodology for calculating the dollar per therm values set forth above is as follows:

The following methodology is proposed for calculation of the Dollar per Therm Values (DTV) that is required to calculate the Acknowledgement of Lost Revenue (ALR) value in accordance with Public Service gas Demand-Side Management Cost Adjustment (DSMCA). Two dollar per therm values are required, one for residence service, which is herein labeled “DTVR”, and one for non-residence service, which is herein labeled “DTVNR”.

### **Calculation of the Residence Service Dollar per Therm Value (DTVR):**

Calculation Components:

1. Residential Base Rate per Therm (RBR)
2. Variable Cost per Therm (VCT)

Formula:  $DTVR = RBR \text{ minus } VCT$

### **Calculation of the Non Residence Service Dollar per Therm Value (DTVNR):**

Calculation Components:

1. Commercial Small Gas Service Base Rate per Therm (CSGBR)
2. Commercial Large Gas Service Base Rate per Therm (CLGBR)
3. Interruptible Industrial Gas Service Base Rate per Therm (IGBR)
4. CSG Sales (CSGS)
5. CLG Sales (CLGS)
6. IG Sales (IGS)
7. Total of CSG + CLG + IG Sales (TS)
8. VCT

Formula:  $DTVNR = \{[CSGBR \text{ times } (CSGS/TS)] + [CLGBR \text{ times } (CLGS/TS)] + [IGBR \text{ times } (IGS/TS)]\} \text{ minus } VCT$

### **Calculation of the VCT**

**[Note: the VCT is the same for both the DTVR and DTVNR formula]:**

Calculation Components:

1. Total Variable Costs (VC)

2. Weather Normalized throughput in Therms (WNT)  
Formula:  $VCT = VC/WNT$

**Proposed VCT to be effective January 1, 2015:**

VCT = \$0.000391

**As stipulated in Service Company's gas tariff, these Dollar per Therm Values are applied to the gas DSMCA factor calculations as follows:**

“The RDSM ALR Value is the sum of multiplying the dollar per therm value, as approved by the Commission for residential service, (DTVR) times the annual number of therms lost from all residential programs executed during the program year under consideration.

“The NDSMCA ALR Value is the sum of multiplying the dollar per therm value, as approved by the Commission for non-residential services (DTVNR), times the annualized number of therms lost from all non-residential programs executed during the program year under consideration.”

## Appendix G – Electric Load Shape Documentation

The following section documents the load shapes applied to electric DSM measures in this plan. These load shapes are scaled to the annual energy savings for each measure, and then applied to the hourly marginal energy price estimates to determine the avoided marginal energy benefit for each measure. See the Direct Testimony of Jeremy A. Petersen for more details.

Load Shape	Description	Measures Applied To
CO-BUS-COMPAIR	Operation of compressed air in business sites	Various compressed air measures
CO-Bus-Cool with Economizer	Operation of cooling equipment with economizers in business sites	Various cooling measures in the Cooling Efficiency product with economizers
CO-BUS-COOL_OUT	Operation of cooling equipment in business sites	Various cooling measures in the Cooling Efficiency product without economizers
CO-Bus-Cooling Thermal Storage	Operation of thermal storage for cooling in business sites	Thermal Energy Storage* in Cooling Efficiency program and Recommissioning Load Shifting* measure.
CO-BUS-CUSTOM_	Operation of measures in past custom projects	Various miscellaneous measures across a few products (aerators/sprayers in business products, TV timer turning off peripherals) and custom measures* within the Custom product.
CO-Bus-Data Center Blend	Blend of the load shapes of the technologies included in past data center projects	Data center prescriptive measures
CO-Bus-ECM	Hourly savings of electrically-commutated motor (ECM) fans in business installations	Various EMS measures in Heating Efficiency product
CO-BUS-EDA_CHNG	Change in load from Energy Design Assistance projects	Projects in Energy Design Assistance and Energy Efficiency Buildings products
CO-Bus-EIS Load Shift	Hourly savings and load increases from load shifting measures from Energy Information Systems	Energy Management System load shifting measures.*
CO-BUS-EMS_OFFP	Energy Management System loads shifted to off-peak	Various measures in the Energy Management System product
CO-BUS-FLAT	Flat load shape	Various measures in the Business program that run flat throughout the year
CO-BUS-Light	Operation of general lighting technologies in business sites	Computer Efficiency Virtualization
CO-BUS-Light All	Blend of lighting loadshape across all building types	Custom Lighting* and bulbs purchased through Residential Home Lighting program installed at businesses
CO-BUS-Light Flat	Flat load shape	Exit signs, stairwell fixtures and parking garage lighting
CO-BUS-Light High Bay†	Blend of lighting loadshape across all building types weighted on installation of high bay lamps and fixtures	High Bay lamps and fixtures
CO-BUS-Light Refrigerated†	Blend of lighting loadshape across all building types weighted on installation of lighting in refrigeration applications	LED Refrigerator and Freezer Cases
CO-BUS-Light Screw In†	Blend of lighting loadshape across all building types weighted on installation of screw-in bulbs	LED Midstream Interior Lamps
CO-BUS-Light Troffer†	Blend of lighting loadshape across all building types weighted on installation of lighting troffers	LED troffer fixtures and lamps
CO-BUS-Light Tube†	Blend of lighting loadshape across all building types weighted on installation of lighting tubes	LED tubes

\*Projects including measures using this shape will be run through a custom analysis during which hourly load shapes will be determined.

†Load shapes in Plan based on historical achievement among different building types. Actual load shape used in status reports will be based on actual achievement among building types in the report year.

Load Shape	Description	Measures Applied To
CO-BUS-LIGHTING	Operation of general lighting technologies in business sites	Misc. lighting measures in a couple products and measures that operate in lighted area and will be operated at the same time as the lighting (aerators, dishwashers)
CO-BUS-Light-Network-Controls	Hourly savings of lighting under network control at a business site	Networked lighting controls
CO-BUS-Light-Sensor	Hourly savings of lighting under sensor control at a business site	Standalone Controls
CO-BUS-MTRS_OUT	Operation of motors in business sites	Variable frequency drives (VFDs) and upgraded motors in the Motors product
CO-BUS-PEAK_CNT	Hourly savings and load increases from a peak control product	Measures in demand response programs including Saver's Switch, Smart Thermostats and Battery Demand Response
CO-BUS-RECM_OUT	Hourly savings of recommissioning projects at a business site	Impact of recommissioning studies and area lighting measures that have the same usage pattern as recommissioning hourly savings
CO-BUS-SBL High Bay†	Blend of lighting loadshape across all building types weighted on installation of high bay lamps and fixtures through Small Business Lighting program	High Bay lamps and fixtures
CO-BUS-SBL Refrigerated†	Blend of lighting loadshape across all building types weighted on installation of lighting in refrigeration applications through Small Business Lighting program	LED Refrigerator and Freezer Cases
CO-BUS-SBL Screw In†	Blend of lighting loadshape across all building types weighted on installation of screw-in bulbs through Small Business Lighting program	LED Midstream Interior Lamps
CO-BUS-SBL Troffer†	Blend of lighting loadshape across all building types weighted on installation of lighting troffers through Small Business Lighting program	LED troffer fixtures and lamps
CO-BUS-SBL Tube†	Blend of lighting loadshape across all building types weighted on installation of lighting tubes through Small Business Lighting program	LED tube lamps
CO-Res_Cooling_DX	Operation of cooling at residential sites	Envelope measures for residential customers with electric cooling and electric cooling equipment and installation measures
CO-Res_Cooling_DX_Heating_DX	Operation of cooling and electric heating at residential sites	Envelope measures for residential customers with electric cooling and heating using heat pump equipment
CO-Res_Cooling_DX_Heating_Elec	Operation of cooling and electric heating at residential sites	Envelope measures for residential customers with electric cooling and heating using electric baseboard heat
CO-Res_Heating_Elec	Operation of electric heating at residential sites	Envelope measures for residential customers with electric heating and without electric cooling
CO-Res_Lighting	Operation of lighting at residential sites	LED bulbs at residential sites
CO-RES-EVAPBASE	Hourly savings of evaporative cooling replacing air conditioning at a residential site	Evaporative cooling measures replacing air-conditioning
CO-RES-FLAT	Flat load shape	Various measures that operate throughout the year
CO-RES-MFLIT	Operation of lighting at multi-family residential sites	Multi-family buildings direct install LED bulbs
CO-RES-SFLIT	Operation of lighting at single-family residential sites	Various LED bulb measures and clothes washer measures
CO-RES-SFMFLOW	Operation of aerators and showerheads at residential sites	Showerheads and aerators in the Multi-family buildings
CO-RES-SFRF1	Operation of refrigerators at residential sites	Refrigerators and electrically-commutated motor (ECM) fan measures in various products
CO-RES-SFWHT	Operation of electric water heaters at residential sites	Showerhead and aerator measures as well as electric water heating equipment in various products

\*Projects including measures using this shape will be run through a custom analysis during which hourly load shapes will be determined.

†Load shapes in Plan based on historical achievement among different building types. Actual load shape used in status reports will be based on actual achievement among building types in the report year.

## Appendix H – Technical Reference Manual

The Technical Reference Manual (TRM) section contains the deemed savings technical assumptions and forecasts for the direct savings products in the DSM portfolio. The deemed savings technical assumptions describe the calculation methodology and assumptions that will be used to determine actual savings, costs, and other values for each product rebate. These calculation methodologies and assumptions are then applied to the population and the number of participants anticipated for each product, to produce an electric and gas forecast of impacts. The forecast is utilized to conduct the cost-benefit analysis of this Plan.

The following algorithms are consistent in their applicability across all deemed savings technical assumptions and therefore are shown here and not repeated within each product's individual deemed savings sheet:

$$\begin{aligned}\text{Electrical Energy Savings (Gross Generator kWh)} &= \text{Customer kWh} / (1-\text{TDLF}) \\ \text{Electrical Demand Savings (Gross Generator kW)} &= \text{Customer kW} \times \text{CF} / (1-\text{TDLF}) \\ \text{Electrical Energy Savings (Net Generator kWh)} &= \text{Gross Generator kWh} \times \text{NTG} \\ \text{Electrical Demand Savings (Net Generator kW)} &= \text{Gross Generator kW} \times \text{NTG} \\ \text{Net Dth} &= \text{Gross Dth} \times \text{NTG}\end{aligned}$$

Where, Net-to-Gross (NTG) is the ratio equal to the net impact divided by the gross impact. This factor is applied to gross savings to determine each product's net impact.

The following constants are consistent in their applicability across all deemed savings technical assumptions and therefore are shown here and not repeated within each product's individual deemed savings sheet:

$$\begin{aligned}\text{Business TDLF} &= 6.50\% \\ \text{Residential TDLF} &= 7.69\%\end{aligned}$$

Where,

- Transmission/Distribution Loss Factor (TDLF) is the percentage loss of electricity as it flows from the power plant to the customer.
- Business TDLF is applicable to measures installed at premises on a business rate schedule.
- Residential TDLF is applicable to measures installed at premises on a residential rate schedule.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Product: Commercial Refrigeration**

**Description:**

Prescriptive rebates will be offered for the installation of reach-in cases with doors, night curtains on refrigerator and freezer cases, EC Motors for Refrigeration Evaporators (retrofit only), Anti-Sweat Heater Controls (retrofit only) and/or replacement of standard refrigeration case doors with No Heat Case Doors, Retrofit of open multi-deck refrigerated cases with no heat doors, and replacement lighting equipment. Prescriptive rebates will also be offered for retrofitting open multideck coolers or freezers with solid glass doors.

**Program References:**

Measure "LED Refrigerated Case Lighting"	Refer to Program "CO - Lighting Efficiency" to find formulas for (Customer kW, Customer kWh, Customer PckW, etc.) for the "LED Refrigerated Case Lighting" measure.
Measure "LED Ref and Frz Screw In Fixture Retrofit"	Refer to Program "CO - Lighting Efficiency - Small Business" to find formulas for (Customer kW, Customer kWh, Customer PckW, etc.), in which the "LED Interior Lamp" measure is referenced.

**Equations:**

<b>Direct Install</b>	
Coil Cleaning Tune-Up	
F GEN Deem Eq kW (Customer kW)	= I_Qty_Prop_Equip * Eq.kW_Savings
F Gen kWh Hrs2 (Customer kWh)	= Customer_kW * Eq.Hours
F GEN PckW (PC_kW_Customer)	= Customer_kW * Eq.Coincidence_Factor
CHW Aerator	
F RFR kW (Customer kW)	= Customer_kWh/Eq.Hours
F RFR Energy Elec (Customer_kWh)	= Density_Water * SpecificHeat * F_RFR_WtrSave * Eq.Water_Heater_Delta_T / Eq.Min_Efficiency_electric / Eq.Conversion_Factor_Electric * I_Qty_Prop_Equip
F RFR PckW (PC_kW_Customer)	= Customer_kW * Eq.Coincidence_Factor
Increm_O_M_Savings	= F_RFR_WtrSave * Eq.Incremental_Cost_per_Gal * I_Qty_Prop_Equip
F RFR Energy Gas (Customer_Dth)	= Density_Water * SpecificHeat * F_RFR_WtrSave * Eq.Water_Heater_Delta_T / Eq.Min_Efficiency_gas / Eq.Conversion_Factor_gas * I_Qty_Prop_Equip
F_RFR_WtrSave	= ( Eq.Baseline_GPM - Eq.Proposed_GPM ) * Eq.Runtime_Hours * P_RFR_Hours * 60
Eq.Water_Heater_Delta_T	= Tset - Tcold
CHW Pre-Rinse	
F RFR kW (Customer kW)	= Customer_kWh/Eq.Hours
F RFR Energy Elec (Customer_kWh)	= Density_Water * SpecificHeat * F_RFR_WtrSave * Eq.Water_Heater_Delta_T / Eq.Min_Efficiency_electric / Eq.Conversion_Factor_Electric * I_Qty_Prop_Equip
F RFR PckW (PC_kW_Customer)	= Customer_kW * Eq.Coincidence_Factor
Increm_O_M_Savings	= F_RFR_WtrSave * Eq.Incremental_Cost_per_Gal * I_Qty_Prop_Equip
Customer_Dth	= Density_Water * SpecificHeat * F_RFR_WtrSave * Eq.Water_Heater_Delta_T / Eq.Min_Efficiency_gas / Eq.Conversion_Factor_gas * I_Qty_Prop_Equip
F_RFR_WtrSave	= ( Eq.Baseline_GPM - Eq.Proposed_GPM ) * Eq.Runtime_Hours * P_RFR_Hours * 60
Eq.Water_Heater_Delta_T	= Tset - Tcold
<b>Prescriptive</b>	
<b>Anti-Sweat Heater Controls</b>	
F Cool AntiSweat kW (Customer_kW)	= Eq.kW_Door * ( 1 + ( Eq.Door_Heat / Eq.COP ) ) * Eq.PAF * I_Doors_Controlled
F Cool AntiSweat kWh (Customer_kWh)	= Customer_kW * Eq.Hours
F Cool Anti Sweat PckW (PC_kW_Customer)	= Customer_kW * Eq.Coincidence_Factor
<b>Open to Closed Refrigerated Cases</b>	
Customer kW	= Customer kWh / Eq.Hours
Customer kWh	= (kWh_open - kWh_closed) x Linear Feet
PC_kW_Customer	= Customer_kW * Eq.Coincidence_Factor
kWh_open	= (Baseline_Load * Infil_open) x (Eq.Load_Factor * 1 / 3412 * Eq.Hours x 1 / COP_Min) - HVAC_kWh_Open
kWh_closed	=(Baseline_Load * Infil_closed) x (Eq.Load_Factor * 1 / 3412 * Eq.Hours x 1 / COP_Min) - HVAC_kWh_Closed
HVAC_kWh_Open	= (Eq.Baseline_Load * Eq.Infil_Open) * 1 / Eq.COP x 1 / 3412 * Eq.clg_duty_cyc * P_Clg_Hrs

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

HVAC_kWh_Closed	= (Eq.Baseline_Load * Eq.Infil_Closed) * 1 / Eq.COP x 1 / 3412 * Eq.clg_duty_cyc * P_Clg_Hrs 73 kW/ft for closed freezer cases.
Close_The_Case_Customer_Dth	= Eq.Baseline_Load * (Eq.Infil_open - * Eq.Infil_closed) * P_Htg_Hours * 1/1000000 * 1/Eq.Max_Efficiency
Kitchen Demand Controlled Ventilation	
F_DCV_kW (Customer_kW)	= i_qty_MC * i_hp_mc01 * P_kW_Factor
F_DCV_kWh (Customer_kWh)	= Customer_kW * P_DCV_hours
F_DCV_PC_kW (PC_kW_Customer)	= Customer_kW * P_DCV_CF
F_DCV_therms (Customer_Therms)	= i_qty_MC * i_hp_mc01 * P_DCV_therms_per_hp
Dishwashers	
F_KC_kW (Customer_kW)	= Eq.kW_Savings * I_Qty_Prop_Equip
F_KC_kWh (Customer_kWh)	= Eq.kW_Savings * Eq.Hours * I_Qty_Prop_Equip
F_KC_PCKW (PC_kW_Customer)	= Eq.kW_Savings * I_Qty_Prop_Equip * Eq.Coincidence_Factor
F_HP_Tstat_Setback_Thm (Customer_Therms)	= Eq.Therms_Savings * I_Qty_Prop_Equip
Incremental_OM_Savings	= Eq.Incremental_OM_Savings * I_Qty_Prop_Equip
Electronically Commutated Motors	
F_Motors_EC_Motors_kW (Customer_kW)	= (Eq.kW_Baseline - Eq.Proposed_kW) * I_Qty_Prop_Equip * (1 + 1/ Eq.COP)
F_Motors_EC_Motors_kWh (Customer_kWh)	= Customer_kW * Eq.Hours
F_Motors_EC_Motors_PCKW (PC_kW_Customer)	= Customer_kW * Eq.Coincidence_Factor
Medium Temperature Reach-In Cases	
F_RCaNC_kW (Customer_kW)	= Eq.kW_Savings_Factor * ((Eq.Baseline_Load - Eq.Proposed_Load) * Eq.Load_Factor * (1 / Eq.COP)) / 3412 * I_Linear_Ft
F_RCaNC_kWh (Customer_kWh)	= Customer_kW * Eq.Hours
F_RCaNC_PCKW (PC_kW_Customer)	= Customer_kW * Eq.Coincidence_Factor
No Heat Case Doors	
F_NHDAFC_kW (Customer_kW)	= (Eq.kW_Baseline - Eq.kW) * (1 + (Eq.Residual_Heat_Fraction / Eq.COP)) * I_Qty_Prop_Equip
F_NHDAFC_kWh (Customer_kWh)	= Customer_kW * Eq.Hours
F_NHDAFC_PCKW (PC_kW_Customer)	= Customer_kW * Eq.Coincidence_Factor

Variable ID	Value	Description
<b>Common</b>		
Eq_Conversion_Factor_Electric	3,412	Conversion of BTU to kWh
Eq_Conversion_Factor_Gas	1,000,000	Conversion of BTU to Dth
SpecificHeat	1.0	Specific Heat of Water in btu / (lb x °F)
Density_water	8.34	Density of water in lbs/gal
Eq.COP (medium temp)	2.28	Coefficient of performance of compressor in the medium temperature applications (Reference)
Eq.COP (low temp)	1.43	Coefficient of performance of compressor in the low temperature applications (Reference 1)
Eq_Min_Efficiency_electric	98%	Efficiency of electric water heater
Eq_Min_Efficiency_gas	80%	Efficiency of gas water heater (Reference 3)
Eq_Load_Factor (cooler)	62%	Load Factor of refrigeration cooler system (Reference 2)
Eq_Load_Factor (freezer)	80%	Load Factor of refrigeration freezer system (Reference 2)
<b>Direct Install</b>		
Coil Cleaning Tune-Up		
I_Qty_Prop_Equip	Customer Input	Quantity of proposed equipment installed
Eq_kW_Savings (Refrigerator)	0.031	Average kW savings for refrigerators
Eq_kW_Savings (Freezer)	0.049	Average kW savings for freezers
Eq_Hours (Refrigerator)	8,760	Equivalent full load hours saved for refrigerators
Eq_Hours (Freezer)	8,760	Equivalent full load hours saved for freezers
Lifetime	1	Measure lifetime
Eq_Incremental_Capital_Cost_Electric	\$15.00	Incremental cost per unit
Eq_Coincidence_Factor (Refrigerator)	100%	Coincidence Factor for refrigerators
Eq_Coincidence_Factor (Freezer)	100%	Coincidence Factor for freezers
CHW Aerator		
I_Qty_Prop_Equip	Customer Input	Quantity of proposed equipment installed
Tset (restroom)	105	Hot water setpoint temperature; °F

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Tset (kitchen)	125	Hot water setpoint temperature; °F
Tcold	51.4	Average groundwater temperature; °F (Reference 37)
Eq.Baseline_GPM	2.2	Nameplate flowrate of baseline in gpm
Eq.Proposed_GPM (restroom)	0.6	Nameplate flowrate of low-flow restroom application in gpm
Eq.Proposed_GPM (kitchen)	1.5	Nameplate flowrate of low-flow kitchen application in gpm
Eq.Runtime_Hours	See Table 2	Number of hours per day equipment is used (Reference 39)
P_RFR_Hours	See Table 2	Number of days per year the equipment is operated based on building type
Eq.Hours	8,760	Available equipment hours per year
Lifetime	9	Measure lifetime
Eq.Incremental_Capital_Cost_Electric & Gas	\$8.00	Incremental Cost per unit (Reference 39)
Eq.Incremental_Cost_per_Gal	\$0.009010	Water and sewer cost per gallon
Eq.Coincidence_Factor (restroom)	1%	Equipment coincidence factor
Eq.Coincidence_Factor (kitchen)	1%	Equipment coincidence factor
CHW Pre-Rinse		
Building Type	Customer Input	See Table 2 for list of choices
I_Qty_Prop_Equip	Customer Input	Quantity of proposed equipment installed
Tset	105	Hot water setpoint temperature; °F
Tcold	51.4	Average groundwater temperature; °F (Reference 37)
Eq.Baseline_GPM	1.6	Nameplate flowrate of baseline in gpm
Eq.Proposed_GPM	1.28	Nameplate flowrate of low-flow prerinse sprayer in gpm
Eq.Runtime_Hours	1.5	Number of hours per day equipment is used
P_RFR_Hours	See Table 2	Number of days per year the equipment is operated based on building type
Eq.Hours	8,760	Available equipment hours per year
Lifetime	5	Measure lifetime
Eq.Incremental_Capital_Cost_Electric & Gas	\$45.00	Incremental Cost per unit
Eq.Incremental_Cost_per_Gal	\$0.009010	Water and sewer cost per gallon
Eq.Coincidence_Factor	6%	Equipment coincidence factor
Prescriptive		
Anti-Sweat Heater Controls		
I_Doors_Controlled	Customer Input	Number of doors being controlled
Eq.kW_Door	See Table 4	Average anti-sweat heater kW per door without controls
Eq.kW_Door_Heat	0.35	Residual Heat fraction; estimated percentage of the heat produced by the heaters that remains in the freezer or cooler case and must be removed by the refrigeration unit. (Reference 24)
Eq.PAF	See Table 4	Percent of time the anti-sweat heaters are turned off by the controller
Eq.Hours	See Table 4	Hours per year
Measure Life	12	Lifetime
Eq.Incremental_Cost_per_Ton	See Table 4	Incremental cost of efficient measures; See Tables 4
Eq.Coincidence_Factor	See Table 4	Coincidence Factor (Reference 15)
Open to Closed Refrigerated Cases		
I_Linear_Ft	Customer Input	Linear feet of equipment installed
Eq.COP_Min (Cooler)	2.28	Coefficient of performance of compressor in the medium temperature applications (Reference 1)
Eq.COP_Min (Freezer)	1.43	Coefficient of performance of compressor in the low temperature applications (Reference 1)
Eq.Hours	8760	Annual hours of operation of refrigerated case
Eq.Baseline_Load (Cooler)	1500	Cooler Total Load in BTU/h/ft (Ref 33)
Eq.Baseline_Load (Freezer)	1850	Freezer Total Load in BTU/h/ft (Ref 33)
Eq.Infil_open (Cooler)	81.77%	Fraction of Refrigerated Case Load that is infiltration for an open cooler
Eq.Infil_open (Freezer)	82.76%	Fraction of Refrigerated Case Load that is infiltration for an open freezer
Eq.Infil_clsd (Cooler)	13.77%	Fraction of Refrigerated Case Load that is infiltration for a closed cooler
Eq.Infil_clsd (Freezer)	14.76%	Fraction of Refrigerated Case Load that is infiltration for a closed freezer
P_Clg_Hrs	2908	Number of hours per year that facility is in cooling mode, based on using a location-specific (Denver) bin hours calculation and an assumed facility balance point of 60 F
Eq.clg_duty_cyc	70%	Cooling compressor duty cycle

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Eq.COP	3.2	Coefficient of Performance for facility HVAC system, from Ref 33. This assumes a DX rooftop unit or similar
P_Htg_Hours	5155	Number of hours per year that facility is in heating mode, based on using a location-specific (Denver) bin hours calculation and an assumed facility balance point of 60 F, with a 5 degree economizing dead band before heating starts at 55 F
Eq.Max_Efficiency	80%	Heating System Efficiency
Eq.Coincidence_Factor	100%	Coincidence Factor, based on 8,760 hour run time per year
Measure Life	12.00	Lifetime (Ref 11)
Eq.Incremental_Capital_Cost_Electric	\$497.82	Incremental cost of efficient measures per linear foot (Ref 34) The incremental cost is split by avoided revenue requirements between gas and electric cost.
<b>Kitchen Demand Controlled Ventilation</b>		
i_qty_MC	Customer Input	Quantity of proposed equipment installed
i_hp_mc01	Customer Input	Horsepower of proposed equipment installed
P_kW_Factor	See Table 10	kW savings per horsepower of controlled fan
P_DCV_hours	See Table 10	hours of operation
P_DCV_CF	See Table 10	Coincidence Factor, based on Zone
P_DCV_therms_per_hp	See Table 10	Therms savings per horsepower of controlled fan
Measure Life	20	Lifetime
Eq.Incremental_Cost_per_HP	\$2,284.26	Incremental cost per HP
<b>Dishwashers</b>		
I_Qty_Prop_Equip	Customer Input	Quantity of proposed equipment installed
Eq.kW_Savings	See Table 9	kW savings per dishwasher
Eq.Hours	See Table 9	Annual hours of operation
Eq.Coincidence_Factor	See Table 8	Coincidence Factor
Eq.Therms_Savings	See Table 6	Natural gas savings per dishwasher
Measure Life	See Table 7 & 8	Lifetime
Eq.Incremental_Cost	See Table 7 & 8	Incremental cost per dishwasher
Eq.Incremental_OM_Savings	See Table 7 & 8	Incremental O&M savings due to decrease in water consumption
<b>Electronically Commutated Motors</b>		
I_Qty_Prop_Equip	Customer Input	Quantity of proposed equipment installed
Eq.kW_Baseline	See Table 3	Average input power for shaded pole or permanent split capacitor motor (Reference 15)
Eq.Proposed kW	See Table 3	Average input power for efficient motor (Reference 15)
Eq.Hours	See Table 3	Hours per year (freezer subtracts defrost time) (Reference 15)
Eq.Incremental_Cost_per_Ton	See Table 3	Incremental cost per motor
Eq.Coincidence_Factor	See Table 3	Coincidence Factor
<b>Medium Temperature Reach-In Cases</b>		
I_Linear_Ft	Customer Input	Linear feet of equipment installed
Eq.kW_Savings_Factor	100%	Percent of time the doors are used
TDA	5.5	Total Display area per linear foot. Assumed to be 5.5 square feet based on a 5.5 foot tall glass door.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Eq.Baseline_Load	1,652	Btuh/ft load of the standard efficiency refrigerated case (Reference 38)
Eq.Proposed_Load	262	Btuh/ft load of the high efficiency refrigerated case. (Reference 5)
Eq.Hours	8,760	Equipment hours per year
Lifetime	15	Measure lifetime
Eq.Incremental_Cost_per_LF	\$686.29	Incremental cost per linear feet of efficient measure (Reference 21).
Eq.Coincidence_Factor	100%	Equipment coincidence factor
<b>No Heat Case Doors</b>		
I_Qty_Prop_Equip	Customer Input	Quantity of proposed equipment installed
Eq.kW_Baseline	See Table 5	Average kW for a standard case door (Reference 23 and 24)
Eq.kW	See Table 5	Average kW for a no heat case door (Reference 2)
Eq.Residual_Heat_Fraction	0.35	Estimated percentage of the heat produced by the heaters that remains in the freezer or cooler case and must be removed by the refrigeration unit.
Eq.Hours	See Table 5	Hours per year for no heat case doors (Reference 2)
Eq.Incremental_Capital_Cost_Electric	See Table 5	Incremental cost per door
Eq.Coincidence_Factor	See Table 5	Coincidence Factor

**Inputs:**

**Verified during M&V:**

<b>Direct Install</b>	
Coil Cleaning Tune-Up	
Type of Unit (freezer or refrigerator)	Yes
Quantity (# of units)	Yes
<b>CHW-Aerator</b>	
Gas or electric water heater	Yes
Quantity (# of faucet aerators)	Yes
Building type	Yes
<b>CHW Pre-Rinse</b>	
Gas or electric water heater	Yes
Quantity (# of sprayers)	Yes
Building type	Yes
<b>Prescriptive</b>	
<b>Anti-Sweat Heater Controls</b>	
Application temperature (medium or low temperature case)	Yes
Number of doors controlled	Yes
<b>Open to Closed Case Retrofit</b>	
Application temperature (cooler or freezer)	Yes
Linear feet installed	Yes
<b>Kitchen Demand Controlled Ventilation</b>	
Quantity (# of motors controlled)	Yes
County/Zone	Yes
Horsepower (per motor controlled)	Yes
<b>Electronically Commutated Motors</b>	
Case type (Display Case or Walk-in)	Yes
Application temperature (Medium Temp or Low Temp)	Yes
Quantity (# of motors)	Yes
<b>Medium Temperature Reach-In Cases</b>	
Application temperature (medium temperature)	Yes
Linear feet installed	Yes
<b>For No Heat Doors:</b>	
Application temperature (freezer or refrigerator)	Yes
Quantity (# of doors)	Yes

**Assumptions:**

Enclosed Reach-In Cases, Open to Closed Case Retrofit  
 Existing case must be either a freezer or cooler multi-deck case.  
 Existing specialty, self-contained, and island cases do not qualify.  
 This measure is for replacement of open cases with new cases that include a case door.

Replacement cases must have doors, be tied into a central refrigeration system, and be purchased new.

Open to Closed Case retrofits must use "no heat" doors

#### EC Motors

Each motor is replaced with the same size on a 1 for 1 basis.

Rebates do not apply to rewound or repaired motors.

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Changes from 2017 / 2018 Plan:**

Updated runtime hours for pre-rinse sprayers.  
Updated coincidence factor and kW savings for coil cleaning tune-up measure.  
Updated incremental costs for medium-temp enclosed reach-in case measure.  
Updated heating efficiency and incremental costs for open to closed refrigerated cases calculations.  
Updated lifetime, incremental costs, and runtime hours for aerators.  
Added annual gallons per faucet values breakdown by end-use as oppsoed to using same value for all end-uses.  
Added gas savings for open to closed refrigerated cases.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 1: Average Water Mains Temperatures, T Cold (Ref. 6).

Location	Temperature (°F)
Denver, CO	51.4

Table 2: Deemed Annual Hot Water Use by Building Type (Reference 6 and 39)

Building Type	P_RFR_Hours (aka. Days/year)	Annual Gallons per Faucet	Faucet Aerator Eq.Runtime_Hours (aka. Hrs/day)
Large Office	250	11,250	0.341
Fast Food Restaurant	365	9,581	0.199
Sit-Down Restaurant	365	15,768	0.327
Grocery Store	365	3,650	0.076
Elementary School	200	3,000	0.114
Jr/Sr High School or College	200	9,000	0.341
Healthcare	365	16,425	0.341
Hotel	365	1,278	0.027
Other Commercial	250	5,000	0.152
<b>Average</b>	<b>303</b>	<b>8,328</b>	<b>0.213</b>

\* The following building types were considered not to apply to this measure: Small Office, Retail, Warehouse and Motel.

Table 3: Baseline Watts, Efficient Watts, Operating Hours and Incremental Cost for EC Motors by Application (Reference 15 and 18)

Motor Application	Eq.kW_Baseline	Eq.Proposed_kW	Eq.Hours	Eq.Incremental_Co st_per_Ton	Eq.Coincidence_Factor
EC Motors - Display Case Medium Temp	0.04969	0.0165	8,672	\$140.71	99%
EC Motors - Display Case Low Temp	0.04969	0.0165	8,672	\$140.71	99%
EC Motors - walk in cooler Medium Temp up to 15 in	0.09508	0.03088	8,585	\$269.01	98%
EC Motors - walk in cooler Low Temp up to 15 in	0.09508	0.03088	8,585	\$269.01	98%
EC Motors - walk in cooler Medium Temp over 15 in	0.09508	0.03088	8,585	\$269.01	98%
EC Motors - walk in cooler Low Temp over 15 in	0.09508	0.03088	8,585	\$269.01	98%

Table 4: Baseline kW, % Off, Operating Hours and Incremental Cost for Anti-Sweat Heater Controls by Application (Reference 23 and 24)

Anti-Sweat Heater Controls	Eq.kW_Door	Eq.PAF	ASHC_Hours	ASH Incremental Cost	Eq.Coincidence_Factor
Anti-Sweat Heater - Med Temp	0.105	97%	8,760	\$180.00	97%
Anti-Sweat Heater - Low Temp	0.191	97%	8,760	\$180.00	97%

Table 5: Baseline Watts, Efficient Watts, Operating Hours and Incremental Cost for No Heat Case Doors by Application (Reference 2, 23 and 24)

No Heat Case Doors	Eq.kW_Baseline	Eq.kW	NHD_Hours	Eq.Incremental_Ca pital_Cost_Electric	Eq.Coincidence_Factor
Refrigerator Case Door	0.105	0.000	8,760	\$275.00	100%
Freezer Case Door	0.191	0.000	8,760	\$800.00	100%

Table 6: Energy Savings - Gas Energy Star Dishwasher (Ref 8)

	Dth/yr Efficient	Dth/yr Baseline	Eq.Therms_Savings	Eq.kW_Savings
<b>Dishwashers - Primary Fuel: Gas; Secondary Fuel: Elec</b>				
Commercial Dishwashers (Door - Gas w/ Electric Booster)	65.33	94.69	293.60	0.737
Commercial Dishwashers (Under Counter - Gas w/ Electric Booster)	16.91	21.43	45.20	0.318
<b>Dishwashers - Primary Fuel: Gas; Secondary Fuel: Gas</b>				
Commercial Dishwashers (Door - Gas w/ Gas Booster)	102.66	148.80	461.40	0.000
Commercial Dishwashers (Under Counter - Gas w/ Gas Booster)	26.57	33.68	71.10	0.000
<b>Dishwashers - Primary Fuel: Gas; Secondary Fuel: None</b>				
Commercial Dishwashers (Door - Gas No Booster)	86.62	154.15	675.30	0.000
Commercial Dishwashers (Under Counter - Gas No Booster)	23.40	34.02	106.20	0.000

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 7: Measure Life, Cost, O&M Savings - Gas Energy Star Dishwasher (Ref 8)

	Measure Life (years)	Eq.Cost	Eq.Incremental_OM_Savings
<b>Dishwashers - Primary Fuel: Gas; Secondary Fuel: Elec</b>			
Commercial Dishwashers (Door - Gas w/ Electric Booster)	15	\$770	\$368.33
Commercial Dishwashers (Under Counter - Gas w/ Electric Booster)	10	\$120	\$56.73
<b>Dishwashers - Primary Fuel: Gas; Secondary Fuel: Gas</b>			
Commercial Dishwashers (Door - Gas w/ Gas Booster)	15	\$770	\$368.33
Commercial Dishwashers (Under Counter - Gas w/ Gas Booster)	10	\$120	\$56.73
<b>Dishwashers - Primary Fuel: Gas; Secondary Fuel: None</b>			
Commercial Dishwashers (Door - Gas No Booster)	15	\$0	\$847.16
Commercial Dishwashers (Under Counter - Gas No Booster)	10	\$50	\$133.19

Table 8: Measure Life, Cost, O&M Savings - Electric Energy Star Dishwasher (Ref 3)

	Measure Life (yrs)	Eq.Cost	Eq.Incremental_OM_Savings	Coincidence Factor (CF) Ref 6 & 7
<b>Dishwashers - Primary Fuel: Elec; Secondary Fuel: Elec</b>				
Commercial Dishwashers (Door - Electric w/ Electric Booster)	15	\$770	\$368.33	85.58%
Commercial Dishwashers (Under Counter - Electric w/ Electric Booster)	10	\$120	\$56.73	85.58%
<b>Dishwashers - Primary Fuel: Elec; Secondary Fuel: Gas</b>				
Commercial Dishwashers (Door - Electric w/ Gas Booster)	15	\$770	\$368.33	85.58%
Commercial Dishwashers (Under Counter - Electric w/ Gas Booster)	10	\$120	\$56.73	85.58%
<b>Dishwashers - Primary Fuel: Elec; Secondary Fuel: None</b>				
Commercial Dishwashers (Door - Electric No Booster)	15	\$0	\$847.16	85.58%
Commercial Dishwashers (Under Counter - Electric - No Booster)	10	\$50	\$133.19	85.58%

Table 9: Energy Savings - Electric Energy Star Dishwasher (Ref 3)

	Efficient kW	Baseline kW	Eq.Hours	Eq.kW Savings	Eq.Therms Savings
<b>Dishwashers - Primary Fuel: Elec; Secondary Fuel: Elec</b>					
Commercial Dishwashers (Door - Electric w/ Electric Booster)	4.256	6.062	6,570	1.806	0.00
Commercial Dishwashers (Under Counter - Electric w/ Electric Booster)	1.398	1.881	6,570	0.483	0.00
<b>Dishwashers - Primary Fuel: Elec; Secondary Fuel: Gas</b>					
Commercial Dishwashers (Door - Electric w/ Gas Booster)	2.897	4.092	6,570	1.195	167.78
Commercial Dishwashers (Under Counter - Electric w/ Gas Booster)	1.046	1.435	6,570	0.389	25.84
<b>Dishwashers - Primary Fuel: Elec; Secondary Fuel: None</b>					
Commercial Dishwashers (Door - Electric No Booster)	3.520	5.979	6,570	2.459	0.00
Commercial Dishwashers (Under Counter - Electric - No Booster)	1.282	1.669	6,570	0.387	0.00

Table 10 Savings Factors for Kitchen Demand Controlled Ventilation

Zone	P_kW_Factor	P_DCV_hours	P_DCV_therms_per_hp	P_DCV_CF
Front Range (Zone 1)	0.559251	5,262	537.30	44%
Western Slope (Zone 2)	0.724	4,335	506.60	48%
Mountain (Zone 3)	0.522	5,355	897.30	42%

\* Factors developed from historical custom projects with corresponding zone weather data transplanted into the analyses.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Product: Company Owned LED Street Lights**

**Description:**

Prescriptive rebates will be offered for company owned LED Street Lights
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**Algorithms:**

Electrical Demand Savings (Customer kW)	= ( kW_Base - kW_EE )
Electrical Energy Savings (Customer kWh/yr)	= ( kW_Base - kW_EE ) x Hrs
Electrical Energy Savings (Net Generator kWh)	= Gross Generator kWh x NTG
Electrical Demand Savings (Net Generator kW)	= Gross Generator kW x NTG

**Variables:**

Hrs	= Annual Operating Hours. Hours to be obtained from Table 1. The type of facility is to be supplied by Night Time Exterior.
kW_Base	= Baseline fixture wattage (kW per fixture) determined from stipulated fixture wattages from Standard Fixture information. Fixture type provided by Night Time Exterior.
kW_EE	= High Efficiency fixture wattage (kW per fixture) determined from stipulated fixture wattages from Standard Fixture information.
CF	= Coincidence Factor, the probability that peak demand of the lights will coincide with peak utility system demand. CF will be determined based on building type in table 1.
Measure Life	= Length of time the lighting equipment will be operational, see Table 2 for Measure Lifetimes
Baseline Cost	= Cost of the baseline technology. For Retrofit, the cost is \$0.00 since the baseline is to continue to operate the existing system. For New Construction, the cost is that of the lower efficiency option. Costs by (Reference 1) and vendors.
High Efficiency Cost	= Cost of the High Efficiency technology.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

NTG	Net-to-gross =90% for prescriptive measures
Incremental operation and maintenance cost	= Other annual savings or costs associated with the electrical savings. For exterior lighting, this is \$0.

**Assumptions:**

Each replacement lighting fixture is going in on a one-for-one basis for existing fixtures. New construction fixtures are put in on a one-for-one basis instead of lower efficiency options.  
 Each LED fixture is required to be listed on the DesignLights Consortium Qualified Products list, and therefore must meet their minimum specification.  
 Customer must be on a company owned metered rate to qualify for program

**Info needed from Customer/Vendor Administrator for Calculations:**

Number of fixtures being installed

**Verified during M&V:**

Yes

Lighting equipment type (baseline and efficient for Retrofit; efficient for New Construction)

Yes

**Table 1: Coincident Peak Demand Factors and Annual Operating Hours by Building Type (Reference 2, 3, and 5)**

Space Type	CF	Hrs
Night Time Exterior	0%	4140

**Table 2: Measure Lifetimes in Years (Reference 1,4)**

Measure	Lifetime in Years
LED Fixtures	15

**References:**

1. Deemed Savings Database, Minnesota Office of Energy Security, 2008. CF, Hours, kW, Costs, Measure life
2. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures Final Report, Nexant. CF
3. Technical Reference User Manual No. 2004-31, Efficiency Vermont, 12/31/04. CF
4. LED Fixture measure life based on Xcel Energy Minnesota Lighting Efficiency Program average replacement fixture lifetime
5. Schedule SL, Tariff Sheet No. 85; Decision Nos. R15-1251/C15-1318. Hours

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Compressed Air

#### Description:

Custom and prescriptive rebates will be offered under the Compressed Air Program. Prescriptive rebates are available for Variable Frequency Drive Compressors that are less than 50 hp, installing a smaller HP VFD controlled air compressor than the current air compressor used, no air loss drain (NALD) valves, cycling refrigerated dryers, mist eliminator filters, and dewpoint demand control for heatless dessicant regenerative dryers. Other measures may receive rebates through the Custom Efficiency product. Each custom efficiency project will be analyzed individually by Xcel Energy. Engineering variables required for the analysis will be obtained from the customer or vendor. Analysis will be based on standard engineering methodologies. Funding is also available for compressed air system studies.

#### Equations:

VFD Compressors	
F_CA_VFD_kW (Customer kW Savings)	$= \text{Eq.Horsepower} * \text{P\_Service\_Factor} * 0.746 * ( ( \text{Eq.Baseline\_Load} / \text{Eq.Baseline\_Efficiency} ) - ( \text{Eq.Proposed\_Load} / \text{Eq.Proposed\_Efficiency} ) ) * \text{I\_Qty\_Prop\_Equip}$
F_CA_VFD_kWh (Customer kWh Savings)	$= \text{Eq.Horsepower} * \text{P\_Service\_Factor} * 0.746 * ( ( \text{Eq.Baseline\_Load} / \text{Eq.Baseline\_Efficiency} ) - ( \text{Eq.Proposed\_Load} / \text{Eq.Proposed\_Efficiency} ) ) * \text{Eq.Hours} * \text{I\_Qty\_Prop\_Equip}$
F CA VFD PCKW (Customer Peak kW Savings)	$= \text{F\_CA\_VFD\_kW} * \text{Eq.Coincidence\_Factor}$
VFD Compressor HP Reduction	
F_CompHP_Reduction_kW (Customer kW Savings)	$= \text{P\_Service\_Factor} * 0.746 * ( \text{Existing\_Model\_r.Horsepower} * ( \text{F\_CompHP\_Reduction\_Base\_Load} / \text{Existing\_Model\_r.Baseline\_Efficiency} ) - \text{Eq.Horsepower} * ( \text{Eq.Proposed\_Load} / \text{Eq.Proposed\_Efficiency} / \text{Eq.VFD\_Efficiency} ) )$
F_CompHP_Reduction_Base_Load	$= \text{P\_CompHP\_Red\_x2} * ( \text{F\_CompHP\_Reduction\_Base\_Flow} ^ 2 ) + \text{P\_CompHP\_Red\_x} * \text{F\_CompHP\_Reduction\_Base\_Flow} + \text{P\_CompHP\_Red\_b}$
F_CompHP_Reduction_Base_Flow	$= \text{Equipment\_Model\_r.Percent\_Flow} * \text{Equipment\_Model\_r.Horsepower} / \text{Existing\_Model\_r.Horsepower}$
F_PC_kW_Customer (Customer Peak kW Savings)	$= \text{F\_CompHP\_Reduction\_kW} * \text{Eq.Coincidence\_Factor}$
F_CompHP_Reduction_kWh (Customer kWh Savings)	$= \text{F\_CompHP\_Reduction\_kW} * \text{Eq.Hours}$
No Air Loss Drain	
F_GEN_kWh (Customer kWh Savings)	$= \text{I\_Qty\_Prop\_Equip} * \text{Eq.kWh\_Savings}$
F_GEN_kW (Customer kW Savings)	$= \text{I\_Qty\_Prop\_Equip} * \text{Eq.kW\_Savings}$
F_GEN_PCKW (Customer Peak kW Savings)	$= \text{F\_GEN\_kW} * \text{Eq.Coincidence\_Factor}$
Cycling Dryers	

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

F_GEN_Deem_Eq_kWh (Customer kWh Savings)	= I_Qty_Prop_Equip * Eq.kWh_Savings *Historical system information gathered through four years of compressed air study data was utilized to estimate savings. Based on dryer size, an average connected system flowrate was determined. Savings due to the reduction in average operating kW for the cycling dryer are proportional to the average flowrate divided by the dryer rated flowrate. See Table 1 for savings results.
F_GEN_kW (Customer kW Savings)	= I_Qty_Prop_Equip * Eq.kW_Savings
F_GEN_PCkW (Customer Peak kW Savings)	= F_GEN_kW * Eq.Coincidence_Factor
<b>Mist Eliminators</b>	
F_GEN_Deem_Eq_kWh (Customer kWh Savings)	= I_Qty_Prop_Equip * Eq.kWh_Savings *Historical system information gathered through four years of compressed air study data was utilized to estimate
F_GEN_kW (Customer kW Savings)	= I_Qty_Prop_Equip * Eq.kW_Savings
F_GEN_PCkW (Customer Peak kW Savings)	= F_GEN_kW * Eq.Coincidence_Factor
<b>Dew Point Controls</b>	
F_GEN_Deem_Eq_kWh (Customer kWh Savings)	= I_Qty_Prop_Equip * Eq.kWh_Savings *Historical system information gathered through four years of compressed air study data was utilized to estimate
F_GEN_kW (Customer kW Savings)	= I_Qty_Prop_Equip * Eq.kW_Savings
F_GEN_PCkW (Customer Peak kW Savings)	= F_GEN_kW * Eq.Coincidence_Factor

Variable ID	Value	Description
<b>Common</b>		
0.746	0.746	Standard conversion from HP to kW.
Incremental Cost of Efficient Equipment	see Table 1, 2, 3, & 5	Incremental cost of efficient measures compared to the do-nothing option.
Lifetime	see Table 6	Lifetimes for individual measures.
I_Qty_Prop_Equip	Customer Input	Quantity of proposed equipment installed.
NTG_Prescriptive	73.0%	Net-to-Gross for all prescriptive products (Reference 8).
NTG_Study&Custom	87.0%	Net-to-Gross for studies and custom projects (Reference 8).
<b>VFD Compressors</b>		
Eq.Coincidence Factor	71.63%	Small VFD Compressor Coincidence Factor - Probability that the measure peak demand
Eq.Baseline_Efficiency	see Table 4	Efficiency of existing compressor motor as determined by customer provided HP.
Eq.Proposed_Efficiency	see Table 4	Efficiency of proposed compressor motor as determined by customer provided HP.
Eq.Baseline_Load	87.43%	Average percent loading for baseline compressor as calculated on VFD Air Comp Calcs tab.
Eq.Horsepower	Customer Input	Nominal horsepower of new compressor for new & upgrade situations.
Eq.Proposed_Load	61.05%	Average percent loading for upgrade and new VFD compressors.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Eq.Hours	see Table 4	Operating hours of new compressors.
P_Service_Factor	1.15	Service factor of the motor (Reference 1).
<b>Cycling Dryers</b>		
Eq.kWh_Savings	see Table 1	kWh savings based on Cycling Dryer rated CFM
Eq.kW_Savings	see Table 1	kW savings based on Cycling Dryer rated CFM
Eq.Coincidence_Factor	100%	Probability that the measure peak demand reduction will occur at the same time as the grid peak demand. See Cell AF3 on Forecast Cycling Dryer tab for more information.
<b>Mist Eliminators</b>		
Eq.kWh_Savings	see Table 2	kWh savings based on Mist Eliminator rated CFM
Eq.kW_Savings	See Table 2	kW savings based on Mist Eliminator rated CFM
Eq.Coincidence_Factor	100%	Probability that the measure peak demand reduction will occur at the same time as the grid peak demand. See Cell AF3 on Forecast Mist Eliminators tab for more information.
<b>Dew Point Controls</b>		
Eq.kWh_Savings	see Table 3	kWh savings based on Dryer rated CFM
Eq.kW_Savings	See Table 3	kW savings based on Dryer rated CFM
Eq.Coincidence_Factor	100%	Probability that the measure peak demand reduction will occur at the same time as the grid peak demand. See Cell AF3 on Forecast Dewpoint Controls tab for more information.
<b>VFD Compressor HP Reduction</b>		
Eq.Proposed_Efficiency	see Table 4	Efficiency of proposed compressor motor as determined by customer provided HP.
Eq.Proposed_Load	73.68%	Average percent load for HP reduction VFD compressors based on average percent flow for proposed VFD compressors.
Eq.Coincidence Factor	71.63%	Small VFD Compressor Coincidence Factor - Probability that the measure peak demand
Eq.VFD_Efficiency	95.00%	Efficiency of VFD.
Equipment_Model__r.Horsepower	Customer Input	Nominal horsepower of new compressor for HP Reduction situations.
Equipment_Model__r.Percent_Flow	70.00%	Average percent flow for proposed VFD compressor.
Existing_Model__r.Baseline_Efficiency	see Table 4	Efficiency of existing compressor motor as determined by customer provided HP.
Existing_Model__r.Horsepower	Customer Input	Nominal horsepower of baseline compressor.
Eq.Hours	see Table 4	Operating hours of new compressors.
P_CompHP_Red_x2	-0.51958	Baseline load curve fit equation coefficient.
P_CompHP_Red_x	1.0853	Baseline load curve fit equation coefficient.
P_CompHP_Red_b	0.4216	Baseline load curve fit equation coefficient.
P_Service_Factor	1.15	Service factor of the motor (Reference 1).
<b>No Air Loss Drain</b>		
Eq.kWh_Savings	3,889	Based on an average annual operating hours of 7523 from completed CO custom compressed
Eq.kW_Savings	0.517	kW savings per no air loss drain.
Eq.Coincidence_Factor	71.63%	No Air Loss Drain Coincidence Factor - Probability that the measure peak demand reduction will

### Inputs:

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

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<b>Provided by Customer:</b>	<b>Verified during M&amp;V:</b>
Quantity of No Air Loss Drains	Yes
Compressor HP, Quantity	Yes
Cycling Dryer CFM and Quantity	Yes
Mist Eliminator CFM and Quantity	Yes
Dew Point Demand Controls CFM and Quantity	Yes

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### **Assumptions:**

#### **VFD Compressors < 50 hp**

Compressed air system in which VFD compressor is installed must have a nominal rating < 50hp.

Existing compressor was a non-reciprocating load/no load type with 2 gallon of storage per cfm capacity or less, or modulation with or without unload.

To qualify for a HP reduction rebate the running HP of the system (excluding backups) must be lower after the installation of the new VFD unit.

For HP reduction Baseline unit may be greater than or equal to 50HP, but HP reduction cannot exceed 20HP.

HP reduction rebate will require documented removal or pneumatic isolation of a compressor.

#### **No Air Loss Drains**

2.74 SCFM loss from existing timed drain (Reference 3).

Existing timed drain is open 15 seconds every 7.5 minutes (Reference 3).

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Cycling Dryer

Rated Flowrate of Dryer is equal to the connected system peak flowrate.  
 Non-cycling dryer load factor of 100% (Reference 3).

### Mist Eliminator Filter

Rated Flowrate of filter is equal to the connected system peak flowrate.  
 Baseline filter pressure drop of 4 psig (Reference 3, confirmed by Ref 9).  
 Efficient filter pressure drop of 0.75 psig (Reference 3, confirmed by Ref 9).  
 Filter element life expectancy of 10 - 15 years (Reference 12 & 13).

### Dewpoint Demand Control

Rated Flowrate of Dryer is equal to the connected system peak flowrate.  
 Uncontrolled dryer purge rate of 17% (Reference 3, Reference 14) for heatless dessicant dryers.  
 Heated or heated blower dessicant dryers are not eligible.

### Hours

Hours for NALDs, cycling dryers, mist eliminators, and dew point demand controls are based on the equipment CFM and historical system information gathered through four years of compressed air study data. Variations in forecast hours between these measures is due to the anticipated quantity per CFM range of these products we will process.

### Tables:

**Table 1: Energy Savings and Costs For Cycling Dryers (Reference 4 & 7)**

Dryer CFM	Customer kW	Customer kWh	Incremental Cost	Incremental O&M
75 CFM to 99 CFM Cycling Dryer - CO	0.395	2,814	\$554	\$0
100 CFM to 124 CFM Cycling Dryer - CO	0.622	4,444	\$580	\$0
125 CFM to 149 CFM Cycling Dryer - CO	0.746	5,349	\$461	\$0
150 CFM to 199 CFM Cycling Dryer - CO	0.865	6,223	\$637	\$0
200 CFM to 249 CFM Cycling Dryer - CO	0.918	6,640	\$1,203	\$0
250 CFM to 299 CFM Cycling Dryer - CO	1.282	9,338	\$860	\$0
300 CFM to 399 CFM Cycling Dryer - CO	1.494	10,936	\$1,047	\$0
400 CFM to 499 CFM Cycling Dryer - CO	1.931	14,307	\$1,187	\$0
500 CFM to 599 CFM Cycling Dryer - CO	2.166	16,218	\$1,095	\$0

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

600 CFM to 699 CFM Cycling Dryer - CO	2.476	18,735	\$629	\$0
700 CFM to 799 CFM Cycling Dryer - CO	3.173	24,243	\$883	\$0
800 CFM to 999 CFM Cycling Dryer - CO	3.322	25,628	\$2,080	\$0
1000 CFM to 1199 CFM Cycling Dryer - CO	4.160	32,662	\$1,785	\$0
1200 CFM to 1599 CFM Cycling Dryer - CO	5.103	40,730	\$2,536	\$0
1600 CFM to 1999 CFM Cycling Dryer - CO	5.969	48,984	\$3,857	\$0
2000 CFM to 2399 CFM Cycling Dryer - CO	6.557	55,015	\$5,811	\$0
2400 CFM to 2799 CFM Cycling Dryer - CO	8.490	72,467	\$3,498	\$0

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 2: Energy Savings and Costs for Mist Eliminator Filters (Reference 4 & 7)**

<b>Filter CFM</b>	<b>Customer kW</b>	<b>Customer kWh</b>	<b>Incremental Cost</b>	<b>Incremental O&amp;M</b>
500 CFM to 799 CFM Mist Eliminator Filter	0.894	6,740	\$3,691	\$70
800 CFM to 1099 CFM Mist Eliminator Filter	1.421	11,086	\$4,862	\$67
1100 CFM to 1499 CFM Mist Eliminator Filter	1.941	15,627	\$5,307	\$85
1500 CFM to 1899 CFM Mist Eliminator Filter	2.624	21,866	\$6,621	\$78
1900 CFM to 2299 CFM Mist Eliminator Filter	3.328	28,450	\$8,568	\$111

**Table 3: Energy Savings and Costs for Dewpoint Demand Control (Reference 4 & 7)**

<b>Dryer CFM</b>	<b>Customer kW</b>	<b>Customer kWh</b>	<b>Incremental Cost</b>	<b>Incremental O&amp;M</b>
90 CFM to 119 CFM Dewpoint Demand Control	3.901	27,866	\$3,148	\$0
120 CFM to 159 CFM Dewpoint Demand Control	4.956	35,536	\$3,176	\$0
160 CFM to 199 CFM Dewpoint Demand Control	6.276	45,222	\$3,210	\$0
200 CFM to 249 CFM Dewpoint Demand Control	7.415	53,689	\$3,515	\$0
250 CFM to 299 CFM Dewpoint Demand Control	8.576	62,491	\$3,286	\$0
300 CFM to 399 CFM Dewpoint Demand Control	9.649	70,737	\$3,335	\$0
400 CFM to 499 CFM Dewpoint Demand Control	11.349	84,185	\$3,375	\$0
500 CFM to 599 CFM Dewpoint Demand Control	12.811	96,175	\$3,438	\$0
600 CFM to 799 CFM Dewpoint Demand Control	14.243	108,144	\$3,438	\$0
800 CFM to 999 CFM Dewpoint Demand Control	18.270	141,687	\$3,473	\$0
1000 CFM to 1249 CFM Dewpoint Demand Control	21.946	173,722	\$3,858	\$0

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

1250 CFM to 1499 CFM Dewpoint Demand Control	26.010	210,652	\$3,678	\$0
1500 CFM to 1999 CFM Dewpoint Demand Control	29.544	244,178	\$3,725	\$0
2000 CFM to 2499 CFM Dewpoint Demand Control	36.258	309,317	\$3,861	\$0

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 4. Motor Efficiencies & Operating Hours**

<b>Compressor HP</b>	<b>Motor Description</b>	<b>New Unit Baseline Motor Efficiency</b>	<b>Upgrade Unit Existing Compressor Motor Efficiency</b>	<b>New and Upgrade Unit Proposed Motor Efficiency</b>	<b>Operating Hours</b>
10	10 HP 1800 RPM ODP	91.7%	89.5%	91.7%	2,131
15	15 HP 1800 RPM ODP	93.0%	91.0%	93.0%	2,131
20	20 HP 1800 RPM ODP	93.0%	91.0%	93.0%	2,131
25	25 HP 1800 RPM ODP	93.6%	91.7%	93.6%	3,528
30	30 HP 1800 RPM ODP	94.1%	92.4%	94.1%	3,528
40	40 HP 1800 RPM ODP	94.1%	93.0%	94.1%	3,528
50	50 HP 1800 RPM ODP	n/a	93.0%	n/a	n/a
60	60 HP 1800 RPM ODP	n/a	93.6%	n/a	n/a

Upgrade Compressor Motor Efficiency and New Compressor Motor Efficiency values are from NEMA EPACT and Premium (New Compressors only) motors United States Industrial Electric Motor Systems Market Opportunities Assessment, EERE, US DOE, Dec 2002 - Source for operating hours for industrial motors

**Table 5. Incremental Costs for Efficient Measures**

<b>Measure</b>	<b>Upgrade &amp; HP Reduction Units</b>	<b>New Unit</b>
10 HP VFD Compressor	10,338	\$2,577
15 HP VFD Compressor	12,277	\$2,694
20 HP VFD Compressor	15,086	\$3,609
25 HP VFD Compressor	17,639	\$5,149
30 HP VFD Compressor	20,345	\$7,212
40 HP VFD Compressor	22,986	\$7,468
No Air Loss Drain	\$323	

Compressor prices are the average price from three retailers plus \$1500 for installation.  
NALD price is average of nine retailers prices as calculated on Forecast NALD tab

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 6. Measure Lifetimes**

Measure	Lifetime, Years
Compressed Air Efficiency Study	5
Cycling Dryers	20
Dewpoint Controls	15
Mist Eliminators	11
No Air Loss Drain	13
VFD Air Compressor New	20
HP Reduction	20
Custom Efficiency - Compressed Air	20

**References:**

- 
- (1) Service factor from Compressed Air & Gas Institute (CAGI) standards comparing Nameplate HP to actual BHP @ 100% Full rated pressure and flow
  - (2) National Energy Efficiency Best Practices Report (<http://www.eebestpractices.com>)
  - (3) Historic compressed air product experience
  - (4) Analysis of Compressed Air Study participants 2008 - 2011
  - (5) National Electric Manufacturers Association. Motor efficiency standards from Pre-EPA Act 2005 and after.
  - (6) United States Industrial Electric Motor Systems Market Opportunities Assessment. US DOE, Dec 2002, Appendix B2
  - (7) Various anonymous retailer and vendor quotes
  - (8) per page iv of "Tetra Tech, Process and Impact Evaluation of the Compressed Air Efficiency Program — Colorado,
  - (9) Massachusetts Technical Reference Manual 2013-2015 Program Years
  - (10) Compressed Air Challenge (Best Practices Guide): source for baseline compressor curves, % efficiency/psi reduction, SCFM per orifice
  - (11) Massachusetts Joint Utilities "Measure Life Study". Energy & Resource Solutions. Table 1-1. 2005. Source for NALD Lifetime
  - (12) ZEKS Mist Eliminator (<http://www.zeks.com/PDF/ZEKS%20Mist%20Eliminator.pdf>)
  - (13) Quincy Mist Eliminator (<https://www.quincycompressor.com/products/mist-eliminators>)
  - (14) Compressed Air Best Practices (<https://www.airbestpractices.com/system-assessments/air-treatmentn2/desiccant-dryers-ten-lessons-learned>)

**Changes from 2017 / 2018 Plan**

- 
- CF for VFD air compressor, HP reduction and NALD measures has been changed to a consistent 71.63%
  - Changed mist eliminator lifetime from 15 years to 11 years based on manufacturer data
  - NALD measure fixed incremental cost to take into account baseline cost of a timed drain
  - Uncontrolled Heatless Desiccant Dryer Purge rate used in forecast changed from 15% to 17% to align with references on Deemed Savings

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Program: Cooling**

**Description:**

Prescriptive rebates will be offered for new cooling equipment. Rebates may be dependent on equipment size or load that is offset and on meeting minimum efficiency requirements. Additional rebates may be available for efficiencies better than the minimum qualifying efficiencies.

Mid-Stream products will be incented at the Distributor to encourage the transformation of market availability of high efficiency cooling products.

Prescriptive rebates will be offered for the installation of EC Motors for Refrigeration Evaporators (retrofit only) and/or Anti-Sweat Heater Controls (retrofit only), along with closing multi-deck cases with solid doors. Prescriptive rebates will also be offered for retrofitting open multideck coolers or freezers with solid glass doors.

Custom rebates are available for cooling-related improvements that are not covered by the aforementioned prescriptive rebates. These would include such applications as heat recovery.

**Program References:**

Measure "ECM" in refrigerated cases	Refer to Program "CO - Refrigeration" to find formulas for (Customer kW, Customer kWh, Customer PckW, etc.) for the "ECM" measures in refrigerated cases.
Measure "Anti-Sweat Heater Controls"	Refer to Program "CO - Refrigeration" to find formulas for (Customer kW, Customer kWh, Customer PckW, etc.) for the "Anti-Sweat Heater Controls" measure.
Measure "ECM" in refrigerated cases	Refer to Program CO - Refrigeration to find references and tables for measure life, ECM_Baseline_Fan_Watts, ECM_Efficient_Fan_Watts, ECM_Hours, CF, Refrigeration Factor, and Incremental Cost values, etc..
Measure "Anti-Sweat Heater Controls"	Refer to Program CO - Refrigeration to find references and tables for measure life, ASHC_Baseline_kW, ASHC_Hours, CF, %_Off, Refrigeration Factor, and Incremental Cost values, etc..
Measure "Retrofit of Open Multideck Cooler (or Freezer) Cases with Solid Glass Doors"	Refer to Program CO - Refrigeration to find references and tables for measure life, FI_Open, FI_Closed, FCR, COPvac, COPrefrig, hours, CF, incremental costs, etc.
Measure "Water Source Heat Pumps"	Refer to Program CO - Heating Efficiency to find references and tables for EFLH_Heat by Climate Zone.

**Conversions:**

Energy Efficiency Ratio	For Forecasting purposes where the EER is not known it will be assumed based on the following equation: $EER = -0.02 * SEER^2 + 1.12 * SEER$ (Reference 7)  For forecasting purposes the EER for MSHPs will be determined by the following empirical formula based on AHRI information: $= (-0.0003 * (SEER/ton)^3 + 0.0101 * (SEER/ton)^2 + 0.5264 * (SEER/ton) - 0.0233) * tons$
Seasonal Energy Efficiency Ratio	For Forecasting and energy calculations for PTAC units where SEER is not provided in the International Energy Conservation Code, 2015, the following algorithm will be used to derive SEER = $28 - \sqrt{784 - (50 * EER)}$
kW/ton	= 12 / Energy Efficiency Ratio
Energy Efficiency Ratio	= 3.412 x Coefficient of Performance
Heating Seasonal Performance Factor (HSPF)	= 3.412 x Heat Energy Output (Btu) / Energy Input to Compressor (Btu)

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Algorithms:**

<b>For Rooftop Units, Split Systems, Condensing Units, PTACs</b>	
Gross Annual kWh Saved at Customer	= Size x EFLH x ( 12/SEER_Standard - 12/SEER_Eff ) Note: IEER replaces SEER for most RTUs
Gross kW Saved at Customer	= Size x ( 12 / EER_Standard - 12 / EER_Eff )
Peak Coincident kW at the Customer (PC_KW_CUST)	= Size x ( 12 / EER_Standard - 12 / EER_Eff ) x CF
<b>For Water Source Heat Pumps</b>	
Gross Annual kWh Saved at Customer	= Quantity x ( WSHP_Cooling_kWh + WSHP_Heating_kWh )
Gross kW Saved at Customer	= Quantity x ( Size x ( 12 / EER_Standard - 12 / EER_Eff ) )
Peak Coincident kW at the Customer (PC_KW_CUST)	= Quantity x ( Size x ( 12 / EER_Standard - 12 / EER_Eff ) x CF )
WSHP_Cooling_kWh	= Size x EFLH x ( 12/SEER_Standard - 12/SEER_Eff ) Note: SEER = EER for water source heat pumps
WSHP_Heating_kWh	= Size_Heat x Heat_EFLH x ( 1 / ( COP_Standard x 3412 ) - 1 / ( COP_Eff x 3412 ) )
<b>For all Water Cooled or Air Cooled Chillers</b>	
Gross Annual kWh Saved at Customer	= Quantity x ( Size x EFLH x ( IPLV_Standard - IPLV_Eff ) )
Gross kW Saved at Customer	= Quantity x ( Size x ( FLV_Standard - FLV_Eff ) )
Peak Coincident kW at the Customer (PC_KW_CUST)	= Quantity x ( Size x ( FLV_Standard - FLV_Eff ) x CF )
<b>For Water Cooled Centrifugal Chillers</b>	
Gross Annual kWh Saved at Customer	= Quantity x ( Size x EFLH x ( IPLV_ARI_Adjusted - IPLV_Eff ) )
Gross kW Saved at Customer	= Quantity x ( Size x ( IPLV_ARI_Adjusted - IPLV_Eff ) )
Peak Coincident kW at the Customer (PC_KW_Cust)	= Quantity x ( Size x ( FLV_ARI_Adjusted - FLV_Eff ) x CF )
FLV_ARI_Adjusted	= FLV_standard / Kadj
IPLV_ARI_Adjusted	= IPLV_standard / Kadj
Kadj	= A x B
A	= 0.00000014592 x (Lift)^4 - 0.0000346496 x (Lift)^3 + 0.00314196 x (Lift)^2 - 0.147199 x (Lift) + 3.9302
B	= 0.0015 x Lvg_Evap_T + 0.934
Lift	= Lvg_Cond_T - Lvg_Evap_T
Minimum Qualifying FLV	= ( FLV_standard / Kadj ) - Qualifying FLV Offset = FLV_ARI_Adjusted - Qualifying FLV Offset
Minimum Qualifying IPLV	= ( IPLV_standard / Kadj ) - Qualifying IPLV Offset = IPLV_ARI_Adjusted - Qualifying IPLV Offset
<b>For VFDs on Centrifugal Chillers</b>	
Gross Annual kWh Saved at Customer	= Quantity x ( Size x EFLH x ( IPLV_VFD_Baseline - IPLV_VFD_Eff ) )
Gross kW Saved at Customer	= Quantity x ( Size x ( IPLV_VFD_Baseline - IPLV_VFD_Eff ) )
Peak Coincident kW at the Customer (PC_KW_CUST)	= Quantity x ( Size x ( FLV_VFD_Baseline - FLV_VFD_Eff ) x CF )

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**For Direct Evaporative Pre-cooling for Air Cooled Condensers (DEPACC)**

Gross Annual kWh Saved at Customer	= Quantity x ( tons x EFLH x EFLH_Factor x kW_per_ton_Eff_Avg )
Gross kW Saved at Customer	= Quantity x ( tons x kW_per_ton_Eff_Peak )
Incremental O&M Cost	= Quantity x ( Incremental_O&M_Cost_Factor x EFLH x EFLH_Factor x Tons )

**For Mini-Split Heat Pumps or Mini-Split Air Conditioners**

Gross Annual kWh Saved at Customer	= Quantity x ( Mini-Split Heating Energy Savings + Mini-Split Cooling Energy Savings )
Gross kW Saved at Customer	= Quantity x ( Size x ( 12 / EER_Standard - 12 / EER_Eff ) )
Peak Coincident kW at the Customer (PC_KW_CUST)	= Quantity x ( Size x ( 12 / EER_Standard - 12 / EER_Eff ) X CF )
Mini-Split Cooling Energy Savings	= Size x EFLH x ( 12 / SEER_Standard - 12 / SEER_Eff )
Mini-Split Heating Energy Savings	= Size_Heat / 1000 x MSHP_EFLHH x ( 1 / HSPF_Standard - 1 / HSPF_Eff )

**Variables:**

**General Water & Air Cooling Variables:**

Size	Customer Input	= The equipment capacity in tons, provided by customer. The maximum size unit for MSHPs is 5 tons
EFLH	See Table 2	= Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year. Values are shown in Table 2 for different building types and locations, to be provided by the customer.
SEER_Standard, IEER_Standard	See Table 1	= Seasonal (or Integrated) Energy Efficiency Ratio in Btu/Wh of standard equipment, based upon the minimum acceptable efficiency defined by International Energy Conservation Code, 2015 (Reference 6). Value determined from table 1 based on customer provided equipment type and size.
SEER_Eff, IEER_Eff	Customer Input	= Seasonal (or Integrated) Energy Efficiency Ratio in Btu/Wh of High Efficiency equipment that the customer will install, provided by customer.
EER_Standard	See Table 1	= EER of standard equipment, based upon the minimum acceptable efficiency defined by the International Energy Conservation Code, 2015, for a specific type of equipment and size. Table 1.
EER_Eff	Customer Input	= EER of High Efficiency that the customer will install, provided by customer.
COP_Standard	4.3	= COP of standard Water Source Heat Pump equipment in Heating Mode for Water:Air Water Loop from the International Energy Conservation Code, 2015, Table 403.3.2.3 (2) .
COP_Eff	Customer Input	= COP of High Efficiency unit that the customer will install, provided by customer.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

FLV_Standard	See Table 1	= Full load cooling efficiency in kW/ton of standard equipment, based upon the minimum acceptable efficiency defined by International Energy Conservation Code, 2015, Table 403.2.3(7) for selected centrifugal chiller type, size, condensing and chilled water temperature (provided by customer). Table 1, excerpt. NOTE: For non-centrifugal chillers, FLV_Standard is the value in IECC Table 403.2.3(7), without variation for condenser and chilled water temperatures and condenser water flow rate.
IPLV_Standard	See Table 1	= Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of standard equipment, based upon the minimum acceptable efficiency defined by International Energy Conservation Code, 2015 for chiller type and size (type and size provided by customer). Table 1
FLV_ARI_Adjusted	= IECC based FLV for water cooled centrifugal chillers adjusted to actual site rated conditions (provided by customer) per IECC 2015 code adjustment formulas.	
IPLV_ARI_Adjusted	= IECC based IPLV or NPLV for water cooled centrifugal chillers adjusted to actual site rated conditions (provided by customer) per IECC 2015 code adjustment formulas.	
Qualifying_FLV_Offset	0.016	= Offset used to determine Minimum Qualifying Full Load Value (FLV) for Centrifugal Chillers based on the k-adjusted Full Load cooling efficiency in kW/ton of standard equipment and for Screw/Scroll Chillers based on code Full Load cooling efficiency in kW/ton.
Qualifying_IPLV_Offset	0.016	= Offset used to determine Minimum Qualifying Integrated Part Load Value (IPLV) for Centrifugal Chillers based on the k-adjusted IPLV cooling efficiency in kW/ton of standard equipment and for Screw/Scroll Chillers based on code IPLV cooling efficiency in kW/ton.
Lvg_Evap_T	Customer Input	= The full load chilled water temperature leaving the evaporator, in deg F
Lvg_Cond_T	Customer Input	= The full load condenser water temperature leaving the condenser, in deg F
FLV_VFD_Baseline	Customer Input	= Full Load Value cooling efficiency in kW/ton, representing the efficiency of existing chiller without a VFD at 100% load, provided by customer.
FLV_VFD_Eff	Customer Input	= Full Load Value cooling efficiency in kW/ton, representing the efficiency of existing chiller with a VFD at 100% load, provided by customer.
IPLV_VFD_Baseline	Customer Input	= Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of existing chiller without a VFD, provided by customer.
IPLV_VFD_EFF	Customer Input	= Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of existing chiller with VFD, provided by customer.
FLV_Eff	Customer Input	= Full Load Value cooling efficiency in kW/ton, representing the efficiency at design conditions, provided by customer.
IPLV_Eff	Customer Input	= Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of High Efficiency equipment, provided by customer.
Size_Heat	Customer Input	= Heating Capacity of Water Source Heat Pumps and Mini Split Heat Pump, in BTU/h, provided by customer
MSHP_EFLHH	950	= Mini-Split Heat Pump Equivalent Full Load Hours Heating ( EFLH) : The equivalent number of hours that MSHP equipment would be running at Full Load over the course of the year for heating.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

HSPF_Standard	8.2	= Heating Seasonal Performance Factor (HSPF) of standard equipment, based upon the minimum Federal standard for efficiency as manufactured.
MSHP_Primary_Use	Customer Input	= Mini-Split Heat Pump Primary use will be a picklist item of Heating or Cooling, provided by the customer.
HSPF_Eff	Customer Input	= Heating Seasonal Performance Factor (HSPF) of High Efficiency equipment that the customer will install, provided by the customer
3.412	= Conversion between BTU/h and Watts	
3412	= Conversion between BTU/h and kilowatts	
12000	= Conversion between BTU/h and tons	
CF	= Coincidence Factor, the probability that peak demand of the unit will coincide with peak utility system demand. 90% will be used for prescriptive rebates except VFD Chillers (Reference 1). For VFD Chillers we will use 0%.	
Measure Life	20	Measure life for all prescriptive water cooled chillers, air cooled chillers, RTUs, and WSHPs cooling equipment (Reference 2)
Measure Life	15	Measure life for all prescriptive PTAC cooling equipment (Reference 2)
Measure Life	18	Measure life for all prescriptive MSAC and MSHP cooling equipment (Reference 12)
Measure Life	20	Measure life for DEPACC installations
NTG_Midstream	92%	Net-to-gross = We will use 92% for all midstream cooling equipment (Reference 4).
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment except MSHP units (Reference 4).
NTG_MSHP	100%	Net-to-gross = We will use 100% for all MSHP units (Reference 4).
NTG_Custom	87%	Net-to-gross = We will use 87% for all custom cooling projects (Reference 4).
NTG_Refrigeration	100%	Net-to-gross = Anti-Sweat Heaters and ECM measures which will be 100%. (Reference 4).
Incremental operation and maintenance cost	= \$0 for all cooling system types (except direct evaporative pre-cooling)	
Baseline Cost of Equipment	The cost of equipment that would exactly meet code requirements.	
Incremental Cost of Equipment	See Table 4	Table 4 contains the incremental cost for equipment in the midstream product offerings. Incremental cost is the cost above the code requirements, expressed in a dollar per ton basis.
Incremental Cost of Equipment	See Table 5	Table 5 contains the incremental cost for equipment in the downstream product offerings. Incremental cost is the cost above the code requirements, expressed in a dollar per ton basis.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**For Direct Evaporative Pre-cooling for Air Cooled Condensers (DEPACC) (Reference 5)**

kW_per_ton_Eff_Avg	0.1488	Average kW/ton = kWh/ ton / DEPACC Operating hrs/yr = Efficiency improvement of incumbent air-cooled condensers in kW per ton resulting from installation of condenser evaporative pre-cooler averaged for annual cooling hours.
EFLH_Factor	1.1631	= DEPACC_Operating_Hours_Office / EFLH for Front Range Office (w/economizer)
DEPACC_Operating_Hours_Office	1134	DEPACC Operating hrs/yr = Estimated annual hours of operation of the DEPACC system for an office in the Front Range. Used to scale DEPACC operating hours to A/C EFLH by segment
kW_per_ton_Eff_Peak	0.4544	Peak Coincident kW/ton = Efficiency improvement of incumbent air-cooled condensers in kW per ton resulting from installation of condenser evaporative pre-cooler at summer cooling design conditions: 0.4% design temperatures @ DIA = 93.9°F DB and 64.7°F WB
Incremental_O&M_Cost_Factor	0.000886667	\$ / ton-hour = ( Water Cost / Ton ) / DEPACC Operating Hours = Factor used to calculate Incremental annual non-energy Operations and Maintenance cost per ton-hr for water usage.
Baseline Cost of Equipment	= \$0 because the baseline option is to do nothing.	
Incremental Cost of Equipment	See Table 3	= Tons x Incremental cost of DEPACC equipment from Table 3. Table 3 is expressed on a cost per ton basis.
Tons	Customer Input	Tons of cooling shown on the rated faceplate of the existing cooling equipment.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Inputs:**

Information Provided by Customer:	
<b>Rooftop Units / Split Systems / Air Cooled Chillers / PTAC / Water Source Heat Pumps / MSHP</b>	Verified during M&V:
Cooling equipment type	Yes
County / Zone	Yes
Market segment	Yes
Cooling equipment size [tons]	Yes
Quantity of Cooling equipment by Size	Yes
Cooling equipment efficiency (EER or FLV in kW/ton - dependent on the technology)	Yes
Cooling equipment efficiency (SEER or IPLV in kW/ton - dependent on the technology)	Yes
Heating Season Performance Factor (HSPF) for Water Source Heat Pumps and Mini-Split Heat Pumps	Yes
Primary use, cooling or heating (MSHP)	
<b>Centrifugal Chillers:</b>	
County / Zone	Yes
Market segment	Yes
Chiller Size [tons]	Yes
Chiller FLV [kW/ton] at full load	Yes
Chiller IPLV [kW/ton] at full load	Yes
Chill water supply temperature [°F] at full load	Yes
Condenser water entering temperature [°F] at full load	Yes
Chilled water leaving temperature [°F]	Yes
Chill water flow [gpm/ton] at full load	Yes
Condenser water flow [gpm/ton] at full load	Yes
<b>VFDs on Centrifugal Chillers</b>	Verified during M&V:
County / Zone	Yes
Market segment	Yes
Chiller Size [tons]	Yes
Chiller FLV [kW/ton] at full load	Yes
Chiller IPLV [kW/ton] at full load	Yes
Chiller with VFD FLV [kW/ton] at full load	Yes
Chiller with VFD IPLV [kW/ton] at full load	Yes
Quantity of same size Chillers with VFD Retrofit	Yes
<b>For DEPACC Provided by Customer:</b>	Verified during M&V:
Cooling equipment type	Yes
Climate zone	Yes
Building type	Yes
Cooling equipment size (tons)	Yes

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

<b>For Electronically Commutated Evaporator Fan Motors:</b>	Verified during M&V:
Size of motor	Yes
Application of motor (Display Case or Walk-in)	Yes
Case or Walk-in temperature (Medium Temp or Low Temp)	Yes
For Walk-in's: Fan diameter (<= 15 inches or >15 inches)	Yes
Cost	
<b>For Anti-Sweat Heaters:</b>	
Number of doors controlled	Yes
Number of controllers	Yes
Cost	
<b>Open to Closed Case Retrofit</b>	
Length of Case(s)	Yes
Freezer or Cooler?	Yes

**Assumptions:**

- Customer selection of cooling equipment is in lieu of equipment of the same size and configuration that met minimum 2015 International Energy Conservation Code requirements.
- Prescriptive rebates are not given for backup cooling equipment.
- Small RTU assumed to have gas heat for code baseline selection
- No Heating kW saving are claimed for MSHP during winter, only summer cooling kW savings are claimed.

**DEPACC:**

- Minimum equipment size that DEPACC can be installed on is 10 ton.
- Qualifying evaporative cooling units must have a minimum Media Saturation Effectiveness of 75% and above. The units must be installed with an evaporative media, a remote thermostat, outside air temp sensor and a periodic purge water control if sump is used.
- Units should have outdoor air, humidity and controls to determine operation of spray nozzles to wet media. If sump is used, periodic purge control would need to be installed.
- Condenser fan energy costs due to DEPACC media are not expected to increase measurably. Media decreases condenser fan cfm while increasing fan static.
- Denver Water 2018 average rate at \$3.167/1000 gal (Source <https://www.denverwater.org/business/billing-and-rates/2018-rates> )
- DEPACC estimate of water consumed by the evaporative pre-cooling system is 0.28 gallons per ton-hour of cooling based on manufacturer's data.

**EC Motors:**

- Each motor is replaced with the same size on a 1 for 1 basis.
- Rebates do not apply to rewind or repaired motors.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Tables:

**Table 1. Deemed Baseline Efficiencies (IECC 2015)**  
**EQUIPMENT BASELINE EFFICIENCIES REQUIRED BY CODE, NOTE: For Rooftop Units Larger Than 5.4 Tons, Add 0.2 to Both IEER and EER for Units That Have No Heat or Electric Heat**

Equipment	Equipment Classification	EER	SEER/ IEER/ IPLV	Path A FLV (kW/ton)	Path A IPLV (kW/ton)	COP or HSPF
Rooftop Units less than 5.4 tons	Standard Efficiency	11.76	14.00			
Split Systems less than 5.4 tons	Standard Efficiency	11.18	13.00			
Rooftop Units Condensing Units & Split Systems 5.5-11.3 tons	Standard Efficiency	11.00	12.60			
Rooftop Units & Split Systems 11.4-19.9 tons & Condensing Units > 11.4 tons	Standard Efficiency	10.80	12.20			
Rooftop Units & Split Systems 20-63.3 tons	Standard Efficiency	9.80	11.40			
Rooftop Units greater than 63.3 tons	Standard Efficiency	9.50	11.00			
Water Source Heat Pumps (Water:Air - Water Loop)	Standard Efficiency	13.00	13.00			4.30
PTAC Replacement <= 7000 BTUH	Standard Efficiency	9.41	11.07			
PTAC Replacement >7000 BTUH to <15000 BTUH	Standard Efficiency	= 10.9-(0.213 * (Size BTUH / 1000))	= 28 - SQRT( 784 - ( 50 x EER ) )			
PTAC Replacement >=15000 BTUH	Standard Efficiency	7.71	9.06			
scroll/screw chiller < 75 tons	Standard Efficiency			0.750	0.600	
scroll/screw chiller >=75 to < 150 tons	Standard Efficiency			0.720	0.560	
scroll/screw chiller >=150 to <300 tons	Standard Efficiency			0.660	0.540	
scroll/screw chiller >= 300 to <600 tons	Standard Efficiency			0.610	0.520	
scroll/screw chiller >= 600 tons	Standard Efficiency			0.560	0.500	
Centrifugal Chillers < 150 tons	ARI rated Efficiency			0.610	0.550	
Centrifugal Chillers >= 150 to < 300 tons	ARI rated Efficiency			0.610	0.550	
Centrifugal Chillers >=300 tons to < 400 tons	ARI rated Efficiency			0.560	0.520	
Centrifugal Chillers >=400 tons to < 600 tons	ARI rated Efficiency			0.560	0.500	
Centrifugal Chillers >= 600 tons	ARI rated Efficiency			0.560	0.500	
Air-Cooled Chillers - < 150 tons	Standard Efficiency	10.100	13.700			
Air-Cooled Chillers - >= 150 tons	Standard Efficiency	10.100	14.000			
Mini-Split Heat Pump (16-21 SEER, 9-12 HSPF)	Standard Efficiency	8.75	14.00			8.20
Mini-Split Heat Pump (21-24 SEER, 9-12 HSPF)	Standard Efficiency	8.75	14.00			8.20
Mini-Split Heat Pump (24-26 SEER, 9-12 HSPF)	Standard Efficiency	8.75	14.00			8.20

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### NOTES

\* Bold values indicates direct sourcing to IECC 2015, tables 403.2.3(x), otherwise estimated by using the code SEER in the algorithm above to get EER, or using EER in the following algorithm to get  $SEER = 28 - \sqrt{784 - (50 \times EER)}$ . For water-sourced heat pumps only, the EER is set equal to the SEER because the condenser water loop temperature is assumed to be maintained by cooling towers.

\* High Efficiency IEER, SEER and EER values are supplied by Customer.

\* ARI rated efficiency is converted to Standard efficiency as per Table 403.2.3(7)

\* Values for Centrifugal Chillers assumed to be at ARI rating conditions of 85 degrees condensing temperature, 44 degrees chilled water temperature, 2.4 gpm/ton chill water flow, and 3 gpm/ton condenser water flow. Reference International Energy Conservation Code (IECC), 2015, Sec. 403.2.3.1

\* Values for PTAC from IECC 2015 formula, Table 403.2.3(3) for Cooling Mode, Replacements.

\* Chiller categories are now aligned with the IECC 2015.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 2. Equivalent Full Load Hours by Building Type

Building Type / Market Segment	Front Range EFLH	Front Range EFLH w/ Economizer	Western Slope EFLH	Western Slope EFLH w/ Economizer	Mountain EFLH	Mountain EFLH w/ Economizer
Education	620	545	653	588	439	368
Health/ Medical	985	866	1,038	934	697	585
Lodging	654	574	688	620	462	388
Office	1,109	975	1,168	1,052	785	659
Retail	492	432	518	466	348	292
Mixed Use (office and retail)	749	658	788	710	530	444
Data Centers	8,760	8,760	8,760	8,760	8,760	8,760
Process Loads	5,840	5,840	5,840	5,840	5,840	5,840

NOTES:

- \* EFLH- Zone 1 (Front Range/Denver); Zone 2 (Western State as represented by Grand Junction) and Zone 3 (Mountain Areas as represented by Alamosa)
- \* Market segment hours scaled from Minnesota OES data (Reference 10) with Office value calculated for Denver and Grand Junction Typical Meteorological Year data. Distributions developed from CBECS data (Reference 3)
- \* WSHP's will use Non-Economizer hours for all projects.
- \* RTU's that are less than 4.5 tons will use Non-Economizer hours for all projects.
- \* Air Cooled Chillers and RTU's will use Economizer hours for all projects.
- \* PTAC's will use Non-Economizer Lodging hours for all projects.

Table 3. DEPACC Incremental Cost (Reference 5)

System Tons	\$/ton
40	\$ 248.27
80	\$ 219.91
120	\$ 209.23
160	\$ 202.80
320	\$ 190.49

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 4 Midstream Minimum Qualifying Tiers and Incremental Costs

Equipment	Equipment Tier	Min Qualifying SEER/IEER/ IPLV	Min Qualifying EER	Min Qualifying COP or HSPF	Incremental Cost per Ton, \$/ton (Reference 8)
Rooftop Units less than 5.4 tons	Tier 1	15.00	12.20		\$98.20
Rooftop Units less than 5.4 tons	Tier 2	16.00	12.20		\$147.77
Rooftop Units less than 5.4 tons	Tier 3	17.00	12.20		\$338.17
Rooftop Units less than 5.4 tons	Tier 4	18.00	12.20		\$797.92
Split Systems less than 5.4 tons	Tier 1	15.00	12.20		\$98.20
Split Systems less than 5.4 tons	Tier 2	16.00	12.20		\$147.77
Split Systems less than 5.4 tons	Tier 3	17.00	12.20		\$338.17
Split Systems less than 5.4 tons	Tier 4	18.00	12.20		\$797.92
Rooftop Units & Split Systems 5.5-11.3 tons	Tier 1	13.00	11.60		\$80.71
Rooftop Units & Split Systems 5.5-11.3 tons	Tier 2	13.80	11.60		\$130.61
Rooftop Units & Split Systems 5.5-11.3 tons	Tier 3	14.60	11.60		\$116.82
Rooftop Units & Split Systems 5.5-11.3 tons	Tier 4	18.00	11.60		\$285.89
Rooftop Units & Split Systems 11.4-19.9 tons	Tier 1	12.60	11.60		\$107.75
Rooftop Units & Split Systems 11.4-19.9 tons	Tier 2	13.40	11.60		\$171.56
Rooftop Units & Split Systems 11.4-19.9 tons	Tier 3	14.00	11.60		\$196.87
Rooftop Units & Split Systems 11.4-19.9 tons	Tier 4	17.50	11.60		\$319.10
Rooftop Units & Split Systems 20-63.3 tons	Tier 1	12.00	10.30		\$12.96
Rooftop Units & Split Systems 20-63.3 tons	Tier 2	12.60	10.30		\$68.35
Rooftop Units & Split Systems 20-63.3 tons	Tier 3	13.30	10.30		\$145.64
Rooftop Units & Split Systems 20-63.3 tons	Tier 4	15.00	10.30		\$165.22
Rooftop Units greater than 63.3 tons	Tier 1	12.00	10.00		\$110.00
Rooftop Units greater than 63.3 tons	Tier 2	12.80	10.00		\$140.50
Rooftop Units greater than 63.3 tons	Tier 3	14.00	10.00		\$266.50
Rooftop Units greater than 63.3 tons	Tier 4	16.00	10.00		\$336.75
Air-Cooled Chillers - < 150 tons	Tier 1	14.5	10.3		\$48.86
Air-Cooled Chillers - < 150 tons	Tier 2	15.0	10.3		\$75.68
Air-Cooled Chillers - < 150 tons	Tier 3	16.0	10.3		\$105.05
Air-Cooled Chillers - < 150 tons	Tier 4	18.0	10.3		\$191.88
Air-Cooled Chillers - >= 150 tons	Tier 1	14.5	10.3		\$48.86
Air-Cooled Chillers - >= 150 tons	Tier 2	15.0	10.3		\$75.68
Air-Cooled Chillers - >= 150 tons	Tier 3	16.0	10.3		\$105.05
Air-Cooled Chillers - >= 150 tons	Tier 4	18.0	10.3		\$191.88
PTAC (Replacements) - 11 EER	Tier 1		11.0		\$172.34
PTAC (Replacements) - 11.5 EER	Tier 2		11.5		\$254.77
PTAC (Replacements) - 12 EER	Tier 3		12.0		\$376.64
Water-source Heat Pumps	Tier 1	13.50	13.50	4.40	\$163.64
Water-source Heat Pumps	Tier 2	15.00	15.00	4.40	\$245.45
Water-source Heat Pumps	Tier 3	16.00	16.00	4.40	\$327.27
Water-source Heat Pumps	Tier 4	18.00	18.00	4.40	\$490.91
MSAC 16-21 SEER - MS	Tier 1	16.00	10.50		\$337.87
MSAC 21-24 SEER - MS	Tier 2	21.00	10.50		\$545.61
MSAC 24+ SEER - MS	Tier 3	24.00	10.50		\$570.04
Mini-Split Heat Pump (16-21 SEER, 9-12 HSPF)	Tier 1	16.00	10.50	9.00	\$337.87
Mini-Split Heat Pump (21-24 SEER, 9-12 HSPF)	Tier 2	21.00	10.50	9.00	\$545.61
Mini-Split Heat Pump (24-26 SEER, 9-12 HSPF)	Tier 3	24.00	10.50	9.00	\$570.04

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 5.  
MINIMUM QUALIFYING EQUIPMENT EFFICIENCIES AND INCREMENTAL**

<b>Equipment</b>	<b>Incremental Cost per Ton, \$/ton (References 9, 11)</b>	<b>Minimum qualifying FLV</b>	<b>Minimum Qualifying IPLV</b>	<b>Minimum Qualifying FLV Offset from Adjusted Code Value</b>	<b>Minimum Qualifying IPLV Offset from Adjusted Code Value</b>
scroll/screw chiller < 75 tons	\$128.00	0.734	0.584		
scroll/screw chiller >=75 to < 150 tons	\$128.00	0.704	0.544		
scroll/screw chiller >=150 to <300 tons	\$70.00	0.644	0.524		
scroll/screw chiller >= 300 to <600 tons	\$70.00	0.594	0.504		
scroll/screw chiller >= 600 tons	\$70.00	0.544	0.484		
Centrifugal Chillers < 150 tons	\$177.00			0.016	0.016
Centrifugal Chillers >= 150 to < 300 tons	\$177.00			0.016	0.016
Centrifugal Chillers >=300 tons to < 400 tons	\$177.00			0.016	0.016
Centrifugal Chillers >=400 tons to < 600 tons	\$177.00			0.016	0.016
Centrifugal Chillers >= 600 tons	\$177.00			0.016	0.016
VFD's for Chillers	\$71.88				

**References:**

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy Smart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECS (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment distributions
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing temperatures.
6. International Energy Conservation Code 2015
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>  
Approximation:  $EER = 1.12 \times SEER - 0.02 \times SEER^2$
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Minnesota Office of Energy Security (MOES) 2008 Cooling Equivalent Full Load Hours
11. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
12. MSHP equipment life is from Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures; <http://library.cee1.org/content/measure-life-report-residential-and-commercialindustrial-lighting-and-hvac-measures>

**Changes from 2017 / 2018 Plan**

Incremental cost are adjusted according to updated information from registered distributors.  
 Equivalent Full Load Hours updated to correct discrepancies between climate zones.  
 Water Source Heat Pump measures altered to capture heating energy savings compared to baseline equipment.  
 Minimum qualifying EERs have been evaluated and updated to improve measure level performance.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Product: Custom Efficiency**

**Description:**

Customer may apply for rebate under the Custom Efficiency product for gas or electric projects not listed under prescriptive rebate products. Each Custom Efficiency project will be analyzed individually by Xcel Energy. Technical variables required for the analysis will be obtained from the customer or vendor. Analysis will be based on standard engineering methodologies.

**Equations:**

All savings, costs, rebates, and lifetimes will be calculated based on the project specific details. Each project will undergo an engineering review in accordance with standard engineering practices. The review will be in accordance with the calculation methodologies detailed in the prescriptive products where applicable.

<b>Variable ID</b>	<b>Value</b>	<b>Description</b>
NTG	87%	Net to Gross

**Changes from 2017 / 2018 Plan:**

None

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Program: Data Center Efficiency

#### Description:

Data Center Holistic: Customers may apply for rebates under the Data Center Efficiency product for measures not listed under prescriptive rebate products for this program (e.g. lighting, motors, etc...).

Data Center Custom: Each Data Center efficiency project will be analyzed individually by Xcel Energy. Technical variables required for the analysis will be obtained from the customer and/or vendor. Analysis will be based on standard engineering methodologies.

Data Center Prescriptive: Commercial customers receive a rebate for installing electronically-commutated, backward-curved plug fans on computer room air conditioning (CRAC) and computer room air handling (CRAH) units' supply fans in data centers instead of baseline forward-curved AC centrifugal fans in new construction applications.

Computer Efficiency Prescriptive: Rebates are offered to end-use customers for installing Virtual Desktop Infrastructure (VDI) devices, also known as "Thin Client" systems, instead of new PCs. Rebates are also offered for purchasing servers that are labeled 80 PLUS titanium; all eligible servers are required to have redundant power supplies and power supplies rated 80 PLUS platinum will serve as a baseline, since this is the Energy Star rating baseline.

New Construction: Provides consulting for new construction, additions, or major renovation projects to identify energy-saving measures.

Study: Evaluation of existing data center systems to identify energy conservation opportunities.

#### Program References:

Data Center Holistic Program Savings	Refer to the appropriate program to find all applicable formulas (Customer kW, Customer kWh, Customer PckW, etc.) or assumptions (Hours, Runtime, etc.) for prescriptive measures savings claimed through the holistic data center product architecture.
Eq.Deemed_Load_Factor	Refer to Product "CO Motor & Drive Efficiency" deemed savings tab.
Eq.Heating_Factor	Refer to Product "CO Lighting Efficiency" deemed savings Table 1 for buildings with heating and cooling.
Eq.kW_Factor	Refer to Product "CO Lighting Efficiency" deemed savings Table 1 for buildings with heating and cooling.
Eq.kWh_Factor	Refer to Product "CO Lighting Efficiency" deemed savings Table 1 for buildings with heating and cooling.
Eq.PL_Efficiency_Baseline	Refer to Product "CO Cooling Efficiency" deemed efficiencies Table 1.

#### Equations:

Data Center Custom Calculations:	Non-prescriptive electrical energy savings and electrical demand savings will be calculated based on the project-specific details. Each project will undergo an engineering review in accordance with standard engineering practices. Where prescriptive elements exist, the review will be in accordance with the calculation methodologies detailed in the prescriptive
Data Center New Construction:	Data Center New Construction electrical energy savings and electrical demand savings will be calculated based on the project-specific details. Each project will undergo an engineering review in accordance with standard engineering practices. Where prescriptive elements exist, the review will be in accordance with the calculation methodologies detailed in the prescriptive products.
EC Plug Fans	
F_Customer_kW (Customer kW Savings)	= F_Fan_kW + F_Secondary_kW
F_Customer_kWh (Customer kWh Savings)	= F_Fan_kWh + F_Secondary_kWh
F_Customer_PCkW (Customer Peak kW Savings)	= F_Customer_kW * Eq.Coincidence_Factor
F_Fan_kW	= I_Quantity_Prop_Fans * Eq.Typical_Units_InUse * P_DCE_CRAC_Base_HP * Eq.Deemed_Load_Factor / Eq.Base_Fan_Qty_Avg * 0.7457 * (1 - (Eq.Base_Fan_Eff * Eq.Base_Belt_Eff * Eq.Base_Motor_Eff / (Eq.Prop_Fan_Eff * Eq.Prop_Drive_Eff * Eq.Prop_Motor_Eff)) - Eq.UnderFloor_Dist_Save_Factor))

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

F_Secondary_kW (Refrigeration Interactive kW Savings)	= F_Fan_kW * 3412/12000 * P_Agg_kW/Ton
F_Fan_kWh	= 8760 * F_Fan_kW
F_Secondary_kWh (Refrigeration Interactive kWh Savings)	= F_Fan_kW * 3412/12000 * P_Agg_kWh/ton
<b>Plate &amp; Frame Heat Exchangers</b>	
F Cool PF kW v2 (Customer kW Savings)	= Customer_kWh / ( Customer_kWh / F_Cool_PF_TONS_OFFSET / I_Chiller_IPLV )
F Cool PF kWh v2 (Customer kWh Savings)	= ( P_Cool_Coeff_A * ( I_WB_Temp^2 ) + P_Cool_Coeff_B * ( I_DB_Temp ^ 2 ) + P_Cool_Coeff_C * I_WB_Temp * I_DB_Temp + P_Cool_Coeff_D * I_WB_Temp + P_Cool_Coeff_E * I_DB_Temp + P_Cool_Coeff_F ) * ( P_Cool_Hrs_No_Econ / P_Cool_Coeff_G_EFLH ) * ( I_Chiller_IPLV / Eq.PL_Efficiency_Baseline ) * ( F_Cool_PF_TONS_OFFSET / 100 )
PC_kW_Customer (Customer Peak kW Savings)	= Customer_kW * Eq.Coincidence_Factor
F Cool PF TONS OFFSET	= Minimum ( i_Tons_Capacity_HX, ( ( i_Chiller_Plant_Peak_Tons / ( P_T_DB_Design - I_DB_Temp ) ) * P_T_WB_TO_MCDB ) + ( i_Chiller_Plant_Peak_Tons - ( i_Chiller_Plant_Peak_Tons / ( P_T_DB_Design - I_DB_Temp ) ) * P_T_DB_Design ) )
<b>Desktop PC Virtualization (VDI)</b>	
Customer_kW	= ( ( Eq.kW_Savings * I_Qty_Prop_Equip ) - ( ( ( I_Watts / 1000 ) + Eq.kW_Server ) * I_Qty_Prop_Equip ) ) * Eq.kW_Factor
Customer_kWh	= ( Eq.kW_Savings * I_Qty_Prop_Equip - ( I_Watts / 1000 + Eq.kW_Server ) * I_Qty_Prop_Equip ) * Eq.kWh_Factor *
PC_kW_Customer	= ( ( Eq.kW_Savings * I_Qty_Prop_Equip ) - ( ( ( I_Watts / 1000 ) + Eq.kW_Server ) * I_Qty_Prop_Equip ) ) * Eq.kW_Factor * Eq.Coincidence_Factor
Increm_Electric_O_M_Savings	= ( ( Eq.Labor_Savings - Eq.License_Fees ) * I_Qty_Prop_Equip ) + ( ( ( Eq.kW_Savings - ( ( I_Watts / 1000 ) + Eq.kW_Server ) ) * I_Qty_Prop_Equip ) * Eq.Hours * Eq.Heating_Factor * P_GasRate )
<b>High Efficiency Power Supply Server</b>	
F Server kW	= ( I_Input_Wattage_per_Power_Supply * Eq.Quantity * Eq.Load_Factor / 1000 ) * ( ( 1 / Eq.Baseline_Efficiency ) - ( 1 / Eq.Proposed_Efficiency ) )
F Server kWh	= F_Server_kW * 8760
F Server Cust PCKW	= F_Server_Cust_kW * Eq.Coincidence_Factor
F Server Sec kW	= F_Server_kW * 3412 / 12000 * P_Agg_kW/Ton_Avg
F Server Sec kWh	= F_Server_kW * 3412 / 12000 * P_Agg_kWhTon_Avg
Customer_kW	= ( F_Server_kW + F_Server_Sec_kW ) * I_Qty_Prop_Equip
Customer_kWh	= ( F_Server_kWh + F_Server_Sec_kWh ) * I_Qty_Prop_Equip

Variable ID	Value	Description
Data Center Custom Project NTG	Table 6	Net-to-gross factor for custom and prescriptive Data Center Projects.
Data Center Holistic Prescriptive NTG	Per Program	Prescriptive products not associated with the study track will utilize the net-to-gross value indicated in their end use.
<b>EC Plug Fans</b>		
Distribution Type	Customer Input	Air distribution type/fan location. Customer must indicate whether the new EC fans will be installed in unit or below floor
HVAC System Type	Table 1	HVAC system type serving the data center/CRAC/CRAH units where the fans will be installed. There are five options and the customer must indicate which option best matches their system. The options are shown in Table 1 below.
Eq.Coincidence_Factor	100%	Assumed coincidence factor for EC fans, based on the fact that most data centers operate 24/7
I_Quantity_Prop_Fans	Customer Input	Number of fans installed. Limited to 3 fans per CRAC/CRAH unit.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Eq.Typical_Units_InUse	82.98%	Assumed % of total CRAC units in the facility that will be operating simultaneously. Many data centers use redundancy for backup capacity, meaning some fans installed in CRAC units will be installed in units that do not operate regularly. To account for this in forecasting and for Net-to-Gross, a %-in-use value is used. This value was derived from a sample of custom rebate projects in Colorado involving CRAC units in data
Eq.Deemed_Load_Factor	75.00%	Assumed load factor on existing CRAC/CRAH fan. Referenced from Motors and Drives tech assumptions.
Eq.Base_Fan_Qty_Avg	2.5	Average quantity of fans in a CRAC/CRAH unit, based on most units having either 2 or 3 fans.
Eq.Base_Fan_Eff	53.81%	Efficiency of baseline forward-curved fans. Computed by taking the average of two values: the efficiency given by Ref 7 for the input motor size and the societal average value used in California given by Ref 8
Eq.Base_Belt_Eff	95.00%	Percentage of energy input into the belt drive from the baseline fan motor that passes to the impeller, averaged over the lifetime of the belt, since the belt's efficiency deteriorates over time (Ref 7)
Eq.Base_Motor_Eff	91.18%	Efficiency of baseline fan motor. This value is dependent on the motor size and is calculated by interpolating within the NEMA Premium Motor Efficiency Table and using the motor type (number of poles, open/closed) distribution assumption to find the average NEMA Premium efficiency for that motor size. (Ref 7)
Eq.Prop_Fan_Eff	65.97%	Efficiency of efficient (EC) fan motor. This value is derived from manufacturer efficiency data on various sizes of EC fan collected from several sources (Ref 8, 11, 12).
Eq.Prop_Drive_Eff	99.50%	Percentage of energy input into the motor drive from the EC fan motor that passes to the impeller, averaged over the lifetime of the drive, since the drive's efficiency deteriorates over time (Ref 7)
Eq.Prop_Motor_Eff	88.96%	Efficiency of the EC fan motor. This value is dependent on the motor size and is calculated by inputting the motor size into each of three motor efficiency cubic curve fits derived from curves in Ref 5 and applying the motor type (number of poles) distribution assumption below to find the average EC motor efficiency for that motor size.
Eq.UnderFloor_Dist_Save_Factor	13.26%	Additional Fan Energy Savings Caused by Mounting EC Fans Below the CRAC Unit For Underfloor Air Distribution compared to baseline. (Derived from Results in Ref 2). This value is not used if the efficient fans will not be installed underfloor.
P_DCE_CRAC_Base_HP	11.55	Assumed baseline motor HP per CRAC unit for new construction applications.
P_Agg_kW/ton	Table 1	Cooling system efficiency in kW/ton at design conditions.
P_Agg_kWh/ton	Table 1	Annual cooling system energy across temperature bins in kWh/ton. Calculated from cooling system efficiencies and hours for each temperature bin.
Measure Life (New Construction)	20	Lifetime (in years) of the new construction EC Fan measure.
Eq.Cost (New Construction)	\$1,700.00	Estimated average incremental cost of selecting an EC fan option over a baseline fan option when purchasing a new CRAC unit. This comes from a Colorado custom rebate project.
NTG	Table 6	Net to gross
<b>Plate &amp; Frame Heat Exchangers</b>		
county	Customer Input	Determines appropriate climate zone values to use (e.g. CO1, CO2, or CO3)
i_mark_seg	Customer Input	Facility type/market segment. Defaults to Data Center for this program
i_qty_prop equip	Customer Input	Quantity of plate & frame heat exchangers
i_Tons_Capacity_HX	Customer Input	Actual HX Capacity in tons
i_Chiller_Plant_Peak_Tons	Customer Input	Existing Chiller plant's maximum load in tons on a design summer day. If chiller nameplate tons are provided, clarification on quantity and manner of operation will also be required. For single chillers with only nameplate data an 85% factor will be applied to account for oversizing.
i_db_temp	Customer Input	Building Balance Point Temperature, the outside air dry bulb temperature at which there is no cooling load. Not used to calculate Process and Data Center Market Segment loads which are assumed constant and independent of OSA DB temperature. This value is assumed to be -20 deg F for data center applications.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

i_wb_temp	Customer Input	Onset Wet Bulb Temperature provided by the customer. This is the wet bulb temperature at which the chiller will be turned off and the FPHX turned on to make chill water.
i_chiller_iplv	Customer Input	Integrated Part Load Value (in kW/ton) for the existing chiller plant.
P_T_DB_Design	Table 2	Design Temperature for Front Range cooling calculations. (°F)
P_T_WB_TO_MCDB	Table 4	Mean coincident dry bulb for wet bulb provided by customer. Based on climate zone.
P_Cool_Hrs_No_Econ	8,760	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
P_Cool_Coeff_A through P_Cool_Coeff_G_EFLH	Table 3	Values for the coefficients based on customer Market Segment. Coefficients resulted from a multivariable data regression analysis to estimate the energy savings based on Flat Plate HX Onset Wetbulb Temperature and the building balance point for a FPHX sized to offset 100 tons building load. The resulting savings are scaled based on market segment hours and customer provided HX tons as part of the overall EPLV formula above.
Eq.PL_Efficiency_Baseline	0.57	kW/ton assumed in building the multivariable regression for Flat Plate Heat Exchanger kWh savings.
Eq.Coincidence_Factor	0%	Equipment Coincidence factor
Measure Life (New Construction)	20	Lifetime (in years) for Plate and Frame Heat Exchanger measure. (Ref 16)
Eq.Incremental_Cost_per_Ton	\$737.00	Estimated average cost per ton for plate and frame heat exchangers. Derived from a sample of custom rebate projects involving FPHX.
NTG	Table 6	Net to gross
<b>Desktop PC Virtualization (VDI)</b>		
Eq.kW_Savings	0.0213	Aggregated power demand of a baseline desktop computer
Eq.kW_Server	0.0040	Average server power used to support a virtualized server
Eq.kW_Factor	1.33	Average annual demand of the cooling system that has to remove the heat gain caused by a desktop
Eq.kWh_Factor	1.13	Average annual energy consumption of the cooling system that has to remove the heat gain caused by a
I_Qty_Prop_Equip	Customer Input	Number of VDI, "thin client", devices installed instead of a desktop PC computer
i_watts_c	Customer Input	Rated wattage of the VDI, "thin client", device installed
Eq.Hours	8760	Number of hours that a desktop computer is connected to a virtualized server and available to operate
Eq.Coincidence_Factor	100%	Probability that the calculated Customer kW will coincide with the period of peak generator operation
Eq.Heating_Factor	-0.000508	Average annual energy consumption of the heating system that has to compensate for the negative heat gain associated with the more efficient desktop computer (Dth/kWh).
P_GasRate	\$5.24	Forecasted natural gas rate for businesses (\$/Dth)
Eq.Labor_Savings	\$42.50	Annual labor savings per desktop
Eq.License_Fees	\$12.00	Annual software license fee per desktop
Net-to-Gross	80%	Reference 30
Measure Life	10	Life of a VDI, "thin client", in years (Reference 9)
Eq.Cost	\$117.00	Cost of high efficiency model over baseline model (Reference 6)
<b>High Efficiency Power Supply Server</b>		
Eq.Baseline_Efficiency	89.10%	Power supply efficiency of a 80 PLUS Platinum rated server
Eq.Proposed_Efficiency	92.82%	Power supply efficiency of a 80 PLUS Titanium rated server
Eq.Quantity	2	Each power supply contains two power supplies for 100% redundancy
Eq.Load_Factor	11.58%	Power supply load factor
P_Agg_kWton_Avg	1.025	Aggergate kW/ton of the cooling system types that have to remove the heat gain caused by a server
P_Agg_kWhTon_Avg	6,611.78	Aggergate kWh/ton of the cooling system types that have to remove the heat gain caused by a server
I_Input_Wattage_per_Power_Supply	Customer Input	Rated wattage of the power supply
I_Qty_Prop_Equip	Customer Input	Number of servers with a high efficiency power supply
Eq.Coincidence_Factor	100%	Probability that the calculated Customer kW will coincide with the period of peak generator operation
Net-to-Gross	80%	Reference 30
Measure Life	5	Lifetime of a server in years (Reference 18)

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Eq.Cost	Table 5	Additional cost required to purchase a server with a high efficiency power supply over the baseline server
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### Inputs

Verified during M&V:

<b>EC Plug Fans</b>	
Distribution Type	Yes
HVAC System Type	Yes
I_Quantity_Prop_Fans	Yes
<b>Plate &amp; Frame Heat Exchangers</b>	
county	Yes
i_mark_seg	Yes
i_qty_prop_equip	Yes
i_Tons_Capacity_HX	Yes
i_Chiller_Plant_Peak_Tons	Yes
i_db_temp	No
i_wb_temp	No
i_chiller_iplv	Yes
<b>Desktop PC Virtualization (VDI)</b>	
I_Qty_Prop_Equip	Yes
i_watts_c	Yes
<b>High Efficiency Power Supply Server</b>	
I_Qty_Prop_Equip	Yes
I_Input_Wattage_per_Power_Supply	Yes

### Assumptions:

<b>EC Plug Fans</b>
Limited the number of fans per CRAC/CRAH unit to 3.
<b>Plate &amp; Frame Heat Exchangers</b>
Existing HX Redundancy - No other airside or waterside economizers are in operation Reasons for HX Peak Coincident Operation - Projects will not have peak kW savings as wet bulb temp will be too high to provide a reasonable chill water supply temperature during peak summer periods. HX Installation Location - Heat exchanger is installed in parallel with the chiller and will use existing cooling towers when in operation.

### Tables:

**Table 1: Aggregate Cooling Efficiencies (kW/ton, kWh/ton)**

HVAC System Type	Chilled Water	DX	Glycol-Cooled DX	Glycol-Cooled DX with WSE	Chilled Water with WSE
Agg_kW/ton	0.717	1.263	1.214	1.214	0.717
Agg_kWh/ton	5252.784	8830.794	8487.100	6876.582	3611.645

**Table 2: Climate Zone Dependent Variables**

Building Type / Market Segment	CO1	CO2	CO3
P_T_DB_Design	93.50	96.60	84.20

CO1 = Zone 1 (Front Range/Denver); CO2 = Zone 2 (Western State as represented by Grand Junction) and CO3 = Zone 3 (Mountain Areas as represented by Alamosa)

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 3: Plate and Frame Savings Formula Coefficients**

	P_Cool_Coeff_A	P_Cool_Coeff_B	P_Cool_Coeff_C	P_Cool_Coeff_D	P_Cool_Coeff_E	P_Cool_Coeff_F	P_Cool_Coeff_G EFLH
Data Center	(19.607)	-	-	10,079.261	-	(173,921.791)	8,760.000

**Table 4: Wet Bulb to Mean Coincident Dry Bulb Conversion (P\_T\_WB\_TO\_MCDB)**

T_Wet_Bulb	CO1	CO2	CO3
15	17.81	31.77	17.38
16	19.19	35.03	18.53
17	20.12	32.59	19.20
18	21.64	32.42	20.48
19	22.04	35.73	21.82
20	22.94	34.47	23.09
21	23.82	34.69	24.62
22	25.32	37.47	25.71
23	27.19	38.58	27.62
24	28.59	35.20	29.32
25	30.50	39.41	30.60
26	31.61	38.74	31.67
27	33.75	37.68	33.47
28	34.99	36.67	34.70
29	36.30	37.80	35.86
30	38.29	40.45	37.31
31	37.90	42.13	38.67
32	38.95	42.32	38.98
33	41.22	43.16	41.38
34	42.40	44.96	43.06
35	44.52	46.98	42.81
36	46.06	48.31	45.80
37	47.67	47.67	46.88
38	49.03	49.38	47.46
39	49.71	49.75	49.32
40	50.44	50.87	49.98
41	53.41	51.59	51.67
42	52.72	51.51	54.46
43	54.87	53.58	55.16
44	56.64	52.93	55.51
45	55.22	56.77	57.25
46	56.64	58.52	57.95
47	58.07	60.31	58.96
48	61.66	60.00	61.66
49	63.14	61.52	63.62
50	64.55	61.16	64.73
51	65.25	60.83	64.22

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

52	66.32	65.72	66.81
53	67.24	69.09	67.39
54	68.70	68.18	67.38
55	70.52	70.43	67.49
56	71.49	68.68	69.74
57	74.93	70.78	73.46
58	74.44	72.00	74.31
59	76.93	72.56	75.31
60	75.61	73.34	74.14
61	77.71	74.06	68.54
62	78.64	75.43	70.79
63	79.70	72.63	73.04
64	82.56	75.76	73.94
65	80.05	73.28	73.94
66	81.90	75.38	73.94

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 4: Wet Bulb to Mean Coincident Dry Bulb Conversion (P\_T\_WB\_TO\_MCDB) (Continued)**

T_Wet_Bulb	CO1	CO2	CO3
67	82.76	75.88	
68	83.48	75.65	
69	87.53	78.07	
70		78.67	
71		78.81	
72		79.95	
73		78.11	
74		77.32	
75		81.35	
76		77.77	
77		84.48	
78		88.00	
79		92.04	
80		89.60	

CO1 = Zone 1 (Front Range/Denver); CO2 = Zone 2 (Western State as represented by Grand Junction) and CO3 = Zone 3 (Mountain Areas as represented by Alamosa)

**Table 5: Incremental Cost (Eq.Cost) for High Efficiency Server Incentives**

	401 - 600 Watt Servers	601 - 1000 Watt Servers	>1000 Watt Servers
80 PLUS Titanium rated	\$ 32.38	\$ 37.63	\$ 42.88

**Table 6: NTG for Data Center Measures by Identification Path**

	Study Identified	Site Visit Identified	Customer Identified
NTG	100%	80%	45%

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Data Center References:

1. Lawrence Berkeley Laboratory Study: Demonstration of Intelligent Control and Fan Improvements in Computer Room Air Handlers
2. Technical Note: Using EC Plug Fans to Improve Energy Efficiency of Chilled Water Cooling Systems in Large Data Centers, by Emerson Power Network ([http://shared.liebert.com/SharedDocuments/White%20Papers/PlugFan\\_Low060608.pdf](http://shared.liebert.com/SharedDocuments/White%20Papers/PlugFan_Low060608.pdf))
3. Bick Group Website FAQ (<http://www.bickgroup.com/data-center-ec-fans-for-data-centers.asp?w=1>)
4. "Energy Conservation and the Electronically Communicated Fan" from Rocky Mountain Utility Efficiency Exchange
5. EBM-Papst ASHRAE Presentation for Connecticut Chapter on 12/9/2010 ([http://ctashrae.org/downloads/ashrae\\_2010\\_12\\_09\\_1.pdf](http://ctashrae.org/downloads/ashrae_2010_12_09_1.pdf))
6. Energy Tips: Replace V-Belts with Cogged or Synchronous Belt Drives (<http://www.nrel.gov/docs/fy00osti/27833.pdf>)
7. Energy Efficiency Baselines for Data Centers, Pacific Gas & Electric, March 1, 2013
8. Measure Information Template Data Centers 2013 California Building Energy Efficiency Standards, by Taylor Engineering ([http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/2011-04-11\\_workshop/presentations/4\\_Data\\_Centers.pdf](http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/2011-04-11_workshop/presentations/4_Data_Centers.pdf), [http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Nonresidential/HVAC/Data\\_Center\\_Final\\_Report.pdf](http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Nonresidential/HVAC/Data_Center_Final_Report.pdf))
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11. Ziehl Abegg Fan Selection Tool ([fanselect.net](http://fanselect.net))
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13. Cig Plant Optimization (<http://academic.udayton.edu/kissock/http/EEB/LecturesAndHomework/23-CoolingPlantOptimization/CoolingPlantOptimization.docx>)
14. AHRI Standard Rating Conditions
15. Data from historic Xcel Energy Custom Efficiency cooling tower projects
16. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Computer Efficiency References:

1. Koomey, J., M. Cramer, M.A. Piette and J. Eto. 1995. "Efficiency Improvements in U.S. Office Equipment: Expected Policy Impacts and Uncertainties." Lawrence
2. Energy Star Calculator Tool; LBNL 2007 or Energy Star Specification
3. Hours of operation for desktop computers from office desktops/laptops and office monitors from Piette, M. A., M. Cramer, J. Eto and J. Koomey. 1995. "Office
4. LBNL Estimate based on Reference 3
5. Ecova Consulting information from manufacturers
6. Vendor data
7. Baseline desktop PC cost assumed at \$600; info from the internet indicates a PC with keyboard averages between \$300-\$1,000 or \$650; assumed the keyboard is \$50
8. Server Wattages from Custom Efficiency program participant; average wattage of 42 models (273W per Server / 68 Virtual Machines per Server). Wattages last
9. 10-year life for thin-client and zero-client based on conversation with MN vendor Nowmicro
10. Not used
11. Ecos Consulting (now Ecova), 2009
12. Various Equipment Vendors
13. Measured Energy Savings and Performance of Power-Managed Personal Computers and Monitors, 1996, Lawrence Berkeley National Laboratory
14. PC and Monitor Night Status: Power Management Enabling and Manual Turn-off, 1998, Lawrence Berkeley National Laboratory
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28. ECOVA - Sales market share analysis, Feb. 2016.
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30. 2016 Computer Efficiency Program Evaluation

### Changes from 2017 / 2018 Plan

Removed retrofit EC Plug Fan measure.  
Added prescriptive measure for VDI and high efficiency servers.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 4: Wet Bulb to Mean Coincident Dry Bulb Conversion (P\_T\_WB\_TO\_MCDB)**

T_Wet_Bulb	CO1	CO2	CO3
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16	19.19	35.03	18.53
17	20.12	32.59	19.20
18	21.64	32.42	20.48
19	22.04	35.73	21.82
20	22.94	34.47	23.09
21	23.82	34.69	24.62
22	25.32	37.47	25.71
23	27.19	38.58	27.62
24	28.59	35.20	29.32
25	30.50	39.41	30.60
26	31.61	38.74	31.67
27	33.75	37.68	33.47
28	34.99	36.67	34.70
29	36.30	37.80	35.86
30	38.29	40.45	37.31
31	37.90	42.13	38.67
32	38.95	42.32	38.98
33	41.22	43.16	41.38
34	42.40	44.96	43.06
35	44.52	46.98	42.81
36	46.06	48.31	45.80
37	47.67	47.67	46.88
38	49.03	49.38	47.46
39	49.71	49.75	49.32
40	50.44	50.87	49.98
41	53.41	51.59	51.67
42	52.72	51.51	54.46

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

43	54.87	53.58	55.16
44	56.64	52.93	55.51
45	55.22	56.77	57.25
46	56.64	58.52	57.95
47	58.07	60.31	58.96
48	61.66	60.00	61.66
49	63.14	61.52	63.62
50	64.55	61.16	64.73
51	65.25	60.83	64.22
52	66.32	65.72	66.81
53	67.24	69.09	67.39
54	68.70	68.18	67.38
55	70.52	70.43	67.49
56	71.49	68.68	69.74
57	74.93	70.78	73.46
58	74.44	72.00	74.31
59	76.93	72.56	75.31
60	75.61	73.34	74.14
61	77.71	74.06	68.54
62	78.64	75.43	70.79
63	79.70	72.63	73.04
64	82.56	75.76	73.94
65	80.05	73.28	73.94
66	81.90	75.38	73.94
67	82.76	75.88	
68	83.48	75.65	
69	87.53	78.07	
70		78.67	
71		78.81	
72		79.95	
73		78.11	

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

74		77.32	
75		81.35	
76		77.77	
77		84.48	
78		88.00	
79		92.04	
80		89.60	

CO1 = Zone 1 (Front Range/Denver); CO2 = Zone 2 (Western State as represented by Grand Junction) and CO3 = Zone 3 (Mountain Areas as represented by Alamosa)

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Business New Construction Energy Design Assist (EDA) and Energy Efficient Buildings (EEB)

#### Description:

**EDA** is a custom product including electric and gas measures. This product relies heavily on expert consultants in the design process; however, we will perform independent project review in accordance with standard engineering methods. Customer may apply for rebate under the New Construction product.  
**EEB** is a holistic program primarily comprised on prescriptive measures for lighting, heating and HVAC programs, custom items are evaluated using the custom model process.

#### Algorithms:

Electrical and gas energy savings and electrical demand savings will be calculated based on the project-specific details. Each project will undergo an engineering review in accordance with standard engineering practices. Prescriptive items within the project will be handled through their respective deemed products.

#### Variables:

Net To Gross	Per filings and settlement with State of Colorado the Gas EDA Net To Gross is 99% and Gas Energy Efficient Building track is 97%. The Electric Net To Gross for EDA and EEB are both 95%. Product requirements are well above code, so we feel free-ridership will be negligible as incremental cost generally increases with performance above minimum code
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#### Assumptions:

Operation and Maintenance Savings will be calculated for each specific project based on project details.  
Per previous filings and settlement with State of Colorado the lifetime of these products are 20 years for gas and electric measures.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Energy Management Systems - CO

#### Description:

This is a custom product including both gas and electric measures. Customer may apply for rebate under the EMS product. Each EMS project will be analyzed individually by Xcel Energy. Technical variables required for the analysis will be obtained from the customer or vendor. Analysis will be based on good engineering practices and standards. M&V shall be utilized to verify individual savings measure greater than 1 GWh or 20,000 Dth.

#### Calculations:

Electrical and gas energy savings and electrical demand savings will be calculated based on the project-specific details provided by customer. Data is provided by the customer, no on site surveys required for this product. Each project will undergo an engineering review in accordance with standard engineering practices.

#### Assumptions:

A net-to-gross factor of 87% will be used for electric measures and a net-to-gross factor of 90% will be used for gas EMS projects per filings and settlement with State of Colorado.

A net-to-gross factor of 100% will be used for EIS measures, as they are new to the product per initial filing and settlement with State of Colorado.

Operation and Maintenance Savings will be calculated for each specific project based on project details. This model assumes 2.5% annual O&M cost to maintain EMS system to 100% Operational levels

Product life for automatically controlled measures is 15 years per program filing. EMS systems are considered non functioning after 15 years due to lack of available controller parts and software.

Lifetime for recommissioning measures is 7 years per Recommissioning program filing.

Lifetime for manual adjustments will be verified through on-site metering and will not exceed the term of the customer's enrollment in the program.

#### Forecast for this Bienneial derived from this historical data:

2017 closed won data as shown on '2017 EMS Results'

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Heating Efficiency - CO

#### Description:

Prescriptive Gas rebates will be offered for Hot Water Boilers (Condensing and non-condensing), Commercial Water Heaters and various heating system improvements, high efficiency furnaces, high efficiency unit heaters that are either: power vented (83% efficiency), condensing ( $\geq 90\%$  efficiency), or low-intensity tube radiant heaters. Electric rebates will be offered for furnaces with ECM fans, both for new furnaces and for retrofitting existing furnaces.

#### Program References:

Measures for all Direct Install - Pre Rinse Sprayer	Refer to the "Commercial Refrigeration Efficiency-CO" program for assumptions and formulas for savings .
Measures for all Direct Install - Direct Install - Faucet Aerator	Refer to the "Commercial Refrigeration Efficiency-CO" program for assumptions and formulas for savings .

#### Gas Savings Algorithms:

<b>Boiler</b>	
New High Efficiency Boiler Savings (Gross Dth)	$= \text{Input Capacity} \times \text{Alt} \times ( (\text{EFFh} - \text{Adj}) / \text{EFFb} ) - 1 ) \times \text{EFLH}$
Boiler Tune Up savings (Gross Dth)	$= \text{Input Capacity} \times \text{Alt} \times ( (\text{EFFh} / \text{EFFb} ) - 1 ) \times \text{EFLH}$
Outdoor Air Reset savings (Gross Dth)	$= \text{Input Capacity} \times \text{Alt} \times ( 1 - ( \text{EFFb} / \text{EFFh} ) ) \times \text{EFLH}$
Stack Dampers savings (Gross Dth)	$= \text{Input Capacity} \times \text{Alt} \times ( 1 - ( \text{EFFb} / \text{EFFh} ) ) \times \text{EFLH}$
Modulating Burner Controls savings (Gross Dth)	$= \text{Input Capacity} \times \text{Alt} \times ( 1 - ( \text{EFFb} / \text{EFFh} ) ) \times \text{EFLH}$
O2 Trim Control savings (Gross Dth)	$= \text{Input Capacity} \times \text{Alt} \times ( 1 - ( \text{EFFb} / \text{EFFh} ) ) \times \text{EFLH}$
<b>New Commercial Furnace</b>	
New High Efficiency Furnace Savings (Gross Dth)	$= \text{Input Capacity} \times \text{Alt} \times ( (\text{EFFh} / \text{EFFb} ) - 1 ) \times \text{Heat\_EFLH} / 1,000,000$
<b>Steam Traps</b>	
Steam Traps savings (Gross Dth)	$= \text{Leak\_Rate} \times \text{Leak\_Hours} \times \text{BTU\_per\_Pound} / \text{EFFb} / 1,000,000$
<b>New Water Heater</b>	
New Water Heater Savings (Dth)	$= (\text{Input Capacity} \times \text{Alt} \times ( (\text{EFFh} / \text{EFFb} ) - 1 ) \times \text{EFLH} + ( (\text{SLb} / \text{EFFb} ) - (\text{SLe} / \text{EFFh} ) ) \times \text{SLHrs} ) / 1,000,000$
<b>Pipe Insulation</b>	
Pipe Insulation Savings (Dth)	$= \text{LF} \times \text{Hrs} \times ( \text{BTU\_per\_foot\_U} - \text{BTU\_per\_foot\_I} ) \times \text{Existing} / \text{EFFb}$
BTU_per_Foot_U	$= \text{Heat loss per foot of uninsulated pipe}$ $' = [\text{Coef0} + (\text{Coef1} \times \text{DeltaT}) + (\text{Coef2} \times \text{DeltaT}^2) + (\text{Coef3} \times \text{DeltaT}^3)]$ 'where the coefficients are selected based on the pipe size and an insulation thickness (both provided by customer). 'Coefficient values are listed in Table 7.
BTU_per_Foot_I	$= \text{Heat loss per foot of insulated pipe}$ $' = [\text{Coef0} + (\text{Coef1} \times \text{DeltaT}) + (\text{Coef2} \times \text{DeltaT}^2) + (\text{Coef3} \times \text{DeltaT}^3)]$ 'where the coefficients are selected based on the pipe size (provided by customer) and an insulation thickness of zero. 'Coefficient values are listed in Table 7.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

DeltaT	= (Tfluid - Tambient)
<b>Unit Heaters</b>	
Unit Heater Savings (Dth)	= Input Capacity x Alt x ( ( EFFh / EFFb ) - 1 ) x EFLH-UH x (Oversize Factor_heat ) / 1,000,000
Infrared Heater Savings (Dth)	= Dth_Base_Infrared - Dth_Eff_Radiant
Dth_Base_Infrared	= ( ( Infrared Input Capacity x Alt ) / Radiation Size Factor ) x ( Oversize Factor_heat ) x EFLH-UH x ( 1 Dth / 1000000 BTU ) - Dth_fan
Dth_Eff_Radiant	= Infrared Input Capacity x Alt x Oversize Factor_heat x EFLH-UH
EFLH-UH	= ( HDD_a x T_indoor ^2 - HDD_b x T_indoor + HDD_c ) / ( T_indoor - T_design ) x 24 x %conditioned
FLH	= ( HDD_a x T_indoor ^2 - HDD_b x T_indoor + HDD_c ) / ( T_indoor + T-Offset ) x 24 x %conditioned.
Dth_fan	= Fan_kW x 3412 x FLH / 1,000,000 ( For Infrared Unit Heater Measure only)
<b>Ozone Laundry</b>	
Ozone Laundry Natural Gas Savings (Gross Therms)	= (HW <sub>e</sub> ÷ WH <sub>Eff</sub> ) X W <sub>utiliz</sub> X Wusage_hot X % Hot_Water_Savings
Ozone Laundry Water Savings (Gross Gallons)	= W <sub>usage</sub> x W <sub>utiliz</sub> x % Water_Savings
Ozone Laundry O&M Savings	(Ozone Laundry Water Savings X (Water Rate + Sewer Rate) ÷ 1000 ) - (O&M Cost X Lb capacity of washing machine)

**Electric Savings Algorithms:**

<b>EC Fan Motor on Commercial Furnace</b>	
EC Fan Savings Customer kWh	=(Heating_kW_PSC - Heating_kW) x Heat_EFLH + (Cooling_KW_PSC -Cooling_kW) x Cool_EFLH + (Ventilation_kW_PSC - Ventilation_kW) x Ventilation_Only_Hours + Cooling_kWh_Savings
EC Fan Savings Customer kW	= Customer kWh / Op_Hrs
Cooling_kW_Savings	= (New_Furnace-Fan_Motor_HP) x (kW/ton x (Cooling_kW_PSC - Cooling_kW) x 3.413 / 12)
Cooling_kWh_Savings	= Cooling_kW_Savings x Cool_EFLH
Peak Coincident KW	= Customer kW X ECM Coincidence Factor
Heating Penalty	= New_Furnace-Fan_Motor_HP x Heating Penalty_per_New_Furnace_Fan_HP

**Unit Heaters**

Fan_kWh ( Customer Gross kWh )	= Fan_kW x FLH (For Radiant Unit Heater Measure Only)
Fan_kW ( Customer gross kW )	= Infrared Input Capacity x Heat_eff_infrared x Alt / Radiation Size Factor x Oversize Factor_heat x HP/BTUh x 0.746 x LF / Mtr_eff (For Infrared Unit Heater Measure Only)

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

Variable ID	Value	Description
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**Boiler Variables**

Alt	Table 1	Altitude Adjustment factor to adjust the sea level manufacturer's rated input for altitude effects
Input Capacity	Customer Input	Rated million BTUH input capacity of the boiler.
Adj		Adjustment for operation at less than nominal efficiency
	5%	Efficiency adjustment for condensing boilers. (Reference 29)
	0%	Efficiency adjustment for non-condensing boilers.
EFFb	Table 2	Efficiency of Baseline equipment.
EFFh	Table 2	Minimum Qualifying Efficiency for high efficiency equipment. Actual efficiency provided by the customer.
EFLH	Table 3	The equivalent full load heating hours for the boilers.
Conversion Factor	1,000,000	Conversion from Dth to BTU
Measure Life	Table 14	Refer to Table 14 in "Deemed Measure Life" tab.
Incremental Cost	Tables 7 to 12	Refer to Tables 7 to 12 in the "Deemed Incremental Cost" tab
NTG	86%	Net-to-gross = 86% Per 2011 Cadmus Program Evaluation and Michaels Energy Review.

**Steam Trap Variables**

Leak_Rate	5	Leakage rate for low pressure steam traps in pounds of steam per hour. (Reference 24)
	11	Leakage rate for high pressure steam traps in pounds of steam per hour. (Reference 24)
Leak_Hours	6,000	Annual hours steam lines are pressurized; Based on estimated of 30% steam systems operate year round, and 70% heating only systems.
EFF <sub>b</sub>	80%	Efficiency of Steam boiler.
BTU_Per_Pound	1,064	Loss in btu/lb for Steam Traps in Low Pressure Applications; 1164 BTU per pound lost to atmosphere, 964 BTU per pound lost to condensate; Assume 50/50 mix = 1064 BTU per pound. (Reference 24)
	1,081	Loss in btu/lb for Steam Traps in High Pressure Applications; = 1181 BTU per pound for lost to atmosphere, 981 BTU per pound lost to condensate. Assume 50/50 mix = 1081 BTU per pound. (Reference 24)
Measure Life	Table 14	Refer to Table 14 in "Deemed Measure Life" tab.
Incremental Cost	Tables 7 to 12	Refer to Tables 7 to 12 in the "Deemed Incremental Cost" tab
NTG	86%	Net-to-gross = 86% Per 2011 Cadmus Program Evaluation and Michaels Energy Review.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Water Heater Variables

Alt	Table 1	Altitude Adjustment factor to adjust the sea level manufacturer's rated input for altitude effects
Input Capacity	Customer Input	Rated BTUH input capacity of the hot water heater.
EFFh	Customer Input	The rated efficiency of the new water heater.
EFFb	80%	The minimum water heater thermal efficiency allowed by the federal standard
SLb	13.21	Standby Losses for baseline storage water heater in BTUH per gallon of storage. (Reference 23)
Sle	8.90	Standby Losses for efficient storage water heater in BTUH per gallon of storage. (Reference 23)
SLHrs	8,760	Standby loss annual hours for commercial water heaters.
EFLH	Table 3	Reference: MN historical custom rebate projects
Measure Life	Table 14	Refer to Table 14 in "Deemed Measure Life" tab.
Incremental Cost	Tables 7 to 12	Refer to Tables 7 to 12 in the "Deemed Incremental Cost" tab
NTG	86%	Net-to-gross = 86% Per 2011 Cadmus Program Evaluation and Michaels Energy Review.

### Pipe Insulation Variables

LF	Customer Input	Linear feet of insulation installed, provided by the customer.
Hrs	Table 4	Annual pipe heat loss hours
T <sub>fluid</sub>	Customer Input	Average temperature of the fluid in the pipe receiving insulation in degrees F.
Pipe location	Customer Input	Ask the customer if the pipe is in a conditioned space or outside.
Pipe use	Customer Input	Ask customer if the steam/hotwater is used for Space heating + Domestic Water Heating, Space Heating Only, Domestic Water Heating Only.
T <sub>ambient</sub>	70	Pipe located inside conditioned space and used for space heating and/or domestic hotwater
	51	Pipe located outside and used for spaceheating and/or domestic hot water. Based on full year average TMY3 temperatures for Colorado. Reference 10
	44	Pipe located outside and used for space heating only, average temperature excluding June-September based on TMY3 temperatures for Colorado. Reference 10
Was existing insulation replaced	Customer Input	Yes/No - Replacing existing deteriorated pipe insulation or Adding new insulation to existing bare pipe
Existing	1	Pipe insulation savings multiplier if no existing insulation is present.
	0.25	Pipe insulation savings multiplier if existing deteriorated insulation is being replaced.
Measure Life	Table 14	Refer to Table 14 in "Deemed Measure Life" tab.
Incremental Cost	Tables 7 to 12	Refer to Tables 7 to 12 in the "Deemed Incremental Cost" tab
NTG	86%	Net-to-gross = 86% Per 2011 Cadmus Program Evaluation and Michaels Energy Review.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Unit Heater Variables**

Input capacity	Customer Input	Rated Input Capacity of the new non-infrared heater in BTU/h
Infrared Input Capacity	Customer Input	Rated Input Capacity of the new infrared heater in BTU/h
Alt	Table 1	Altitude Adjustment factor to adjust the sea level manufacturer's rated input for altitude effects
%conditioned	Customer Input	Percentage of the time during heating season the space is heated
T_indoor	Customer Input	Space temperature set point of space being heated
HP/BTUh	2.9683E-06	Average axial/propeller/centrifugal fan power (rated) per BTU/h of heating output. Taken from manufacturer data for 38 unit heaters from Trane and Sterling; Applies to Infrared Heaters only
Oversize Factor_heat	0.90	Factor to account for design oversize commonly found on unit heater installations. Reference 1
T_design	Table 5	Winter Design temperature for the given location. Reference 2.
LF	0.80	Design load factor of fan motor, deemed based on typical engineering assumption
EFFb	80%	Thermal efficiency of the baseline, non-power-vented, code-compliant unit heater. Reference 3.
EFFh	Table 2	Thermal efficiency of the new, efficient unit heater
EFLH	Table 3	The equivalent full load heating hours for unit heaters.
Heat_eff_infrared	80%	Thermal efficiency of the new, radiant heater. = 0.80, same as baseline because the radiant heaters do not have specific combustion efficiency improvements over the baseline unit heater, their savings are all from radiation heat transfer versus convection. Also, Ref 5 uses this value.
Radiation Size Factor	0.85	= Factor to account for the fact that radiant heaters should be designed smaller than an equivalent standard unit heater due to radiation heat transfer being more effective at producing thermal comfort. This also accounts for the lower room temperature afforded by radiant heaters. = 0.85 (Ref 4)
HDD_a	Table 5	Polynomial Constants used in calculating HDD based on TMY3 weather data and design indoor temperature. HDD is proportional to the indoor temperature based on the formula $HDD = a * Tin^2 + b * Tin + c$
HDD_b	Table 5	Polynomial Constants used in calculating HDD based on TMY3 weather data and design indoor temperature. HDD is proportional to the indoor temperature based on the formula $HDD = a * Tin^2 + b * Tin + c$
HDD_c	Table 5	Polynomial Constants used in calculating HDD based on TMY3 weather data and design indoor temperature. HDD is proportional to the indoor temperature based on the formula $HDD = a * Tin^2 + b * Tin + c$
T-Offset	Table 5	Difference between the maximum heating degree day and the indoor design temperature. See Table 5 for values in each climate zone.
Mtr_eff	29.58%	Average efficiency of 6 unit heater fans, calculated by taking the manufacturer-provided (Reznor, Sterling, and Trane) current draw to calculate power consumption and working backwards with the rated motor power and an assumed load factor of 0.8 to compute the efficiency for each fan and then taking the average of all of the fans. = 0.296 and includes both axial and centrifugal fans.
Conversion Factor	0.746	Conversion factor from HP to kW
Conversion Factor	1,000	Conversion factor from kBTU/h to BTU/h
Conversion Factor	3,412	Conversion factor from kW to BTU/h
Measure Life	Table 14	Refer to Table 14 in "Deemed Measure Life" tab.
Incremental Cost	Tables 7 to 12	Refer to Tables 7 to 12 in the "Deemed Incremental Cost" tab
NTG	86%	Net-to-gross = 86% Per 2011 Cadmus Program Evaluation and Michaels Energy Review.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Commercial Furnace Variables**

Input capacity	Customer Input	Rated Input Capacity of the new furnace in BTU/h
New_Furnace-Fan_Motor_HP	Customer Input	HP of new Furnace Fan ECM
Heat_EFLH	Table 6	Annual Equivalent Full Load Hours (EFLH).
Occ Hours	4,439	Annual operating hours of the space served by the furnace, assumed to be equal to the operating hours of a typical office, as used in the Small Business Lighting Efficiency program
Op_Hrs	Table 6	Combined heating and cooling full load hours occurring during unoccupied hours plus Occ Hours. Calculated using bin hours and the assumed balance point of 57F. This value is location specific. For projects without cooling, this value does not include any cooling full load hours.
Heating_kW_PSC	0.707	Reference 20
Cooling_kW_PSC	0.880	Reference 20
Ventilation_kW_PSC	0.747	Reference 20
Cool_EFLH	Table 6	Annual Equivalent Full Load Hours of the furnace in cooling mode, calculated by estimating building loads based on outdoor conditions and building balance point (balance point set by heating EFLH analysis at 57F)
Ventilation Only Hours	Table 6	Annual Hours of the furnace in ventilation mode, calculated by subtracting the cooling and heating EFLH occurring during occupied hours from Op Hrs.
kW/ton	1.105	Efficiency of air conditioning system, calculated by taking new baseline SEER of 13, dividing by 1.1 to get EER and then taking 12/EER to get kW/ton (1.015)
Cooling_kW	0.709	Reference 20
Heating_kW	0.271	Reference 20
Ventilation_kW	0.285	Reference 20
Conversion Factor	3.413	Conversion from Watts of power to BTU/h of heat
Conversion Factor	12,000	Conversion from BTU/h to tons of cooling
ECM Coincidence Factor	Table 6	
Heating Penalty_per_New_ECM-HP	Table 6	
Measure Life	Table 14	Refer to Table 14 in "Deemed Measure Life" tab.
Incremental Cost	Tables 7 to 12	Refer to Tables 7 to 12 in the "Deemed Incremental Cost" tab
NTG	86%	Net-to-gross = 86% Per 2011 Cadmus Program Evaluation and Michaels Energy Review.

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Ozone Laundry Variables		
$W_{utiliz}$ (lbs laundry/yr)	Customer Input	Annual pounds of clothes washed per year
Water Heater Type	Customer Input	Standard Gas Storage WH, Condensing Gas WH, Tankless Gas WH or Plant Gas Boiler with Storage
Lb capacity of washing machine	Customer Input	Lb capacity of washing machine served by ozone generator
% Hot_Water_Savings	81%	How much more efficient is an ozone injection machine as a rate of hot water reduction (Reference 1)
$W_{usage}$ (gal/lb of laundry)	2.03	How efficiently a typical conventional washing machine utilized hot and cold water per unit of clothes washed (Reference 1)
% Water_Savings	25%	How much more efficient an ozone injection washing machine is compared to a typical conventional washing machine as a rate of hot and cold water reduction (Reference 1)
$W_{usage-hot}$ (gallons/lbs laundry)	1.19	Hot water used by a typical conventional washing machine (Reference 1)
$HW_e$ (Therms/gal)	0.007235	Energy required to make 140F hot water from 51.4 F ground water
Water Rate (\$/1000 gal)	\$2.60	Reference 32
Sewer Rate (\$/1000 gal)	\$3.78	Reference 33
Water Heater Thermal Efficiency ( $WH_{Eff}$ )	Table 7	
O&M Cost (\$ per lb capacity of washing machine)	\$0.79	Reference 31
$Therm_{baseline}$ / Lb capacity of washing machine	37.90	Reference 31
Measure Life	Table 14	Refer to Table 14 in "Deemed Measure Life" tab.
Incremental Cost	Tables 7 to 12	Refer to Tables 7 to 12 in the "Deemed Incremental Cost" tab
NTG	86%	Net-to-gross = 86% Per 2011 Cadmus Program Evaluation and Michaels Energy Review.

**Table 1: Altitude Adjustment factor to adjust the sea level**

Climate Zone	Alt
CO1: Denver / Front Range	0.823
CO2: Alamosa / Mountain is climate zone	0.756
CO3 Grand Junction / Western Slope	0.837

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 2: Heating Equipment Efficiencies**

	Baseline Efficiency (EFFb)	Efficient Efficiency (EFFh)	Unit	Reference
New Boilers (Non-Condensing) <300,000 BTU/h	80.0%	85.0%*	AFUE	Ref. 11
New Boilers (Non-Condensing) >= 300,000 BTU/h and <=2,500,000 BTU/h	80.0%	85.0%*	Et (Thermal Eff)	Ref. 11
New Boilers (Non-Condensing) >2,500,000 BTU/h	82.0%	85.0%*	Ec (Combustion Eff)	Ref. 11
New Boilers (Condensing) <300,000 BTU/h	80.0%	92.0%*	AFUE	Ref. 11
New Boilers (Condensing) >= 300,000 BTU/h and <=2,500,000 BTU/h	80.0%	92.0%*	Et (Thermal Eff)	Ref. 11
New Boilers (Condensing) >2,500,000 BTU/h	82.0%	92.0%*	Ec (Combustion Eff)	Ref. 11
Boiler Tune Up (Non-Condensing)	78.0%	80.0%		Ref. 12
Boiler Tune Up (Condensing)	87.2%	88.0%		Ref. 29
Outdoor Air Reset	80.0%	83.0%		Ref. 13
Stack Dampers	80.0%	81.0%		Ref. 14
Modulating Burner Controls	80.0%	83.0%		Ref. 15
O2 Trim Control	80.0%	82.0%		Ref. 16
Steam Traps	80.0%	N/A		Ref. 17
Commercial Furnaces < 225,000 BTUH input	78.0%	92.0%*	AFUE	Ref. 3
Commercial Furnaces >= 225,000 BTUH input	80.0%	92.0%*	Et (Thermal Eff)	Ref. 3
Water Heaters	80.0%	92.0%*		Ref. 18
Unit Heater (Non-condensing)	80.0%	83.0%*		Ref. 3
Unit Heater (Condensing)	80.0%	90.0%*		Ref. 3
Pipe Insulation	80.0%	N/A		Ref 17

\*High efficiency boiler and furnace efficiencies are per customer. Listed efficiencies are minimum qualifying efficiencies.

**Table 3: Effective Full Load Heating Hours**

Equipment	Use	Hours	Explanation
Boiler	Space Heating Only	769	Based on Bin Analysis assuming 30% oversizing for boiler plant. See "Forecast Boiler Op Hours " tab.
	Domestic Hot Water Only	674	
	Space Heating and Domestic Hot Water	1,443	Based on Bin Analysis assuming 30% oversizing for boiler plant. See "Forecast Boiler Op Hours " tab.
Furnace	All	950	
Commercial Water Heaters	All	1,092	Based on historical custom rebate projects from MN

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 4: Hours for Pipe Insulation**

Use of Pipe	Location	Pipe Insulation Hours	Explanation
Domestic Hot Water	Inside	5,558	Hours when outside temp is above building balance point. Heat loss from pipe is wasted.
Domestic Hot Water	Outside	8,760	Domestic hot water available year round, outside temp is always less than 120 F.
Space Heating	Inside	1,648	Hours when boiler is running but outdoor temp is above building balance point
Space Heating	Outside	4,791	Hours that boiler is running

**Table 5: HDD Estimation constants and Site Weather Data**

Climate Zone	HDD_a	HDD_b	HDD_c	altitude (ft ASL)	T_design
CO1: Denver / Front Range	2.87	-111.29	901.25	5,285	-4.00
CO2: Alamosa / Mountain is climate zone	2.65	-103.77	906.11	4,839	3.40
CO3 Grand Junction / Western Slope	3.33	-109.56	1,677.73	7,536	-16.80

Climate Zone	T-Offset
CO1: Denver / Front Range	-12.40
CO2: Alamosa / Mountain is climate zone	-14.62
CO3: Grand Junction / Western Slope	4.96

**Table 6: Annual Hours, CF and Heating Penalty - EC Fan Motors on Commercial Furnaces**

Climate Zone	New and Retrofit ECM			
	Annual Operating Hours for Furnace with Cooling (Op_Hrs)	Annual Operating Hours for Furnace without Cooling (Op_Hrs)	Annual Equivalent Cooling Full Load Hours (Cool_EFLH)	Annual Equivalent Heating Full Load Hours (Heat_EFLH)
CO1: Denver / Front Range	3,579	3,215	765	950
CO2: Alamosa / Mountain is climate zone	3,755	3,611	460	1,396
CO3: Grand Junction / Western Slope	3,717	3,139	1,083	856

Climate Zone	New and Retrofit ECM	
	Annual Ventilation Only Hours for Furnace with Cooling	Annual Ventilation Only Hours for Furnace without Cooling
CO1: Denver / Front Range	1,865	2,265
CO2: Alamosa / Mountain is climate zone	1,900	2,215
CO3: Grand Junction / Western Slope	1,779	2,567

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

Climate Zone	New ECM		Retrofit ECM	
	ECM Coincidence Factor for Furnace with Cooling	ECM Coincidence Factor for Furnace without Cooling	ECM Coincidence Factor for Furnace with Cooling	ECM Coincidence Factor for Furnace without Cooling
CO1: Denver / Front Range	53.76%	101.50%	54.83%	101.71%
CO2: Alamosa / Mountain is climate zone	51.47%	102.01%	52.34%	102.25%
CO3: Grand Junction / Western Slope	56.02%	88.29%	57.35%	88.44%

Climate Zone	New ECM		Retrofit ECM	
	Heating Penalty for Furnace with Cooling (Heating Penalty_per_New_ECM-HP)	Heating Penalty for Furnace without Cooling (Heating Penalty_per_New_ECM-HP)	Heating Penalty for Furnace with Cooling (Heating Penalty_per_New_ECM-HP)	Heating Penalty for Furnace without Cooling (Heating Penalty_per_New_ECM-HP)
CO1: Denver / Front Range	-\$6.64	-\$6.64	-\$8.23	-\$8.23
CO2: Alamosa / Mountain is climate zone	-\$9.75	-\$9.75	-\$12.09	-\$12.09
CO3: Grand Junction / Western Slope	-\$5.98	-\$5.98	-\$7.42	-\$7.42

**Table 7: Water Heater Efficiencies for Ozone Laundry**

Water Heater Type	Thermal Eff (%)
Gas Non-Condensing Storage	80%
Gas Condensing Storage	95%
Gas Tankless	96%
Gas Storage with Side-Arm Boiler	80%

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Inputs:

#### (Inputs as required by referenced programs)

##### For boilers:

New Boiler size rated at sea level (million BTUH)

New boiler type (Non-Condensing or Condensing)

Boiler Use (Space heating and/or water heating)

##### For steam traps:

High or low pressure

Incremental cost

##### For all but boilers, steam traps, and pipe insulation:

Boiler size (BTUH)

Implemented measure

Incremental cost

##### For Insulation:

Linear feet of insulation added

Nominal diameter of pipe

Thickness of insulation

Insulation R-Value or thermal conductivity (k)

Average fluid temperature

Pipe location (conditioned space or not)

Pipe use (Space heating and/or water heating)

Was existing insulation replaced

Incremental cost

% Process load

##### For Water Heaters:

Building type

Square footage served by water heater

Storage capacity (gallons); 0 if tankless

BTUH input

Other Water Heater BTUH Input

Thermal efficiency rating

##### For Furnaces:

New furnace size (BTUH)

New furnace efficiency

##### For Furnace fans:

New furnace fan size (hp)

##### For non-radiant unit heaters:

Space temperature set point

% of the time the space is heated

Input capacity of the heater in BTU/h

Fan type (blower/propeller)

Heating Efficiency

Colorado

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### For radiant heaters:

Space temperature set point  
% of the time the space is heated  
Input capacity of the heater in kBTU/h

### **Assumptions:**

- Each boiler or furnace is replaced with the same size on a 1 for 1 basis.
- Only boilers used for space and/or domestic water heating can receive prescriptive rebates; other boilers must go through Custom Efficiency.
- Assumed savings for boiler tune-up = 2% for non condensing boiler. This is an average value of the two years, 4% initial to no savings at the end of the two years. Life of product
- Assumed savings for outdoor air reset on non condensing boilers = 3%. Life of product is 20 years. The Natural Gas consortium states up to 5% savings
- Assumed savings for installing Stack dampers on non condensing boilers = 1%. Life of product is 20 years. Canada energy council, up to 4%
- Assumed savings for modulating burner controls on non condensing boilers = 3%. Life of product is 20 years. The Natural Gas consortium states up to 4% savings
- Assumed savings for O2 trim controls on non condensing boilers = 2%. Life of product is 20 years. The Natural Gas consortium states of 2 to 4% savings
- The baseline efficiency for the furnace is based on 2015 IECC, minimum of 80%.
- Thermal Efficiency as defined in ASHRAE 90.1-2007 indicates the total efficiency of the boiler equal to 100% fuel energy minus all losses.
- Prescriptive rebates are only given for furnaces put into service, rebates are not given for backup furnaces.
- Furnaces must have a minimum efficiency of 92% AFUE for a rebate, and 94% AFUE or higher efficiency will receive a larger rebate.
- Infrared heater is vented (has exhaust to exterior)
- "% Conditioned" is the percentage of the time that the space temperature set point is maintained
- The infrared heater has no fan energy consumption (it may have a very small (<100W) fan to distribute hot exhaust, but that is ignored)
- The fan full load hours equal the heating full load hours
- Fan power per BTU/h is constant, regardless of fan size for each fan type
- Heat produced by the fan is beneficial to heating the space
- Fan motor efficiency is constant
- Radiant heaters are low-intensity tube type
- Furnace fan will operate for ventilation during all business hours, assumed to be equal to the "office" lighting hours for the business lighting program technical assumptions
- For furnace fan measure, cooling is assumed to be 13 SEER and heating 90% efficient
- The baseline PSC furnace fan motor is 2/3 the size of the new motor, based on Ref 20 and 21
- Furnace fan measure: there is no ventilation during unoccupied hours
- Climate zone assumed to be Denver, unless otherwise specified

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11. International Energy Conservation Code (IECC) 2015 Table C403.2.3 (5)
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## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

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13. 3% efficiency improvement for boiler outdoor air reset based on Michaels Energy literature review. Sources included (but not limited to):
  - 13A. Arkansas Technical Reference Manual <<http://www.apscservices.info/EEInfo/TRM4.pdf>>
  - 13B. NEEP Mid-Atlantic TRM. V5. >[http://www.neep.org/sites/default/files/resources/Mid-Atlantic\\_TRM\\_V5\\_FINAL\\_5-26-2015.pdf](http://www.neep.org/sites/default/files/resources/Mid-Atlantic_TRM_V5_FINAL_5-26-2015.pdf)>
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  - 14A. Arkansas Technical Reference Manual <<http://www.apscservices.info/EEInfo/TRM4.pdf>>
  - 14B. Illinois Technical Reference Manual (2015-2016) <[http://ilsagfiles.org/SAG\\_files/Technical\\_Reference\\_Manual/Version\\_4/2-13-15\\_Final/Updated/Illinois\\_Statewide\\_TRM\\_Effective\\_060115\\_Final\\_02-24-15\\_Clean.pdf](http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_4/2-13-15_Final/Updated/Illinois_Statewide_TRM_Effective_060115_Final_02-24-15_Clean.pdf)>
  - 14C. Minnesota TRM. Version 1.3. <<http://mn.gov/commerce-stat/pdfs/trm-version-1.3.pdf>>
15. 3% efficiency improvement for modulating boiler controls based on Michaels Energy literature review. Sources included (but not limited to):
  - 15A. Illinois Technical Reference Manual (2015-2016)  
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33. City and County of Denver Sanitary Sewer Rate Schedule; <https://www.denvergov.org/content/denvergov/en/wastewater-management/billing-and-rates/wastewater-rates.html>

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Boiler Nameplate Capacity	Non-condensing		Condensing	Incremental	Incremental
	Baseline	High Efficient - Non Condensing	High Efficient - Condensing	Baseline to High Efficient - Non Condensing	Baseline to High Efficient - Condensing
175,000 Btuh	\$3,000	\$3,500	\$4,600	\$500	\$1,600
500,000 Btuh	\$5,000	\$9,000	\$11,200	\$4,000	\$6,200
1,000,000 Btuh	\$7,300	\$11,700	\$15,000	\$4,400	\$7,700
2,000,000 Btuh	\$12,000	\$17,000	\$26,500	\$5,000	\$14,500
4,000,000 Btuh	\$24,000	\$34,000	\$53,000	\$10,000	\$29,000
6,000,000 Btuh	\$36,000	\$51,000	\$79,500	\$15,000	\$43,500
8,000,000 Btuh	\$48,000	\$68,000	\$106,000	\$20,000	\$58,000

Boiler Tune Up	Actual costs will be provided by customer
Outdoor Air Reset	Actual costs will be provided by customer
Stack Dampers > 750 Mbtuh	Actual costs will be provided by customer
Stack Dampers > 750 Mbtuh	Actual costs will be provided by customer
Modulating Burner Controls < 750 Mbtuh	Actual costs will be provided by customer
Modulating Burner Controls > 750 Mbtuh	Actual costs will be provided by customer
O2 Trim Control	Actual costs will be provided by customer
Steam Traps	Actual costs will be provided by customer
Pipe Insulation	Actual costs will be provided by customer

Btu Input	Incremental Cost
60,000	\$804.95
70,000	\$782.26
80,000	\$775.83
90,000	\$785.68
100,000	\$811.80
115,000	\$893.02
120,000	\$912.86
125,000	\$948.29
140,000	\$1,079.00

Reference unknown

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 10: Commercial Furnaces (References 18 & 19)**

	Cost
Baseline Fan	\$236.00
EC Fan	\$448.00
Incremental	\$212.00

References from Deemed reference tab.

**Table 11: Unit Heater and Radiant Heater Costs (Ref 7)**

	\$/kBTU/h (output)	Incremental Cost (\$/kBTU/h)
Baseline Unit Heater	\$8.42	N/A
Power-vented Unit Heater (83%)	\$10.04	\$1.62
Condensing Unit Heater (90%)	\$18.47	\$10.05
Radiant Heater (uses input kBTU/h)	\$9.45	\$1.03

References from Deemed Savings tab

**Table 12: Ozone Laundry (Reference 30)**

	Incremental Cost
Ozone Washing Machine <=100lbs	\$8,750.00
Ozone Washing Machine >100lbs<500lbs	\$15,500.00
Ozone Washing Machine =>500lbs	\$27,500.00

References from Deemed Savings tab

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 13: Pipe Insulation polynomial equation coefficients and incremental cost

Pipe Nominal Diameter (inches)	Insulation Thickness (Inches)	Heat Loss (BTU/Hr) at Specified Temperature Difference				Polynomial Coefficients				Cost Per Foot	Cost Per 3' Materials
		5	70	135	200	Coef0	Coef1	Coef2	Coef3	Total	(Ref 28)
0.50	-	1.73000	35.90	81.40	136.0	-0.516993	0.43276708	0.001310573	-2.82203E-07	\$ -	\$ -
0.50	0.5	0.64500	10.10	21.20	34.4	-0.0205549	0.13279564	0.000150494	2.291E-07	\$ 6.18	\$ 6.18
0.50	1	0.46300	7.07	14.80	23.9	-0.0050679	0.09314387	0.000102935	1.44743E-07	\$ 7.47	\$ 7.47
0.50	1.5	0.37900	5.75	12.00	19.4	0.003985	0.07518613	8.91729E-05	9.74056E-08	\$ 14.18	\$ 14.18
0.50	2	0.33700	5.10	10.60	17.1	0.0006083	0.06740019	6.8221E-05	1.1015E-07	\$ 22.02	\$ 22.02
0.50	2.5	0.29500	4.45	9.28	14.9	-0.0074784	0.05974442	4.96359E-05	1.22895E-07	\$ 26.02	\$ 26.02
0.50	3	0.27800	4.18	8.72	14.0	-0.0063056	0.05611641	4.66467E-05	1.15916E-07	\$ 31.44	\$ 31.44
0.50	3.5	0.26400	3.97	8.28	13.3	-0.0018504	0.05272378	5.22687E-05	8.37506E-08	\$ 36.87	\$ 36.87
0.50	4	0.25300	3.80	7.92	12.7	-0.0060451	0.05110554	4.13115E-05	1.05295E-07	\$ 42.29	\$ 42.29
0.50	4.5	0.24200	3.64	7.59	12.2	-0.0005635	0.04820003	4.96014E-05	7.22197E-08	\$ 47.71	\$ 47.71
0.50	5	0.23500	3.53	7.34	11.8	-0.003366	0.04731939	3.88419E-05	9.86193E-08	\$ 53.14	\$ 53.14
0.50	5.5	0.23400	3.51	7.31	11.8	0.0052211	0.0459022	5.38618E-05	5.64406E-08	\$ 58.56	\$ 58.56
0.50	6	0.22700	3.41	7.10	11.4	-0.0035402	0.04566163	3.91228E-05	8.89091E-08	\$ 63.98	\$ 63.98
0.75	-	2.09000	43.40	98.50	165.0	-0.6410162	0.52569402	0.001536569	-8.79988E-08	\$ -	\$ -
0.75	0.5	0.75300	11.80	24.90	40.4	-0.0239628	0.15426539	0.000194013	2.26673E-07	\$ 7.00	\$ 7.00
0.75	1	0.55600	8.51	17.80	28.8	-0.007622	0.11236975	0.000117924	2.01487E-07	\$ 8.17	\$ 8.17
0.75	1.5	0.43900	6.66	13.90	22.4	-0.0084985	0.08880715	8.10579E-05	1.76301E-07	\$ 14.24	\$ 14.24
0.75	2	0.38300	5.80	12.10	19.5	-0.00261	0.07677564	7.83555E-05	1.26536E-07	\$ 22.77	\$ 22.77
0.75	2.5	0.32900	4.97	10.40	16.7	-0.0040483	0.0658327	6.97763E-05	9.43711E-08	\$ 26.39	\$ 26.39
0.75	3	0.30800	4.64	9.66	15.5	-0.0094616	0.06266411	4.6068E-05	1.43226E-07	\$ 31.73	\$ 31.73
0.75	3.5	0.29100	4.38	9.12	14.7	0.0026927	0.05765753	6.2664E-05	8.16265E-08	\$ 37.07	\$ 37.07
0.75	4	0.27700	4.17	8.69	14.0	0.0015434	0.05497413	5.90396E-05	7.98058E-08	\$ 42.40	\$ 42.40
0.75	4.5	0.26600	3.99	8.32	13.4	0.0036913	0.05237176	5.99558E-05	6.4937E-08	\$ 47.74	\$ 47.74
0.75	5	0.25600	3.85	8.02	12.9	0.0005858	0.05088343	5.32258E-05	7.40404E-08	\$ 53.08	\$ 53.08
0.75	5.5	0.25300	3.80	7.92	12.7	-0.0060451	0.05110554	4.13115E-05	1.05295E-07	\$ 58.42	\$ 58.42
0.75	6	0.24500	3.68	7.67	12.3	-0.0049141	0.04935649	4.19306E-05	9.55849E-08	\$ 63.76	\$ 63.76
1.00	-	2.52000	52.60	120.00	201.0	-0.7283662	0.62472376	0.002067703	-7.0399E-07	\$ -	\$ -
1.00	0.5	0.88700	13.90	29.40	47.8	-0.0222722	0.18067121	0.000242842	2.467E-07	\$ 7.22	\$ 7.22
1.00	1	0.57800	8.83	18.50	29.8	-0.0152071	0.11731005	0.000117809	2.06949E-07	\$ 8.77	\$ 8.77
1.00	1.5	0.47600	7.22	15.10	24.3	-0.009419	0.09605189	9.35275E-05	1.71142E-07	\$ 15.25	\$ 15.25
1.00	2	0.41300	6.24	13.00	21.0	0.0052303	0.08179042	9.32915E-05	1.11364E-07	\$ 24.21	\$ 24.21
1.00	2.5	0.37300	5.63	11.70	18.9	0.0038193	0.07414985	7.78159E-05	1.17433E-07	\$ 28.23	\$ 28.23
1.00	3	0.34500	5.21	10.90	17.5	-0.0020109	0.06871287	7.74465E-05	8.34471E-08	\$ 33.97	\$ 33.97
1.00	3.5	0.32400	4.88	10.20	16.4	0.0016851	0.06407339	7.52741E-05	7.16128E-08	\$ 39.72	\$ 39.72

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.00	4	0.30700	4.63	9.64	15.5	-0.0029178	0.06161312	5.81228E-05	1.07116E-07	\$ 45.46	\$ 45.46
1.00	4.5	0.29200	4.40	9.16	14.7	-0.0071996	0.05916601	4.73061E-05	1.23805E-07	\$ 51.21	\$ 51.21
1.00	5	0.26800	4.02	8.37	13.5	0.0071897	0.05238594	6.46778E-05	5.21924E-08	\$ 56.95	\$ 56.95
1.00	5.5	0.27500	4.13	8.61	13.8	-0.0073319	0.05562929	4.39788E-05	1.16826E-07	\$ 62.70	\$ 62.70
1.00	6	0.26600	4.00	8.33	13.4	0.001648	0.05273795	5.69907E-05	7.10059E-08	\$ 68.44	\$ 68.44
1.00	6.5	0.25800	3.88	8.08	13.0	-0.0015204	0.05160684	4.87015E-05	9.16401E-08	\$ 74.19	\$ 74.19
1.00	7	0.25100	3.78	7.87	12.7	0.0040483	0.04953021	5.68509E-05	6.34198E-08	\$ 79.93	\$ 79.93
1.00	7.5	0.24500	3.69	7.67	12.3	-0.0056523	0.04963139	3.93036E-05	1.01654E-07	\$ 85.68	\$ 85.68
1.00	8	0.24000	3.60	7.50	12.1	0.0061962	0.04692785	5.77671E-05	4.85511E-08	\$ 91.42	\$ 91.42
1.00	8.5	0.23500	3.53	7.35	11.8	-0.0046712	0.04741068	3.85038E-05	9.86193E-08	\$ 97.17	\$ 97.17
1.00	9	0.23000	3.46	7.20	11.6	0.0030907	0.04543952	5.10371E-05	5.76544E-08	\$ 102.91	\$ 102.91
1.00	9.5	0.22600	3.40	7.07	11.4	0.0043088	0.04451934	5.15157E-05	5.27993E-08	\$ 108.66	\$ 108.66
1.00	10	0.22200	3.34	6.95	11.2	0.0042217	0.04369047	5.16562E-05	4.79442E-08	\$ 114.40	\$ 114.40
1.25	-	3.11000	64.80	147.00	248.0	-0.8189409	0.76796747	0.002475005	-4.58201E-07	\$ -	\$ -
1.25	0.5	1.01000	15.80	33.40	54.2	-0.0315139	0.2063746	0.000264133	3.0041E-07	\$ 7.71	\$ 7.71
1.25	1	0.73700	11.30	23.70	38.4	-0.0014191	0.14752113	0.000181817	2.01183E-07	\$ 9.48	\$ 9.48
1.25	1.5	0.53100	8.05	16.80	27.1	-0.0025774	0.10635244	0.000111172	1.7266E-07	\$ 16.60	\$ 16.60
1.25	2	0.48900	7.41	15.50	24.9	-0.0097132	0.09853622	9.81917E-05	1.61129E-07	\$ 25.56	\$ 25.56
1.25	2.5	0.43300	6.55	13.70	22.0	-0.008124	0.08712265	8.65811E-05	1.41708E-07	\$ 30.01	\$ 30.01
1.25	3	0.39700	5.98	12.50	20.1	-0.001062	0.07896063	8.58034E-05	1.1015E-07	\$ 36.07	\$ 36.07
1.25	3.5	0.36900	5.56	11.60	18.7	0.0061594	0.07261071	8.88153E-05	7.61645E-08	\$ 42.14	\$ 42.14
1.25	4	0.34700	5.23	10.90	17.5	-0.0055785	0.06983173	6.35978E-05	1.25322E-07	\$ 48.21	\$ 48.21
1.25	4.5	0.32800	4.94	10.30	16.5	-0.0099474	0.06655574	5.29215E-05	1.37157E-07	\$ 54.27	\$ 54.27
1.25	5	0.31400	4.72	9.83	15.8	-0.0008386	0.06261432	6.21848E-05	9.89228E-08	\$ 60.34	\$ 60.34
1.25	5.5	0.30300	4.55	9.47	15.2	-0.0050333	0.06099609	5.12276E-05	1.20467E-07	\$ 66.41	\$ 66.41
1.25	6	0.29200	4.39	9.14	14.7	0.0004482	0.05809058	5.95175E-05	8.73919E-08	\$ 72.47	\$ 72.47
1.50	-	3.50000	73.10	167.00	280.0	-1.0894675	0.8782643	0.002727811	-3.94477E-07	\$ -	\$ -
1.50	0.5	1.18000	18.70	39.40	64.1	-0.0414329	0.24393112	0.00030924	3.70202E-07	\$ 8.88	\$ 8.88
1.50	1	0.74800	11.50	24.00	38.8	-0.011669	0.15185253	0.000158962	2.58534E-07	\$ 10.23	\$ 10.23
1.50	1.5	0.59900	9.11	19.00	30.7	-0.0005716	0.11994951	0.000129735	1.88439E-07	\$ 17.36	\$ 17.36
1.50	2	0.47800	7.23	15.10	24.3	-0.0036498	0.09565997	0.000100122	1.4626E-07	\$ 26.68	\$ 26.68
1.50	2.5	0.43400	6.54	13.60	22.0	0.0110691	0.08529243	0.000101654	1.04992E-07	\$ 30.92	\$ 30.92
1.50	3	0.40100	6.04	12.60	20.3	0.0016354	0.07960692	8.63392E-05	1.15005E-07	\$ 36.97	\$ 36.97
1.50	3.5	0.37500	5.65	11.80	19.0	0.00153	0.07434559	8.34742E-05	9.86193E-08	\$ 43.03	\$ 43.03
1.50	4	0.35300	5.31	11.10	17.8	-0.0051704	0.07067377	6.97919E-05	1.11364E-07	\$ 49.08	\$ 49.08
1.50	4.5	0.33700	5.06	10.50	17.0	0.0108813	0.06598783	7.70382E-05	8.58747E-08	\$ 55.13	\$ 55.13
1.50	5	0.32300	4.85	10.10	16.3	0.0058165	0.06357831	7.23994E-05	8.4054E-08	\$ 61.19	\$ 61.19
1.50	5.5	0.32100	4.82	10.00	16.1	-0.0011866	0.06432578	5.53879E-05	1.27143E-07	\$ 67.24	\$ 67.24
1.50	6	0.30900	4.64	9.68	15.6	0.0033621	0.0609862	6.84368E-05	8.22333E-08	\$ 73.29	\$ 73.29
2.00	-	4.30000	90.00	205.00	346.0	-1.1689421	1.06399527	0.003504974	-6.97921E-07	\$ -	\$ -

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

2.00	0.5	1.43000	22.70	48.00	78.1	-0.0711994	0.29777781	0.0003583	5.37096E-07	\$ 9.48	\$ 9.48
2.00	1	0.87700	13.40	28.20	45.5	-0.0188967	0.17681671	0.000198555	2.80079E-07	\$ 11.07	\$ 11.07
2.00	1.5	0.68300	10.40	21.70	35.0	-0.0058209	0.13736995	0.000144615	2.17569E-07	\$ 19.13	\$ 19.13
2.00	2	0.58000	8.79	18.30	29.6	0.0088937	0.11491811	0.000134157	1.51722E-07	\$ 28.12	\$ 28.12
2.00	2.5	0.51600	7.80	16.30	26.2	-0.0042044	0.10315517	0.000110122	1.46867E-07	\$ 32.95	\$ 32.95
2.00	3	0.47000	7.09	14.80	23.8	-0.0045472	0.09412276	9.37057E-05	1.54756E-07	\$ 39.34	\$ 39.34
2.00	3.5	0.43600	6.56	13.70	22.0	-0.0055501	0.08732423	8.44242E-05	1.46867E-07	\$ 45.74	\$ 45.74
2.00	4	0.40500	6.10	12.70	20.4	-0.0056978	0.08147132	7.28949E-05	1.50205E-07	\$ 52.14	\$ 52.14
2.00	4.5	0.38400	5.78	12.00	19.4	0.0072907	0.07588864	8.20756E-05	1.14095E-07	\$ 58.54	\$ 58.54
2.00	5	0.36600	5.51	11.50	18.5	-0.0004715	0.07283282	7.6901E-05	1.07419E-07	\$ 64.94	\$ 64.94
2.00	5.5	0.35600	5.35	11.10	17.9	0.0009203	0.07109988	6.48261E-05	1.34729E-07	\$ 71.33	\$ 71.33
2.00	6	0.34900	5.25	10.90	17.6	0.0051838	0.06911454	7.26374E-05	1.06509E-07	\$ 77.73	\$ 77.73
2.50	-	5.12000	107.00	244.00	412.0	-1.3642333	1.26111581	0.00422519	-9.46746E-07	\$ -	\$ -
2.50	0.5	1.65000	26.20	55.40	90.0	-0.078113	0.34273284	0.00043244	5.31027E-07	\$ 9.94	\$ 9.94
2.50	1	1.01000	15.50	32.40	52.4	-0.0121108	0.20412695	0.000223103	3.30754E-07	\$ 12.60	\$ 12.60
2.50	1.5	0.70300	10.70	22.30	35.9	-0.0111167	0.14211452	0.000138841	2.41845E-07	\$ 20.55	\$ 20.55
2.50	2	0.61000	9.24	19.30	31.0	-0.015685	0.12357472	0.000111288	2.33652E-07	\$ 30.28	\$ 30.28
2.50	2.5	0.54700	8.26	17.20	27.8	0.0089948	0.10809514	0.000125032	1.43529E-07	\$ 35.59	\$ 35.59
2.50	3	0.50100	7.56	15.80	25.4	-0.0008384	0.09963263	0.000111516	1.27143E-07	\$ 42.48	\$ 42.48
2.50	3.5	0.46200	6.96	14.50	23.3	-0.0061829	0.09286046	8.46622E-05	1.69322E-07	\$ 49.38	\$ 49.38
2.50	4	0.43400	6.54	13.60	21.9	0.0010385	0.08651054	8.76741E-05	1.35336E-07	\$ 56.28	\$ 56.28
2.50	4.5	0.41200	6.20	12.90	20.8	0.0043687	0.08162061	8.79719E-05	1.17736E-07	\$ 63.17	\$ 63.17
2.50	5	0.38900	5.85	12.20	19.6	-0.0026976	0.07769832	7.67599E-05	1.24716E-07	\$ 70.07	\$ 70.07
2.50	5.5	0.39000	5.86	12.20	19.6	-0.0066311	0.07856673	6.53814E-05	1.60825E-07	\$ 76.97	\$ 76.97
2.50	6	0.36100	5.42	11.30	18.2	0.0052619	0.07107351	8.23987E-05	8.46609E-08	\$ 83.86	\$ 83.86
3.00	-	6.12000	128.00	292.00	493.0	-1.7130596	1.51885905	0.004913792	-6.43301E-07	\$ -	\$ -
3.00	0.5	1.97000	31.30	66.30	108.0	-0.0623502	0.40479604	0.000578041	4.94614E-07	\$ 11.11	\$ 11.11
3.00	1	1.18000	18.20	38.10	61.5	-0.0354585	0.24133775	0.000245777	4.30891E-07	\$ 13.47	\$ 13.47
3.00	1.5	0.90300	13.80	28.80	46.4	-0.0206505	0.18354569	0.000176359	3.32878E-07	\$ 21.50	\$ 21.50
3.00	2	0.75600	11.50	23.90	38.6	-0.0012476	0.15194443	0.000153453	2.56107E-07	\$ 32.08	\$ 32.08
3.00	2.5	0.66100	10.00	20.90	33.6	-0.0108026	0.13295408	0.000131023	2.24245E-07	\$ 37.28	\$ 37.28
3.00	3	0.59500	8.98	18.70	30.1	-0.0078217	0.11980756	0.000107338	2.32135E-07	\$ 44.37	\$ 44.37
3.00	3.5	0.53900	8.13	16.90	27.3	0.0073592	0.10683283	0.000115989	1.58094E-07	\$ 51.46	\$ 51.46
3.00	4	0.50200	7.56	15.80	25.4	0.0002657	0.09960819	0.000111673	1.2684E-07	\$ 58.56	\$ 58.56
3.00	4.5	0.47300	7.12	14.80	23.9	0.0065809	0.09365604	0.000100275	1.41708E-07	\$ 65.65	\$ 65.65
3.00	5	0.44200	6.65	13.90	22.3	-0.0058801	0.08844116	8.79914E-05	1.38977E-07	\$ 72.75	\$ 72.75
3.00	5.5	0.42300	6.36	13.30	21.3	-0.010249	0.08516517	7.73152E-05	1.50812E-07	\$ 79.84	\$ 79.84
3.00	6	0.40600	6.10	12.70	20.4	-0.0045937	0.08144689	7.30516E-05	1.49901E-07	\$ 86.93	\$ 86.93
3.50	-	6.92000	145.00	331.00	559.0	-1.9304314	1.71646834	0.005630873	-8.86057E-07	\$ -	\$ -
3.50	0.5	2.18000	34.60	73.30	119.0	-0.1423042	0.45737022	0.000510683	9.16401E-07	\$ 13.37	\$ 13.37

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

3.50	1.0	1.11000	17.00	35.70	57.6	-0.0204286	0.22391562	0.000255225	3.30754E-07	\$ 14.60	\$ 14.60
3.50	1.5	0.89900	13.70	28.50	46.0	-0.0100539	0.18179222	0.000174042	3.34092E-07	\$ 23.58	\$ 23.58
3.50	2.0	0.76700	11.60	24.30	39.1	-0.007137	0.15322166	0.000167467	2.22425E-07	\$ 34.83	\$ 34.83
3.50	2.5	0.67900	10.30	21.40	34.5	-0.0052549	0.13683459	0.000128317	2.49128E-07	\$ 39.94	\$ 39.94
3.50	3.0	0.60900	9.19	19.20	30.9	-0.0014786	0.12129396	0.000131484	1.73267E-07	\$ 47.27	\$ 47.27
3.50	3.5	0.56200	8.47	17.70	28.4	-0.0079185	0.11261127	0.000112466	1.75391E-07	\$ 54.61	\$ 54.61
3.50	4.0	0.52400	7.90	16.50	26.5	-0.0073639	0.10511607	0.000102467	1.74784E-07	\$ 61.94	\$ 61.94
3.50	4.5	0.52600	7.92	16.50	26.6	0.0033985	0.10439888	0.000111507	1.5597E-07	\$ 69.28	\$ 69.28
3.50	5.0	0.48800	7.34	15.30	24.6	-0.0053393	0.09784689	9.01541E-05	1.79639E-07	\$ 76.62	\$ 76.62
3.50	5.5	0.46500	6.99	14.60	23.4	-0.0124056	0.0939246	7.89421E-05	1.86618E-07	\$ 83.95	\$ 83.95
3.50	6.0	0.44400	6.68	13.90	22.4	0.004144	0.08799887	9.44041E-05	1.26233E-07	\$ 91.29	\$ 91.29
4.00	-	7.72000	162.00	369.00	624.0	-2.1175931	1.91712942	0.006241966	-8.25368E-07	\$ -	\$ -
4.00	0.5	2.32000	36.70	77.80	126.0	-0.1569142	0.48603008	0.000540165	9.34608E-07	\$ 14.12	\$ 14.12
4.00	1.0	1.42000	21.90	45.80	74.1	-0.0082947	0.28613195	0.000349321	3.58064E-07	\$ 17.83	\$ 17.83
4.00	1.5	1.09000	16.60	34.70	55.9	-0.0185921	0.22004346	0.000224585	3.67167E-07	\$ 24.48	\$ 24.48
4.00	2.0	0.90100	13.70	28.50	46.0	-0.0078458	0.18174334	0.000174355	3.33485E-07	\$ 37.48	\$ 37.48
4.00	2.5	0.78100	11.80	24.70	39.7	-0.015664	0.15719233	0.000151844	2.78865E-07	\$ 42.66	\$ 42.66
4.00	3.0	0.68800	10.40	21.70	34.9	-0.006032	0.13784793	0.000140326	2.16052E-07	\$ 50.33	\$ 50.33
4.00	3.5	0.62800	9.48	19.80	31.8	-0.0114396	0.12640601	0.000119272	2.22121E-07	\$ 58.01	\$ 58.01
4.00	4.0	0.58200	8.77	18.30	29.4	-0.0074831	0.11675566	0.000111764	1.99666E-07	\$ 65.68	\$ 65.68
4.00	4.5	0.53700	8.09	16.90	27.1	-0.0119574	0.10821834	9.82229E-05	1.95115E-07	\$ 73.35	\$ 73.35
4.00	5.0	0.50800	7.64	15.90	25.6	-0.0006046	0.10137334	9.83601E-05	1.7357E-07	\$ 81.03	\$ 81.03
4.00	5.5	0.48400	7.29	15.20	24.4	-0.0087749	0.0974755	8.69914E-05	1.80853E-07	\$ 88.70	\$ 88.70
4.00	6.0	0.46300	6.96	14.50	23.3	-0.0050788	0.09283602	8.48189E-05	1.69018E-07	\$ 96.37	\$ 96.37
4.50	-	8.52000	178.00	408.00	689.0	-2.4044492	2.10560938	0.00699286	-1.06812E-06	\$ -	\$ -
4.50	0.5	2.55000	40.30	85.30	139.0	-0.0585851	0.52038548	0.000748911	6.2206E-07	\$ 15.84	\$ 15.84
4.50	1.0	1.33000	20.30	42.50	64.7	-0.5748134	0.33922828	-0.000598459	2.78258E-06	\$ 18.42	\$ 18.42
4.50	1.5	1.06000	16.10	33.60	54.3	0.0026678	0.21153564	0.00023601	3.15582E-07	\$ 25.56	\$ 25.56
4.50	2.0	0.89700	13.60	28.40	45.8	-0.0032913	0.17937951	0.000193236	2.7401E-07	\$ 40.36	\$ 40.36
4.50	2.5	0.77800	11.80	24.60	39.5	-0.0173869	0.15755305	0.000144611	2.79775E-07	\$ 45.22	\$ 45.22
4.50	3.0	0.70300	10.60	22.10	35.6	-0.0034244	0.14057606	0.000138841	2.41845E-07	\$ 53.29	\$ 53.29
4.50	3.5	0.64500	9.73	20.30	32.6	-0.0133357	0.13015457	0.000115563	2.47307E-07	\$ 61.36	\$ 61.36
4.50	4.0	0.59000	8.89	18.50	29.8	-0.0020883	0.11804825	0.000112836	2.09376E-07	\$ 69.43	\$ 69.43
4.50	4.5	0.59100	8.90	18.60	29.9	-0.0004441	0.11737559	0.000129873	1.54453E-07	\$ 77.50	\$ 77.50
4.50	5.0	0.55500	8.36	17.40	28.0	-0.0041952	0.11127415	0.000103397	2.0179E-07	\$ 85.57	\$ 85.57
4.50	5.5	0.52800	7.95	16.60	26.6	-0.0139589	0.10670557	9.16497E-05	2.03914E-07	\$ 93.64	\$ 93.64
4.50	6.0	0.50300	7.56	15.80	25.3	-0.0129602	0.1014198	8.89414E-05	1.87225E-07	\$ 101.71	\$ 101.71
5.00	-	9.49000	199.00	454.00	768.0	-2.6399888	2.35783048	0.007642948	-7.55576E-07	\$ -	\$ -
5.00	0.5	2.90000	46.00	97.40	158.0	-0.196291	0.60934239	0.000662657	1.24412E-06	\$ 17.71	\$ 17.71
5.00	1	1.76000	27.20	57.00	92.2	-0.0530328	0.36028654	0.000369179	6.79715E-07	\$ 20.14	\$ 20.14

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

5.00	1.5	1.32000	20.10	42.10	68.0	-0.0116018	0.26478965	0.00029262	4.18753E-07	\$ 27.40	\$ 27.40
5.00	2	1.08000	16.40	34.20	55.1	-0.0126586	0.21749832	0.000216256	3.70202E-07	\$ 42.88	\$ 42.88
5.00	2.5	0.90700	13.70	28.70	46.2	-0.0072637	0.18098636	0.000196493	2.70976E-07	\$ 47.73	\$ 47.73
5.00	3	0.80600	12.20	25.40	40.9	-0.0100804	0.16244023	0.000150235	3.01623E-07	\$ 56.00	\$ 56.00
5.00	3.5	0.73100	11.00	23.00	37.1	0.0094598	0.14392218	0.000172879	1.7266E-07	\$ 64.28	\$ 64.28
5.00	4	0.66100	9.97	20.80	33.5	0.0030316	0.13119868	0.000146122	1.75694E-07	\$ 72.56	\$ 72.56
5.00	4.5	0.61700	9.29	19.40	31.2	-0.0003387	0.12263692	0.000132737	1.70839E-07	\$ 80.83	\$ 80.83
5.00	5	0.58100	8.74	18.20	29.3	0.0009477	0.11564264	0.000117798	1.81763E-07	\$ 89.11	\$ 89.11
5.00	5.5	0.55200	8.31	17.30	27.9	0.0078032	0.10904227	0.00012328	1.42012E-07	\$ 97.39	\$ 97.39
5.00	6	0.52700	7.92	16.50	26.6	0.0045025	0.10437444	0.000111663	1.55667E-07	\$ 105.66	\$ 105.66
6.00	-	11.20000	234.00	535.00	905.0	-3.0890981	2.76905087	0.009072892	-9.71021E-07	\$ -	\$ -
6.00	0.5	3.53000	56.30	119.00	194.0	-0.1570841	0.7346363	0.000932785	1.23502E-06	\$ 19.84	\$ 19.84
6.00	1	2.09000	32.20	67.70	109.0	-0.1217106	0.43338373	0.000363801	1.0044E-06	\$ 21.37	\$ 21.37
6.00	1.5	1.54000	23.50	49.20	79.4	-0.022132	0.31034744	0.000333273	5.03717E-07	\$ 28.93	\$ 28.93
6.00	2	1.22000	18.50	38.70	62.3	-0.0201056	0.24557579	0.000246973	4.18753E-07	\$ 44.19	\$ 44.19
6.00	2.5	1.04000	15.80	32.90	53.1	-0.0004778	0.20829659	0.000221042	3.21651E-07	\$ 48.74	\$ 48.74
6.00	3	0.92000	13.90	29.00	46.7	-0.005275	0.18405076	0.000187932	2.97375E-07	\$ 56.80	\$ 56.80
6.00	3.5	0.81000	12.20	25.50	41.0	-0.0086854	0.1620373	0.00016146	2.70065E-07	\$ 64.86	\$ 64.86
6.00	4	0.74500	11.20	23.40	37.7	0.0052322	0.14727491	0.000166165	1.98756E-07	\$ 72.92	\$ 72.92
6.00	4.5	0.69200	10.40	21.70	35.0	0.0084147	0.13653207	0.000154933	1.84494E-07	\$ 80.98	\$ 80.98
6.00	5	0.64500	9.70	20.20	32.5	-0.0038009	0.12901711	0.000121754	2.291E-07	\$ 89.04	\$ 89.04
6.00	5.5	0.61600	9.27	19.30	31.1	0.0030546	0.12241674	0.000127236	1.89349E-07	\$ 97.10	\$ 97.10
6.00	6	0.58600	8.82	18.40	29.6	0.0002518	0.11650911	0.000123835	1.68108E-07	\$ 105.16	\$ 105.16
7.00	-	12.70000	267.00	611.00	1034.0	-3.557321	3.15132865	0.010491384	-1.42619E-06	\$ -	\$ -
7.00	0.5	4.01000	64.00	136.00	221.0	-0.2219658	0.83503966	0.001116074	1.21074E-06	\$ 39.14	\$ 39.14
7.00	1	2.43000	37.60	79.00	128.0	-0.0149188	0.48849633	0.000649086	5.37096E-07	\$ 43.13	\$ 43.13
7.00	1.5	1.68000	25.60	53.60	86.5	-0.0093606	0.33625832	0.000389024	4.61235E-07	\$ 47.13	\$ 47.13
7.00	2	1.36000	20.70	43.20	69.6	-0.0335023	0.27642001	0.000247584	5.58337E-07	\$ 51.12	\$ 51.12
7.00	2.5	1.16000	17.60	36.60	59.1	0.0019811	0.23222208	0.000240172	3.76271E-07	\$ 55.11	\$ 55.11
7.00	3	0.98900	15.00	31.20	50.2	-0.0151484	0.1999411	0.000182163	3.67471E-07	\$ 59.11	\$ 59.11
7.00	3.5	0.89400	13.50	28.10	45.3	-0.0016212	0.17881971	0.000177095	3.05265E-07	\$ 63.10	\$ 63.10
7.00	4	0.82000	12.40	25.80	41.5	-0.0057093	0.16455708	0.000161337	2.67031E-07	\$ 67.10	\$ 67.10
7.00	4.5	0.76000	11.40	23.90	38.4	-0.0052118	0.15091597	0.000161298	2.24549E-07	\$ 71.09	\$ 71.09
7.00	5	0.71100	10.70	22.30	35.9	-0.0022845	0.14191901	0.000140094	2.39417E-07	\$ 75.08	\$ 75.08
7.00	5.5	0.67400	10.20	21.20	34.0	-0.0188445	0.1372366	0.000108482	2.80989E-07	\$ 79.08	\$ 79.08
7.00	6	0.63900	9.62	20.00	32.3	0.0101209	0.12633902	0.000138448	1.8237E-07	\$ 83.07	\$ 83.07
8.00	-	14.30000	300.00	687.00	1163.0	-3.9151414	3.53116262	0.011925548	-1.9117E-06	\$ -	\$ -
8.00	0.5	4.56000	72.80	155.00	252.0	-0.2365584	0.94586427	0.001334781	1.22591E-06	\$ 44.73	\$ 44.73
8.00	1	2.60000	40.20	84.50	137.0	-0.0062137	0.52111451	0.000708629	5.46199E-07	\$ 49.29	\$ 49.29
8.00	1.5	1.86000	28.40	59.40	95.9	-0.0292068	0.3757041	0.000389921	6.4937E-07	\$ 53.86	\$ 53.86

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

8.00	2	1.50000	22.80	47.70	76.9	-0.0051226	0.29957171	0.000345731	3.94477E-07	\$ 58.42	\$ 58.42
8.00	2.5	1.23000	18.60	38.90	62.6	-0.0124583	0.24625192	0.000257448	3.85374E-07	\$ 62.99	\$ 62.99
8.00	3	1.08000	16.40	34.20	55.1	-0.0083592	0.21688038	0.000225164	3.39857E-07	\$ 67.55	\$ 67.55
8.00	3.5	0.97700	14.80	30.80	49.5	-0.0187432	0.1977576	0.000175211	3.71112E-07	\$ 72.12	\$ 72.12
8.00	4	0.89400	13.50	28.10	45.3	0.0026781	0.17820177	0.000186003	2.7492E-07	\$ 76.68	\$ 76.68
8.00	4.5	0.82700	12.50	26.00	41.8	-0.0099728	0.16654242	0.000153526	2.95251E-07	\$ 81.24	\$ 81.24
8.00	5	0.77200	11.60	24.20	39.0	0.0057035	0.1527867	0.00016656	2.20907E-07	\$ 85.81	\$ 85.81
8.00	5.5	0.73100	11.00	22.90	36.9	0.0024503	0.14544547	0.0001483	2.33349E-07	\$ 90.37	\$ 90.37
8.00	6	0.69300	10.40	21.70	35.0	0.0095187	0.13650763	0.00015509	1.84191E-07	\$ 94.94	\$ 94.94
9.00	-	15.90000	333.00	762.00	1291.0	-4.2857455	3.9202278	0.01316464	-1.79032E-06	\$ -	\$ -
9.00	0.5	4.69000	74.60	158.00	257.0	-0.244902	0.97718978	0.001212621	1.67198E-06	\$ 50.32	\$ 50.32
9.00	1	2.85000	44.00	92.40	150.0	0.004233	0.57031027	0.000765362	6.52405E-07	\$ 55.46	\$ 55.46
9.00	1.5	2.04000	31.20	65.20	105.0	-0.0490492	0.41447862	0.000411236	7.16128E-07	\$ 60.59	\$ 60.59
9.00	2	1.57000	23.80	49.70	80.2	-0.0047678	0.31391692	0.000336283	4.94614E-07	\$ 65.73	\$ 65.73
9.00	2.5	1.34000	20.30	42.40	68.3	-0.0090479	0.26826538	0.00028392	4.12684E-07	\$ 70.86	\$ 70.86
9.00	3	1.18000	17.80	37.20	59.9	-0.0059637	0.23543577	0.000246687	3.70202E-07	\$ 76.00	\$ 76.00
9.00	3.5	1.06000	16.00	33.40	53.8	-0.0011023	0.21119752	0.000225866	3.15582E-07	\$ 81.13	\$ 81.13
9.00	4	0.96800	14.60	30.50	49.0	-0.0120165	0.1939775	0.000193308	3.13154E-07	\$ 86.27	\$ 86.27
9.00	4.5	0.89300	13.50	28.10	45.2	-0.0041571	0.17882638	0.000180774	2.75224E-07	\$ 91.40	\$ 91.40
9.00	5	0.83300	12.50	26.20	42.1	-0.0036595	0.16518526	0.000180735	2.32742E-07	\$ 96.53	\$ 96.53
9.00	5.5	0.78800	11.90	24.70	39.8	0.0033119	0.15731625	0.000158468	2.46397E-07	\$ 101.67	\$ 101.67
9.00	6	0.75100	11.30	23.60	37.9	-0.0058665	0.14988485	0.000153125	2.2728E-07	\$ 106.80	\$ 106.80
10.00	-	17.70000	370.00	847.00	1435.0	-4.7750205	4.36019572	0.014570323	-1.72963E-06	\$ -	\$ -
10.00	0.5	5.68000	91.00	193.00	315.0	-0.2306402	1.17751696	0.001668431	1.61432E-06	\$ 55.91	\$ 55.91
10.00	1	3.35000	51.90	109.00	177.0	-0.0441186	0.67825054	0.000823688	1.04688E-06	\$ 61.62	\$ 61.62
10.00	1.5	2.18000	33.30	69.60	112.0	-0.0936014	0.44840497	0.000355017	1.03778E-06	\$ 67.32	\$ 67.32
10.00	2	1.76000	26.80	56.00	90.2	-0.0506088	0.35834406	0.00031755	7.40404E-07	\$ 73.03	\$ 73.03
10.00	2.5	1.49000	22.60	47.30	76.2	-0.0065094	0.29733934	0.000339092	3.97512E-07	\$ 78.73	\$ 78.73
10.00	3	1.31000	19.80	41.30	66.5	-0.0078491	0.26219379	0.000267384	4.21787E-07	\$ 84.44	\$ 84.44
10.00	3.5	1.17000	17.70	36.90	59.4	-0.0077225	0.23442909	0.000238358	3.73236E-07	\$ 90.14	\$ 90.14
10.00	4	1.06000	16.10	33.50	53.9	-0.0158041	0.21425927	0.000201287	3.76271E-07	\$ 95.85	\$ 95.85
10.00	4.5	0.97800	14.70	30.70	49.5	0.0070932	0.1934533	0.000213927	2.79775E-07	\$ 101.56	\$ 101.56
10.00	5	0.91000	13.70	28.60	46.0	-0.0023624	0.18120045	0.000190201	2.70065E-07	\$ 107.26	\$ 107.26
10.00	5.5	0.85900	12.90	27.00	43.4	-0.0042923	0.17072149	0.000180973	2.55196E-07	\$ 112.97	\$ 112.97
10.00	6	0.81000	12.20	25.40	40.9	0.0029344	0.1611066	0.000168678	2.39721E-07	\$ 118.67	\$ 118.67
12.00	-	20.80000	435.00	997.00	1691.0	-5.4668288	5.10092117	0.017473698	-2.67031E-06	\$ -	\$ -
12.00	0.5	6.02000	95.60	203.00	330.0	-0.2533548	1.24131456	0.001737707	1.57184E-06	\$ 67.10	\$ 67.10
12.00	1	3.51000	54.10	114.00	184.0	-0.1092875	0.71373529	0.000813128	1.11971E-06	\$ 73.94	\$ 73.94
12.00	1.5	2.53000	38.60	80.80	130.0	-0.0986355	0.5179718	0.000442636	1.11364E-06	\$ 80.79	\$ 80.79
12.00	2	2.04000	30.90	64.70	104.0	-0.0619525	0.4138481	0.00036715	8.37506E-07	\$ 87.63	\$ 87.63

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.00	2.5	1.72000	26.10	54.40	87.7	-0.0205478	0.3466554	0.00033339	6.31164E-07	\$ 94.48	\$ 94.48
12.00	3	1.50000	22.70	47.30	76.3	0.0114793	0.29800789	0.000337278	3.94477E-07	\$ 101.33	\$ 101.33
12.00	3.5	1.34000	20.20	42.10	67.9	0.0059648	0.26641416	0.000282229	4.12684E-07	\$ 108.17	\$ 108.17
12.00	4	1.21000	18.30	38.20	61.4	-0.0156039	0.24301287	0.00024248	3.91443E-07	\$ 115.02	\$ 115.02
12.00	4.5	1.11000	16.80	34.90	56.2	-0.007286	0.2232242	0.000210358	3.91443E-07	\$ 121.87	\$ 121.87
12.00	5	1.03000	15.50	32.40	52.1	-0.0072239	0.20543869	0.000211022	3.24685E-07	\$ 128.71	\$ 128.71
12.00	5.5	0.97200	14.60	30.50	49.1	0.0024302	0.19266164	0.000207915	2.81596E-07	\$ 135.56	\$ 135.56
12.00	6	0.91400	13.80	28.70	46.1	-0.0126482	0.18416445	0.000166249	3.2954E-07	\$ 142.41	\$ 142.41

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

<b>Table 14: Measure Lives</b>		
<b>Measure</b>	<b>Product Life (yrs)</b>	<b>Source of Information</b>
<b>Hot Water Boilers (Non-condensing)</b>		
Hot Water Boiler - Non-condensing 175 MBTUH	20	Federal Energy Management Program
Hot Water Boiler - Non-condensing 500 MBTUH	20	Federal Energy Management Program
Hot Water Boiler - Non-condensing 1MMBTUH	20	Federal Energy Management Program
Hot Water Boiler - Non-condensing 2 MMBTUH	20	Federal Energy Management Program
Hot Water Boiler - Non-condensing 4 MMBTUH	20	Federal Energy Management Program
Hot Water Boiler - Non-condensing 6 MMBTUH	20	Federal Energy Management Program
Hot Water Boiler - Non-condensing 8, MMBTUH	20	Federal Energy Management Program
<b>Hot Water Boilers (Condensing)</b>		
Hot Water Boiler - Condensing 175 MBTUH	20	Federal Energy Management Program
Hot Water Boiler - Condensing 500 MBTUH	20	Federal Energy Management Program
Hot Water Boiler - Condensing 1 MMBTUH	20	Federal Energy Management Program
Hot Water Boiler - Condensing 2 MMBTUH	20	Federal Energy Management Program
Hot Water Boiler - Condensing 4 MMBTUH	20	Federal Energy Management Program
Hot Water Boiler - Condensing 6 MMBTUH	20	Federal Energy Management Program
Hot Water Boiler - Condensing 8 MMBTUH	20	Federal Energy Management Program
<b>Custom Boiler</b>		
Other Custom Boiler Measures	20	Similar to prescriptive boiler EUL
<b>Commercial Furnaces and New EC Furnace Fans</b>		
	15	Federal Energy Management Program
<b>Retrofit EC Furnace Fans</b>		
	7	California DEER Database for RUL of High Efficiency Furnaces (Ref 22)
<b>Commercial Water Heaters</b>		
Commercial Hot Water Heater - Condensing; 125 MBTUH	15	Federal Energy Management Program
Commercial Hot Water Heater - Condensing; 160 MBTUH	15	Federal Energy Management Program
Commercial Hot Water Heater - Condensing; 199 MBTUH	15	Federal Energy Management Program
Commercial Hot Water Heater - Condensing; 300 MBTUH	15	Federal Energy Management Program
Commercial Tankless Hot Water Heater - Non-condensing; 150 MBTUH	15	Federal Energy Management Program
Commercial Tankless Hot Water Heater - Non-condensing; 199 MBTUH	15	Federal Energy Management Program
Commercial Tankless Hot Water Heater - Non-condensing; 399 MBTUH	15	Federal Energy Management Program
Commercial Tankless Hot Water Heater - Non-condensing; 500 MBTUH	15	Federal Energy Management Program

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

<b>Steam Traps</b>		
Gas Boiler - Steam Traps - Low Pressure - average of 10 and 15 PSI	10	2010 Tetra Tech Heating Efficiency Program Evaluation
Gas Boiler - Steam Traps - High Pressure - average of 50 PSI and 65 PSI	4	2010 Tetra Tech Heating Efficiency Program Evaluation
<b>Boiler Tune Ups</b>	2	Federal Energy Management Program
<b>Pipe Insulation</b>		
Insulation - Hot Water System	15	2010 Tetra Tech Heating Efficiency Program Evaluation
Insulation - Steam System	15	2010 Tetra Tech Heating Efficiency Program Evaluation
<b>Unit Heaters</b>		
Unit Heaters	20	9. Sachs, Harvey M., Unit Heaters Deserve Attention for Commercial Programs, ACEEE, April 2003
Radiant Heaters	15	Nicor Gas Energy Efficiency Plan 2011-2014.
<b>Ozone Laundry</b>		
Ozone Laundry Systems	10	Illinois 2017 TRM ; <a href="http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_6/Final/IL-TRM_Effective_010118_v6.0_Vol_2_C_and_I_020817_Final.pdf">http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_6/Final/IL-TRM_Effective_010118_v6.0_Vol_2_C_and_I_020817_Final.pdf</a>

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Lighting - Small Business

#### Description:

Prescriptive rebates will be offered for replacement lighting equipment. Custom rebates are available for lighting-related improvements that are not prescriptive.

#### Program References

All Lamp, Fixture and Lighting Control Measures	Refer to Product "CO Lighting Efficiency" to find equations (Customer kW, Customer kWh, Customer PckW, etc.), Variable IDs, Deemed Values, and Eligibility Requirements for the measures. Exceptions are listed below.
Measures "Faucet Aerators"	Refer to Product "CO Commercial Refrigeration" to find equations (Customer kW, Customer kWh, Customer PckW, etc.) for the "Faucet Aerator (Kitchen), elec water heating", "Faucet Aerator (Restroom), elec water heating", "Faucet Aerator (Kitchen), gas water heating", and the "Faucet Aerator (Restroom), gas water heating" measures.

Variable ID:	Value	Description
Existing_Model_kW	Customer Input from Picklist	Existing equipment wattage collected on-site for Direct Install lamps. Specific lighting product provided by customer and verified during M&V. EISA affected lamps are modified, see Table 1 below for values.
NTG	89%	Net-to-gross for prescriptive and custom measures for Small Business Lighting Retrofit rebates. <sup>1</sup>
NTG	90%	Net-to-gross for Direct Install. <sup>1</sup>
<b>NTG</b>	<b>100%</b>	<b>Net-to-gross for Network Lighting Controls <sup>3</sup></b>
High Efficiency Cost	Customer Input from Picklist	Cost of the High Efficiency technology. <sup>2</sup> Costs are re-evaluated throughout the year and updated to account for the rapidly evolving market.

#### Tables:

**Table 1: Baseline Wattages for EISA Affected Bulbs**

Lumens	EISA Baseline Wattage (halogen)	Non-EISA Baseline Wattage (incandescent)
310 - 749	29	40
750 - 1,049	43	60
1,050 - 1,489	53	75
1,490 - 2,600	72	100

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 2: Direct Install Lamps <sup>2</sup>**

Lamp Type	Measure Life	Current Cost
A Lamps	7	\$2.50
BR30	7	\$3.75
MR16	7	\$3.58
PAR20	7	\$3.50
R20	5	\$3.40
PAR30	7	\$4.86
PAR38	7	\$12.50

\* = See note above on updating costs throughout the program year.

**Table 3: Aerator Costs <sup>2</sup>**

Aerator Type	Current Cost
0.5 GPS Restroom Aerators	\$0.49
1.5 GPS Kitchan Aerators	\$0.51

\* = See note above on updating costs throughout the program year.

**References:**

1. Net-to-Gross Factors from Evaluation of the Small Business Lighting Program - Colorado. Dec 16, 2016. Tetra Tech.				
2. Rated Life for Direct Install Lamps and Costs Provided by third-party implementer from their new inventory list as of July 27th, 2018.				
3. <a href="#">The Unopposed Settlement Agreement in Proceeding No. 18A-0606EG.</a>				

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Lighting Efficiency - CO

#### Description:

Prescriptive rebates will be offered for replacement lighting equipment. New Construction rebates will be offered for new facilities, spaces overhauled for a new purpose, spaces where new lighting is required for safety/code requirements and spaces with fixtures that are at the end of their useful life. Custom rebates are available for lighting-related improvements that are not prescriptive.

#### Equations:

<b>Fixtures and Lamps</b>	
Electrical Demand Savings (Customer kW)	= (kW_Exist - kW_Prop) x Cooling_kW_Savings_Factor
Electrical Energy Savings (Customer kWh/yr)	= (kW_Exist - kW_Prop) x Hours x Cooling_kWh_Savings_Factor
Electrical Peak Coincident Demand Savings (Customer PCKW)	= (kW_Exist - kW_Prop) x Cooling_kW_Savings_Factor x CF
kW_Exist	= Qty_Existing_Equip x Existing_Model_kW
kW_Prop	= Qty_Prop_Equip x Equipment_Model_kW
Natural Gas Savings (Dth)	= (kW_Exist - kW_Prop) x Hours x Heating_Penalty_Factor
<b>Lighting Controls</b>	
Electrical Demand Savings (Customer kW)	= (kW_Connected) x % Savings x Cooling_kW_Savings_Factor
Electrical Energy Savings (Customer kWh/yr)	= (kW_Connected) x % Savings x Hours x Cooling_kWh_Savings_Factor
Electrical Peak Coincident Demand Savings (Customer PCKW)	= (kW_Connected) x % Savings x Cooling_kW_Savings_Factor x CF
Natural Gas Savings (Dth)	= (kW_Connected) x % Savings x Hours x Heating_Penalty_Factor

#### Variable ID:

Variable ID:	Value	Description
Qty_Existing_Equip	Customer Input	Quantity of existing equipment, verified during M&V.
Qty_Prop_Equip	Customer Input	Quantity of proposed equipment, verified during M&V.
HVAC_Type	Customer Input	Type of heating or cooling, verified during M&V.
Facility_Type	Customer Input	Type of facility.
Existing_Model_kW	Customer Input	Existing equipment wattage determined from stipulated fixture or lamp wattage. Specific lighting product provided by customer and verified during M&V.

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Equipment_Model_kW	Customer Input	Proposed equipment wattage of fixture or lamp. Specific lighting product provided by customer and verified during M&V.
kW_Connected	Customer Input	Total connected fixture load connected to lighting controls, provided by customer and verified during M&V.
Cooling_kW_Savings_Factor	Table 1	Cooling system secondary demand savings factor resulting from efficient lighting. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Cooling_kWh_Savings_Factor	Table 1	Cooling system secondary energy savings factor resulting from efficient lighting. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Heating_Penalty_Factor	Table 1	Heating system secondary energy penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has gas heating. Existence of gas heating to be determined by HVAC_Type.
CF	Table 2	Coincidence Factor is the probability that the peak demand of the lights will coincide with the peak utility system demand, determined by Facility_Type.
Hours	Table 2	Annual operating hours, determined by Facility_Type.
% Savings	Table 3	Stipulated savings percentage based on control type.
NTG	74%	Net-to-gross. <sup>9</sup>
NTG	100%	Net-to-gross for Network Lighting Controls. <sup>11</sup>
Measure Life	Table 4	Length of time the lighting equipment will be operational. For lamps, the measure life equals the lifetime hours of the lamp divided by the estimated hours of use.
Baseline Cost	Customer Input from Picklist	Cost of the baseline technology. For Retrofit, the cost is \$0.00 since the baseline is to continue to operate the existing system. For New Construction, the cost is that of the lower efficiency option. Costs are determined through market research and provided by vendors. <sup>10</sup>

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

High Efficiency Cost	Customer Input from Picklist	Cost of the High Efficiency technology. <sup>10</sup> Equipment and Labor costs are also collected on a per measure basis, data is used to evaluate and identify the need to update costs as needed throughout the year to account for the rapidly evolving market.
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**Tables:**

**Table 1: HVAC Interactive Factors <sup>1,2</sup>**

HVAC_Type	Cooling_kWh_Savings_Factor	Cooling_kW_Savings_Factor	Heating_Penalty_Factor (Dth/kWh)
Heating Only	1.00	1.00	-0.000508
Heating and Cooling	1.13	1.33	-0.000508
Cooler Door Retrofit to LED	1.44	1.44	N/A
Freezer Door Retrofit to LED	1.70	1.70	N/A

**Table 2: Coincident Peak Demand Factors and Annual Operating Hours by Facility Type <sup>3</sup>**

Facility_Type	CF	Annual Operating Hours
24-Hour Facility	100%	8,760
Assisted Living	100%	7,862
College	63%	3,395
Elementary School	72%	3,038
Exterior - Dusk to Dawn	0%	4,380
Grocery/Convenience Store	75%	4,661
Healthcare Office/Outpatient	65%	3,890
Hospital	76%	7,616
Hotel/Motel Common Areas	73%	6,138
Hotel/Motel Guest Rooms	28%	2,390
Manufacturing	81%	4,618
Office - Low Rise	52%	2,698
Office - Mid Rise	52%	3,068
Office - High Rise	57%	2,886
Other/Misc.	58%	3,379
Religious Building	48%	2,085
Restaurant	68%	5,571
Retail - Department Store	95%	5,478
Retail - Strip Mall	71%	4,093
Safety or Code Required (Including Exit Signs)	100%	8,760
Secondary School	72%	3,038
Warehouse	68%	5,242

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 3. Lighting Controls** <sup>4, 5</sup>

Control Type	% Savings	Full Cost Per Watt	Rebate Per Watt
Standalone - Occupancy Sensor	24%	\$0.61	\$0.05
Standalone - Daylighting (Photocell) Sensor	28%	\$0.61	\$0.10
Standalone - Occupancy and Daylighting (Photocell) Sensor	38%	\$0.61	\$0.15
Networked Lighting Controls	47%	\$1.57	\$0.40

**Table 4: Measure Lifetimes in Years** <sup>6, 7, 8</sup>

Measure	Lifetime
LED Fixtures, Retrofit Kits and LED Linear Lamps - Type C	20.0
Lighting Sensors	8.0
Networked Lighting Controls	15.0

**Eligibility Requirements and Methodologies:**

The following represents the eligibility requirements and savings methodologies for lamps, retrofit kits, fixtures and controls.

**Rebates:**

LED fixture, retrofit kit and lamp rebates are determined on a dollar per unit basis. Rebates are available for equipment that is listed on the Design Lights Consortium Qualified Products List (DLC QPL) and ENERGY STAR rated lighting equipment. A tiered rebate is available for equipment that either does not qualify for ENERGY STAR or is not listed on the DLC QPL. Non-DLC and non-ENERGY STAR products must meet the DLC or ENERGY STAR product eligibility category definitions. Lighting Controls rebates are determined on a dollar per controlled watt basis. Networked lighting controls must meet the Design Lights Consortium specification and be included on the DLC QPL to qualify for a rebate.

**Equipment Pairings Methodology:**

Each replacement lighting fixture assumes equivalent lighting levels for the baseline and proposed (see sections below that discuss the case where a customer is over or under lit). New construction fixtures are put in on a one-for-one basis instead of lower efficiency options, equipment pairings used produce equivalent lighting levels.

Fixture identity with "Over"

Applied for lighting technologies where there is a discrete set of fixture options which results in a non-continuous set of input wattages. Customer was initially over lit, and we have deemed that an intermediate step to reduce the over lit condition was made before the decision to reduce input wattage again with LED retrofit fixture. Baseline input wattage is adjusted to deemed value and the replacement fixture cost is subtracted from the LED fixture cost to determine the project incremental cost. Examples include HID wall packs which have a range of 35 to 400 watts or more but are available only in input wattages of 35, 45, 70, 100, 125, 150, 175, 250 and 400 Watts (nominal values meant to illustrate baseline wattages, other input wattages exist).

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Fixture identity with "Under"

Applied for lighting technologies where there is a discrete set of fixture options which results in a non-continuous set of input wattages. Customer was initially under lit, and we have deemed that an intermediate step to increase the under lit condition was made before the decision to reduce input wattage with LED retrofit fixture. Baseline input wattage is adjusted to deemed value and the replacement fixture cost is subtracted from the LED fixture cost to determine the project incremental cost. Examples include HID wall packs which have a range of 35 to 400 watts or more but are available only in input wattages of 35, 45, 70, 100, 125, 150, 175, 250 and 400 Watts (nominal values meant to illustrate baseline wattages, other input wattages exist).

### Fixture identity with "Not-On-the-List"

Applied for lighting technologies where the range of available input wattages for a technology is relatively narrow (as compared to HID fixtures) and can essentially be viewed as a continuous range (there are many possible of lamps and ballasts for example). This approach essentially allows all baseline choices to be considered whether or not they are listed in the choice list for any particular proposed input wattage. The deemed value for the "Not-On-the-List" identity is the average value derived from all choices extant for a particular proposed input wattage selection. In other words, the several baseline choices for a proposed input wattage of 32w for an LED fixture has the available baseline choices averaged and the baseline cost reduced to determine kW savings and incremental cost and adjusts for both the over or under conditions. This process allows any baseline to be considered for a particular proposed input wattage obviating the need for a custom preapproval.

### **Baseline Adjustments:**

- Rebates are available for T12 baseline equipment. For T12 baseline equipment the T12 baseline is adjusted to a T8 baseline and the replacement fixture cost is subtracted from the LED fixture cost to determine the incremental cost.

### **References:**

1. HVAC Interactive Factors developed based on the Rundquist Simplified HVAC Interaction Factor method for Colorado, ASHRAE Journal - "Calculating lighting and HVAC interactions".
2. COP values from the Deemed Savings for CO Commercial Refrigeration, 2019-2020. (Cooler and Freezer Door Interactive Factors).
3. State of Illinois Energy Efficiency Technical Reference Manual Final Technical Version as of February 8th, 2017. Effective January 1st, 2018. (Hours and CF)
4. Design Lights Consortium. (2017). Energy Savings from Networked Lighting Control (NLC) Systems. Medford: Design Lights Consortium. Retrieved 10 01, 2017, from <https://www.designlights.org/lighting-controls/reports-tools-resources/nlc-energy-savings-report/>
5. Lawrence Berkeley National Laboratory. (2011). A Meta-Analysis of Energy Savings from Lighting Controls in Commercial Buildings. Berkeley, CA: Lawrence Berkeley National Laboratory. Retrieved 10 01, 2017, from [https://eta.lbl.gov/sites/default/files/publications/a\\_meta-analysis\\_of\\_energy\\_savings\\_from\\_lighting\\_controls\\_in\\_commercial\\_buildings\\_lbnl-5095e.pdf](https://eta.lbl.gov/sites/default/files/publications/a_meta-analysis_of_energy_savings_from_lighting_controls_in_commercial_buildings_lbnl-5095e.pdf)
6. Measure Life for automatically controlled measures from the Deemed Savings for CO Energy Management Systems, 2019-2020. (NLC Measure Life)
7. Design Lights Consortium (2018). Qualified Products List as of February 27, 2018. (Lamp Lifetime Hours)
8. Hours of Use to calculate measure life for lamps was determined using a weighted hours of operation from Xcel Energy 2017/2018 participation.
9. Net-to-Gross factor from Evaluation of Xcel Energy's Lighting Efficiency Program. Jan 21, 2018. EMI Consulting.
10. LED baseline and proposed costs come from previous Xcel Energy Custom Lighting Efficiency projects, as well as market research through ShineRetrofits.com, LightingAtlanta.org, 1000bulbs.com, grainger.com, Pro Lighting.com, and more.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Product: Lighting Efficiency (Midstream)**

**Description:**

Customers will receive point of sale rebates at their lighting equipment distributor for qualified Lamps and Retrofit Kits.
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**Equations:**

Electrical Demand Savings (Customer kW)	= Quantity x (Watts_Base - Watts_EE)/1000 x Cooling_kW_Savings_Factor
Electrical Energy Savings (Customer kWh)	= Quantity x (Watts_Base - Watts_EE)/1000 x Hours x Cooling_kWh_Savings_Factor
Electrical Peak Coincident Demand Savings (Customer PCKW)	= Quantity x (Watts_Base - Watts_EE)/1000 x Cooling_kW_Savings_Factor x CF
LPW_EE	= Lumens_EE / Watts_EE
Watts_Base	= Watts_EE x LPW_EE / LPW_Base
Natural Gas Savings (Dth)	= Quantity x (Watts_Base - Watts_EE)/1000 x Hours x Heating_Penalty_Factor

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Variable ID:	Value	Description
Quantity	Vendor Input	Quantity of lamps or retrofit kits.
Measure Category	Vendor Input	Type of lamp or retrofit kit.
Watts_EE	Vendor Input	High efficiency lamp wattage. This is defined by the manufacturer and maintained and reported by the distributor.
Lumens_EE	Vendor Input	High efficiency lamp rated brightness (lumens). This is defined by the manufacturer and maintained and reported by the distributor.
LPW_Base	Table 1	Efficacy of the baseline technology (lumens per watt).
Cooling_kW_Savings_Factor	1.24	Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. The program will not have direct access to market segment information, so a deemed weighted average was created based on a three year history of downstream participation. <sup>1,2</sup>
Cooling_kWh_Savings_Factor	1.09	Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. The program will not have direct access to market segment information, so a deemed weighted average was created based on a three year history of downstream participation. <sup>1,2</sup>
Heating_Penalty_Factor	-0.000508	Reduction in lighting energy results in an increase in heating usage, if the customer has gas heating (Dth/kWh). <sup>2</sup>
CF	63%	Coincidence Factor is the probability that the peak demand of the lights will coincide with peak utility system demand. The program will not have direct access to market segment information, so a deemed weighted average was created based on a three year history of downstream participation. <sup>1,2</sup>
Hours	4,350	Annual operating hours. The program will not have direct access to market segment information, so a deemed weighted average based on a three year history of downstream participation was created. <sup>1,2</sup>
Measure Life	Table 2	Length of time the lighting equipment will be operational, equals the lifetime hours of the lamp divided by the deemed hours of use.
Baseline Cost	Table 3	Cost of the baseline technology.
High Efficiency Cost	Vendor Input	Cost of the high efficiency technology. Costs will be collected from the equipment distributor on the product invoice.
NTG	92%	Net-to-gross factor. <sup>3</sup>

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Assumptions:

- Midstream LED Lamps are put in on a one-for-one basis instead of lower efficiency options.
- ENERGY STAR and non - ENERGY STAR rebates available. Non-ENERGY STAR products must meet the ENERGY STAR product eligibility category definitions.

### Tables:

**Table 1: Baseline Lamp Efficacy based on Lamp Category** <sup>4 - 9, 14</sup>

Measure Category	Avg. Efficacy
A Lamp rated for 310 - 749 Lumens	27.12
A Lamp rated for 750 - 1049 Lumens	36.88
A Lamp rated for 1050 - 1489 Lumens	39.45
A Lamp rated for 1490 - 2600 Lumens	37.93
General Directional (PAR, BR, R)	18.69
Multifaceted Reflector (MR16)	13.00
Decorative (B, BA, Candle, Globe)	10.45
Downlight Retrofit Kit	24.39
Fluorescent Linear Lamps	88.70
PL/G based CFL lamp	69.30
HID Screw-in Lamp	83.20

**Table 2: Measure Lifetimes in Years** <sup>10, 12, 13</sup>

Measure Category	Lifetime
LED Interior Lamp - A Lamp	4.91
General Directional (PAR, BR, R)	5.76
Multifaceted Reflector (MR16)	5.78
Decorative (B, BA, Candle, Globe)	4.29
Downlight Retrofit Kit	10.52
LED Linear Lamps - Type A	11.8
LED Linear Lamps - Type B	10.2
LED Linear Lamps - Type C	20.0
LED PL/G based CFL Replacement lamp	9.0
LED Screw-in Lamps, HID Replacement	10.2

**Table 3: Baseline Costs** <sup>11</sup>

Measure Category	Baseline Cost
A19 60W, 750-1049 lm	\$2.84
A19 100W, 1490-2600 lm	\$3.48
Decorative (Candle/Globe)	\$1.85
BR30	\$3.34
BR40	\$7.48
MR16	\$8.65
PAR16	\$12.32
PAR20	\$6.29
R20	\$4.30

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

PAR30	\$10.96
PAR38	\$11.70
Downlight Retrofit Kit	\$8.41
LED Linear Lamps - Type A	\$2.08
LED Linear Lamps - Type B	\$2.11
LED Linear Lamps - Type C	\$2.15
LED PL/G based CFL Replacement lamp	\$7.56
LED Screw-in Lamps, HID Replacement	\$41.59

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

1. "Lighting Efficiency - CO" and "Lighting - Small Business" participation data from 2016 through 2018.
2. Deemed Savings for 2019-2020 "Product: Lighting Efficiency - CO" to reference deemed values used to create weighted
3. Net-to-Gross factor from 2016 Xcel Energy Small Business Lighting Efficiency Program Evaluation
4. Energy Independence and Security Act. United States Congress. Jan 4, 2007. [http://www1.eere.energy.gov/buildings/appliance\\_standards/commercial/pdfs/eisa\\_2007.pdf](http://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/eisa_2007.pdf)
5. Adoption of Light-Emitting Diodes in Common Lighting Applications. Prepared for the U.S. Department Of Energy by Navigant Consulting. April 2013. <http://apps1.eere.ener>
6. Caliper Benchmark Report - Performance of Incandescent A-Type and Decorative Lamps and LED Replacements. U.S. Department of Energy. November, 2008. <http://app>
7. ENERGY STAR ® Integral LED Product Qualifications
8. Caliper Benchmark Report - Performance of Halogen Incandescent MR 16 Lamps and LED Replacements. U.S. Department of Energy. November, 2008. <http://apps1.eere>
9. Incandescent Reflector Lamps minimum efficacy standards. [http://www1.eere.energy.gov/buildings/appliance\\_standards/product.aspx/productid/58](http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/58)
10. ENERGY STAR ® Certified Light Bulbs and Light Fixtures
11. Actual sales data from distributors from the past two years. Collected June 2018.
12. Design Lights Consortium (2018). Qualified Products List as of February 27, 2018. (Lamp Lifetime Hours)
13. Hours of Use to calculate measure life for lamps was determined using a weighted hours of operation from Xcel Energy 2017/2018 participation.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Motor & Drive Efficiency

#### Description:

Prescriptive rebates will be offered for new motors and replacement of currently operating motors up to 200 HP, installation of new variable frequency drives (VFD) up to 200 HP, installation of new VFD's on previously throttled water well pumps up to 200 HP, and installation of constant speed motor controllers (CSMC) on select applications from 5 HP up to 500 HP.

#### Algorithms:

Motor Electrical Energy Savings (Customer kWh)	= HP x LF_Motors x Conversion x ( 1 / Standard_Eff - 1 / High_Eff ) x Hrs x Refrigeration_Factor
Motor Electrical Demand Savings (Customer kW)	= HP x LF_Motors x Conversion x ( 1 / Standard_Eff - 1 / High_Eff ) x Refrigeration_Factor
VFD Electrical Energy Savings (Customer kWh)	= HP x LF_Drives x Conversion x ( 1 / Standard_Eff ) x Hrs x %_Savings_Drives x Refrigeration_Factor
VFD Electrical Demand Savings (Customer kW)	= HP x LF_Drives x Conversion x ( 1 / Standard_Eff ) x %_Savings_Drives x Refrigeration_Factor
CSMC Electrical Energy Savings (Customer kWh)	= HP x kW_per_HP x Hrs
CSMC Electrical Demand Savings (Customer kW)	= HP x kW_per_HP

#### Water Well Pump VFD Algorithms:

Well Pump VFD Electrical Energy Savings (Customer kWh)	= (Base_kW - VFD_kW) x Well Hours
Well Pump VFD Electrical Demand Savings (Customer kW)	= Base_kW - VFD_kW
VFD_kW	= VFD_BHP / Standard_Eff / VFD_Eff x Conversion
Base_kW	= Base_BHP / Standard_Eff x Conversion
VFD_BHP	= (Flow x VFD_Head) / (3960 x Design_Pump_Eff)
Base_BHP	= (Flow x Base_Head) / (3960 x Base_Pump_Eff)
Base_Pump_Eff	= -0.40205 x (%_Flow)^2 + 1.00876 x %_Flow + 0.20113
VFD_Head	= Static_Head + Flow_Coeff x (Flow)^2
Base_Head	= %_Design_Head x Design_Head
Static_Head	= %_Flow x (Max_Well_Depth - Average_Well_Depth) + Average_Well_Depth
Flow_Coeff	= Peak_Dynamic_Head / (Design_Flow)^2
%_Design_Head	= -0.11656 x (%_Flow)^2 - 0.34465 x %_Flow + 1.46170
%_Flow	= Flow / Design_Flow
Peak_Dynamic_Head	= Design_Head - Max_Well_Depth

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Variables:

Variable ID	Value	Description
Hrs	See Tables 1, 2, & 3 below	Annual operational hours per year of the motor. Deemed values are used for hours based on the type and use of the motor. The customer provides the following information on the rebate form: HP, industrial/non-industrial, building type, and compressor/pump/fan/other.
LF_Motors	75%	Motor load factor as a percentage. <sup>3</sup>
LF_PumpDrives	75%	Pump drive load factor as a percentage. <sup>5</sup> Excludes water well pump VFD's.
LF_FanDrives	65%	Fan drive load factor as a percentage. <sup>5</sup>
HP	Customer Input	Rated motor horsepower. Can refer to baseline motor or to proposed new motor.
High_Eff	See Table 6 - Deemed Motors Table	Efficiency of high efficiency replacement motor expressed as a percentage. New Enhanced and Upgrade Enhanced use NEMA Premium plus 1%. The customer will provide the model and serial number of the motor along with actual nameplate efficiency from the new motor. If the actual efficiency is not provided by the customer, it will be determined from specification sheet.
Standard_Eff	See Table 6 - Deemed Motors Table	Efficiency of standard replacement motor expressed as a percentage. New Enhanced measure uses NEMA Premium as its standard efficiency baseline. Upgrade Enhanced uses EPACT as its standard efficiency baseline. Customer provided motor size in HP, nominal speed in RPM, and enclosure type will select motor efficiencies from deemed table data.
%_Savings_Drives	33%	Average savings achieved by installing a VFD on a fan or pumping motor. <sup>5</sup>
kW_per_HP_Escalator	0.066	Demand savings per HP for CSMC's on escalators. <sup>9, 18</sup>
kW_per_HP_Other	0.012	Demand savings per HP for CSMC's for all other qualifying applications. <sup>7, 8, 9, 10</sup>
Refrigeration_Factor	See Table 4	Multiplier to include interactive effects of refrigeration or cooling energy to remove heat from the motors located in the refrigeration load. Reduction in motor energy results in a reduction in refrigeration/cooling energy. Equation Factor = 1 +1/COP
COP	See Table 4	Coefficient of Performance = Refrigeration/Cooling Capacity (BTU/hr) / Energy Input (BTU/hr)
<b>Well Pump VFD Variables:</b>		
Well Hours	See Table 5	Number of hours per year the well pump will operate. Deemed values are used for hours based on the well pump application that will be provided by the customer.
VFD_Eff	97%	Drive efficiency of a VFD, deemed to be 97% using a table of drive efficiency versus percent of rated power using the motor rated power. <sup>13</sup>
3960	3,960	Pump power equation constant used to convert units of feet of water and gallons per minute to HP. The calculation is 33,000 foot lbs per horsepower / 8.333 lbs per gallon.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Base_Pump_Eff	Calculated Value	Percent efficiency of the water well pump at a given percent of design flow rate. The algorithm is defined above and comes from a linear regression of a second-order polynomial on pump curve data (normalized to design head and flow) from Xcel well pump custom rebate projects. <sup>14</sup> Formula is Base Pump Efficiency = $-0.40205 \times (\%\_Flow)^2 + 1.00876 \times \%\_Flow + 0.20113$ and is a function of the Average Flow from customer information.
Design_Pump_Eff	80.8%	Pumping efficiency at given conditions (%_Flow). This algorithm comes from a second-order polynomial curve fit of achievable pump efficiency versus flow rate from custom rebates and their associated pump curves. The design pump efficiency is a constant value used at all flow rates for VFD driven pumps. <sup>14</sup>
Design_Flow	Customer Input	Flow rate (in GPM) of well pump at design conditions.
Design_Head	Customer Input	Total head (in feet of water) of well pump at design conditions.
Flow	Customer Input	Flow rate (in GPM) of well pump at proposed operating conditions. If there are multiple flow rates at which the pump will operate, this is the time-weighted average of those flow rates.
Average_Well_Depth	Customer Input	Average water level in well, i.e. vertical distance (in feet), between the pump discharge and the water level.
Max_Well_Depth	Customer Input	Minimum level in well at design flow rate, i.e. how far below the pump discharge the water level is (in feet), when the pump is operating at design flow.
%_Design_Head	Calculated Value	Percent of design total pump head occurring at a given percent of design flow rate. The algorithm is defined above and comes from a linear regression of a second-order polynomial on pump curve data (normalized to design head and flow) from seven Xcel well pump custom rebate projects. <sup>14</sup>
<b>Other Variables:</b>		
Conversion	0.746	Standard constant used to convert from HP to kW.
Coincidence Factor	78%	Probability that peak demand of the motor will coincide with peak utility system demand. Excludes water well pump VFD's. <sup>2</sup>
Coincidence Factor VFD on Well Pump	53%	Probability that peak demand of well pump motor will coincide with peak utility system demand. <sup>14</sup>
Measure Life_New Motor	20	Length of time the motor will be operational. <sup>2, 3, 11</sup>
Measure Life_Upgrade Motor	20	Length of time the motor will be operational. <sup>2, 3, 11</sup>
Measure Life_VFD	15	Length of time the VFD will be operational. <sup>3, 11</sup> Includes water well pump VFD's.
Measure Life_CSMC	20	Length of time the controller will be operational. <sup>2, 11</sup>
Incremental O&M Costs or Savings	\$0.00	Non energy costs or savings associated with the measure
Incremental Cost_Motors	See Table 6	Deemed Cost Table for Incremental cost
Incremental Cost_VFD	See Table 7	All VFD's including water well pumps.
Incremental Cost_CSMC	See Table 3	Deemed Cost Table for Constant Speed Motor Controllers
NTG_CSMC	95%	Net-to-Gross factor for CSMC's. <sup>6</sup>
NTG_Other	65%	Net-to-Gross factor for motor replacement, VFD's, and custom products. <sup>6</sup>

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Inputs provided by customer:	Verified during M&V:
<b>For Motors:</b>	
New motor model and serial number (HP, efficiency, type, and speed can then be looked up in a database)	Yes
Application of motor (Industrial/non-industrial)	Yes
Building type where motor is installed for non-industrial motors	Yes
Use of motor (pump, fan, other) for non-industrial motors	Yes
Equipment is installed	Yes
<b>For VFD's:</b>	
Size, speed, type and use of motor drive is connected to (if speed & enclosure information is not available we will deem 1800 RPM, and the average between TEFC and ODP for the given motor HP)	Yes
Application of motor (Industrial/non-industrial)	Yes
Building type where motor is installed for non-industrial motors	Yes
Use of motor (pump, fan, other) for non-industrial motors	Yes
Equipment is installed	Yes
<b>For Constant Speed Motor Controllers:</b>	
Size of motor	Yes
Application of motor (Escalator/Other that qualify)	Yes
<b>For Water Well Pump VFD's:</b>	
Pump Rated HP	Yes
Design Flow (GPM)	Yes
Design Head (ft)	Yes
Well Depth (ft)	No
Max Well Depth at design flow (ft)	No
Average Flow Rate (GPM)	No
Application of well pump (agriculture, golf course, municipal, etc.)	Yes
<b>Assumptions:</b>	
- Each motor is replaced with the same size on a 1 for 1 basis. Motors replaced with different sizes can participate in the Custom Efficiency product.	
- Prescriptive rebates are only given for motors put into service, rebates are not given for backup motors.	
- Prescriptive rebates are only given to VFD's installed on centrifugal pump or fan applications.	
- Rebates do not apply to rewound or repaired motors.	
- Constant speed motor controllers are only eligible if installed on escalators, or industrial/commercial applications that cannot be shut off or slowed down during normal business operation, and operate at a load factor of less than 20% more than 65% of the time.	
- COP for Low Temperature Applications and Medium Temperature Applications are from our anti-sweat heater projects, EC Motor custom projects, and are consistent with custom projects from various custom refrigeration applications.	
- COP for Data Center Applications based on custom projects from various custom data center applications.	
<b>Water Well Pump VFD Assumptions:</b>	
- Existing system is controlled by a throttling valve.	

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

- Pump efficiency for the proposed VFD case is constant at all flows and equal to the design pump efficiency. The baseline pump efficiency depends on the flow rate.
- Static head varies linearly with flow rate and ranges from static water level to max well depth.
- Backup well pumps do not qualify, only primary pumps.
  
- On-Peak operation (pump will operate below 100% speed during 9a-9p, M-F in summer).

**Table 1: Operating Hours by Motor Size, Industrial Applications<sup>5</sup>**

HP	Fans	Pumps	Air Compressor	Other
1	4,550	3,380	1,257	2,435
1.5	4,550	3,380	1,257	2,435
2	4,550	3,380	1,257	2,435
3	4,550	3,380	1,257	2,435
5	4,550	3,380	1,257	2,435
7.5	4,316	4,121	2,131	2,939
10	4,316	4,121	2,131	2,939
15	4,316	4,121	2,131	2,939
20	4,316	4,121	2,131	2,939
25	5,101	4,889	3,528	3,488
30	5,101	4,889	3,528	3,488
40	5,101	4,889	3,528	3,488
50	5,101	4,889	3,528	3,488
60	6,151	5,667	4,520	5,079
75	6,151	5,667	4,520	5,079
100	6,151	5,667	4,520	5,079
125	5,964	5,126	4,685	5,137
150	5,964	5,126	4,685	5,137
200	5,964	5,126	4,685	5,137
250	7,044	5,968	6,148	6,102
300	7,044	5,968	6,148	6,102
350	7,044	5,968	6,148	6,102
400	7,044	5,968	6,148	6,102
450	7,044	5,968	6,148	6,102
500	7,044	5,968	6,148	6,102

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 2: Operating Hours by Application for all products other than motor controllers, Non-Industrial<sup>3</sup>**

Building Type	Operating Hours
Office HVAC Pump	2,000
Retail HVAC Pump	2,000
Hospitals HVAC Pump	2,754
Elem/Sec Schools HVAC Pump	2,190
Restaurant HVAC Pump	2,000
Warehouse HVAC Pump	2,241
Hotels/Motels HVAC Pump	4,231
Grocery HVAC Pump	2,080
Health HVAC Pump	2,559
College/Univ HVAC Pump	3,641
Office Ventilation Fan	6,192
Retail Ventilation Fan	3,261
Hospitals Ventilation Fan	8,374
Elem/Sec Schools Ventilation Fan	3,699
Restaurant Ventilation Fan	4,155
Warehouse Ventilation Fan	6,389
Hotels/Motels Ventilation Fan	3,719
Grocery Ventilation Fan	6,389
Health Ventilation Fan	2,000
College/Univ Ventilation Fan	3,631
Office Other Application	4,500
Retail Other Application	4,500
Hospitals Other Application	4,500
Elem/Sec Schools Other Application	4,500
Restaurant Other Application	4,500
Warehouse Other Application	4,500
Hotels/Motels Other Application	4,500
Grocery Other Application	4,500
Health Other Application	4,500
College/Univ Other Application	4,500
Data Center Pump	8,760
Data Center Fan	8,760
Low Temperature Case Fan	8,629
Medium Temperature Case Fan	8,629

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 3: Operating Hours & Incremental Cost for Motor Controllers by Application, Non-Industrial<sup>10</sup>**

Building Type & Motor Application	Escalator	Industrial	Incremental Cost
5	4,500	2,435	\$918
7.5	4,500	2,939	\$918
10	4,500	2,939	\$918
15	4,500	2,939	\$918
20	4,500	2,939	\$933
25	4,500	3,488	\$1,012
30	4,500	3,488	\$1,091
40	4,500	3,488	\$1,300
50	4,500	3,488	\$1,497
60	4,500	5,079	\$1,796
75	4,500	5,079	\$1,943
100	4,500	5,079	\$2,389
125	4,500	5,137	\$3,087
150	4,500	5,137	\$3,784
200	4,500	5,137	\$4,555
250	4,500	6,102	\$4,655
300	4,500	6,102	\$4,755
350	4,500	6,102	\$4,855
400	4,500	6,102	\$4,955
450	4,500	6,102	\$5,055
500	4,500	6,102	\$5,155

**Table 4: Coefficient of Performance**

Application	kW / Ton Refrig.	COP	kW Factor
Low Temperature	2.459	1.43	1.70
Medium Temperature	1.543	2.28	1.44
Data Center	0.879	4.00	1.25

**Table 5: Operating Hours by Application for Well Pumps<sup>14, 15, 16, 17</sup>**

Application	Operating Hours
Agricultural Irrigation	1,954
Golf & Landscape Irrigation	1,941
Municipal Water Supply	3,177
Other Water Well Pump	3,630

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

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3. Efficiency Vermont's Technical Reference User Manual, 2004 - Source for operating hours for non-industrial motors (p.15) and source for measure life, source for load factor
4. Not used
5. Office of Industrial Electric Motor Systems Market Opportunities Assessment : Department of Energy (assessment of 265 Industrial facilities in 1997) - Source for VSD opportunity in the US market along with load factors for fans and pumps along with average savings
6. Net-to-gross factor from Program Evaluation in 2010 by third party and other sources for new products.
7. Example is constructed based on the methodology presented in Esource Document, adapted to 200 hp motor. Originally from: Blake Ogden (January 2006), Senior Applications Engineer, Power Efficiency Corp., 702-697-0377 ext 101, bogden@powerefficiencycorp.com.
8. Installed costs gathered by E-Source presented in TAS-F-1, March 2007 from: Power Efficiency Corp.'s PowerGenius, Blake Ogden (January 2006) 4; Somar International's Powerboss, Paul Isom(January 2007), Vice President for Business Development, Mialink Companies, paul@mialink.com; Motortronics' XLD Series, Southland Electrical Supply, from www.southlandelectrical.com (January 2007); and Magnetek's RVS-DN Series, Joliett Technologies, from www.joliettech.com (January 2007).
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25. Energy Conservation Program: Energy Conservation Standards for Commercial and Industrial Electric Motors

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## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Stipulated Values

Load Factor <sup>3</sup>	75%	( 1 HP = .746 kW)
Conversion	0.746	
Coincidence Factor <sup>2</sup>	78%	
Measure Life New Motors <sup>2, 3, 5</sup>	20	
Measure Life Upgrade Motor <sup>2, 3, 5</sup>	20	

**Table 6: Motor Efficiency and Incremental Costs<sup>1, 19, 20, 25</sup>**

Motor Tag	HP	Speed	Type	EPACT Motor Efficiency	NEMA Premium Motor Efficiency	NEMA Premium +1% Motor Efficiency	NEMA Premium Installed Cost	NEMA Premium +1% Installed Cost
1 HP 900 RPM ODP	1	900	ODP	74.0%	75.5%	76.5%	\$637	\$769
1.5 HP 900 RPM ODP	1.5	900	ODP	75.5%	77.0%	78.0%	\$682	\$832
2 HP 900 RPM ODP	2	900	ODP	85.5%	86.5%	87.5%	\$680	\$829
3 HP 900 RPM ODP	3	900	ODP	86.5%	87.5%	88.5%	\$706	\$866
5 HP 900 RPM ODP	5	900	ODP	87.5%	88.5%	89.5%	\$740	\$914
7.5 HP 900 RPM ODP	7.5	900	ODP	88.5%	89.5%	90.5%	\$936	\$1,191
10 HP 900 RPM ODP	10	900	ODP	89.5%	90.2%	91.2%	\$1,067	\$1,376
15 HP 900 RPM ODP	15	900	ODP	89.5%	90.2%	91.2%	\$1,973	\$2,393
20 HP 900 RPM ODP	20	900	ODP	90.2%	91.0%	92.0%	\$2,179	\$2,684
25 HP 900 RPM ODP	25	900	ODP	90.2%	91.0%	92.0%	\$2,442	\$3,057
30 HP 900 RPM ODP	30	900	ODP	91.0%	91.7%	92.7%	\$2,639	\$3,335
40 HP 900 RPM ODP	40	900	ODP	91.0%	91.7%	92.7%	\$3,003	\$3,850
50 HP 900 RPM ODP	50	900	ODP	91.7%	92.4%	93.4%	\$3,269	\$4,227
60 HP 900 RPM ODP	60	900	ODP	92.4%	93.0%	94.0%	\$3,981	\$5,233
75 HP 900 RPM ODP	75	900	ODP	93.6%	94.1%	95.1%	\$4,612	\$6,127
100 HP 900 RPM ODP	100	900	ODP	93.6%	94.1%	95.1%	\$5,896	\$7,677
125 HP 900 RPM ODP	125	900	ODP	93.6%	94.1%	95.1%	\$7,057	\$9,319
150 HP 900 RPM ODP	150	900	ODP	93.6%	94.1%	95.1%	\$8,134	\$10,842
200 HP 900 RPM ODP	200	900	ODP	93.6%	94.1%	95.1%	\$9,764	\$13,148
250 HP 900 RPM ODP	250	900	ODP	94.5%	95.0%	96.0%	\$10,815	\$14,636
300 HP 900 RPM ODP	300	900	ODP	94.5%	95.0%	96.0%	\$13,293	\$18,140
350 HP 900 RPM ODP	350	900	ODP	94.5%	95.0%	96.0%	\$24,766	\$34,370
400 HP 900 RPM ODP	400	900	ODP	94.9%	95.1%	96.1%	\$28,224	\$39,260
450 HP 900 RPM ODP	450	900	ODP	95.3%	95.5%	96.5%	\$31,975	\$44,566
500 HP 900 RPM ODP	500	900	ODP	95.3%	95.5%	96.5%	\$33,093	\$46,149

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 6: Motor Efficiency and Incremental Costs<sup>1, 19, 20, 25</sup>**

Motor Tag	HP	Speed	Type	EPACT Motor Efficiency	NEMA Premium Motor Efficiency	NEMA Premium +1% Motor Efficiency	NEMA Premium Installed Cost	NEMA Premium +1% Installed Cost
1 HP 1200 RPM ODP	1	1200	ODP	80.0%	82.5%	83.5%	\$637	\$769
1.5 HP 1200 RPM ODP	1.5	1200	ODP	84.0%	86.5%	87.5%	\$682	\$832
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3 HP 1200 RPM ODP	3	1200	ODP	86.5%	88.5%	89.5%	\$706	\$866
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7.5 HP 1200 RPM ODP	7.5	1200	ODP	88.5%	90.2%	91.2%	\$936	\$1,191
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5 HP 1800 RPM ODP	5	1800	ODP	87.5%	89.5%	90.5%	\$740	\$914
7.5 HP 1800 RPM ODP	7.5	1800	ODP	88.5%	91.0%	92.0%	\$936	\$1,191
10 HP 1800 RPM ODP	10	1800	ODP	89.5%	91.7%	92.7%	\$1,067	\$1,376
15 HP 1800 RPM ODP	15	1800	ODP	91.0%	93.0%	94.0%	\$1,973	\$2,393
20 HP 1800 RPM ODP	20	1800	ODP	91.0%	93.0%	94.0%	\$2,179	\$2,684
25 HP 1800 RPM ODP	25	1800	ODP	91.7%	93.6%	94.6%	\$2,442	\$3,057

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 6: Motor Efficiency and Incremental Costs**<sup>1, 19, 20, 25</sup>

Motor Tag	HP	Speed	Type	EPACT Motor Efficiency	NEMA Premium Motor Efficiency	NEMA Premium +1% Motor Efficiency	NEMA Premium Installed Cost	NEMA Premium +1% Installed Cost
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**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

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300 HP 1200 RPM TEFC	300	1200	TEFC	95.0%	95.8%	96.8%	\$13,293	\$18,140
350 HP 1200 RPM TEFC	350	1200	TEFC	95.0%	95.8%	96.8%	\$24,766	\$34,370
400 HP 1200 RPM TEFC	400	1200	TEFC	95.0%	95.8%	96.8%	\$28,224	\$39,260
450 HP 1200 RPM TEFC	450	1200	TEFC	95.0%	95.8%	96.8%	\$31,975	\$44,566
500 HP 1200 RPM TEFC	500	1200	TEFC	95.0%	95.8%	96.8%	\$33,093	\$46,149
1 HP 1800 RPM TEFC	1	1800	TEFC	82.5%	85.5%	86.5%	\$637	\$769
1.5 HP 1800 RPM TEFC	1.5	1800	TEFC	84.0%	86.5%	87.5%	\$682	\$832
2 HP 1800 RPM TEFC	2	1800	TEFC	84.0%	86.5%	87.5%	\$680	\$829
3 HP 1800 RPM TEFC	3	1800	TEFC	87.5%	89.5%	90.5%	\$706	\$866
5 HP 1800 RPM TEFC	5	1800	TEFC	87.5%	89.5%	90.5%	\$740	\$914
7.5 HP 1800 RPM TEFC	7.5	1800	TEFC	89.5%	91.7%	92.7%	\$936	\$1,191
10 HP 1800 RPM TEFC	10	1800	TEFC	89.5%	91.7%	92.7%	\$1,067	\$1,376
15 HP 1800 RPM TEFC	15	1800	TEFC	91.0%	92.4%	93.4%	\$1,973	\$2,393
20 HP 1800 RPM TEFC	20	1800	TEFC	91.0%	93.0%	94.0%	\$2,179	\$2,684
25 HP 1800 RPM TEFC	25	1800	TEFC	92.4%	93.6%	94.6%	\$2,442	\$3,057
30 HP 1800 RPM TEFC	30	1800	TEFC	92.4%	93.6%	94.6%	\$2,639	\$3,335
40 HP 1800 RPM TEFC	40	1800	TEFC	93.0%	94.1%	95.1%	\$3,003	\$3,850
50 HP 1800 RPM TEFC	50	1800	TEFC	93.0%	94.5%	95.5%	\$3,269	\$4,227
60 HP 1800 RPM TEFC	60	1800	TEFC	93.6%	95.0%	96.0%	\$3,981	\$5,233
75 HP 1800 RPM TEFC	75	1800	TEFC	94.1%	95.4%	96.4%	\$4,612	\$6,127

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 6: Motor Efficiency and Incremental Costs<sup>1, 19, 20, 25</sup>**

Motor Tag	HP	Speed	Type	EPACT Motor Efficiency	NEMA Premium Motor Efficiency	NEMA Premium +1% Motor Efficiency	NEMA Premium Installed Cost	NEMA Premium +1% Installed Cost
100 HP 1800 RPM TEFC	100	1800	TEFC	94.5%	95.4%	96.4%	\$5,896	\$7,677
125 HP 1800 RPM TEFC	125	1800	TEFC	94.5%	95.4%	96.4%	\$7,057	\$9,319
150 HP 1800 RPM TEFC	150	1800	TEFC	95.0%	95.8%	96.8%	\$8,134	\$10,842
200 HP 1800 RPM TEFC	200	1800	TEFC	95.0%	96.2%	97.2%	\$9,764	\$13,148
250 HP 1800 RPM TEFC	250	1800	TEFC	95.0%	96.2%	97.2%	\$10,815	\$14,636
300 HP 1800 RPM TEFC	300	1800	TEFC	95.4%	96.2%	97.2%	\$13,293	\$18,140
350 HP 1800 RPM TEFC	350	1800	TEFC	95.4%	96.2%	97.2%	\$24,766	\$34,370
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450 HP 1800 RPM TEFC	450	1800	TEFC	95.4%	96.2%	97.2%	\$31,975	\$44,566
500 HP 1800 RPM TEFC	500	1800	TEFC	95.8%	96.2%	97.2%	\$33,093	\$46,149
1 HP 3600 RPM TEFC	1	3600	TEFC	75.5%	77.0%	78.0%	\$637	\$769
1.5 HP 3600 RPM TEFC	1.5	3600	TEFC	82.5%	84.0%	85.0%	\$682	\$832
2 HP 3600 RPM TEFC	2	3600	TEFC	84.0%	85.5%	86.5%	\$680	\$829
3 HP 3600 RPM TEFC	3	3600	TEFC	85.5%	86.5%	87.5%	\$706	\$866
5 HP 3600 RPM TEFC	5	3600	TEFC	87.5%	88.5%	89.5%	\$740	\$914
7.5 HP 3600 RPM TEFC	7.5	3600	TEFC	88.5%	89.5%	90.5%	\$936	\$1,191
10 HP 3600 RPM TEFC	10	3600	TEFC	89.5%	90.2%	91.2%	\$1,067	\$1,376
15 HP 3600 RPM TEFC	15	3600	TEFC	90.2%	91.0%	92.0%	\$1,973	\$2,393
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40 HP 3600 RPM TEFC	40	3600	TEFC	91.7%	92.4%	93.4%	\$3,003	\$3,850
50 HP 3600 RPM TEFC	50	3600	TEFC	92.4%	93.0%	94.0%	\$3,269	\$4,227
60 HP 3600 RPM TEFC	60	3600	TEFC	93.0%	93.6%	94.6%	\$3,981	\$5,233
75 HP 3600 RPM TEFC	75	3600	TEFC	93.0%	93.6%	94.6%	\$4,612	\$6,127
100 HP 3600 RPM TEFC	100	3600	TEFC	93.6%	94.1%	95.1%	\$5,896	\$7,677
125 HP 3600 RPM TEFC	125	3600	TEFC	94.5%	95.0%	96.0%	\$7,057	\$9,319
150 HP 3600 RPM TEFC	150	3600	TEFC	94.5%	95.0%	96.0%	\$8,134	\$10,842
200 HP 3600 RPM TEFC	200	3600	TEFC	95.0%	95.4%	96.4%	\$9,764	\$13,148
250 HP 3600 RPM TEFC	250	3600	TEFC	95.4%	95.8%	96.8%	\$10,815	\$14,636
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350 HP 3600 RPM TEFC	350	3600	TEFC	95.4%	95.8%	96.8%	\$24,766	\$34,370
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450 HP 3600 RPM TEFC	450	3600	TEFC	95.4%	95.8%	96.8%	\$31,975	\$44,566
500 HP 3600 RPM TEFC	500	3600	TEFC	95.4%	95.8%	96.8%	\$33,093	\$46,149

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

VFDs  
 460V, 3 phase, normal duty  
 HP rated as constant torque  
 All NEMA 1 enclosure or less

**Table 7: ASD Costs**<sup>21, 22, 23, 24</sup>

HP	Avg. Motor MSRP	Motor less discount plus mark-up and inflation	Installed Loaded
1	\$782	\$702	\$1,053
1.5	\$1,234	\$741	\$1,111
2	\$1,299	\$779	\$1,169
3	\$1,433	\$1,578	\$2,367
5	\$1,689	\$1,762	\$2,642
7.5	\$2,075	\$1,891	\$2,837
10	\$2,352	\$2,039	\$3,058
15	\$2,969	\$2,702	\$4,053
20	\$3,804	\$3,477	\$5,216
25	\$4,664	\$4,337	\$6,506
30	\$5,504	\$4,635	\$6,952
40	\$6,770	\$5,262	\$7,893
50	\$8,386	\$7,609	\$11,414
60	\$10,094	\$9,310	\$13,965
75	\$11,814	\$10,509	\$15,764
100	\$15,433	\$11,856	\$17,785
125	\$19,836	\$12,789	\$19,184
150	\$25,897	\$15,101	\$22,651
200	\$35,992	\$19,652	\$29,478

Average % savings <sup>5</sup>	33%
Measure Life (years) <sup>3, 11</sup>	15
Pumping Load Factor <sup>5</sup>	75%
Fan Load Factor <sup>5</sup>	65%
Average Load Factor	70%

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Program: Multifamily Buildings - CO**

**Description:**

Multifamily buildings that are electric and natural gas customers can receive an energy assessment and direct-install measures they are eligible for based on the assessment at no additional cost. These customers will also be eligible to participate in larger, capital-intensive projects that offer rebates for custom and prescriptive measures.

**Program References:**

Measure "Direct Install - LED"	Refer to Product "CO Home Lighting & Recycling" for calculation methodology. See table 1 for incremental cost of measures.
Measure "Direct Install - Low-Flow Showerhead"	Refer to Product "CO Energy Efficient Showerheads" for calculation methodology. See table 1 for incremental cost of measures.
Measure "Direct Install - Kitchen Aerator"	Refer to Product "CO Energy Efficient Showerheads" for calculation methodology. See table 1 for incremental cost of measures.
Measure "Direct Install - Bath Aerator"	Refer to Product "CO Energy Efficient Showerheads" for calculation methodology. See table 1 for incremental cost of measures.
Measure "Direct Install - LED Exit Sign"	Refer to Product "CO Lighting Efficiency" for calculation methodology. See table 1 for incremental cost of measures.

Variable ID	Value	Description
NTG	100%	Net-to-gross factor.
Incremental Cost	See Table 1	Incremental cost of direct install measures

Table 1	Incremental Cost
Showerhead - Regular	\$14.88
Showerhead - Handheld	\$21.02
Kitchen Aerator	\$5.20
Bath Aerator	\$4.17
Bath Aerator 0.5GPM	\$4.22
LED Globe	\$5.45
LED A19 Energy Star Rated Lamp	\$5.35
LED Candelabra	\$5.41
LED BR30 Flood	\$5.48
LED Exit Kit	\$24.78

Inputs Provided by Customer or Vendor:	Verified during M&V:
Wattage of LEDs installed	Yes
Quantity of each Wattage of LEDs installed	Yes
Quantity of primary showerheads installed	Yes
Quantity of handheld showerheads installed	Yes
Quantity of kitchen faucet aerators installed	Yes
Quantity of bathroom faucet aerators installed	Yes
Quantity of water heater blankets installed	Yes
Quantity of LED Exit sign retrofits installed	Yes

**Changes from 2017 / 2018 Plan**

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Product: Recommissioning - CO**

**Description:**

Recommissioning is a special product that involves a Study phase and an Implementation phase. The customer may apply for a rebate under the Recommissioning product. Each Recommissioning project will be analyzed on an individual basis by Xcel Energy; this includes project that identify load shifting opportunities. A qualified engineering vendor will perform the study and provide a report and technical calculations to Xcel Energy for review. Analysis will be based on standard engineering methodologies. Customers may also submit for the implementation of a proposed "Fast Track" project without going through the Recommissioning Study phase, as long as they have performed a study. Recommissioning projects do not have to demonstrate a TRC factor greater than one, this is on a project-by-project basis. In that regard, the product is similar to deemed products. In most other respects, it is a custom product.

Small Building Tune-Up (SBTU) is a measure under the Recommissioning product. SBTU provides a smaller scale recommissioning-type study for buildings between 5,000 and 50,000 square feet. Study-driven credit is taken for the implementation of quick payback, low-cost, no-cost and behavioral measures identified by the study.

**Program References:**

None	

**Algorithms (Building Operator Certification):**

Customer_kWh	= BOC_Electric x Building_Area
Customer_kW	= Customer_kWh / Hours
Peak_Coincident_kW	= Customer_kW * CF
Customer_Therms	= BOC_Gas x Building_Area

Variable ID	Value	Description
NTG	90%	The net-to-gross factor is assumed, and based on the following justification: The customer would not have known about energy-saving opportunities without using our product to complete a study. If the opportunities were already known to the customer, then they would have done them on their own; due to the high likelihood that the opportunities are low-cost, or no-cost, items with very quick paybacks.
Measure Life	7	Persistence of the Recommissioning product (product life) comes from Reference 1.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Variables (Building Operator Certification):

BOC_Electric	0.109982	kWh/sqft of attributable savings (Reference 1)
BOC_Gas	0.006918	Therms/sqft of attributable savings (Reference 1)
Building_Area	Customer Input	Area of building
Hours	8760	Annual hours of operation
Measure Lifetime (years)	5	Building Operator Certification measure life (Reference 4)
Unit Participant Incremental Cost	\$1,995	Cost of course per participant
CF	54%	Average CF from Recommissioning projects with < 1 year payback

### Inputs:

None	<b>Verified during M&amp;V:</b>

### Assumptions:

None
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### Tables:

None
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### References:

<ol style="list-style-type: none"> <li>1. Recommissioning Persistence - Task 1 Benchmarking Deliverable 040607.pdf</li> <li>2. MN Department of Energy Resource Technical Reference Manual 2015 Version 2.1</li> <li>3. U.S Energy Administration Information Commercial Buildings Energy Consumption Survey 2012: <a href="https://www.eia.gov/consumption/commercial/data/2012/">https://www.eia.gov/consumption/commercial/data/2012/</a></li> <li>4. BOC-Expansion Initiative Market Progress Evaluation Report #1; <a href="http://theboc.info/pdf/Eval-BOC-expansion-initiative-market-progress-0414.pdf">http://theboc.info/pdf/Eval-BOC-expansion-initiative-market-progress-0414.pdf</a></li> </ol>

### Changes from 2017 / 2018 Plan:

<ol style="list-style-type: none"> <li>1. Small Building Tune-Up was changed to apply to buildings from 5,000 to 50,000 sq. ft. Previously applied to buildings with less than 75,000 sq. ft.</li> <li>2. TDLF was removed from the Deemed Savings tab. This is provided on the Utility Information tab.</li> <li>3. Added load shifting as a possible measure.</li> <li>4. Added Building Operator Certification</li> </ol>
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## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Self Direct

The Self-Direct product will provide large commercial and industrial customers in Colorado the opportunity to self-fund electric energy conservation projects at their facilities. Customers who engineer, implement, and commission qualifying projects will receive rebates to offset their costs to implement efficient projects.

### Calculations:

Electrical energy savings and electrical demand savings will be calculated based on the actual savings from a project.

A net-to-gross factor of 91% will be used for Self-Direct projects. The NTG assumption (91%) was developed based on the weighted average of the net-to-gross factors from our stand alone programs, using the weighting from previously completed self-direct projects.

Measure life and operation and maintenance savings will be calculated for each project.

### Changes from 2017 / 2018 Plan:

No changes.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Product: Strategic Energy Management - CO**

**Description:**

The Strategic Energy Management program targets **large commercial energy users** and energy intensive processes at large industrial facilities. **These customers will have installed energy information systems as part of their enrollment.** Customers who implement identified upgrades may receive rebates for large process changes that are not completed through Custom Efficiency or the prescriptive products. Calculations for prescriptive products will follow the methodologies described in end use program with the exception of net to gross.

**Program References:**

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**Equations:**

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Variable ID	Value	Description
NTG	90%	Net to Gross

**Inputs:**

**Verified during M&V:**


**Assumptions:**

A net-to-gross factor of 100% will be used for EIS measures.
Lifetime for recommissioning measures is 7 years per Recommissioning program filing.
Lifetime for manual adjustments will be verified through on-site metering and will not exceed the term of the customer's enrollment in the program.
Lifetime for Systemic O&M assumed to be 3 years

**Tables:**

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**References:**

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

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### Changes from 2017 / 2018 Plan:

1. Addition of Systemic O&M measures
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## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Program: Energy Savings Kit

#### Description:

A package of home energy efficiency measures in a kit that will be distributed to low-income customers. Each participant receives a kit containing a high-efficiency showerhead, two high efficiency sink aerators (1.0 GPM and 1.5 GPM), and eight LED bulbs, 10 Watts each.

#### Program References:

Measures "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PckW, etc. for the "Efficient Showerhead" measures.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PckW, etc. for the "Efficient Kitchen Faucet Aerator" measure.
Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PckW, etc. for the "Efficient Bath Faucet Aerator" measure.
Replace incandescent lamps with LEDs	Refer to Program CO Home Lighting & Recycling to find formulas for Customer kW, Customer kWh, Customer PckW for the "Replace incandescent lamp with LED".
Measure "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Measure Life", "Hours", "Coincidence Factor", etc values.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Measure Life", "Hours", "Coincidence Factor", etc values.
Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Measure Life", "Hours", "Coincidence Factor", etc values.
Measure "LED"	Refer to Program "Home Lighting and Recycling - CO" to find references and tables for "Measure Life", "Hours", "Coincidence Factor", etc values.
Measure "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for Operation and Maintenance cost savings value due to water savings.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for Operation and Maintenance cost savings value due to water savings.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Operation and Maintenance cost savings", value due to water savings.

### Algorithms:

All measures	Refer to Source Programs for energy savings calculation algorithms.
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### Variables:

Energy O&M savings	Varies by customer	= Savings attributed to savings of fuel not served by Xcel Energy. Varies by customer depending on customer type and water heating fuel.
Net-to-Gross Factor (NTG)	100%	= We will use 100% as these kits would not be available without the product.
Install Rate	Table 1	= Installation rates will be determined during the year.
Incremental Costs for all measures	Input	= costs provided by vendor.

### Inputs:

	Verified during
<b>Provided by Vendor/customer:</b>	<b>M&amp;V:</b>
Number of kits distributed	Yes
Number of LEDs installed	Yes
Showerhead Installed	Yes
Kitchen aerator installed	Yes
Bath aerator installed	Yes

### Assumptions:

Savings shown above include homes with either electric or gas water heaters. The Energy Efficient Showerhead - CO program monitors and establishes a gas split factor for use in homes where the water heater type is unknown. Energy Savings Kits will use the Energy Efficient Showerhead - CO program's gas split factor for unknown water heater types to calculate and claim energy savings.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Tables:

**Table 1**

Measure	Install Rate
Replace incandescent lamps with LEDs	74.60%
Provide Efficient Showerhead - Electric Water Heater	70.10%
Provide Efficient Kitchen Faucet Aerator - Electric Water Heater	64.00%
Provide Efficient Bath Faucet Aerator - Electric Water Heater	68.10%

### References:

See Reference Programs  
Energy Efficient Showerhead - CO  
Home Lighting and Recycling - CO

### Changes from 2017 / 2018 Plan

Cleaned up Deemed sheet  
Added table for install rate in deemed sheet

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Product: Low Income Multi-Family Weatherization - CO**

**Description:**

Multi-Family buildings that are Xcel Energy customers may apply for rebates under the Low Income Multi-Family Weatherization product. Rebates are for implementing energy efficiency measures that will reduce energy bills. Projects must demonstrate a positive total resource cost test score for each fuel purchased from Xcel Energy. Passing projects receive a rebate that is equivalent to 100% of the project incremental cost. This is a custom product.

<b>Variable ID</b>	<b>Value</b>	<b>Description</b>
NTG	100%	Net-to-Gross factor
Measure Life	Varies	Measure life is project dependent. The measure life of each energy efficiency measure implemented in the project is used to create a weighted average measure life for the project.

**References:**

None

**Changes from 2017 / 2018 Plan**

- 1. Revised product description
- 2. Added net-to-gross and measure life to the variable ID list

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Low Income Non-Profit Weatherization - CO

#### Description:

Non-Profit organizations that are Xcel Energy customers may apply for rebates under the Low Income Non-Profit Weatherization product. Rebates are for implementing energy efficiency measures that will reduce energy bills. Projects must demonstrate a positive total resource cost test score for each fuel purchased from Xcel Energy. Passing projects receive a rebate that is equivalent to 100% of the project incremental cost. This is a custom product.

Variable ID	Value	Description
NTG	100%	Net-to-Gross factor
Measure Life	Varies	Measure life is project dependent. The measure life of each energy efficiency measure implemented in the project is used to create a weighted average measure life for the project.

#### References:

None

#### Changes from 2017 / 2018 Plan

1. Revised product description
2. Added net-to-gross and measure life to the variable ID list

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Program: Low Income SF Weatherization - CO

#### Description:

Residential income-qualified natural gas and electricity customers have energy efficiency measures performed at no cost.

#### Program References:

Measures "Refrigerator Replacements"	Refer to Program "Refrigerator Recycling - CO" to find formulas for (Customer Dth, Customer kW, Customer kWh, Customer PCkW, etc.) for all "Refrigerator Replacements" measures.
Measures "Heating Efficiency" and "EC Motor Furnace Fan"	Refer to Program "Residential Heating - CO" to find formulas for (Customer Dth, Customer kW, Customer kWh, Customer PCkW, etc.) for all "Heating Efficiency" measures.
Measures for "Water Heating Efficiency"	Refer to Program "Water Heating - CO" to find formulas for (Customer Dth, Customer kW, Customer kWh, Customer PCkW, etc.) for all "Water Heating Efficiency" measures.
Measures "Attic Insulation", "Wall Insulation", and "Air Sealing"	Refer to Program "Insulation Rebates - CO" to find formulas for (Customer kW, Customer kWh, Customer PCkW, etc.) for all "Attic Insulation", "Wall Insulation", and "Air Sealing" measures.
Measures "LEDs"	Refer to Program "Home Lighting and Recycling - CO" to find formulas for (Customer kW, Customer kWh, Customer PCkW, etc.) for the "LED" measures.
Measures "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PCkW, etc. for the "Efficient Showerhead" measures.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PCkW, etc. for the "Efficient Kitchen Faucet Aerator" measure.
Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PCkW, etc. for the "Efficient Bath Faucet Aerator" measure.
Measures "Install New Thermostat"	Refer to Program "Home Energy Squad - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PCkW, etc. for the "Install New Thermostat" measure.
Measures "Water Heater Blanket"	Refer to Program "Home Energy Squad - CO" to find formulas for Customer Dth, Customer kWh, Customer kW, Customer PCkW, etc. for the measure "Water Heater Blanket".
Measures "Heating Efficiency" and "EC Motor Furnace Fan"	Refer to Program "Residential Heating - CO" to find values for Heating Hours, Coincidence Factors, Measure Life, EC Motor Baseline Watts and EC Motor Efficient Watts and EC Motor Operating Hours.
Measures "Attic Insulation", "Wall Insulation", "Crawl Space Wall", and "Air Sealing"	Refer to Program "Insulation Rebates - CO" to find reference table for Measure Life, Deemed and Customer Inputs, Heating and Cooling Degree Days, Climate Zone data, Heating and Cooling Hour Data values, Measure Life.
Measures "Storm Windows"	Refer to Program "Residential Heating - CO" to find values for Heating Hours, Measure Life. For use in the Storm Windows Customer kW calculation.

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Measure "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Measure Life", "Hours", "Coincidence Factor", etc values.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Measure Life", "Hours", "Coincidence Factor", etc values.
Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Measure Life", "Hours", "Coincidence Factor", etc values.
Measures "Water Heating Efficiency"	Refer to Program "Water Heating - CO" to find references for baseline water heater efficiency, tank sizes, Measure Life, incremental costs.
Measures "Install New Thermostat"	Refer to Program "Home Energy Squad - CO" to find references and deemed savings values, Measure Life for the "Install New Thermostat" measure.
Measures "Water Heater Blanket"	Refer to Program "Home Energy Squad - CO" to find references for deemed savings values, tank sizes, Measure Life, incremental costs.
Measure "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for Operation and Maintenance cost savings value due to water savings.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for Operation and Maintenance cost savings value due to water savings.
Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Operation and Maintenance cost savings", value due to water savings.

**Algorithms:**

**Crawl Space Wall Insulation:**

Customer Dth	$= ( 1 / R\_Crawl\_Space\_Wall\_Base - 1 / R\_Crawl\_Space\_Wall\_Proposed ) * Wall\_Area * HDD\_Insulation * 24 / 1,000,000 / Heating\_Eff\_Gas$
Customer kWh	$= ( 1 / R\_Crawl\_Space\_Wall\_Base - 1 / R\_Crawl\_Space\_Wall\_Proposed ) * Wall\_Area * HDD\_Insulation * 24 / 3,412 / Heating\_Eff\_Elec$
Customer kW	$= Customer\ kWh / ( Heating\_Hours )$
Customer PckW	$= Customer\_kW * CF$

**Tune-up:**

Boiler Tune Up savings (Gross Dth)	$= Input\ Capacity * Alt * ( ( EFFh / EFFb ) - 1 ) * EFLH$
Furnace Tune Up savings (Gross Dth)	$= Input\ Capacity * Alt * ( ( EFFh / EFFb ) - 1 ) * EFLH$

**Boilers:**

Customer Therms F_Res_Heat_Therm__c	$(((Size * Proposed\_Efficiency)/Baseline\_Efficiency) - Size ) * (1 - Oversize\_Factor) * (Furnace\_Hours / 100000) * Qty\_Prop\_Equip$
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## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Storm Window Equations:

Storm Windows Customer kW	= Customer kWh / Heating_Hours
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### Refrigerator Replacement Equations:

Customer kW	= Customer kWh / ( Operating_Hours )
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### Variables:

R_Crawl_Space_Wall_Base	4.41	R-Value for baseline wall insulation, calculated assuming no cavity insulation
R_Crawl_Space_Wall_Proposed	20.34	R-Value for proposed crawl space wall insulation, calculated assuming R-19 cavity insulation
CF	0%	Insulation Coincidence Factor in electrically heated homes.
Crawlspace Insulation Measure Life	20.00	Measure Life for crawl space insulation. Reference 3

### Tuneup Measure:

	Value	
Input Capacity	Customer Input	Size of the unit in BTUh
Alt	0.792	Altitude correction factor for Denver
EFFh	80%	Efficiency of the unit after the tune-up
EFFb	75%	Efficiency of the unit before tune-up
EFLH	Table 4	Full load heating hours of the unit

### Boilers:

	Value	
I_Qty_Prop_Equip__c	Customer Input	
I_Size__c	Customer Input	Rated new furnace or boiler Input BTUH nameplate data provided by customer on rebate form.
Baseline_Efficiency__c	80%	Efficiency of baseline code minimum boiler (Reference 10)
Proposed_Efficiency__c	Customer Input	Efficiency for higher efficiency boiler will be provided by the customer on the rebate form.
Furnace_Hours	1,054	Equivalent Full Load Heating Hours assumed for installed high efficiency boiler equipment

### Storm Window Variables:

	Value	
Customer kWh Savings	Table 3	Storm window savings in electrically heated homes.
Customer Dth savings	Table 2	Storm window savings in gas heated homes.
CF	0%	Storm window Coincidence Factor in electrically heated homes.
Storm Window Installation	\$1,225.00	Incremental Cost for Storm window installation. (Reference 5)
Storm Window Measure Life	20.00	Life of the installed Storm Windows. (Reference 3)
Furnace_Size_Mobile_Home	57.9	MBTUH of new fuel fired heating equipment for Mobile homes (Reference 1)
Furnace_Size_Site_Built	65.9	MBTUH of new fuel fired heating equipment for Site Built homes (Reference 1)

### Refrigerator Recycling Variables:

	Value	
Customer kWh Refrigerator Replacement	204	Refrigerator replacement energy savings kWh
Refrigerator Hours	5,592	Operating Hours for the refrigerator
CF	64%	Coincidence Factor for Refrigerator measures
Refrigerator Replacement Measure Life	18	Measure Life for Refrigerator Replacement measure based on program data

### LED Variables:

	Value	
kW_Bulb_New	Customer Input	Efficient Lamp Wattage provided by Vendor.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**New Programmable T-Stat:**

**Value**

Heating_Delta_T	3.37	Deemed one-week weighted average temperature difference between normal operation and heating setback temperature in degrees F.
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**Inputs:**

Inputs as required by referenced programs		
Wattage of CFLs Installed	Customer Input	
Quantity of CFLs Installed by wattage	Customer Input	
Quantity of Refrigerators Replaced	Customer Input	
R-Value of existing Attic Insulation	Customer Input	R-value of existing insulation without adjustments for structure or air films.
R-Value of as-built Attic Insulation	Customer Input	Overall R-value of insulation at completion of work; existing plus new insulation.
Attic Insulation Square Feet Installed	Customer Input	
Wall Insulation Square Feet Installed	Customer Input	
Crawl Space Insulation Square Feet Installed	Customer Input	
EFFn of new heating equipment	Customer Input	
EFn of new domestic water heating equipment	Customer Input	
Blower Door Test-in CFM50	Customer Input	
Blower Door Test-out CFM50	Customer Input	
Conditioned Square Footage	Customer Input	
Climate Zone (Front Range, Western Slope, or Mountains)	Customer Input	
Quantity of Storm Windows Installed	Customer Input	
Quantity of Showerhead or Aeroator Installed	Customer Input	
New Thermostat Installed	Customer Input	Assume that only one T-stat will be provided per home.
Wattage of LED A-Style Lamps Installed	Customer Input	
Quantity of LED A-Style Lamps Installed by wattage	Customer Input	
Wattage of LED BR-Style Lamps Installed	Customer Input	
Quantity of LED BR-Style Lamps Installed by wattage	Customer Input	
WH_Tank_Size	Customer Input	Tank Size of customer's Water Heater

**Assumptions:**

Work performed in coordination with the Governors Energy Office
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## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Tables:**

**Table 1: Home Characteristics (Reference 1)**

Category	Characteristic	Evaluation Result	Units	Home Type
Envelope and Mechanical Systems	Home Type	Mobile and Site Built		Specified
	Location	Multiple Regions		Both
	Conditioned Floor Area	961	SF	Mobile
		1451	SF	Site Built
	Number of Bedrooms	Two		Mobile
		Three		Site Built
	Foundation Type	Open Crawlspace		Mobile
		Enclosed Crawlspace		Site Built
	Foundation Wall Type	Mobile Home Skirt		Mobile
		R-11 Draped Insulation		Site Built
	Home Complexity	Four Corners		Both
	Nominal Ceiling Height	7.6	FT	Mobile
		8.2	FT	Site Built
	Ceiling Type Baseline	REM/Rate Default		Mobile
		R-11 + Grade III		Site Built
	Above Grade Wall Type Baseline	REM/Rate Default		Mobile
		Empty Cavity Insulation		Site Built
		R-4.37 Grade III		
	Foundation Floor Type	R-9.3		Mobile
		Uninsulated		Site Built
	Door Type	R-1.7		Both
	Infiltration Rate	0.8 ACH		Both
	Window Properties	U Value 0.86		Mobile
SHGC 0.72				
U Value 0.75				
SHGC 0.67			Site Built	
108.25 sqft				
144.15 sqft				
Refrigerators	Adjusted Volume	Value	CU FT	Both
	Survival Rate	Value		Both
	Degradation	Value		Both

**Table 2: Gas Energy Savings (Dtherms) by Region (Reference 1)\***

Measure	Denver	Dillon	Eagle	Grand Junction	Leadville	Alamosa
Storm Window Installation	16.3	29.0	23.1	14.8	33.7	28.6

\*SB = Site Built, MH = Mobile Home. All others are not expected to be affected by home type.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 3: Electric Energy Savings by Measure (Reference 1)\*, \*\***

Measure	Denver	Dillon	Eagle	Grand Junction	Leadville	Alamosa
Storm Window Installation	3,794	6,771	5,384	3,454	7,873	6676.1

\*SB = Site Built, MH = Mobile Home. All others are not expected to be affected by home type.

\*\* envelope measures contribute electric savings when an electric heating source is utilized. Assumed efficiency is 98%.

**Table 4: Effective Full Load Hours for Space Heating**

Heating	Denver	Grand Junction	Alamosa
EFLH for New Home	1073	1041	1353
EFLH for Existing Weatherized Home	1011	969	918
EFLH for Existing Non -Weatherized Home	1230	1248	1120

**References:**

- 1) 2011 Program Evaluation by Cadmus Group
- 2) Xcel Energy Water Heater Rebate Program
- 3) California Measurement Advisory Committee (CALMAC) Protocols, Appendix F ([www.calmac.org/events/APX\\_F.pdf](http://www.calmac.org/events/APX_F.pdf)).
- 4) CO Governor's Energy Office Guidance
- 5) RS Means RR 2007
- 6) NEAT/Frontier
- 7) Energy Outreach Colorado equipment costs
- 8) These numbers are based on "CO Insulation Rebate" analysis and references provided in that program.
- 9) California Energy Commission's Database for Energy Efficient Resources (DEER) <http://www.deeresources.com/>
- 10) US Department of Energy; Residential Furnaces and Boilers; [http://www1.eere.energy.gov/buildings/appliance\\_standards/product.aspx/productid/72](http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72)
- 11) 2015 ASHRAE Handbook - HVAC Applications; Comparison of Service Life Estimates; Page 37.3, Table 4

**Changes from 2017 / 2018 Plan**

- Changed lifetime for storm windows to 20 years
- Removed CFL measure
- Created tier 1 and tier 2 measures for certain technologies
- Updated values for furnace size based on reference 1
- Added Boilers, Boiler tuneup, and furnace tuneup measures
- Removed incremental cost information from the deemed sheet

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Critical Peak Pricing Pilot

#### Description:

Critical Peak Pricing (CPP) is a tariff being offered on a pilot basis to commercial and industrial customers. The rate was filed as part of the 2016 Phase II rate case. Per terms of the tariff, participation will be capped at the first 30 MW of customer load. Participants must have existing interval metering and an average load factor >30%.

#### Algorithms:

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#### Variables:

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#### Inputs:

#### Assumptions:

Participant Information					
Customer Rate Class	SG	PG	TG	Total	
Average Coincident Peak Demand (kW)	591	1,725	12,882	15,198	Based on 2013 class average load profile data
Discretionary Load Reduction	20%	20%	20%	20%	Estimate based on 2013 Brattle DR Study
Coincident Peak Reduction (kW)	118	345	2,576	3,040	Calculation
Participants	10	19	1	30	Estimate based on discussion with Account Management
Total peak reduction (kW)	1,182	6,555	2,576	10,313	Calculation
Pilot Parameters					
Event Window	12 p.m. - 8 p.m.	Per tariff			
Event duration (hours)	4	Per tariff			
Events per year	10	Required to avoid potential for lost revenue			
Pilot Duration	3	Filed for 2017-2019			
Annual event hours	40	Calculation			
Average Coincident Peak Reduction	344				
Participation (incremental)					
	2,017	2018			
Participants	15	15			
Load reduction	5,157	5,157			

Cost/Benefits	2017	2018	2019	NPV
Program Costs	\$ 145,000	\$ 65,000	\$ 65,000	\$ 246,189
Expected Capacity (kW)	5,157	10,313	10,313	
Program Benefits	\$ 446,519	\$ 909,332	\$ 925,937	\$ 1,976,211
Benefit/Cost Ratio	8.03			
WAAC	6.78%			

#### References:

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Program: Residential Demand Response - CO

#### Description:

Prescriptive rebates will be offered to residential customers who install a Smart Saver's Switch or a Smart Thermostat on their air conditioning (AC). Only DR demand savings will be claimed at this time for Smart Thermostats, no EE savings on AC or heating till program can do EE savings evaluation.

#### Algorithms:

Saver Switch	
F GEN Deem Eq kW (Customer_kW)	= I_Qty_Prop_Equip * Eq.kW_Savings
F HES AC EQ kWh (Customer_kWh)	= I_Qty_Prop_Equip * Eq.kWh_Savings
F Gen Equip PCKW 2 (PC_kW_Customer)	= I_Qty_Prop_Equip * Eq.PC_kW_Customer
Eq.kW_Savings	= (tons / EER) * 12
Smart Thermostats	
F Smart Tstat kW (Customer_kW)	= Min( I_Qty_AC_Units , Pm.Eq.Maximum_Quantity ) * Pm.Eq.kW_Savings
F Smart Tstat kWh (Customer_kWh)	= Min( I_Qty_AC_Units , Pm.Eq.Maximum_Quantity ) * Pm.Eq.kWh_Savings
F Smart Tstat pckW 2 (PC_kW_Customer)	= Min( I_Qty_AC_Units , Pm.Eq.Maximum_Quantity ) * Pm.Eq.PC_kW_Customer
Eq.kW_Savings	= (tons / EER) * 12

Variable ID	Value	Description
Common Assumptions		
tons	2.50	Deemed Capacity of average residential AC Unit in tons.
EER	11.05	Deemed Energy Efficiency Ratio (EER) of average residential AC Unit.
Saver Switch		
I_Qty_Prop_Equip	Customer Input	Quantity of smart saver switches installed.
Eq.kW_Savings	2.715	kW savings per average res AC Unit with a smart switch.
Eq.kWh_Savings	4	kWh savings per year per average res AC Unit with a smart switch (Reference 1 & 2).
Eq.PC_kW_Customer	0.930	Peak Coincident kW savings per average res AC Unit with a smart switch (Ref 4).
Lifetime	15	Length of time the switch will be operational.
NTG	100%	Net-to-Gross factor for Saver's Switch will be 100% as customers would not have the ability to install a switch without the program.
Smart Thermostats		
I_Qty_AC_Units	Customer Input	Quantity of AC Units being controlled
Pm.Eq.Maximum_Quantity	See Table 1	Maximum quantity of smart thermostats that can be rebated.
PM.Eq.kW_Savings	2.715	kW savings per average res AC Unit with a smart switch.
PM.Eq.kWh_Savings	4	kWh savings per year per average residential AC Unit with a smart thermostat (Reference 3 & 2).

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

PM.Eq.PC_kW_Customer	1.164	Peak Coincident kW savings per average residential AC Unit with a smart thermostat (Reference 3).
Life_ResST	10	Length of time the smart thermostat will be operational.
NTG - DR	100%	Net-to-Gross factor for DR smart thermostat will be 100% as customers would not have the ability to install a DR smart thermostat without the program.

**Table 1**

Smart Thermostat Type	Cost	Pm.Eq.Maximum_Quantity
Smart Thermostat - DR - Direct Install - CO	\$225.00	2
Smart Thermostat - DR - BYOT - CO	\$0.00	4

**Inputs:**

Provided by Customer:	Verified during M&V:
Number of Saver Switches installed.	Yes
Number of Smart DR Thermostats installed.	Yes

**Assumptions:**

Savings are calculated at system peaking conditions of 95 degree Fahrenheit dry bulb.

**References:**

- (1) DNV GL & AEC, January 2016. Saver's Switch Program, Residential Program, 2015 Impact Evaluation Report.
- (2) Xcel Energy, May 2018. Saver's Switch Control History.
- (3) Nexant, 2017. Evaluation of 2016 Smart Thermostat Pilot.
- (4) DNV GL & AEC, January 2018. Saver's Switch Program, Residential Wireless Modeling & Event Day Report, Version 8.

**Changes from 2017 / 2018 Plan**

Added Smart Thermostats to the program offering.  
 Removed self-install offering from smart thermostats product.  
 Updated kWh savings based on average number of events called per year.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Product: Residential Battery Demand Response - CO**

**Description:**

Residential customers with ~~select solar and~~ battery storage systems, receive a rebate for participating in a demand response program. Xcel Energy calls on a customer's battery to off-set the customer's load and potentially export capacity during frequent DR events called in the afternoon.

**Equations:**

Eq.kW_Savings (Customer kW)	See Table 2
Eq.kWh_Savings (Customer kW)	See Table 2
Average Annual Battery Electric Demand Savings (Gross Generator kW)	= Customer_kW * Coincidence_Factor

Variable ID	Value	Description
Cycles_Year	100	Estimated number of demand response events the pilot will call in a year
Baseline_kW	See Table 2	
Proposed_kW	0	
Event_Duration	4	The duration, in hours, that each event will last
Round_Trip_Efficiency	Customer Input	Customer input describing the round trip efficiency expected from their battery
Coincidence_Factor	See Table 1	Percentage of Customer_kW savings that will coincide with peak summer kW savings
NTG	See Table 1	Net to Gross
Battery_Capacity	6.75	Amount of energy (kWh) in the battery reserved for demand response. We assume the full battery is 13.5 kWh and 50% of battery is reserved for the pilot.
Inverter_Size	6	The continuous power (kW) rating of the battery.

**Inputs:**

**Verified during M&V:**

<del>Battery charges with rooftop solar</del>	Yes

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Assumptions:

Regardless of whether the system is permitted to export or not, we assume that all systems will charge exclusively with rooftop solar. We make this assumption because we imagine most customers will seek to take advantage of the federal Investment Tax Credit (ITC), which requires that at least 75% of the charging comes from on-site solar. To take advantage of the full ITC, all battery charging must come from on-site solar.
The program is for customers that install rooftop solar and storage, it currently excludes customers with stand-alone storage.
Load reduction calculations found in Table 2 assume randomized demand response in summer and non-summer months. The total number of calls is 100 per year.
Non-export means a customer that interconnects a <del>solar plus</del> storage system under an interconnection standard that does not allow the battery system to export because it can charge from the grid <del>and the on-site solar</del> . The relevant interconnection standards are "1b," "2a," and "2c" and more can be found about these standards in reference 2 and 3. A non-export customer's demand response potential would be affected by the availability of energy stored in the battery and the customer's load during an event.
Export means a customer that interconnects a solar plus storage system under an interconnection standard that does allow the battery system to export because it charges exclusively with solar. The relevant interconnection standards are "2b" and "3a" and "3b". More can be learned about these systems in reference 2 and 3. An export customers demand response potential would be affected by the availability of energy stored in the battery. Since this customer is able to export the battery capacity, the demand response potential is not affected by the customer's actual load.
Table 2 averages assume that the typical demand response event in the summer will fluctuate between 2-6 pm and 3-7 pm. In the winter the typical DR event will occur from 5-9 pm. These hours/days are used to calculate the average demand response potential for a battery.
The customer participants are battery early adopters and are already bearing the full cost of the battery for purposes that aren't related to program participation.

### Tables:

Table 1	Measure Life (Reference 1)	Incremental Capital Cost (Assumptions)	NTG	Estimated Round_Trip_Efficiency (1)	Coincidence Factors
Non-export participant	10	\$ -	100%	90%	100%
Export participant	10	\$ -	100%	90%	100%

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 2: Average monthly peak load reduction from residential batteries**

Month	Non-export kW Savings	Export kW Savings	Non-export kWh Savings*	Export kWh Savings*
January	1.310	1.470	-3.48	-3.93
February	1.240	1.520	0.68	0.68
March	1.120	1.520	-8.60	-10.80
April	1.050	1.520	-2.79	-4.05
May	1.190	1.520	3.70	4.73
June	1.520	1.520	-9.57	-11.03
July	1.460	1.460	-14.98	-14.98
August	1.460	1.520	-7.78	-8.10
September	1.490	1.520	0.75	1.31
October	1.060	1.520	-8.88	-10.76
November	1.120	1.480	-4.48	-5.93
December	1.170	1.520	-3.12	-4.05
<b>Average</b>	<b>1.320</b>	<b>1.510</b>	<b>-58.55</b>	<b>-66.92</b>

Table 2 calculations use **one-calendar-year-of-hourly-solar-production-and-load** data from five representative PSCo residential solar customers. The calculations use this data to simulate hourly solar, battery, and load conditions and derive kilowatt and kilowatt hour values for 100 demand response events. The kilowatt and kilowatt hour estimates are based on the differences between a baseline customer that only uses their battery during a grid outage and a participating customer that discharges their battery during a demand response event. We assume a baseline customer only uses their battery during grid outages because there is no economic rationale for a customer (unless they have enrolled on a time-of-use or demand charge rate) to use the battery other than during a grid outage.

\*Some months have positive kWh balances because the analysis dispatches the battery on the last day of the month. The re-charge of the battery occurs the following day, during the next month. The positive kWh associated with a discharge for a DR event is therefore not off-set by the re-charge. This occurrence leads to a positive kWh balance for the month, but this is driven by accounting convention rather than what is actually happening to kWh savings.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

1. Tesla Powerwall 2.0 Product Specifications; <https://www.tesla.com/powerwall>

2. Xcel Energy, Storage Guidance 1: <https://www.xcelenergy.com/staticfiles/xe-responsive/Programs%20and%20Rebates/Residential/CO-solar-residence-Storage-Guidance-1.pdf>.

23. Xcel Energy, Storage Guidance 2: <https://www.xcelenergy.com/staticfiles/xe-responsive/Programs%20and%20Rebates/Residential/CO-solar-residents-Storage-Guidance-2.pdf>

34. Xcel Energy, Storage Guidance 3: <https://www.xcelenergy.com/staticfiles/xe-responsive/Programs%20and%20Rebates/Residential/CO-solar->

### Changes from Recent Filing:

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Product: Smart Thermostat - CO**

**Description:**

Residential electric and combo customers can receive a rebate for installing an Energy Star certified smart thermostat. Additional savings may be claimed for seasonal savings from smart thermostat optimization

**Program References:**

Measure "Smart Thermostat Optimization"	See "Programmable Thermostat" from 'Home Energy Squad - CO' for equations and variables with the exception of Cooling_Delta_T and Heating_Delta_T which are documented in the Variable ID table below.
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**Equations:**

ENERGY STAR Smart Thermostat Demand Savings (Gross kW)	= Baseline kW * (1 - ES_Reduction_Cooling)
ENERGY STAR Smart Thermostat Electrical Energy Savings (Gross Annual kWh)	= Baseline kW * (1 - ES_Reduction_Cooling) * EFLH
ENERGY STAR Smart Thermostat Coincident Demand Savings (Gross PckW)	= Baseline kW * (1 - ES_Reduction_Cooling) * EnergyStar_CF
ENERGY STAR Smart Thermostat Gas Savings (Gross Dth/Yr)	= Baseline Dth * (1 - ES_Reduction_Heating)

Variable ID	Value	Description
ES_Reduction_Cooling	10%	Energy Star Connected Thermostat criteria for annual cooling equipment runtime reduction (Reference 1)
ES_Reduction_Heating	8%	Energy Star Connected Thermostat criteria for annual heating equipment runtime reduction (Reference 1)
Baseline kW	2.912	Forecasted High Efficiency Thermostat demand from 'Home Energy Squad - CO'
EFLH	573	Forecasted High Efficiency Thermostat hours from 'Home Energy Squad - CO'
Baseline Dth	60.2	Forecasted High Efficiency Thermostat gas use from 'Home Energy Squad - CO'
Heating_Delta_T	0.81	Average degrees of setback during heating season for seasonal thermostat savings
Cooling_Delta_T	0.38	Average degrees of setback during cooling season for seasonal thermostat savings (Reference 2)
EnergyStar_CF	76%	Coincidence Factor for High Efficiency Thermostat from 'Home Energy Squad - CO'
Measure Life	10	Measure life for programmable thermostat (Reference 4)

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Incremental Cost	\$ 215.00	Incremental cost for ENERGY STAR smart thermostat.
NTG	100%	Net-to-gross factor. Assumed to be 100% for a new program.

### References:

1. ENERGY STAR Connected Thermostat Key Product Criteria - [https://www.energystar.gov/products/heating\\_cooling/smart\\_thermostats/key\\_product\\_criteria](https://www.energystar.gov/products/heating_cooling/smart_thermostats/key_product_criteria)
2. 2017 Seasonal Savings Evaluation, Navigant, 3/5/2018
3. Xcel Study of Winter Seasonal Savings, 2017-2018, Initial Estimates
4. Lifetime of 10 years for programmable T-Stats from "Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures", June 2007 by GDS Associates.

### Changes from 2017 / 2018 Plan

1. New program

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Product: Residential Air Conditioning

Description:

Prescriptive incentives will be offered for new cooling equipment. Plan A is defined as central air conditioning (CAC) or air-source heat pump (ASHP) systems installed in new homes, existing homes without CAC or ASHP systems or homes with CAC or ASHP systems that are inoperable or unrepairable. Ground Source Heat Pumps will be rebated with a Quality Install (appropriate for GSHP) in new homes or when replacing electric resistance heating equipment in existing homes. For new Mini-Split Heat Pumps (MSHP) it is assumed that the MSHP is being installed in either new construction or to supplement an existing heating and cooling system. The MSHP rebate is intended to incent customers to install a high efficiency MSHP rather than the code level baseline unit.

Algorithms:

High Efficiency Air Conditioning - Equipment:

Gross kW Saved at Customer / Unit F_MC_Res_Cool_EQ_kW__c	IF ( Program_Measure__r.eo3__Component__r.Name = "13.0+ SEER" , 0 , I_MC_Qty_Prop_Equip__c * ((( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Sizing_Loss__c ) * 12 / ( P_MC_EER_Standard__c ) ) - (( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Sizing_Loss__c ) * 12 / ( F_MC_Res_Cool_EER_Value__c ) ) ) )
Gross PCKW Saved at Customer / Unit F_MC_Res_Cool_EQ_PCKW__c	IF ( Program_Measure__r.eo3__Component__r.Name = "13.0+ SEER" , 0 , I_MC_Qty_Prop_Equip__c * Project_Measure__r.eo3__Equipment_Model__r.Coincidence_Factor__c * ((( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Sizing_Loss__c ) * 12 / ( P_MC_EER_Standard__c ) ) - (( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Sizing_Loss__c ) * 12 / ( F_MC_Res_Cool_EER_Value__c ) ) ) )
Gross kWh Saved at Customer / Unit F_MC_Res_Cool_EQ_kWh__c	IF ( Program_Measure__r.eo3__Component__r.Name = "13.0+ SEER" , 0 , I_MC_Qty_Prop_Equip__c * ((( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Loss_No_QI__c ) * P_MC_EFLH__c * 12 / P_MC_SEER_Standard__c ) - (( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Loss_No_QI__c ) * P_MC_EFLH__c * 12 / I_MC_SEER_Eff__c ) )
Incremental Cost / Unit F_MC_Res_Cool_EQ_Inc_Cost__c	IF ( AND ( State__c = "CO" , TEXT ( I_MC_Replacement_Picklist__c ) = "Yes" ) , Project_Measure__r.eo3__Equipment_Model__r.Increm_Cost_per_12000_BTUh__c , Project_Measure__r.eo3__Equipment_Model__r.Incremental_Cost_per_Ton__c ) * I_MC_Equipment_Tons__c / 12000 * I_MC_Qty_Prop_Equip__c
Sub-Formula F_MC_Res_Cool_EER_Value__c	IF ( AND ( ( I_MC_EER_Eff__c = 0 , ISPICKVAL ( Measure__r.eo3__Component_Type__c , "Res Cooling AC/ASHP v2" ) ) , Project_Measure__r.eo3__Equipment_Model__r.Coef0__c * ( I_MC_SEER_Eff__c ^ 2 ) + Project_Measure__r.eo3__Equipment_Model__r.Coef1__c * I_MC_SEER_Eff__c , I_MC_EER_Eff__c )

High Efficiency Air Conditioning - Quality Install:

Gross kW Saved at Customer / Unit	I_MC_Qty_Prop_Equip__c * ( ( ( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Sizing_Loss__c ) * 12 / ( F_MC_Res_Cool_EER_Value__c ) ) - (( I_MC_Equipment_Tons__c / 12000 ) * ( 1 - P_MC_Sizing_Loss_QI__c ) * 12 / ( F_MC_Res_Cool_EER_Value__c ) ) )
Gross PCKW Saved at Customer / Unit	I_MC_Qty_Prop_Equip__c * Project_Measure__r.eo3__Equipment_Model__r.Coincidence_Factor__c * ((( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Sizing_Loss__c ) * 12 / ( F_MC_Res_Cool_EER_Value__c ) ) - (( I_MC_Equipment_Tons__c / 12000 ) * ( 1 - P_MC_Sizing_Loss_QI__c ) * 12 / ( F_MC_Res_Cool_EER_Value__c ) ) )
Gross kWh Saved at Customer / Unit - STANDARD EQUIPMENT BASELINE	I_MC_Qty_Prop_Equip__c * ((( ( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Loss_No_QI__c ) * P_MC_EFLH__c * 12 / P_MC_SEER_Standard__c ) - (( I_MC_Equipment_Tons__c / 12000 ) / ( 1 - P_MC_Uncorr_Loss__c ) * P_MC_EFLH__c * 12 / P_MC_SEER_Standard__c ) ) )

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

High Efficiency Air Conditioning - Quality Install (Continued):

Gross kWh Saved at Customer / Unit - EFFICIENT EQUIPMENT BASELINE	$\frac{I\_MC\_Qty\_Prop\_Equip\_c * (( ( ( I\_MC\_Equipment\_Tons\_c / 12000 ) / ( 1 - P\_MC\_Loss\_No\_QI\_c ) * P\_MC\_EFLH\_c * 12 / I\_MC\_SEER\_Eff\_c ) - ( I\_MC\_Equipment\_Tons\_c / 12000 ) / ( 1 - P\_MC\_Uncorr\_Loss\_c ) * P\_MC\_EFLH\_c * 12 / I\_MC\_SEER\_Eff\_c ) ) )}{1}$
Incremental Cost / Unit	$IF ( TEXT ( I\_MC\_Home\_Type\_c ) = "new" , I\_MC\_Qty\_Prop\_Equip\_c * P\_MC\_QI\_Incremental\_Cost\_c , MAX ( 75 , I\_MC\_Qty\_Prop\_Equip\_c * ( P\_MC\_QI\_Incremental\_Cost\_c - ( IF ( TEXT ( Project\_Measure\_r.eo3\_Equipment\_Model\_r.eo3\_Equipment\_Type\_c ) = "Res Cooling GSHP - CO v2" , I\_MC\_Size\_Heat\_c , I\_MC\_Equipment\_Tons\_c ) / 12000 * Project\_Measure\_r.eo3\_Equipment\_Model\_r.Baseline\_Cost\_c * P\_MC\_Sizing\_Loss\_QI\_c ) ) ) ) )$

Ground Source Heat Pump - Equipment:

Gross kW Saved at Customer / Unit	$\frac{MAX( I\_MC\_Qty\_Prop\_Equip\_c * ( ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) / ( 1 - P\_MC\_Sizing\_Loss\_c ) * 12 / ( P\_MC\_EER\_Standard\_HP\_c ) ) - ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) / ( 1 - P\_MC\_Sizing\_Loss\_c ) * 12 / ( I\_MC\_EER\_Eff\_c ) ) ) + I\_MC\_Qty\_Prop\_Equip\_c * ( ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) / ( 1 - P\_MC\_Sizing\_Loss\_c ) * 12 / ( I\_MC\_EER\_Eff\_c ) ) - ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) * ( 1 - P\_MC\_Sizing\_Loss\_QI\_c ) * 12 / ( I\_MC\_EER\_Eff\_c ) ) ) , ( I\_MC\_Size\_Heat\_c * ( 1 + P\_MC\_Sizing\_Loss\_c ) / P\_MC\_Standard\_COP\_c / 3412 ) - ( I\_MC\_Size\_Heat\_c / I\_MC\_GSHP\_COP\_c / 3412 ) ) )}{1}$
Gross PckW Saved at Customer / Unit	$\frac{( I\_MC\_Qty\_Prop\_Equip\_c * ( ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) / ( 1 - P\_MC\_Sizing\_Loss\_c ) * 12 / ( P\_MC\_EER\_Standard\_HP\_c ) ) - ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) / ( 1 - P\_MC\_Sizing\_Loss\_c ) * 12 / ( I\_MC\_EER\_Eff\_c ) ) ) + I\_MC\_Qty\_Prop\_Equip\_c * ( ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) / ( 1 - P\_MC\_Sizing\_Loss\_c ) * 12 / ( I\_MC\_EER\_Eff\_c ) ) - ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) * ( 1 - P\_MC\_Sizing\_Loss\_QI\_c ) * 12 / ( I\_MC\_EER\_Eff\_c ) ) ) ) * Project\_Measure\_r.eo3\_Equipment\_Model\_r.Coincidence\_Factor\_c )}{1}$
Gross kWh Saved at Customer / Unit - COOLING	$\frac{( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) * P\_MC\_EFLH\_c * 12 / ( P\_MC\_SEER\_Standard\_HP\_c * ( 1 - P\_MC\_Loss\_No\_QI\_c ) ) ) - ( ( MIN ( I\_MC\_Size\_Heat\_c / 12000 * P\_MC\_GSHP\_Cooling\_Ratio\_c , I\_MC\_Equipment\_Tons\_c / 12000 ) ) * P\_MC\_EFLH\_c * 12 / ( F\_MC\_GSHP\_SEER\_c * ( 1 - P\_MC\_Loss\_No\_QI\_c ) ) ) )}{1}$
Gross kWh Saved at Customer / Unit - HEATING (NEW HOME)	$\frac{( P\_MC\_BTU\_Heat\_c / 3412 * 3.412 / ( Project\_Measure\_r.eo3\_Equipment\_Model\_r.HSPF\_Baseline\_c * ( 1 - P\_MC\_Loss\_No\_QI\_c ) ) ) - ( P\_MC\_BTU\_Heat\_c * ( 1 + P\_MC\_Sizing\_Loss\_c ) / P\_MC\_Standard\_COP\_c / 3412 )}{1}$
Gross kWh Saved at Customer / Unit - HEATING (EXISTING HOME)	$\frac{( P\_MC\_BTU\_Heat\_c / 3412 / ( P\_MC\_Standard\_COP\_c * ( 1 - P\_MC\_Loss\_No\_QI\_c ) ) ) - ( P\_MC\_BTU\_Heat\_c * ( 1 + P\_MC\_Sizing\_Loss\_c ) / P\_MC\_Standard\_COP\_c / 3412 )}{1}$
Incremental Cost / Unit - COOLING	$\frac{I\_MC\_Size\_Heat\_c / 12000 * Project\_Measure\_r.eo3\_Equipment\_Model\_r.Incremental\_Cost\_per\_Ton\_c * Project\_Measure\_r.eo3\_Equipment\_Model\_r.ARR\_Electric\_Cooling\_c}{1}$
Incremental Cost / Unit - HEATING	$\frac{I\_MC\_Size\_Heat\_c / 12000 * Project\_Measure\_r.eo3\_Equipment\_Model\_r.Incremental\_Cost\_per\_Ton\_c * Project\_Measure\_r.eo3\_Equipment\_Model\_r.ARR\_Electric\_Heating\_c}{1}$

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Sub-Formula F_MC_GSHP_SEER__c	I_MC_EER_Eff__c
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**Ground Source Heat Pump - Quality Install:**

Gross kW Saved at Customer / Unit	N/A
Gross PckW Saved at Customer / Unit	N/A
Gross kWh Saved at Customer / Unit - COOLING	$((\text{MIN}(\text{I\_MC\_Size\_Heat\_c} / 12000 * \text{P\_MC\_GSHP\_Cooling\_Ratio\_c}, \text{I\_MC\_Equipment\_Tons\_c} / 12000)) * \text{P\_MC\_EFLH\_c} * 12 / (\text{F\_MC\_GSHP\_SEER\_c} * (1 - \text{P\_MC\_Loss\_No\_QI\_c}))) - ((\text{MIN}(\text{I\_MC\_Size\_Heat\_c} / 12000 * \text{P\_MC\_GSHP\_Cooling\_Ratio\_c}, \text{I\_MC\_Equipment\_Tons\_c} / 12000)) * \text{P\_MC\_EFLH\_c} * 12 / (\text{F\_MC\_GSHP\_SEER\_c} * (1 - \text{P\_MC\_Uncorr\_Loss\_c})))$
Gross kWh Saved at Customer / Unit - HEATING (NEW HOME)	$(\text{P\_MC\_BTU\_Heat\_c} * (1 + \text{P\_MC\_Sizing\_Loss\_c}) / \text{P\_MC\_Standard\_COP\_c} / 3412) - ((\text{P\_MC\_BTU\_Heat\_c} / \text{I\_MC\_GSHP\_COP\_c} * (1 - \text{P\_MC\_Uncorr\_Loss\_c})) / 3412)$
Gross kWh Saved at Customer / Unit - HEATING (EXISTING HOME)	$(\text{P\_MC\_BTU\_Heat\_c} * (1 + \text{P\_MC\_Sizing\_Loss\_c}) / \text{P\_MC\_Standard\_COP\_c} / 3412) - (\text{P\_MC\_BTU\_Heat\_c} / (\text{I\_MC\_GSHP\_COP\_c} * (1 - \text{P\_MC\_Uncorr\_Loss\_c})) / 3412)$
Incremental Cost / Unit	$\text{IF}(\text{TEXT}(\text{I\_MC\_Home\_Type\_c}) = \text{"new"}, \text{I\_MC\_Qty\_Prop\_Equip\_c} * \text{P\_MC\_QI\_Incremental\_Cost\_c}, \text{MAX}(75, \text{I\_MC\_Qty\_Prop\_Equip\_c} * (\text{P\_MC\_QI\_Incremental\_Cost\_c} - (\text{IF}(\text{TEXT}(\text{Project\_Measure\_r.eo3\_Equipment\_Model\_r.eo3\_Equipment\_Type\_c}) = \text{"Res Cooling GSHP - CO v2"}, \text{I\_MC\_Size\_Heat\_c}, \text{I\_MC\_Equipment\_Tons\_c}) / 12000 * \text{Project\_Measure\_r.eo3\_Equipment\_Model\_r.Baseline\_Cost\_c} * \text{P\_MC\_Sizing\_Loss\_QI\_c})))$

**Western Cooling Control Device:**

Gross kW Saved at Customer / Unit	$\text{I\_MC\_Qty\_Prop\_Equip\_c} * \text{Project\_Measure\_r.eo3\_Equipment\_Model\_r.eo3\_kW\_Savings\_c}$
Gross PckW Saved at Customer / Unit	$\text{I\_MC\_Qty\_Prop\_Equip\_c} * \text{Project\_Measure\_r.eo3\_Equipment\_Model\_r.eo3\_kW\_Savings\_c} * \text{Project\_Measure\_r.eo3\_Equipment\_Model\_r.Coincidence\_Factor\_c}$
Gross kWh Saved at Customer / Unit	$\text{I\_MC\_Qty\_Prop\_Equip\_c} * \text{Project\_Measure\_r.eo3\_Equipment\_Model\_r.eo3\_kWh\_Savings\_c}$
Incremental Cost / Unit	$\text{I\_MC\_Qty\_Prop\_Equip\_c} * \text{Project\_Measure\_r.eo3\_Equipment\_Model\_r.Cost\_c}$

**Minisplit Heat Pump:**

Gross kW Saved at Customer / Unit	$\text{I\_MC\_Equipment\_Tons\_c} / 12000 * (12 / \text{F\_MC\_MSHP\_EER\_Std\_c} - 12 / \text{F\_MC\_Res\_Cool\_EER\_Value\_c})$
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**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

Gross PCKW Saved at Customer / Unit	$\frac{I\_MC\_Equipment\_Tons\_c}{12000} * ( \frac{12}{F\_MC\_MSHP\_EER\_Std\_c} - \frac{12}{F\_MC\_Res\_Cool\_EER\_Value\_c} ) * Project\_Measure\_r.eo3\_Equipment\_Model\_r.Coincidence\_Factor\_c$
Gross kWh Saved at Customer / Unit - COOLING	$(\frac{I\_MC\_Equipment\_Tons\_c}{12000} * P\_MC\_MSHP\_EFLHC\_c * ( \frac{12}{P\_MC\_SEER\_Standard\_HP\_c} - \frac{12}{I\_MC\_SEER\_Eff\_c} )) / (1 - P\_MC\_Loss\_No\_QI\_c)$
Gross kWh Saved at Customer / Unit - HEATING	$(( \frac{I\_MC\_Size\_Heat\_c}{1000} * P\_MC\_MSHP\_EFLHH\_c * ( \frac{1}{Project\_Measure\_r.eo3\_Equipment\_Model\_r.HSPF\_Baseline\_c} - \frac{1}{I\_MC\_HSPF\_Eff\_c} )) / (1 - P\_MC\_Loss\_No\_QI\_c))$
Incremental Cost / Unit	IF ( AND ( State_c = "CO", TEXT ( I_MC_Replacement_Picklist_c ) = "Yes" ) , Project_Measure_r.eo3_Equipment_Model_r.Increm_Cost_per_12000_BTUh_c , Project_Measure_r.eo3_Equipment_Model_r.Incremental_Cost_per_Ton_c ) * I_MC_Equipment_Tons_c / 12000 * I_MC_Qty_Prop_Equip_c
Sub-Formula F_MC_MSHP_EER_Std_c	$(( Project\_Measure\_r.eo3\_Equipment\_Model\_r.Coef0\_c * ( ( P\_MC\_SEER\_Standard\_HP\_c / ( I\_MC\_Equipment\_Tons\_c / 12000 ) ) ^3 ) + Project\_Measure\_r.eo3\_Equipment\_Model\_r.Coef1\_c * ( ( P\_MC\_SEER\_Standard\_HP\_c / ( I\_MC\_Equipment\_Tons\_c / 12000 ) ) ^2 ) + Project\_Measure\_r.eo3\_Equipment\_Model\_r.Coef2\_c * ( P\_MC\_SEER\_Standard\_HP\_c / ( I\_MC\_Equipment\_Tons\_c / 12000 ) ) + Project\_Measure\_r.eo3\_Equipment\_Model\_r.Coef3\_c ) * ( I\_MC\_Equipment\_Tons\_c / 12000 ) )$
Sub-Formula F_MC_Res_Cool_EER_Value_c	IF ( AND ( I_MC_EER_Eff_c = 0 , ISPICKVAL ( Measure_r.eo3_Component_Type_c , "Res Cooling AC/ASHP v2" ) ) , Project_Measure_r.eo3_Equipment_Model_r.Coef0_c * ( I_MC_SEER_Eff_c ^2 ) + Project_Measure_r.eo3_Equipment_Model_r.Coef1_c * I_MC_SEER_Eff_c , I_MC_EER_Eff_c )

**Variables:**

Numeric Constant	3,412	Conversion between BTU/h and kilowatts
Numeric Constant	12,000	Conversion between BTU/h and tons
State_c		Applicable DSM Jurisdiction (CO, MN, NM). Variable is used for formula management only and is based on customer premise location
Program_Measure_r.eo3_Component_r.Name		Administrative data categorization flag - Triggers changes in formula manipulation between programs.
Measure_r.eo3_Component_Type_c		Administrative data categorization flag - Triggers changes in formula manipulation between programs.
Project_Measure_r.eo3_Equipment_Model_r.Incremental_Cost_per_Ton_c	Tables 1a, 1d	Deemed Plan A & MSHP Incremental Capital Cost per Ton, Based On Unit Efficiency (New Construction) - where applicable
Project_Measure_r.eo3_Equipment_Model_r.Increm_Cost_per_12000_BTUh_c	Table 1b	Deemed Plan B Incremental Capital Cost per Ton, Based On Unit Efficiency (Retrofit)
Project_Measure_r.eo3_Equipment_Model_r.Coincidence_Factor_c	Table 3	Coincidence Factor, the probability that peak demand savings will coincide with peak utility system demand.
Project_Measure_r.eo3_Equipment_Model_r.Baseline_Cost_c	Table 2	Deemed baseline installation cost.
Project_Measure_r.eo3_Equipment_Model_r.Cost_c	WCCD Incremental cost	Deemed Equipment Specific incremental cost (\$) Refer to data or tables below where appropriate.
Project_Measure_r.eo3_Equipment_Model_r.Coef0_c	Table 7	Conversion Coefficient
Project_Measure_r.eo3_Equipment_Model_r.Coef1_c	Table 7	Conversion Coefficient
Project_Measure_r.eo3_Equipment_Model_r.Coef2_c	Table 7	Conversion Coefficient
Project_Measure_r.eo3_Equipment_Model_r.Coef3_c	Table 7	Conversion Coefficient
Project_Measure_r.eo3_Equipment_Model_r.HSPF_Baseline_c	8.20	GSHP & MSHP Deemed Baseline Heating Seasonal Performance Factor (HSPF)
Project_Measure_r.eo3_Equipment_Model_r.ARR_Electric_Cooling_c	0.19	GSHP 'Deemed Elec Heat/Cool Ratio - Cooling
Project_Measure_r.eo3_Equipment_Model_r.ARR_Electric_Heating_c	0.81	GSHP 'Deemed Elec Heat/Cool Ratio - Heating
Project_Measure_r.eo3_Equipment_Model_r.eo3_Equipment_Type_c		Administrative data categorization flag - Triggers changes in formula manipulation between programs.
Project_Measure_r.eo3_Equipment_Model_r.eo3_kW_Savings_c	Table 8	Deemed Equipment Specific demand savings (kW)
Project_Measure_r.eo3_Equipment_Model_r.eo3_kWh_Savings_c	Table 8	Deemed Equipment Specific energy savings (kWh)
I_MC_Qty_Prop_Equip_c	#	Quantity of HEAC Equipment associated with measure, provided by the customer.
I_MC_Equipment_Tons_c	#	AHRI Total ( Sensible + Latent ) Cooling Capacity of HEAC Equipment ( in BTU/h ) , provided by the customer.
I_MC_EER_Eff_c	#	AHRI EER of HEAC Equipment, provided by the customer.
I_MC_SEER_Eff_c	#	AHRI SEER of HEAC Equipment, provided by the customer.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

I_MC_Size_Heat_c	#	AHRI Heating Capacity of HEAC Equipment, provided by the customer (BTU/h).
I_MC_GSHP_COP_c	#	AHRI COP of GSHP HEAC Equipment, provided by the customer.
I_MC_HSPF_Eff_c	#	AHRI Heating Seasonal Performance Factor, provided by the customer.
I_MC_Replacement_Picklist_c	Yes, No	Identifies if measure represents a replacement of existing equipment ( Plan A or B ), provided by the customer.
I_MC_Home_Type_c	New, Existing	Identifies if measure represents installation at a new or existing home, provided by the customer.
P_MC_EER_Standard_c	Table 3	Energy Efficiency Ratio (EER) of standard equipment, based upon the minimum Federal acceptable efficiency.
P_MC_EER_Standard_HP_c	Table 3	Energy Efficiency Ratio (EER) of standard equipment, based upon the minimum Federal acceptable efficiency. (Heat Pump)
P_MC_SEER_Standard_c	Table 3	Seasonal Energy Efficiency Ratio (SEER) of std. equipment, based upon the minimum Federal acceptable efficiency.
P_MC_SEER_Standard_HP_c	Table 3	Seasonal Energy Efficiency Ratio (SEER) of std. equipment, based upon the minimum Federal acceptable efficiency. (Heat Pump)
P_MC_Standard_COP_c	Table 3	Deemed coefficient of performance (COP) of baseline heating system
P_MC_EFLH_c	Table 4	The Equivalent Full Load Hours (EFLH) of residential cooling. Values are determined through modeling.
P_MC_BTU_Heat_c	Table 4	The annual heating load in Btu. Value is determined through modeling.
P_MC_Loss_No_QI_c	Table 5	Efficiency of average unit lost due to improper installation of HEAC Equipment
P_MC_QI_Incremental_Cost_c	Table 1c	Deemed incremental cost for 'quality install' installation effort.
P_MC_GSHP_Cooling_Ratio_c	Table 6	Ratio applied on the Rated Heating Capacity of GSHP to determine cooling load.
P_MC_Sizing_Loss_c	Table 6	Specific losses from non-QI installation effects that impact peak load operation
P_MC_Sizing_Loss_QI_c	Table 6	Reduction in necessary equipment size due to application of quality install.
P_MC_Uncorr_Loss_c	Table 6	Deemed value for uncorrectable duct leakage losses
P_MC_MSHP_EFLHC_c	416	Deemed Equivalent Full Load Cooling Hours (ELFHC)
P_MC_MSHP_EFLHH_c	1,013	Deemed Equivalent Full Load Heating Hours (ELFHH). Consistent with the residential heating program for an existing home that is the average of a weatherized and non-weatherized home
NTG	67.6%	Net-to-gross for AC units which is calculated from High Efficiency AC Program Evaluation conducted in 2012.
NTG	100.0%	Net-to-gross for GSHP units
Measure Life - Matched Split-System Air Conditioner (Plan A)	18	Reference 16
Measure Life - Matched Split-System Air -Source Heat Pump	18	Reference 16
Measure Life - Ground Source Heat Pump	20	Reference 3
Measure Life - Mini-Split Heat Pump	18	Reference 9
Measure Life - WCCD	7.5	Matches associated AC System Lifetime (Plan A/B)
Measure Life - Quality Installation (Plan A)	18	Reference 16
WCCD Incremental cost	\$100.00	Market Data

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 1a. Incremental Capital Costs - New Construction (Plan A) - Reference 6**  
**Project\_Measure\_r.eo3\_Equipment\_Model\_r.Incremental\_Cost\_per\_Ton\_c**

SEER	AC Base Cost per Ton	AC Incremental Cost per Ton	ASHP Base Cost per Ton	ASHP Incremental Cost per Ton	GSHP Base Cost per Ton	GSHP Incremental Cost per Ton
13 SEER	\$ 422.85	N/A	N/A	N/A	\$ 422.85	N/A
14/14.5 SEER	\$ 514.98	\$ 92.13	\$ 777.64	N/A	N/A	N/A
15 SEER	\$ 607.10	\$ 184.25	\$ 960.40	\$ 182.76	N/A	N/A
16 SEER	\$ 699.23	\$ 276.38	\$ 1,143.16	\$ 365.52	N/A	N/A
17/18+ SEER	\$ 791.36	\$ 368.51	\$ 1,325.93	\$ 548.29	N/A	N/A
All Efficiencies	N/A	N/A	N/A	N/A	\$ 1,006.85	\$ 584.00

**Table 1c. Incremental Capital Costs - Quality Install (Reference 6)**

Measures	New Home	Existing Home*
Quality Installation	\$ 103.56	\$ 286.58

**Table 1d. Incremental Capital Costs - Mini-Split Heat Pump (Reference 8)**

Mini-Split Heat Pump	Current Year Purchase Price	Incremental cost per ton Cooling
Mini-Split Heat Pump (15-20 SEER, 11+ EER, 9-12 HSPF)	\$ 3,322.19	\$ 401.99
Mini-Split Heat Pump (21-26 SEER, 11+ EER, 9-12 HSPF)	\$ 3,535.64	\$ 555.94

Incremental costs for unit sizes not listed will be interpolated/extrapolated from listed values

Incremental costs for GSHP to High Efficient GSHP will use the incremental cost table for standard A/C Units. This is due to a GSHP to HE GSHP the loop cost are the same so that cost is

**Table 3. Coincidence Factor, EER Baseline**

Equipment Type	Home Type	Replace / Plan	Deemed Equipment Coincidence Factor	Deemed QI Coincidence Factor	EER Baseline	SEER Baseline	Heating COP	Notes
AC	New	No / A	90%	100%	11.18	13.00	N/A	Reference 14
AC	Existing	No / A	90%	100%	11.18	13.00	N/A	Reference 14
ASHP	New	No / A	90%	100%	11.76	14.00	N/A	Reference 14
ASHP	Existing	No / A	90%	100%	11.76	14.00	N/A	Reference 14
GSHP	New	N/A	90%	100%	11.18	13.00	2.4	Reference 14
GSHP	Existing	N/A	90%	100%	11.18	13.00	1.0	Reference 14
MSHP (Cooling Only)	N/A	N/A	90%		8.28	14.00	N/A	Reference 14
WCCD	N/A	N/A	90%		N/A	N/A	N/A	N/A

**Table 4. Modeled AC/ASHP/GSHP EFLH and Total Annual Heating Load:**

Home Type	EFLH	BTU Heat	Modeled Area	Modeled Tons	Modeled SEER	Notes
New	610	37,400,000	2,460	2	13	Reference 4
Existing	549	74,900,000	2,206	3.0	13	Reference 4

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 5. Loss NO QI Derivation (References 5 & 12)**

P_MC_Loss_No_QI_c		Reference 11	Reference 13	Reference 5	Reference 12	
Equipment Type	Home Type	Equipment Sizing	Refrigeration Charge	Improper Airflow	Duct Leakage	Total
AC	New	0.0%	7.0%	2.0%	0.0%	9.00%
AC	Existing	2.5%	7.0%	2.0%	21.6%	33.10%
ASHP	New	0.0%	7.0%	2.0%	0.0%	9.00%
ASHP	Existing	2.5%	7.0%	2.0%	21.6%	33.10%
GSHP	New	0.0%	0.0%	2.0%	0.0%	2.00%
GSHP	Existing	2.5%	0.0%	2.0%	21.6%	26.10%
MSHP	New	0.0%	0.0%	0.0%	0.0%	0.00%
MSHP	Existing	0.0%	0.0%	0.0%	0.0%	0.00%

**Table 6. HEAC Equipment Characteristics**

P_MC_Sizing_Loss_c					
P_MC_Sizing_Loss_QI_c					
P_MC_Uncorr_Loss_c					
P_MC_GSHP_Cooling_Ratio_c					
Home Type - HEAC	Reference 11	Reference 13	Reference 12	Deemed	
	Sizing Loss	Sizing Loss QI	Uncorrected Loss	GSHP Cooling Ratio	
New - General	0%	0%	0%	0.806451613	
Existing - General	2.5%	10.0%	12.7%	0.638297872	
New or Existing - MSHP	0.0%	0.0%	N/A	N/A	

**Table 7. Conversion Coefficients**

Equipment type	Coef0	Coef1	Coef2	Coef3	Notes
MSHP - SEER to EER	-0.0002600	0.0101270	0.5263880	-0.0233300	Xcel Derivation
AC/ASHP/GSHP - EER to SEER	-0.020	1.120	N/A	N/A	Reference 1

**Table 8. Deemed Demand and Energy Savings (per unit)**

Equipment type	kW_Savings	kWh_Savings	Notes
Western Cooling Control Device	0.130	73.0	Based on Internal Analysis

**Assumptions:**

Baseline equipment meets applicable minimum Federal standards for efficiency

Baseline equipment installation (for QI) has 33.1% efficiency losses

Baseline equipment installation in Existing Homes has 26.75% efficiency losses

High efficiency equipment exceeds minimum Federal standards for efficiency

Installed equipment does not operate at optimum efficiency until a Quality Installation is completed.

To qualify for a rebate, each piece of equipment must meet the minimum EER and SEER requirements. The customer should provide both the EER and SEER values for the particular piece of equipment. If the customer is unable to provide both values, the value(s) not provided will be calculated using the equations shown above. If a value is not provided by the customer, the calculated value still must meet the minimum requirement.

10-year Average Inflation Rate = 2.57% (InflationData.com)

CO Weighted Average Cost of Capital = 7.88%

Average Cost of Central AC Repair=\$750 (EEBC)

GSHP New Home REMRATE Modeling = Larger, more tightly built, better insulated new home was modeled with GSHP COP of 3.3

GSHP Existing Home REMRATE modeling = Smaller, less tightly built, poorly insulated existing home was modeled with GSHP of 3.3.

GSHP Installed Loop Cost/Ton = \$2004 per loop per Ton

GSHP Baseline Equipment Cost combines AC unit and electric resistance heating

GSHP appropriate Quality Install savings included in modeling

No Heating kW saving are claimed for GSHP or MSHP during winter, only summer cooling kW savings are claimed.

Assumed \$50 each for contractor to complete right sizing calculations and air flow work on AC and HP units.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

1. For equation to convert SEER to EER "Building America, Research Benchmark Definitions, 2010", see p. 10. <http://www.nrel.gov/docs/fy10osti/47246.pdf>
2. ASHRAE, 2007, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. For estimated life of GSHP see [http://www.energysavers.gov/your\\_home/space\\_heating\\_cooling/index.cfm/mytopic=12640](http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12640) (indoor components up to 25 years; ground loop =50 years)
4. Building loads were estimated using Building Energy Optimization (BEOpt) software version 2.5.0.0. The model was run Jan 2016. See "Model Data New" and "Model Data Existing" tabs for assumptions.
5. For losses with air flow see Neme, Proctor, Nadel, ACEEE, 1999. Energy Savings Potential From Addressing Residential Air Conditioner and Heat Pump Installation Problems. <http://aceee.org/research-report/a992>
6. Costs obtained from "2010-2012 WO017 Ex Ante Measure Cost Study Final Report", by Itron, May 2014. These are used in the DEER 2016 database.
7. DOE Appliance Standards Website, Residential Central Air Conditioners and Heat Pumps. [https://www1.eere.energy.gov/buildings/appliance\\_standards/product.aspx/productid/75](https://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75)
8. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
9. MSHP equipment life is from Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures; <http://library.cee1.org/content/measure-life-report-residential-and-commercialindustrial-lighting-and-hvac-measures>
10. For assumptions on GSHP efficiencies see "ENERGY STAR Geothermal Heat Pumps Key Product Criteria"; [www.energystar.gov](http://www.energystar.gov)
11. For losses with equipment sizing see ENERGY STAR Quality Installation. [https://www.energystar.gov/index.cfm?c=hvac\\_install.hvac\\_install\\_index](https://www.energystar.gov/index.cfm?c=hvac_install.hvac_install_index)
12. For assumptions on duct leak losses see "NREL 2011 Measure Guideline Sealing and Insulating Ducts in Existing Homes". <http://www.nrel.gov/docs/fy12osti/53494.pdf>
13. For assumptions on losses related to overcharge or undercharge on refrigerant see "Sensitivity Analysis of Installation Faults on Heat Pump Performance", by P. Domanski, et. al., Sept 2014. <http://www.acca.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=f02c1f61-4d1d-4a24-971d-cc9ea3e626b2&forceDialog=0>
14. For Efficiency assumptions associated with baseline AC/ASHP/MSHP systems, refer to: 2015 International Energy Conservation Code
15. For Residential A/C System Lifetime, Refer to DOE Technical Support Document: Energy Efficiency Program for Consumer Products: CHAPTER 8. LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS
16. Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures, GDS, June 2007. [http://library.cee1.org/sites/default/files/library/8842/CEE\\_Eval\\_MeasureLifeStudyLights&HVACGDS\\_1Jun2007.pdf](http://library.cee1.org/sites/default/files/library/8842/CEE_Eval_MeasureLifeStudyLights&HVACGDS_1Jun2007.pdf)

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Residential Energy Feedback

#### Description:

Program will deliver energy use feedback via print, email and online web portal access to customer groups and measure the difference in energy use between Participants and an appropriately sized Control Group that does not receive energy use feedback. Program will include residential customers with both gas and electric service from Xcel Energy.

#### Algorithms:

Monthly Electrical Energy Savings (Gross_Treatment_Monthly_kWh)	The development of the savings by each variable group ( Print, Email, Online) follow this basic formula: = (Control_kWh_usage_post_treatment - Group_Rebate_Product_Participation) - (Treatment_kWh_usage_post_treatment - Group_Rebate_Product_Participation)
Electrical Energy Savings (Gross_Annual_kWh)	= sum of each month of Monthly Electrical Energy Savings
Electrical Demand Savings (Gross_Coincident_kW)	= Gross_kW * CF
Electrical Demand Savings (Gross_kW)	= Customer_kW_Max
Coincidence Factor (CF)	= Customer_kW_Peak_Month / Customer_kW_Max
Monthly Natural Gas Energy Savings (Gross_Treatment_Monthly_Dth)	The development of the savings by each variable group ( Print, Email, Online) follow this basic formula: = (Control_Dth_usage_post_treatment - Group_Rebate_Product_Participation) - (Treatment_Dth_usage_post_treatment - Group_Rebate_Product_Participation)
Natural Gas Energy Savings (Gross_Annual_Dth)	= Sum of each month of the Monthly Natural Gas Energy Savings
Behavioral Adjustment	= -2/3 * Gross_kW; This adjustment is applied to reduce the first year savings to 1/3 of the actual savings in compliance with ordered treatment.

#### Variables:

Treatment_Print	= Group of electric and gas customers receiving periodic paper reports providing feedback on their energy use.
Treatment_Email	= Group of electric and gas customers receiving internet delivered reports that provide feedback on their energy use.
Treatment_Online	= Group electric and gas customers (unknown size) who choose to opt-in to a web feedback portal that provides feedback on their energy use.
Control_Print	= Group of electric and gas customers who are similar in structure (demographics, life stage, house size, geography) to the participant Group, but receive no contact from Xcel or its contractors.
Control_Email	= Group of electric and gas customers who are similar in structure (demographics, life stage, house size, geography) to the participant Group, but receive no contact from Xcel or its contractors.
Control_Online	= Group of electric and gas customers who are similar in structure (demographics, life stage, house size, geography) to the participant Group, but receive no contact from Xcel or its contractors

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Treatment_kWh_usage_post_treatment	= Electrical energy use of the Treatment Group as determined through multi-variate regression analysis.	
Control_kWh_usage_post_treatment	= Electrical energy use of the Control Group as determined through multi-variate regression analysis.	
Treatment_Dth_usage_post_treatment	= Natural gas energy use of the Treatment Group as determined through multi-variate regression analysis.	
Control_Dth_usage_post_treatment	= Natural gas energy use of the Control Group as determined through multi-variate regression analysis.	
Group_Rebate_Product_Participation	= Energy savings generated by participation in Xcel's rebate products for both Treatment and Control groups, kWh and Dth. Rebated product participation from other products, (e.g.new furnace), are savings that will be included in the regression analysis and deducted from the EFP results if statistically significant.	
Gross_Treatment_Monthly_kWh_Saved	Provided by Vendor	= monthly MWh savings provided by the vendor for all homes in the treatment group.
Customer_kW_Peak_Month	Provided by Vendor	= Average electrical demand savings per household achieved in the month, day, and hour that contained the peak demand on Xcel Energy's system. Actual value calculated each year.
Customer_kW_Max	Provided by Vendor	= The maximum of the peak electrical demand savings per household achieved in the summer months: June, July, August, and September. Actual value calculated each year. Formula for each monthly Customer_kW = Customer_Daily_kWh * Treatment_Percent_Savings * Peak_Factor * Daily_Usage_at_Peak
Gross_Treatment_Monthly_Dth_Saved	Provided by Vendor	= monthly therm savings provided by the vendor for all homes in the treatment group.
Peak_Factor	Provided by Vendor	= The ratio of energy usage in peak hour to average hourly energy use. Actual value calculated each year.
Daily_Usage_at_Peak	Provided by Vendor	= Percentage of energy usage in peak hour to daily total energy use. Actual value calculated each year.
Measure Life	= Assumed to be 1.0 year since there is no equipment purchase - just behavior changes.	
Measure Life (Behavioral Adjustment)	= is set to zero in order to not affect the lifetime net benefits	
Incremental Cost	= Assumed to be zero since the program induces behavior change which has no capital cost.	
Operation & Maintenance (O&M) Savings	= Assumed to be zero.	
Net-to-Gross Factor (NTG)	= 100%	

**References:**

Savings data from Xcel Colorado Opower pilot, June 2011 - July 2014. File "Xcel\_Monthly Results Summary\_Through July 2014"

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Program: ENERGY STAR New Homes

#### Description:

The CO ENERGY STAR New Homes (ESNH) product provides residential homebuilders with an incentive to build new single-family, small multi-family and town homes that are at least 10% more energy-efficient than what local building codes require. Builders are encouraged to consider a “whole-house” approach and have the flexibility to install any combination of efficient technologies and building techniques to meet the program requirements and qualify for rebate. The product utilizes Performance testing per Residential Energy Services Network (RESNET) Home Energy Rating System (HERS) and each home will be modeled by a certified RESNET energy rater using the widely adopted REM/Rate™ software application or a Company approved equivalent.

#### Program References:

LEDs	Refer to Program "Home Lighting & Recycling" to find formulas for (Customer kW, Customer kWh, Customer PCKW, etc.) for the "LED" measure.
LEDs	Refer to Program "Home Lighting & Recycling" to find reference table for "Existing lighting wattage for
LEDs	Refer to Program "Home Lighting & Recycling" to find reference table for "Average Cost" values.
LEDs	Refer to Program "Home Lighting & Recycling" to find reference table for "Measure Life" values.
Heat Pump Water Heaters	Refer to Program "Water Heaters" to find formulas (Customer kW, Customer kWh, Customer PCKW, etc.) for the "Heat Pump Water Heater" measures.
Heat Pump Water Heaters	Refer to Program "Water Heaters" to find reference table for "Secondary Cooling and heating Benefits"
Heat Pump Water Heaters	Refer to Program "Water Heaters" to find reference table for "Incremental cost, NTG and lifetime" values.
Heat Pump Water Heaters	Refer to Program "Water Heaters" to find reference table for "Baseline Efficiency Coefficients" values.
Energy Star Smart Thermostats	Refer to Program "Smart Thermostat & Optimization" to find formulas (Customer kW, Customer kWh, Customer PCKW, etc.) for the "Energy Star Smart Thermostats" measures.

#### Algorithms:

Gross kW Saved at Customer Envelope Measures Envelope_kW	=MAX( summer peak kW savings ; winter peak kW savings ) Data for the summer and winter peak kW savings are included in the software model for each individual home as provided by the House Rating Agent.
Gross Coincident kW Saved at Customer Envelope Measures Coincident_Envelope_kW	= ( Envelope_kW ) x 90% CF
Gross Annual kWh Saved at Customer Envelope measure Envelope_kWh	= Total Reference Home kWh - Total As-built Home kWh Data for The Reference Home and As-Built Home kWh are included in the software model for each individual Home As provided by the House Rating Agent and based on Local codes.

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Gross Dth/Yr Envelope Measures Envelope_Dth/Yr	= (Total Reference Home Therms - Total As-built Home Therms ) / 10 Data for The Reference Home and As-Built Home Therms are included in the software model for each individual Home as provided by the House Rating Agent and based on Local codes.
Gross kW Saved at Customer kW_Saved	= Gross Annual kWh / Hours
Gross Coincident kW Saved at Customer Coincidence_kW_Saved	= Gross kW Saved at Customer * CF
As-Built_Home_MMBTU	= ( As-Built Heating (kWh) + As-Built Cooling (kWh) + As-Built Lights & Appliances (kWh) ) x 3412 / 1000000 + ( As-Built Heating (therms) + As-Built Water Heating (therms) + As-Built Lights & Appliances (therms) ) / 10
Ref_Home_MMBTU	= ( Reference Heating (kWh) + Reference Cooling (kWh) + Reference Lights & Appliances (kWh) ) x 3412 / 1000000 + ( Reference Heating (therms) + Reference Water Heating (therms) + Reference Lights & Appliances (therms) ) / 10
Percent better than code	= ( Ref_Home_MMBTU - As-Built_Home_MMBTU ) / Ref_Home_MMBTU
Incremental capital cost adjustment factor	= 1 + ( ICC_ADJ_a X LN ( Home_Size ) + ICC_ADJ_b )
As Built Incremental Capital Cost As-built_ICC/SF	= ( ICC/SF_a x %_BTC^2 + ICC/SF_b x %_BTC + ICC/SF_c ) x ICC_Adj_Factor
summer peak kW savings	= Summer Peak kW (Reference) - Summer Peak kW (As Built)
winter peak kW savings Winter_Peak_kW	= Winter Peak kW (Reference) - Winter Peak kW (As Built)
Gross Annual kWh Saved at Customer ES Radon Measure	= (1-%EE Fans Installed) * (W <sub>base</sub> -W <sub>ES</sub> )*Radon Fan hours/1000
Peak Coincident kW Saved at Customer Radon Fan Measure	= ( Radon_kW ) x 100% CF
Gross Annual kWh Saved at Customer ES Radon Measure (Radon_kW)	= (1-%EE Fans Installed) * (W <sub>base</sub> -W <sub>ES</sub> )/1000
Incremental Cost Radon Fan Measure	= Efficient Radon Fan Cost - Baseline Radon Fan Cost

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Variables:	Value	Description
As-Built_HERS	Customer Input	As-Built Home's HERS Index Score calculated by the Home Rater using a software modeling tool and provided under HERS Index (Final)
Baseline Energy Code	Customer Input	Home Rater identified Baseline Energy Code for the jurisdiction in which the home is being built. IECC 2006, IECC 2009, IECC 2012, IECC 2015
Home_Size	Customer Input	Home's conditioned square footage, provided by the home rater.
ICC/SF_a ICC/SF_b ICC/SF_c	See Table 2	Constants for use in calculating an Incremental Cost / Square Foot of home. The cost curve is derived from information provided by Residential Science Resources estimates and home modeling of the most common measures implemented to improve the envelope performance over local codes. Curves are developed for IECC 2006/2009 and
ICC_ADJ_a ICC_ADJ_b	See Table 3	Constants for use in calculating an adjustment factor to correct the incremental cost for home size. An increase in homes size reduces the cost per square foot for the same set of measures due to economies of scale. This factor is used in conjunction with the As-built_ICC/SF cost formula
Clothes washer electric energy savings (Gross Annual kWh)	See Table 1	Energy savings for the clothes washer are based on the ENERGY STAR Clothes Washer Savings Calculator: Reference 7. This will vary based on source for domestic hot water heat; gas or electric.
Clothes washer Hours	312	Assumed Hours of operation for a clothes washer, based on number of duty cycles and a duty cycle of 1 hour.
Clothes washer natural gas savings (Gross Dth/Yr)	0.12	Energy savings for the clothes washer are based on the ENERGY STAR Clothes Washer Savings Calculator: Reference 7. For homes with gas domestic hot water heat.
Quantity_LEDs	See Table 4	Deemed quantity of high efficacy lamps used in the LED measures.
Eff_LED_Lamp_Wattage	See Table 4	Deemed efficient lamp wattage used in the LED measures. Based on weighted average lamps sold under the Home Lighting and Recycling program

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Baseline_Lamp_Wattage	See Table 4	Deemed baseline lamp wattage used in the LED measures. Based on weighted average baseline lamps for the associated Eff_LED_Lamp_Wattages from the Home Lighting and Recycling program.
Refrigerator electric energy savings (Gross Annual kWh)	16	Energy savings for the refrigerator were based on the ENERGY STAR Refrigerator Savings Calculator: Reference 8.
Refrigerator Hours	8,760	Assumed Hours of operation for a refrigerator.
Incremental Cost Energy Star Certification	\$505.00	Incremental cost for completing the construction measures necessary and the paperwork required to achieve Energy Star Certification.
Non-energy O&M savings	See Table 1	Water Savings per year for an Energy Star Clothes Washer
CF Clothes Washer	See Table 1	Coincidence Factor of an energy star Clothes Washer
Measure Life As-built Home	20	Envelope Measures (Reference 1)
Measure Life Refrigerator	13	Life of an energy star refrigerator (Reference 4)
Measure Life Clothes Washer	11	Life of an energy star Clothes Washer (Reference 5)
Pipe Diameter (in)	4	Assumption based on contractor feedback (Reference 10)
Pipe Length (ft)	25	Assumption based on contractor feedback (Reference 10)
Efficient Radon Fan Airflow (CFM)	33	Reference 9
Baseline Radon Fan Airflow (CFM)	63	Reference 9
Efficient Radon Fan Operating Pressure	0.68	Operating Pressure in "WC (Reference 10)
Baseline Radon Fan Operating Pressure	1.30	Operating Pressure in "WC (Reference 10)
Radon Fan Hours	8,760	Assumed Hours of operation for a radon fan
$W_{base}$	53.6	Reference 9
$W_{ES}$	16.9	Reference 9
% EE Fans Installed	15%	Assumed percentage of Energy Star Radon Fans being sized correctly and installed currently based on contractor feedback (Reference 9)
Radon Fan Coincidence Factor	100%	Fans run 24x7x365
Baseline Radon Fan Cost	\$139.00	Reference 11
Efficient Radon Fan Cost	\$135.00	Reference 11
Incremental Cost	-\$4.00	Incremental cost of RP140 as compared to RP145 (Reference 11)
Measure Life Radon Fan	10	Life of an energy star Radon Fan (Reference 10)

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Inputs:**

Home As-built energy model and the reference home energy model are developed by the House Rater using a modeling software tool. The	
Home Size (Square Footage)	
HERS Index (Final)	
Baseline Energy Code	
Reference Heating (therms)	
Reference Heating (kWh)	
Reference Cooling (kWh)	
Reference Water Heating (therms)	
Reference Lights & Appliances (therms)	
Reference Lights & Appliances (kWh)	
As-Built Heating (therms)	
As-Built Heating (kWh)	
As-Built Cooling (kWh)	
As-Built Water Heating (therms)	
As-Built Lights & Appliances (therms)	
As-Built Lights & Appliances (kWh)	
Reference Summer Peak kW	
As-Built Summer Peak kW	
Reference Winter Peak kW	
As-Built Winter Peak kW	
Energy Star Certification	
Water Heater Fuel	
Clothes Washer Installed	
Quantity high efficacy lamps Installed (Minimum 20) for IECC 2006 or IECC 2009 baseline homes	
100% high efficacy lamps Installed for IECC 2012 or IECC 2015 baseline homes	

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Assumptions:

Peak load and average annual load are not necessarily the same, though they could be depending on if the refrigerator is located indoors in a conditioned or not. In addition, if the refrigerator is located in a conditioned space, then there would be HVAC interactive effects.

### Tables:

**Table 1** **Clothes Washer**

Total Water Savings/Year - Gallons	1,180
kWh Savings in home with electric water heater	32
kWh Savings in home with gas water heater	6
Coincidence_Factor (CF)	3.37%
Non-Energy O&M Savings	\$ 8.30
Incremental Cost	\$ 30.00

**Table 2**

Inc Cost / SF Formula Constants	ICC/SF_a	ICC/SF_b	ICC/SF_c
IECC 2006 Cost / SF Curve:	2.532679697	1.686152873	-0.035377136
IECC 2009 Cost / SF curve:	2.532679697	1.686152873	-0.035377136
IECC 2012 Cost / SF Curve:	17.13726794	-2.192988956	0.10462244
IECC 2015 Cost/SF Curve:	17.13726794	-2.192988956	0.10462244

**Table 3**

Cost / SF Adjustment Factor Constants	ICC_ADJ_a	ICC_ADJ_b
IECC 2006 Size Cost Adjustment:	-0.53096769	4.273345067
IECC 2009 Size Cost Adjustment:	-0.53096769	4.273345067
IECC 2012 Size Cost Adjustment:	-0.813411346	6.710386107
IECC 2015 Size Cost Adjustment	-0.813411346	6.710386107

**Table 4**

	Quantity LED Lamps	Eff Wattage LED Lamps	Baseline Wattage	Coincidence Factor
IECC 2009 or earlier code	20	9.84	45.41	12.6%
IECC 2012 or newer code	10	9.84	45.41	12.6%

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Changes from Previous Filing:

Updated costs Converted deemed sheet to the new standardized format Moved unused references to Useful Docs sheet Removed Refrigerator replacement Added heat pump water heater measure
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### References:

1. California Measurement Advisory Committee (CALMAC) Protocols, Appendix F ([www.calmac.org/events/APX\\_F.pdf](http://www.calmac.org/events/APX_F.pdf)).
2. National Energy Efficiency Best Practices Study - Residential Single-Family Comprehensive Weatherization Best Practices Report from December
3. US Lighting Market Characterization Study performed for the Department of Energy in 2002
4. [www.energystar.gov](http://www.energystar.gov)
5. Appliance Magazine, September 2007
6. Incremental cost data are estimates from Residential Science Resources
7. [http://www.energystar.gov/index.cfm?c=clotheswash.pr\\_clothes\\_washers](http://www.energystar.gov/index.cfm?c=clotheswash.pr_clothes_washers)
8. [http://www.energystar.gov/index.cfm?c=refrig.pr\\_refrigerators](http://www.energystar.gov/index.cfm?c=refrig.pr_refrigerators)
9. [http://wpb-radon.com/radon\\_fan\\_performance.html](http://wpb-radon.com/radon_fan_performance.html)
10. Information from manufacturer and contractors (Radonaway)
11. <https://www.radonaway.com/products/radon-fans/rp140-pro.php>

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Evaporative Cooling

#### Description:

Prescriptive rebates will be offered for the purchase and installation of evaporative coolers. Three tiers of rebates are offered based on the Evaporative Efficacy of the unit and the type of media. The rebates and analyses are based on a nominal 3 ton cooling load. **Premium units** are high efficiency evaporative coolers (see assumptions for details). **Multi-Ducted Premium units** are an integrated HVAC system rebate that compares the "whole house" conventional HVAC with an integrated heating and evaporative cooling system in new homes or existing homes with existing or new supply ducts. Credit will be calculated based on the number and type of units installed, the type of the existing unit and the location of the home

#### Program References:

Baseline Product Consumption	Refer to Program "Air Conditioning" to find all applicable formulas and assumptions for baseline product consumption for all evaporative cooling measures.
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#### Algorithms:

GEN_kWh Customer kWh	$Qty\_Prop\_Equip * kWh\_Savings$
GEN_PcKW Customer PcKW	$GEN\_kW * Coincidence\_Factor$
GEN_kW Customer kW	$Qty\_Prop\_Equip * kW\_Savings$
Inc_Elec_O_M Electric O&M Savings	$Incremental\_OM\_Savings\_Electric * Qty\_Prop\_Equip$

#### Variables:

Qty_Prop_Equip	Input	Quantity of equipment being replaced
13 SEER 3 Ton energy (Front Range)	1812	Energy use of 13 SEER 3 Ton AC unit (kWh)
13 SEER 3 Ton energy (Western Slope)	1907	Energy use of 13 SEER 3 Ton AC unit (kWh)
13 SEER 3 Ton energy (Alamosa/Mountain Area)	1283	Energy use of 13 SEER 3 Ton AC unit (kWh)
13 SEER 3 Ton demand	3.3	Demand (kW) of 13 SEER 3 Ton AC unit
kWh_Savings	Table 1	Energy savings for switching from a 3 ton AC unit to 3 ton evap cooling unit
kW_Savings	Table 1	Demand savings for switching from a 3 ton AC unit to 3 ton evap cooling unit
kWh Usage	Table 2	$Motor\ HP * 0.746 * Load\ Factor / Motor\ Eff * OpHr$
kW Usage	Table 2	$Motor\ HP * 0.746 * Load\ Factor / Motor\ Eff$
EFLH Front Range/Denver	549	Effective full load hours for the front range
EFLH Western Slope	578	Effective full load hours for the western slope
EFLH Alamosa/Mountain Area	389	Effective full load hours for Alamosa/Mountain Area

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

MotorHP	Table 3	Motor Horsepower represents the motor size for an evaporative cooler which corresponds to the cooling output of a 3 ton AC unit. (Reference 4)
HP to kW	0.746	Standard conversion from HP to kW
Load Factor on High	80.00%	Load factor for motor - We will use 80% for standard systems and 80% on high and 10% on low for premium systems.
Load Factor on Low	10.00%	Load factor for motor - We will use 80% for standard systems and 80% on high and 10% on low for premium systems.
Motor Eff	81.67%	Efficiency of the evaporative cooler motor (Reference 2)
Coincidence_Factor	70%	Coincidence factor for the refrigerated air system, the probability that peak demand of the AC unit will coincide with peak utility system demand. (Program Evaluation 2010)
TDLF	6.38%	Transmission Distribution Loss Factor the percentage loss of electricity as it flows from the power plant to the customer, calculated using factors from Enhanced DSM Filing SRD-2
NTG	Table 4	Net-to-Gross Factor calculated based on Xcel Energy product experience.
Incremental Costs	Table 5	Incremental cost of efficient technology over baseline technology
Incremental_OM_Savings_Electric	Table 6	Operation and Maintenance savings related to water use
Measure Life	15	Life of evap cooling equipment

**Table 1. Energy and Demand Savings for Evap Cooling**

Description	Front Range	Western Slope	Alamosa/Mountain Area
Standard System Energy Savings	1603	1687	1759
Standard System Demand Savings	2.92	2.92	2.92
Premium System Energy Savings	1603	1687	1759
Premium System Demand Savings	2.92	2.92	2.92
Multi-Ducted Premium System Energy Savings	1403	1476	1617
Multi-Ducted Premium System Demand Savings	2.56	2.56	2.56

**Table 2. Energy and Demand Usage for Evap Cooling**

Description	Front Range	Western Slope	Alamosa/Mountain Area
Standard System Energy Usage	209	220	148
Standard System Demand	0.38	0.38	0.38
Premium System Energy Usage	209	220	148
Premium System Demand	0.38	0.38	0.38
Multi-Ducted Premium System Energy Usage	409	431	290
Multi-Ducted Premium System Demand	0.745	0.745	0.745

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 3. Motor HP**

System Type	HP
Standard System	0.52
Premium System	0.52
Multi-Ducted Premium System	1.02

**Table 4. Net to Gross Factor**

System Type	Replacement installation	New installation
Standard System	70%	70%
Premium System	70%	70%
Multi-Ducted Premium System	70%	90%

**Table 5. Incremental Cost of Evaporative Coolers (Reference 5,6,7)**

	Cost	Incremental Cost
13 SEER AC 3 T (Baseline System)	\$ 3,811	N/A
Standard System Evaporative Cooling Unit	\$ 867	\$ (2,943)
Premium System Evaporative Cooling Unit	\$ 2,778	\$ (1,032)
Multi-Ducted Premium System Evap Cooling Unit	\$ 4,021	\$ 210

**Table 6. Operation and Maintenance Savings (Reference 8)**

Base System	New System	O&M Savings
13 SEER AC 3 T	Standard Evap Cooling	\$ (19.80)
13 SEER AC 3 T	Premium Evap Cooling	\$ (8.32)
Conventional 3 Ton HVAC; gas furn; elec cen AC	Gas furnace; Multi-Ducted Premium System	\$ (8.32)

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Provided by Customer:

Type of unit installed (Standard System or Premium System) or installation type (Multi-Ducted Premium System).

### Verified during M&V

Yes

### Assumptions:

Baseline AC equipment is matched to the HEAC program. Please see the HEAC program for more information

The installed unit is assumed to have a 0.52 HP motor for Standard and Premium Systems, and a 1.02 HP motor for Multi-Ducted Premium System (commonly available unit, confirmed through metering) .

Qualifying equipment must be new and be a permanently installed direct (Standard System or Premium System), indirect or two-stage evaporative cooling unit. Portable Standard System: Qualifying evaporative cooling units must have a minimum Industry Standard Rated airflow of 2,500 CFM

Premium System: Qualifying evaporative cooling units must meet standard system requirements and additionally have a minimum Media Saturation Effectiveness of 85%. The units must be installed with a remote thermostat and a periodic purge water control.

Multi-Ducted Premium System: Integrated HVAC system rebate that compares the "whole house" conventional HVAC with an integrated heating and evaporative cooling system in new homes or existing homes with existing or new supply ducts (minimum of 3 ducts). Multi-Ducted Premium System evaporative cooling units must be indirect or indirect/direct combination units. Units utilizing only direct cooling units do not qualify for Multi-Ducted Premium System due to concerns with moisture loading.

Multi-Ducted Premium System incremental cost data from 2017 program invoices

Assumed that the EFLH for an evaporative cooling unit is equivalent to the EFLH for a standard AC unit

Assumed all sales from retail were self install unless otherwise noted

The technical assumptions for the Evaporative Cooling Rebate product were developed assuming that a standard 13 SEER central air conditioning system was replaced or displaced by either a standard evaporative cooling system or a premium unit with the same capacity. These units have a measure life of 15 years.

### References:

1. ESPRE 2.1 engineering model: Simplified energy analysis methods for residential buildings
2. Average motor efficiency for 1 hp motor from NEMA, "Premium Efficiency Motor Selection and Application Guide"
3. Kinney, Larry. New Evaporative Cooling Systems: An Emerging Solution for Homes in Hot Dry Climates with Modest Cooling Loads. SWEEP 2007
4. Web site information - Grainger Evap Cooler - Essick Model N28W; Pheonix Mfg Corp; Model PD4231
5. <http://www.google.com/products?q=home+depot+evaporative+cooler+cost&ie=UTF-8&oe=utf-8&rls=org.mozilla:en-US:official&client=firefox->
6. Xcel Program Data
7. SWEEP 2007 Report. O&M Savings based on manufacturers water use data and current Denver water rates (Denver Water Board).
8. ASHRAE Applications 2007 p.36.3 Used AC window unit as estimate for evaporative cooler.
9. <https://www.denverwater.org/residential/billing-and-rates/2018-rates>
10. <https://www.denvergov.org/content/denvergov/en/wastewater-management/billing-and-rates/wastewater-rates.html>

### Updates:

1. Updated costs for equipment to 2017 values
2. Updated water cost to 2018 value
3. Removed old calculation for Type 3 using RS Means
4. Cleaned up Deemed sheet to fit with new format
5. Updated Baseline cost based on trade partner data
6. Added Alamosa/Mountain Area to the deemed sheet

**Product: Residential Heating - CO**

**Description:**

Residential natural gas customers receive a cash rebate for purchasing high-efficiency heating equipment. Residential electric customers can receive an additional cash rebate for purchasing an electronically commutated motor (ECM) furnace fan with their heating system.

Customer kW F_GEN_kW__c	$Qty\_Prop\_Equip * kW\_Savings$
Customer kWh F_Gen_kWh_Hrs2__c	$Qty\_Prop\_Equip * kW\_Savings * ECM\_Hours$
PcKw F_GEN_PcKw__c	$GEN\_kW * Coincidence\_Factor$
Customer Therms F_Res_Heat_Therm__c	$((Size * Proposed\_Efficiency) / Baseline\_Efficiency) - Size$ * $(1 - Oversize\_Factor) * (Furnace\_Hours / 100000) * Qty\_Prop\_Equip$
ECM Heating O&M Penalty	$= Incremental\_OM\_Savings\_Electric\_c$

Variable ID	Value	Description
I_Qty_Prop_Equip__c	Customer Input	
kW_Savings	Table 2	Difference between ECM_Baseline_kW and ECM_Proposed_kW
ECM_hours__c	Table 2	Operating hours of the EC motor only
Incremental_Capital_Cost_Electric__c	Table 3	Incremental cost of the EC motors
Incremental_OM_Savings_Electric__c	Table 2	O&M Dollars spent in additional gas use to offset heating done by fan during winter
Coincidence_Factor	Table 3	Percent of the peak period the EC motor is running
Incremental_Capital_Cost_Gas__c	Table 1	Incremental cost of the furnace
I_Size__c	Customer Input	Rated new furnace or boiler Input BTUH nameplate data provided by customer on rebate form.
Baseline_Efficiency__c	80%	Efficiency of baseline code minimum furnace (Reference 1)
Proposed_Efficiency__c	Customer Input	Efficiency for higher efficiency furnace will be provided by the customer on the rebate form.
Furnace_Hours	1,159	Equivalent Full Load Heating Hours assumed for installed high efficiency furnace equipment
Conversion from Btu to Therms	100,000	1 Therm = 100,000 Btuh

Oversize Factor	0	Oversize factor account for deration of the equipment with altitude. Currently it is being accounted for in the equivalent full load heating hours
NTG	Table 1 & 3	Net to Gross

**Inputs:**

**Verified during M&V:**

Furnace Efficiency	Yes
Furnace Nameplate Capacity of new unit at sea level (BTUH, Input)	Yes
Was ECM furnace fan motor provided	Yes
Does residence have central air conditioning	Yes

Table 1	Measure Life (Reference 2)	Incremental Cost (Reference 4)	NTG
Furnace	18	\$ 1,460.05	86%

Table 2	ECM_Baseline_k W	ECM_Proposed_ kW	ECM_Operating _Hours	Incremental_OM_ Savings_Electric
New ECM w/ AC	0.649	0.456	4,192	\$ (11.76)
New ECM w/o AC	0.569	0.364	3,356	\$ (11.76)

Table 3	Measure Life	Incremental Cost	Coincidence _Factor	NTG
New ECM w/ AC	18	\$ 235.00	79%	94%
New ECM w/o AC	18	\$ 235.00	30%	94%

**References:**

1. US Department of Energy; Residential Furnaces and Boilers; [http://www1.eere.energy.gov/buildings/appliance\\_standards/product.aspx/productid/72](http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72)
2. 2015 ASHRAE Handbook - HVAC Applications; Comparison of Service Life Estimates; Page 37.3, Table 4
3. ECM Furnace Impact Assessment Report [https://focusonenergy.com/sites/default/files/emcfurnaceimpactassessment\\_evaluationreport.pdf](https://focusonenergy.com/sites/default/files/emcfurnaceimpactassessment_evaluationreport.pdf)
4. Xcel program data from 2017 program year
5. Cost information from "2010 - 2012 W0017 Ex Ante Measure Cost Study Final Report.", Itron, May 2014.
6. DOE incremental cost for EC motors <https://www.regulations.gov/document?D=EERE-2010-BT-STD-0011-0117>

**Changes from Recent Filing:**

1. Updated format of the deemed sheet to be able to reference the variables in the rest of the document
2. Changed Reference 2 to be IECC 2015 because ASHRAE 2015 does not exist
3. Updated costs for EC motors
4. Updated Program data to include the furnaces rebated in 2017

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Program: Home Energy Squad - CO

#### Description:

Residential electric and natural gas customers can have energy efficiency measures directly installed while paying for certain material and/or contractor costs.

#### Program References:

CFL Lighting Measures	Refer to Product "CO Home Lighting & Recycling" formulas for (Gross kW, Gross Annual kWh, Gross Coincident kW, etc.) for the "Replace incandescent lamps with CFLs" measure, except kW_Savings_per_Bulb will be determined by subtracting the wattage of the direct-installed bulb from the actual bulb removed.
CFL Lighting Measures	Refer to Product "CO Home Lighting & Recycling" reference table for "CFL" values.
LED Lighting Measures	Refer to Product "CO Home Lighting & Recycling" formulas for (Gross kW, Gross Annual kWh, Gross Coincident kW, etc.) for the "Replace incandescent lamps with LEDs" measure, except kW_Savings_per_Bulb will be determined by subtracting the wattage of the direct-installed bulb from the actual bulb removed.
LED Lighting Measures	Refer to Product "CO Home Lighting & Recycling" reference table for "LED" values.
Measure "Direct Install - Low-Flow Showerhead"	Refer to Product "CO Energy Efficient Showerhead" formulas for (Gross kW, Gross Annual kWh, Gross Coincident kW, etc.) for the "Provide Efficient Showerhead" measure.
Measure "Direct Install - Low-Flow Showerhead"	Refer to Product "CO Energy Efficient Showerhead" reference table for "Low-Flow Showerhead" values.
Measure "Direct Install - Kitchen Aerator"	Refer to Product "CO Energy Efficient Showerhead" formulas for (Gross kW, Gross Annual kWh, Gross Coincident kW, etc.) for the "Provide Kitchen Faucet Aerator" measure.
Measure "Direct Install - Kitchen Aerator"	Refer to Product "CO Energy Efficient Showerhead" reference table for "Kitchen Aerator" values.
Measure "Direct Install - Bath Aerator"	Refer to Product "CO Energy Efficient Showerhead" formulas for (Gross kW, Gross Annual kWh, Gross Coincident kW, etc.) for the "Provide Bath Faucet Aerator" measure.
Measure "Direct Install - Bath Aerator"	Refer to Product "CO Energy Efficient Showerhead" reference table for "Bath Aerator" values.
Measure "Weatherstrip Door"	Refer to Product "CO Insulation" formulas for (Gross kW, Gross Annual kWh, Gross Coincident kW, etc.) for the "Air Sealing" measure.
Measure "Weatherstrip Door"	Refer to Product "CO Insulation" reference table for "Air Sealing" values with the following exceptions: CFM50_Baseline and CFM50_Proposed are calculated below in the equations section.
Measure "Smart Thermostat"	Refer to Product "CO Smart Thermostat & Optimization" formulas for (Gross kW, Gross Annual kWh, Gross Coincident kW, etc.) for the "Smart Thermostat" measure.
Measure "Smart Thermostat"	Refer to Product "CO Smart Thermostat & Optimization" reference table for "Smart Thermostat" values. Equipment Incremental costs shown in forecast are estimates only. Actual costs will be utilized.

#### Equations:

TV & Electronics Controller Electrical Energy Savings (Gross Annual kWh)	$= (\text{Measured\_Watts\_WO} - \text{Measured\_Watts\_WITH}) / 1000 \times \text{Controller\_Hours}$
TV & Electronics Controller Electrical Demand Savings (Gross kW)	$= (\text{Measured\_Watts\_WO} - \text{Measured\_Watts\_WITH}) / 1000$
Programmable Thermostat Electrical Energy Savings (Gross Annual kWh)	$= \text{Cooling\_Delta\_T} \times \text{kWh\_Savings\_per\_Degree}$
Programmable Thermostat Electric Demand Savings (Gross kW)	$= \text{Cooling\_Delta\_T} \times \text{kW\_Savings\_per\_Degree}$
Programmable Thermostat Electric Peak Coincident Demand Savings (PC kW)	$= \text{Cooling\_Delta\_T} \times \text{kW\_Savings\_per\_Degree} \times \text{Coincidence\_Factor}$
Programmable Thermostat Gas Savings (Gross Dth/Yr)	$= \text{Heating\_Delta\_T} \times \text{Dth\_Savings\_per\_Degree}$
Water Heater Blanket Electrical Energy Savings (Gross Annual kWh)	$= (\text{WH\_Tank\_Size} / 45) \times (\text{HLF before} - \text{HLF with blanket}) \times 8760 / \text{HE\_Elec} / 3412$

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Water Heater Blanket Electrical Demand Savings (Gross kW)	= (WH_Tank_Size / 45 ) x (HLF before - HLF with blanket) x 8760 / HE_Elec / 3412 / Hr_WH_Operation
Water Heater Blanket Gas Savings (Gross Dth/Yr)	= (WH_Tank_Size / 45 ) x (HLF before - HLF with blanket) x 8760 / HE_Gas / 1,000,000
Water Heater Temperature Setback Gas Savings (Gross Dth/Yr)	= (WH_S_Baseline - WH_S_Proposed) / 10
CFM50_Baseline	= (Air_Gap_Base X Gap_Length)/LAF, CFM at 50 pascals similar to blower door tests results. For use in "Air Sealing" equations.
CFM50_Proposed	= (Air_Gap_Eff X Gap_Length)/LAF, CFM at 50 pascals similar to blower door test results. For use in "Air Sealing" equations.

Variable ID	Value	Description
Measured_Watts_WO	Vendor Input	Measured demand for appliances that will be connected to controller before controller is installed
Measured_Watts_WITH	Vendor Input	Measured demand for controller with appliances connected when controller is in off state
Controller_Hours	Vendor Input	Hours of operation for the controller determined for each customer based on interview results.
HE_Elec	1.00	Heat generation efficiency for electric water heater based on steady-state water heater efficiency.
HE_Gas	0.80	Heat generation efficiency for gas water heater based on steady-state water heater efficiency.
Hr_WH_Operation	8760	Annual water heater "on" time
HLF_Before	237	Heat loss in BTU/hr based on a 45 gallon average of water heater sizes with 2" of polyurethane insulation at 135 F degrees.
HLF_with_blanket	138	Heat loss in BTU/hr based on a 45 gallon average of water heater sizes with 2" of polyurethane insulation at 135 F degrees plus an additional 2.5" fiberglass blanket.
WH_Tank_Size	Vendor Input	Tank Size of customer's Water Heater
WH_S_Baseline	26.18	Baseline gas water heater shell losses, Therms/year
WH_S_Proposed	22.44	Proposed gas water heater shell losses, with -10 F adjustment of setpoint, Therms/year
Cooling_Delta_T	Vendor Input	One-week weighted average temperature difference between normal operation and cooling setback temperature in degrees F, based on information provided by the customer during the interview.
kW_Savings_per_Degree	0.106	kW per degree F of setback (Reference 1, 2)
kWh_Savings_per_Degree	88.61	kWh per degree F of setback (Reference 1, 2)
kW_Savings_per_Degree_2	0.053	kW per degree F of setback for second thermostat = half of savings for first thermostat (Reference 1, 2)
kWh_Savings_per_Degree_2	44.30	kWh per degree F of setback for second thermostat = half of savings for first thermostat (Reference 1, 2)
Heating_Delta_T	Vendor Input	One-week weighted average temperature difference between normal operation and heating setback temperature in degrees F, based on information provided by the customer during the interview.
Dth_Savings_per_Degree	1.754	Dth per degree F of setback (Reference 1, 2)
Dth_Savings_per_Degree_2	0.877	Dth per degree F of setback for second thermostat = half of savings for first thermostat (Reference 1, 2)
Air_Gap_Base	0.56	Effective Air Leakage Area per foot of door gap for door without weatherstripping. (Reference 5)
Air_Gap_Eff	0.15	Effective Air Leakage Area per foot of door gap for door with weatherstripping. (Reference 5)
Gap_Length	Vendor Input	Length of weatherstripping installed. Provided by contractor.
Air_Density	See Table 2	Density of air, Lbm / ft <sup>3</sup> . Values for different climate zones provided in Table 2.
LAF	See Table 2	Leakage Area Factor calculated from formula below for use in calculating CFM50 from a gap area in the building envelope. Values for different climate zones provided in table 2. "= 0.186 X SQRT (Air_Density / (2 X Ref_Pressure)) / Discharge_Coefficient
Ref_Pressure	0.20	Reference pressure, inches WC, equivalent to 50 Pa
Discharge_Coefficient	1.00	Discharge coefficient for opening, dimensionless
Coincidence Factor	See Table 1	Coincidence Factor for lighting, programmable thermostat, door weatherstrip, and water heater blanket.
Measure Life	See Table 1	Measure life for lighting, programmable thermostat, door weatherstrip, and water heater blanket.
Incremental Cost	See Table 1	Incremental cost for lighting, second programmable thermostat, second door weatherstrip.
NTG	100%	Net-to-gross factor. Assumed to be 100% for a new program.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 1: Measure Life, Coincidence Factor, and Hours (Reference 3)**

Type of measure:	Measure life:	Incremental Cost:	Coincidence Factor:	Hours of Operation	
Programmable thermostat (Cooling)	10	\$ 30	76%		Reference 6
Programmable thermostat (Heating)	10	\$ 30	0%		
Weatherstripping (electrically heated and cooled homes)	10	\$ 10	19%		Reference 10
Weatherstripping (electrically cooled and gas heated homes)	10	\$ 10	90%		Reference 2
Water heater blanket elec HW	7.5	na	100%	8760	
Water heater temperature setback	8	\$ 0			
TV & Electronics Controller	5	\$ 20	80%		

**Table 2: Leakage Area Factor (Reference 4)**

	Front Range	Western Slope	Mountain
Air Density	0.0619	0.0629	0.0565
Leakage Area Factor	0.0730	0.0736	0.0698

**References:**

1. Energy Information Administration's (EIA) 2009 Residential Energy Consumption Survey (RECS)
2. Bin analysis using RECS data for thermostat operation and typical CO home cooling and heating conditions.
3. Consumer Electronics Characteristics <http://standby.lbl.gov/summary-table.html>
4. 2013 ASHRAE Fundamentals, Chapter 16
5. Door leakage from Colorado Energy Office website: [http://www.coloradoenergy.org/procorner/stuff/window\\_air\\_leakage.htm](http://www.coloradoenergy.org/procorner/stuff/window_air_leakage.htm)
6. Lifetime of 5 years for door weatherstripping and 10 years for programmable T-Stats from "Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures", June 2007 by GDS Associates.
7. Lifetime of 5 years for TV controller/timer based on DEER database from READI v2.3.0 for Res-Plug-AdvPwrStrip Ex Ante 2015
8. These numbers are based on "CO Home Lighting & Recycling" analysis and references provided in that program.

**Changes from 2017 / 2018 Plan**

Revised weatherstripping savings calculations so they are consistent with changes in air sealing calculations.  
 Updated savings methodology for water heater blankets and setback of gas water heater temperature setpoint.  
 Removed CFL lamps from the program  
 Added LED lamps to the program

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

<b>Product: Home Lighting &amp; Recycling</b>		
<b>Description:</b>		
The Home Lighting product is an upstream program that offers instant rebates on the purchase of Light Emitting Diodes (LEDs). Customers receive the discounted price at the register and there are no forms to fill out. Free CFL recycling is also available to customers through our program.		
<b>Equations and Program References:</b>		
Electrical Demand Savings (Customer kW)	=Number_of_Bulbs x kW_Savings_per_Bulb	
Electrical Energy Savings (Customer kWh/yr)	=Number_of_Bulbs x kW_Savings_per_Bulb x Hours	
kW_Savings_per_Bulb	=Baseline_Wattage - LED_Wattage	
<b>Variables:</b>		
Number_of_Bulbs	Vendor Input	Number of bulbs sold.
Baseline Wattage	Table 1 - 4	Baseline wattages are determined using an adjusted ENERGY STAR lumen equivalency rating, adjusted for EISA requirements based on lumen output. <sup>1,2</sup>
LED_Wattage	Manufacturer Provided	Wattage of the LED bulb, provided by each manufacturer.
Hours	Table 6	Annual hours of operation for the bulbs for both residential and non-residential segments. The program does not have direct access to market segment information for non-residential installations, so a deemed weighted average was created based on history of small business downstream participation. <sup>3, 4, 8</sup>
CF	Table 6	Probability that peak demand of the bulb will coincide with peak utility system demand. The program does not have direct access to market segment information for non-residential installations, so a deemed weighted average was created based on history of small business downstream participation. <sup>3, 4, 8</sup>
Lifetime Hours	Table 8	Lifetime Hours for LEDs. <sup>5</sup>
Measure Life	Table 7	Measure life of the average bulb sold, determined by lifetime hours divided by hours of use by segment. The measure life for EISA impacted lamps takes into account the planned elimination of the baseline halogen bulbs. The analysis assumes that halogens will be available to install for 2 years after they can no longer be sold (January 1, 2020).  The measure life is the minimum of the following for EISA impacted lamps: Lifetime Hours/Hours 2023 + (Halogen Bulb Life/Hours) - Current Year
Incremental Cost of Bulbs	Table 8	Cost difference between baseline and efficient bulb options. <sup>6, 7</sup>
NTG	61%	Net to Gross for A-Line and Specialty bulbs. <sup>9</sup>
NTG	100%	Net to Gross for LED Tubes (Linear Lamps) <sup>10</sup>

### DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Installation Rate	99%	Future savings for bulbs purchased and put in storage and installed in later years. The net present value of the savings for all bulbs purchased is 99% if all bulbs are installed when purchased. <sup>8</sup>
Savings Reduction	75%	Savings and incremental costs from home lighting sold at stores within 1 mile of our service territory border will be reduced to 75% of their value to account for leakage <sup>10</sup>
O&M savings	\$0.00	Operation and Maintenance savings are assumed to be zero.

**Provided by product Vendor:** **Verified during M&V:**

Number and type of bulbs purchased	Yes
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**Assumptions:**

Manufacturer-recommended baseline wattages are used for GSL bulbs and Specialty bulbs outside the lumen values shown in Tables 1 and 2 below. <sup>8</sup>  
 The baseline bulb cost and LED bulb cost will be tracked and updated at the end of the year in the status report to account for the rapidly evolving market and cost for LED bulbs. The baseline will be reviewed and updated at least semi-annually and the LED bulb cost will be reviewed and updated monthly.

**Baseline Wattages for Lumen Equivalencies**

**Table 1: GSL Bulbs <sup>1</sup>**

Minimum Lumens	Maximum Lumens	Incandescent Equivalent Wattage	
		Baseline (Exempt Bulbs)	Baseline (Post-EISA)
2,000	2,600	150	72
1,600	1,999	100	72
1,100	1,599	75	53
800	1,099	60	43
450	799	40	29
310	449	25	25

\*GSL bulbs are medium screw-base bulbs that are not globe, bullet, candle, flood, reflector, or decorative shaped

**Table 2: Specialty Bulbs <sup>1</sup>**

Lumen Bins		Incandescent Equivalent Wattage	
Decorative Shape	Globe Shape	Baseline (Exempt Bulbs)	Baseline (Post-EISA)
	1,100 - 1,300	150	72
	650 - 1,099	100	72
	575 - 649	75	53
500 - 699	500 - 574	60	43
300 - 499	350 - 499	40	29
150 - 299	250 - 349	25	25
90 - 149		15	15
70 - 89		10	10

\*Specialty bulbs are medium screw-base bulbs that are globe, bullet, candle or decorative shaped

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Tables 3 and 4 - Directional (reflector) Bulbs <sup>1,2</sup>**

**Table 3: R, BR, and ER Bulbs**

Bulb Type	Lower Lumen Range	Upper Lumen Range	Watts <sub>Base</sub>
R, ER, BR with medium screw bases w/diameter >2.25" (*see exceptions below)	420	472	40
	473	524	45
	525	714	50
	715	937	65
	938	1,259	75
	1,260	1,399	90
	1,400	1,739	100
	1,740	2,174	120
	2,175	2,624	150
	2,625	2,999	175
*R, BR, and ER with medium screw bases w/diameter <=2.25"	3,000	4,500	200
	400	449	40
	450	499	45
	500	649	50
*ER30, BR30, BR40, or ER40	650	1,199	65
	400	449	40
	450	499	45
*BR30, BR40, or ER40	500	649	50
	650	1,419	65
*R20	400	449	40
	450	719	45
*All reflector lamps below lumen ranges specified	200	299	20
	300	399	30

**PAR, MR, MRX Bulbs**

The following equation is used to determine the baseline wattage for these bulbs, result should be rounded down to the nearest wattage in Table 4.

$$Watts_{base} = 375.1 - 4.355(D) - \sqrt{227,800 - 937.9(D) - 0.9903(D^2) - 1479(BA) - 12.02(D * BA) + 14.69(BA^2) - 16,720 * \ln(CBCP)}$$

D = Bulb Diameter

BA = Beam Angle

CBCP = Center Beam Candle Power

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Table 4: PAR, MR, MRX Bulbs - Energy Star Permitted Wattages**

Diameter	Permitted Wattages
16	20, 35, 40, 45, 50, 60, 75
20	50
30S	40, 45, 50, 60, 75
30L	50, 75
38	40, 45, 50, 55, 60, 65, 75, 85, 90, 100, 120, 150, 250

**Table 5: Lifetime Hours <sup>5</sup>**

Bulb Category	Lifetime
A-Line	16,283
Specialty	23,044

**Table 6: Hours, CF <sup>3, 4, 8</sup>**

Installation Type	Hours	CF	% Breakdown
Residential	986	12.6%	94%
Non-Residential	3866	67.0%	6%

**Table 7: Measure Life**

Installation Type	2019				2020			
	A-Line (Post-EISA)	Specialty (Post-EISA)	Specialty (Exempt)	LED Tubes (Linear Lamps)	A-Line (Post-EISA)	Specialty (EISA)	Specialty (Exempt)	LED Tubes (Linear Lamps)
Residential	5.0	6.0	20.0	20.0	4.0	5.0	20.0	20.0
Non-Residential	4.2	4.5	6.0	13.1	3.3	3.5	6.0	13.1

**Table 8: Average Costs\* <sup>6, 7</sup>**

	A-Line	Specialty
Gross Retail (per bulb)	\$2.67	\$4.67
Baseline (per bulb)	\$0.93	\$2.78
Incremental	\$1.74	\$1.89
Rebate	\$1.33	\$1.46
Net Retail	\$0.41	\$0.44

\* = See assumption above on baseline costs and LED costs throughout the program year.

**Table 9: Linear Lamps <sup>11</sup>**

	Watts	Cost
Baseline	31.00	\$2.00

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

1. The Uniform Methods Project: Residential Lighting Evaluation Protocol, published April 2013. Page 11.
2. State of Illinois Energy Efficiency Technical Reference Manual Final Technical Version as of February 8th, 2017, effective January 1st, 2018. Vol 3, Pages 244-245.
3. Northeast Residential Lighting Hours-of-Use Study, Pages XVI and 37
4. "Lighting - Small Business" participation data from 3/1/2017 through 2018.
5. Lifetime hours from WECC for bulbs sold in 2018 used to calculate weighted lifetime for A-Line and Specialty categories.
6. 2018 CO Home Lighting Product Results compiled by WECC (program administrator).
7. Market survey 2018 (homedepot.com, lowes.com, samsclub.com, target.com, walmart.com, etc)
8. 2016 CO Home Lighting and Recycling Evaluation by Cadmus, 2016. Pages 35, 72-73.
9. 2018 CO Home Lighting and Recycling Evaluation by EMI Consulting, Dec 12 2018. Page 5.
10. 2019 Unopposed Comprehensive Settlement Agreement
11. Estimated values based on ranges provided by Slipstream (WECC) and historical participation in "CO Lighting Efficiency" product

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Program: Home Performance with ENERGY STAR

#### Description:

Home Performance with Energy Star program, residential natural gas and electric customers receive a cash rebate for implementing multiple energy efficiency improvements.

The Home Performance with ENERGY STAR Product provides a “systems approach” to comprehensive energy improvements. Public Service uses this approach by requiring an upgraded home “shell,” including code level attic insulation and a reduction in air infiltration coupled with a combustion safety check if naturally vented combustion appliances (furnace/boiler or water heater) remain in the home after product participation.

Low-income customers may participate in this product, but also have dedicated product offerings.

#### Program References:

Measures "Attic Insulation", "Wall Insulation", and "Air Sealing"	Refer to Program "Insulation and Air Sealing - CO" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCKW, etc.) for all "Attic Insulation", "Wall Insulation", and "Air Sealing" measures.
Measures "Heating Efficiency", "High Efficiency Furnace"	Refer to Program "Residential Heating - CO" to find formulas and variables for (Customer Dth, Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCKW, etc.) for all "Heating Efficiency" measures.
Measures for "Energy Star Clothes Washer"	Refer to Program "Energy Star New Homes - CO" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCKW, etc.) for all "Energy Star Clothes Washer" measures.
Measures for "Water Heating Efficiency"	Refer to Program "Water Heating - CO" to find formulas and variables for (Customer Dth, Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCKW, etc.) for all "Water Heating Efficiency" measures including condensing water heaters, instantaneous water heaters, and heat pump water heaters.
Measures for "Refrigerator Replacement", "Removal of Primary Refrigerator"	Refer to Program "Refrigerator and Freezer Recycling - CO" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCKW, etc.) for "Refrigerator Replacement", and "Removal of Primary Refrigerator" measures.
Measures for "Air Conditioning" and "Ground Source Heat Pumps"	Refer to Program "High Efficiency Air Conditioning - CO" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCKW, etc.) for all "Air Conditioning", "Ground Source Heat Pump" and "Quality Install" measures.
Measures for "Evaporative Cooling"	Refer to Program "Evaporative Cooling - CO" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCKW, etc.) for all "Evaporative Cooling" measures.
Measures for "Programmable T-Stat Setback"	Refer to Program "Home Energy Squad - CO" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCKW, etc.) for all "Programmable T-Stat" measures.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Measures for "Energy Star Smart Thermostat"	Refer to Program "Smart Thermostat and Optimization" to find formulas and variables for (Gross kW Saved at Customer, Gross kWh Saved at Customer, Customer PCkW, etc.) for all "Energy Star Smart Thermostat" measures.
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### Algorithms:

Setback_Thermostat_PCkW (Coincident kW Saved at Customer)	= Setback_Thermostat_kW x CF
---	------------------------------

### Variables:

Effn	Customer Input	= Efficiency of the newly installed natural gas heating unit. We will use the nameplate value provided by the customer.
BTUH	Customer Input	= Size of the newly installed natural gas heating unit. We will use the nameplate value provided by the customer.
Setback_Thermostat_Dtherm (Customer Dth Savings per year)	4.19	Annual energy savings for heating due to an average temperature setback of 2.4 degree F for Heating Season and baseline home heating is 61.6 DTherms / year. Savings is = 4.19 DTherms / year.
Setback_Thermostat_kWh (Customer kWh Savings per year)	118	Annual energy savings for cooling energy due to average temperature setback of 1.33 Degree F for Cooling Season. Baseline cooling energy per year is 1,901 kWh and the annual savings is 118 kWh / year.
CF (Setback Thermostat Coincidence Factor)	76%	CF for cooling only per T-Stat Setback Bin Calcs in the "Home Energy Squad - CO" program.
Setback Thermostat Measure Life	10	Reference 2
Setback Thermostat Incremental Cost	\$50.00	Reference 3
Setback_Thermostat_kW (Customer kW Savings)	0.140	Customer kW savings for cooling energy due to average temperature setback of 1.33 Degree F and Home Energy Squad's model savings of 0.1056 kW / degree of setback.
BTU to kWh	3412	Conversion from BTU to kWh, 1kWh = 3412 BTU
NTG	116.00%	Net-to-Gross Factor = We will use 116% based on Reference 1.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Inputs:

Reference Stand-alone programs for a complete list of required customer inputs	
Identify all implemented measures	Customer Input
Quantity Refrigerators Removed	Customer Input
Example Inputs from Standalone Programs:	
Actual cost of Attic Insulation	Customer Input
Attic Square Footage Insulated	Customer Input
Attic Insulation R-Value Pre Project	Customer Input
Attic Insulation R-Value Post-Project	Customer Input
Actual Cost of Air Sealing	Customer Input
BTUH size of new fuel fired heating equipment	Customer Input
EFFn of new heating equipment	Customer Input
EFFn of new domestic water heating equipment	Customer Input
Blower Door Test-in CFM50	Customer Input
Blower Door Test-out CFM50	Customer Input
Climate Zone (Front Range, Western Slope, or Mountains)	Customer Input
Number of Stories above grade in Home	Customer Input
Conditioned Square Footage	Customer Input

### Assumptions:

Any home with an existing ACH natural of 0.45 ACH will not be eligible for the air sealing measure.

A Blower Door Test will be required for all participating homes.

The Attic Bypass Air Sealing energy savings will be captured with Air Sealing and Weather Stripping measure.

TMY3 Climate Data used for the following areas: Front Range = Denver; Western Slope = Grand Junction; Mountains = Alamosa

The NTG for the Tier 1 evaporative coolers is 59.7%. This was determined in the 2006 Summit Blue Consulting report. The NTG for the Tier 2 evaporative coolers is assumed to be 100% due to the low market participation. The average of these two numbers (

Qualifying Evaporative Cooling Equipment must be new and be a permanently installed direct (Tier 1 or 2), indirect or two-stage evaporative cooling unit. Portable coolers or systems with vapor compression equipment are not eligible, nor is used or reconditioned equipment.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### **References:**

1. COLORADO HOME PERFORMANCE WITH ENERGY STAR® PROGRAM EVALUATION Printed May 2014
2. Lifetime of 10 years for programmable T-Stats from "Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures", June 2007 by GDS Associates
3. Xcel Energy estimate

### **Changes from 2017 / 2018 Plan**

Added evaporative cooling  
Revised Deemed sheet to fit new standard format  
removed refrigerator replacement measure

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Product: Insulation and Air Sealing Rebate

#### Description:

Residential natural gas and/or electric customers receive a cash rebate for installing insulation in their existing single-family home or one-to-four unit property.

#### Wall Insulation Algorithms:

Customer Dth	$= ( 1 / R\_Wall\_Base - 1 / R\_Wall\_Proposed ) * Wall\_Area * HDD * 24 / 1,000,000 / Heating\_Eff\_Gas$
Cooling_kWh	$= ( 1 / R\_Wall\_Base - 1 / R\_Wall\_Proposed ) * Wall\_Area * CDD * 24 / 3,412 / Cooling\_Eff$
Heating_kWh	$= ( 1 / R\_Wall\_Base - 1 / R\_Wall\_Proposed ) * Wall\_Area * HDD * 24 / 3,412 / Heating\_Eff\_Elec$
Gross Annual kWh Saved at Customer	$= Cooling\_kWh + Heating\_kWh$
Customer kW (Gross kW)	$= Gross\ Annual\ kWh\ Saved\ at\ Customer / ( Cooling\_Hours + Heating\_Hours )$
Customer PCkW	$= Cooling\_kWh / Cooling\_Hours$

#### Attic Insulation Algorithms:

Customer Dth	$= ( 1 / ( 2 + R\_Attic\_Base ) - 1 / ( 2 + R\_Attic\_Proposed ) ) * Attic\_Area * HDD * 24 / 1,000,000 / Heating\_Eff\_Gas$
Cooling_kWh	$= ( 1 / ( 2 + R\_Attic\_Base ) - 1 / ( 2 + R\_Attic\_Proposed ) ) * Attic\_Area * CDD * 24 / 3,412 / Cooling\_Eff$
Heating_kWh	$= ( 1 / ( 2 + R\_Attic\_Base ) - 1 / ( 2 + R\_Attic\_Proposed ) ) * Attic\_Area * HDD * 24 / 3,412 / Heating\_Eff\_Elec$
Gross Annual kWh Saved at Customer	$= Cooling\_kWh + Heating\_kWh$
Customer kW (Gross kW)	$= Gross\ Annual\ kWh\ Saved\ at\ Customer / ( Cooling\_Hours + Heating\_Hours )$
Customer PCkW	$= Cooling\_kWh / Cooling\_Hours$

#### Air Sealing Algorithms:

Customer Dth	$= ( CFM50\_Baseline - CFM50\_Proposed ) / N\_Winter * ATF * HDD * 24 / Heating\_Eff\_Gas / 1,000,000$
Cooling_kWh	$= ( CFM50\_Baseline - CFM50\_Proposed ) / N\_Summer * ATF * CDD * 24 / Cooling\_Eff / 3,412$
Heating_kWh	$= ( CFM50\_Baseline - CFM50\_Proposed ) / N\_Winter * ATF * HDD * 24 / Heating\_Eff\_Elec / 3,412$

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Gross Annual kWh Saved at Customer	= Cooling_kWh + Heating_kWh
Customer kW (Gross kW)	= Gross Annual kWh Saved at Customer / ( Cooling_Hours + Heating_Hours )
Customer PCkW	= Cooling_kWh / Cooling_Hours

### Cellular Shades:

Gas Savings (Gross Dth)	= Square_Feet x (Th/SF_Baseline - Th/SF_Proposed)/10
Electric Demand Savings (Gross kW saved at Customer)	= Square_Feet x (kW/SF_Baseline - kW/SF_Proposed)
Electric Demand Savings (Gross Generator kW)	= Electric Demand Savings x Coincidence_Factor
Electric Energy Savings (Gross Annual kWh Saved at Customer)	= Square_Feet x (kWh/SF_Baseline - kWh/SF_Proposed)

Variable ID	Value	Description
R_Wall_Base	4.41	R-Value for baseline wall insulation, calculated assuming no cavity insulation (Ref.7)
R_Wall_Proposed	13.09	R-Value for proposed wall insulation, calculated assuming R-11 cavity insulation (Ref.7)
Wall_Area	Customer Input	Square footage of wall insulation added, provided by customer
R_Attic_Base	Customer Input	R-Value for baseline attic insulation, provided by customer
R_Attic_Proposed	Customer Input	R-Value for proposed attic insulation, provided by customer
Attic_Area	Customer Input	Square footage of attic insulation added, provided by customer
Heating_Efficiency_Gas	See Table 1	Heating efficiency is determined based on the customer's heating system type. <sup>8</sup>
Cooling_Eff	See Table 2	Cooling efficiency is determined based on the customer's cooling system type.
Heating_Efficiency_Elec	See Table 1	Heating efficiency is determined based on the customer's heating system type. <sup>8</sup>
CFM50_Baseline	Customer Input	Blower Door test air leakage rate at 50 pascals maintained pressure, measured in cubic
CFM50_Proposed	Customer Input	Blower Door test air leakage rate at 50 pascals maintained pressure, measured in cubic
N_Winter	See Table 3	Conversion factor used to relate actual measured CFM leakage rate (taken at a reference
N_Summer	See Table 3	Conversion factor used to relate actual measured CFM leakage rate (taken at a reference
ATF	See Table 4	Air Transfer Factor is a conversion factor for calculating BTU/hour from airflow in CFM
HDD	See Table 4	Heating Degree Days base 65, based on TMY3 data.
CDD	See Table 4	Cooling Degree Days base 65, based on TMY3 data.
Cooling_Hours	329	Full load cooling hours per Residential Cooling program

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Heating_Hours	1,159	Full load heating hours per Residential Heating program
Conversion from Btu to Dth	1,000,000	1 Dth = 1,000,000 Btu
Conversion from Btu to kWh	3,412	1 kWh = 3,412 Btu
Incremental Cost	Customer Input	Cost of the insulation or air sealing is provided by the customer
Measure Lifetime	See Table 5	Length of time the lighting equipment will be operational. <sup>1</sup>
Square_Feet	Customer Input	Window square feet covered by cellular shades
Cooling_Type	Customer Input	Cooling type for the residence. Only residence with central AC are eligible
Heating_Type	Customer Input	Heating type for the residence. Only residence with natural gas furnace or electric
kW/SF_Baseline	See Table 6	kW per square foot of roller shades
kW/SF_Proposed	See Table 6	kW per square foot of cellular shades
kWh/SF_Baseline	See Table 6	kWh per square foot of roller shades
kWh/SF_Proposed	See Table 6	kWh per square foot of cellular shades
Th/SF_Baseline	See Table 6	Therms per square foot of roller shades
Th/SF_Proposed	See Table 6	Therms per square foot of cellular shades
Lifetime	13.7	Average product lifetime based on product manufacturing testing protocols.
Cost_baseline	\$2.79	Incremental cost per square foot of new roller shades (Reference 12)
Cost_proposed	\$4.67	Incremental cost per square foot of new cellular shades (Reference 11)
Average Shade SF	15	Square feet of average shade installed
Coincidence_Factor	100%	Percentage of Customer_kW savings that will coincide with peak summer kW savings

**Table 1** Heating\_Eff\_Gas Heating\_Eff\_Elec

Air Source Heat Pump		2.26
Electric Resistance		1.00
Ground Source Heat Pump		3.30
Natural Gas	0.78	

**Table 2** Cooling\_Eff

AC/Air Source Heat Pump	3.93
Evap or None	0.00
Ground Source Heat Pump	4.13

**Table 3 - Reference 5, 6**

Stories	N_Winter			N_Summer		
	Front Range	Western Slope	Mountain	Front Range	Western Slope	Mountain
1	14.328	16.021	15.138	19.313	18.405	18.321
2	11.282	12.405	11.520	16.449	15.969	14.762
3	9.713	10.577	9.730	14.932	14.712	12.890

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

	Front Range	Western Slope	Mountain	
ATF	0.891	0.906	0.813	Reference 3
HDD	6,016	5,580	9,015	
CDD	1,116	1,452	434	

	Lifetime
Wall Insulation	20
Attic Insulation	20
Air Sealing	10

	kW/SF_Baseline	kW/SF_Proposed	kWh/SF_Baseline	kWh/SF_Proposed	Th/SF_Baseline	Th/SF_Proposed
Central AC & Gas Heat	0.0054	0.0051	5.895	5.553	1.346	1.319
Central AC & Electric Resistance Heat	0.0054	0.0051	37.443	36.471		

Inputs:	Verified during M&V:
Window square feet	Yes

### Assumptions

1. For minimum attic R-value, we are assuming non-vented attic for a minimum R-value of 4.74. Any inputs into the calculator that are under 2.74 will use
2. Roof assembly R-value approximated to R=2. Asphalt Shingles, Sheathing, and Air space may or may not apply depending on attic ventilation.
3. Heating Efficiency for electric resistance is assumed to be 1.0
4. Qualifying products meet AERC 1 technical standard: "fenestration attachments incorporating a cellular construction made from fabric or other materials joined together to form cells that trap air."
5. Qualifying products will meet the following performance standards: U-factor & SHGC  $\leq 0.3$  –AND/OR-  $EP_H \geq 5$  &  $EP_C \geq 35$ . Performance ratings must be calculated in accordance with AERC technical procedures and listed on the AERC Certified Products Website
6. Customer has central AC and gas or electric resistance heat.

### Changes from Recent Filing:

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## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

1. California Measurement Advisory Committee (CALMAC) Protocols, Appendix F ([www.calmac.org/events/APX\\_F.pdf](http://www.calmac.org/events/APX_F.pdf)).
2. ASHRAE 2013 Fundamentals, Chapter 16, Equations (41) defining Equivalent Air Leakage Area and (48) defining airflow rate from infiltration.
3. Engineering Toolbox; Air Densities; [http://www.engineeringtoolbox.com/air-altitude-density-volume-d\\_195.html](http://www.engineeringtoolbox.com/air-altitude-density-volume-d_195.html)
4. Existing Equipment Efficiencies from Table 5 of "Building America Research Benchmark Definition", January 2010. R. Hendron and C. Engebrecht.
5. 2013 ASHRAE Fundamentals; Page 16.23 Table 4 Defining Stack Coefficient  $C_s$
6. 2013 ASHRAE Fundamentals; Page 16.24 Table 6, defining basic model Wind Coefficient,  $C_w$ . Assumed Colorado is classified as Shelter Class 3.
7. R-Value estimate for wall insulation based on 2013 ASHRAE Fundamentals; Page 26.20, Table 10
8. Metzger CE, J Zhang, VV Mendon, and KA Cort. 2017. Modeling Cellular Shades in Energy Plus. PNNL-27187. For City of Santa Clara and Silicon Valley Power
9. Cort, KA, JA McIntosh, GP Sullivan, TA Ashley, CE Metzger, and N Fernandez. Testing the Performance and Dynamic Control of Energy-Efficient Cellular Shades in the PNNL Lab Homes. August 2018. PNNL-27663, <https://www.osti.gov/servlets/purl/1477792>
10. D&R International (2013). "Residential Windows and Window Coverings: A Detailed View of the Installed Base and User Behavior." [https://www.energy.gov/sites/prod/files/2013/11/f5/residential\\_windows\\_coverings.pdf](https://www.energy.gov/sites/prod/files/2013/11/f5/residential_windows_coverings.pdf)
11. AERC. 2018. Window Attachments: Efficiency Program Brief. [https://aercnet.org/wp-content/uploads/2018/03/AERC\\_Utility\\_Briefing\\_Doc\\_27FEB18.pdf](https://aercnet.org/wp-content/uploads/2018/03/AERC_Utility_Briefing_Doc_27FEB18.pdf)
12. Blinds.Com. 2019. Pricing information of Roller Shades <https://www.blinds.com/c/roller-shades/45/?filters={}&width=36&height=60&pagesize=24&q=&sorts=Price%20Asc>

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Product: Refrigerator Recycling**

**Description:**

Rebates will be offered for pickup of a primary or secondary working refrigerator or freezer or room air conditioner that will be demanufactured and re-cycled.

**Program References:**

Mearsures "Refrigerator Recycling - Room AC"	Refer to Program "Air Conditioning - CO" to find reference table for "CF_RAC" and "EFLH_RAC"
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**Algorithms:**

**For Refrigerator Recycling**

F_RefrigR_Cost_v2	Existing_Equipment_Quantity * Increm_Electric_Capital_Cost
F_RefrigR_PcKw_v2	F_RefrigR_kW_v2 * CF
F_RefrigR_Rebate_v2	Maximum_Rebate_Currency * Existing_Equipment_Quantity
F_RefrigR_kW_v2	( Base_kWh /Hours * Refrigerator_Factor ) * Existing_Equipment_Quantity
F_RefrigR_kWh_v2	Base_kWh * Refrigerator_Factor * Existing_Equipment_Quantity

**For RAC (Room Air Conditioner) Recycling**

RAC Electrical Demand Savings (Gross kW Saved at Customer)	= Size_RAC x ( 1 / 12000 ) x ( 12 / EER_RAC )
RAC Coincident Peak Demand Savings (Peak kW Saved at Customer)	= Size_RAC x ( 1 / 12000 ) x ( 12 / EER_RAC ) x CF_RAC
RAC Electrical Cooling Energy Savings (Gross Annual kWh Saved at Customer)	= Size_RAC x ( 1 / 12000 ) x EFLH_RAC x ( 12 / SEER_RAC )

**Variables for refrigerator recycling:**

Existing_Equipment_Quantity	Customer Input	Defined on a per case basis (input)
Increm_Electric_Capital_Cost	0	Customer does not pay for recycling cost
CF	64%	Probability of the refrigerator operating during peak time (Reference 6, Table 4)
Maximum_Rebate_Currency	50	Rebate offered for recycling
Hours	5592	8760 (number of hours during the year) times the coincidence factor
Refrigerator_Factor	Table 1	Adjustment between refrigerators and freezers (Reference 3)
Base_kWh	Table 2	Deemed savings based on the age of the refrigerator (Reference 1)

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Variables for RAC recycling:**

Size_RAC	Customer Input	Capacity of the unit in Btu/hr
SEER_RAC	10.85	Seasonal Energy Efficiency Ratio (Assumption - Derived from EER)
EER_RAC	9.80	Energy Efficiency Ratio (Reference 13)
EFLH_RAC	416	Equivalent full load hours
CF_RAC	90%	Coincidence Factor
NTG_RAC	57%	Net to Gross values for room AC recycling (Reference 14, page 20)
Measure Lifetime	3	

**Needed from Customer/Vendor/Administrator for Calculations:**

Confirm removal of working appliance Year of manufacture for the working appliance Size or capacity of room AC
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**Assumptions:**

<p>Rebates are available only for working units. Primary units, secondary units and standalone freezers</p> <p>Primary Units are removed and recycled under the assumption if they were not recycled they would become a secondary unit</p> <p>Calculations assume that the peak coincidence factor is the same as the average coincidence factor</p> <p>Several Baseline scenarios exist. HO can keep and use working secondary unit; HO can sell/give away unit into secondary market and unit will remain on grid; HO can take unit to recycling center and pay for recycling. Since options have positive and negative cash consequences for HO, assume \$0.00 Baseline cost on average.</p> <p>Assuming removal of room air conditioners without replacement. For room air conditioners it is assumed that this recycling program is achieving energy savings by preventing the old unit from entering the secondary market (Reference 16, page 20).</p>
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**Table 1: Refrigeration Factor**

Equipment	Refrigerator Factor
Freezer	0.85
Primary Refrigerator	1.00
Secondary Refrigerator	1.00

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Table 2: Deemed Savings by Age of Refrigerator (Reference 1)**

Year of Manufacture	Deemed Savings kWh
1970	2316
1971	2302
1972	2288
1973	2215
1974	2179
1975	2094
1976	1972
1977	1905
1978	1857
1979	1727
1980	1617
1981	1495
1982	1487
1983	1440
1984	1406
1985	1297
1986	1308
1987	1181
1988	1162
1989	1118
1990	1116
1991	1110
1992	1103
1993	787
1994	783
1995	778
1996	781
1997	783
1998	786
1999	788
2000	790
2001	547
2002	546
2003	544
2004	533
2005	521
2006	534
2007	527
2008	518
2009	511
2010	524
2011	521
2012	523
2013	510
2014	424

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

1. Baseline kWh and Average to peak kW ratio from 1995 and 2012 versions of Residential Energy Data Sourcebook for the U.S. Residential Sector. Berkeley, CA: Lawrence Berkeley National Laboratory. LBNL-40297
2. Data on expected life for savings on secondary refrigerators, "9th year Persistence Study for Southern California Edison", KEMA, 2004
3. Estimate for annual energy use for freezers as percent of refrigerator use. See Table Final Estimates on page 6-15 of report by KEMA-XENERGY (2004). "Final Report, Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program." February 13, 2004
4. Data on NTG numbers in Table 2, "*Primary Refrigerators: An Examination of Appliance Recycling Program Design*", Kate Bushman, The Cadmus Group, Inc., Portland, OR. <http://www.iepec.org/conf-docs/papers/2011PapersTOC/papers/038B.pdf#page=1>
6. Data to support CF of 63.8% from "Domestic Refrigerators: Field Studies and Energy Efficiency Improvement", M. Siddhartha Bhatt, CPRI, July 2001.
7. Data on Efficiency Standards, "Technical Support Document Refrigerators and Freezers", DOE, 2014.
8. Shipment Weighted Efficiencies from Residential Energy Databook, Years 1950 - 1995, <http://enduse.lbl.gov/Projects/RED.html>
9. Refrigerator-Freezer Sizes and Energy Factors (Shipment-Weighted Averages), Residential Energy Databook, Years 1972 - 2010, <http://buildingsdatabook.eren.doe.gov/TableView.aspx?table=5.7.5>
10. California Measurement Advisory Committee (CALMAC) Protocols, Appendix F ([www.calmac.org/events/APX\\_F.pdf](http://www.calmac.org/events/APX_F.pdf)).
11. Energy Star Program Requirements for Refrigerators. [https://www.energystar.gov/ia/partners/product\\_specs/program\\_reqs/refrig\\_prog\\_req.pdf](https://www.energystar.gov/ia/partners/product_specs/program_reqs/refrig_prog_req.pdf)
12. 2017 program data
13. NREL House Simulation Protocols 2010, available at: <https://www.nrel.gov/docs/fy11osti/49246.pdf>
14. Impact, Process, And Market Study Of The Connecticut Appliance Retirement Program: Overall Report; December 23, 2005; available at:

### Changes from 2017 / 2018 Plan:

1. Added room air conditioners

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Product: School Education Kit**

**Description:**

A package of home energy efficiency measures in a kit that can be distributed to 5th or 6th grade students. Each participant receives a kit containing LED bulbs, a high efficiency showerhead, and high efficiency sink aerators (kitchen and bath).

**Product References:**

Measures "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PckW, etc. for the "Efficient Showerhead" measures.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PckW, etc. for the "Efficient Kitchen Faucet Aerator" measure.
Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find formulas for Customer Dth, Customer kWh, customer kW, customer PckW, etc. for the "Efficient Bath Faucet Aerator" measure.
Measures "Replace incandescent lamps with LEDs"	Refer to Program CO Home Lighting & Recycling to find formulas for Customer kW, Customer kWh, Customer PckW for the "LED" measure.
Measures "Bonus LEDs"	Refer to Program CO Home Lighting & Recycling to find formulas for Customer kW, Customer kWh, Customer PckW for the "LED" measure.
Measure "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Hours", "Coincidence Factor", etc values.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Hours", "Coincidence Factor", etc values.
Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for "Gas Split Factor", "Hours", "Coincidence Factor", etc values.
Measures "Replace incandescent lamps with LEDs"	Refer to Program "Home Lighting and Recycling - CO" to find references and tables for "Hours", "Coincidence Factor", etc values.
Measures "Bonus LEDs"	Refer to Program "Home Lighting and Recycling - CO" to find references and tables for "Hours", "Coincidence Factor", etc values.
Measure "Provide Efficient Showerhead"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for Operation and Maintenance cost savings value due to water savings, measure lifetime, etc.
Measures "Provide Efficient Kitchen Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for Operation and Maintenance cost savings value due to water savings, measure lifetime, etc.
Measures "Provide Efficient Bath Faucet Aerator"	Refer to Program "Energy Efficient Showerhead - CO" to find reference table for Operation and Maintenance cost savings value due to water savings, measure lifetime, etc.
Measures "Replace incandescent lamps with LEDs"	Refer to Program "Home Lighting and Recycling - CO" to find reference table for measure lifetime, etc.
Measures "Bonus LEDs"	Refer to Program "Home Lighting and Recycling - CO" to find reference table for measure lifetime, etc.

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

**Variables:**

Incremental Costs		= costs provided by vendor.
Net-to-Gross Factor (NTG)	100%	As these kits would not be available without the product.
Install Rate (Kit LEDs)	95%	Actual Installation Rates will be collected as part of the M&V. Assumed Forecast Value for LED
Install Rate (Bonus LEDs)	99%	Actual Installation Rates will be collected as part of the M&V. Assumed Forecast Value for Bonus LED
Install Rate	45%	Actual Installation Rates will be collected as part of the M&V. Assumed Forecast Value for Showerheads & Aerators

**Inputs:**

**Provided by Customer:**

Number of kits distributed  
 Was LED installed  
 Was showerhead installed

**Verified during M&V:**

Yes  
 Yes  
 Yes

Was Kitchen aerator installed

Yes

Was Bath aerator installed

Yes

**Assumptions:**

Savings shown above include homes with either electric or gas water heaters. The Energy Efficient Showerhead - CO program monitors and establishes a gas split factor for use in homes where the water heater type is unknown. School Education Kits will use the Energy Efficient Showerhead - CO program's gas split factor for unknown water heater types to calculate and claim energy savings.

**Changes from 2017 / 2018 Plan**

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Program: Energy Efficient Showerhead**

**Description:**

Residential customers are eligible to receive a free kit containing a high-efficiency showerhead, kitchen aerator, and bathroom aerator to reduce energy and water use.

**Algorithms:**

Showerhead or Aerator Natural Gas Savings (Gross Dth/unit)	= GPY_DHW_Savings x Water_Heater_Delta_T x 8.33 / Gas_Water_Heater_Efficiency / 1,000,000 x Gas_Split_Factor
Showerhead or Aerator Energy Savings (Customer kWh/unit)	= GPY_DHW_Savings x Water_Heater_Delta_T x 8.33 / Electric_Water_Heater_Efficiency / 3,412 x ( 1 - Gas_Split_Factor )
Water_Heater_Delta_T	= Water_Heater_Temperature - City_Mains_Temperature
Showerhead or Aerator Demand Savings (Customer kW)	= Customer_kWh / 8,760
Showerhead or Aerator Demand Savings (Gross Generator kW)	= Customer_kW * Coincidence_Factor

**Variables:**

GPY_DHW_Savings	See Table 1	Gallons per year of hot water saved with high-efficiency showerhead or aerator.
Water_Heater_Temperature	120	Water heater setpoint temperature °F. (Reference 1)
City_Mains_Temperature	51.4	Water temperature of city water entering the water heater °F. (Reference 2)
Gas_Water_Heater_Efficiency	80%	Assumed gas water heater efficiency without standby losses. This only includes combustion efficiency.
Electric_Water_Heater_Efficiency	100%	Assumed electric water heater efficiency without standby losses.
Gas_Split_Factor	See Table 3	Gas_Electric_Split_Factor is based on customer response to showerhead post card. The customer selects from three options for water heating fuel.
Coincidence_Factor	See Table 1	Amount of Customer_kW demand that will coincide with peak utility system demand.
NTG	99%	Net to Gross is assumed to be 99%

**Inputs:**

Showerhead received by customer	Yes
Showerhead installed by customer	Yes
Water Heating Fuel provided by Customer	Yes

**General Assumptions:**

Baseline Flowrates	Baseline showerhead flowrate is assumed to be 2.5GPM per federal minimum standards. Kitchen and bathroom aerator baseline flowrates are assumed to be 2.2GPM per federal minimum standards.	
Heat content of 1 gallon water	8.33	Btu/gal °F
Specific Heat of Water	1.00	Btu/lb/°F
Conversion from Btu to kWh	3,412	1 kWh = 3,412 Btu
Conversion from Btu to Dth	1,000,000	1 Dth = 1,000,000 Btu
Measure Life	10	Lifetime of showerhead and aerator measures. (Reference 3)
Incremental Costs	See Table 2	Actual costs provided by vendor; cost per showerhead is assumed for the material costs for cost/benefit calculation purposes.
Water Rate	2.69	\$ / 1000 Gallons (Reference 4)
Sewer Rate	4.34	\$ / 1000 Gallons (Reference 5)

**Showerhead Assumptions:**

	Single Family	Multifamily	
Baseline Showerhead Flowrate	2.50	2.50	per federal minimum standards
Proposed Showerhead Flowrate	1.50	1.50	
Shower Duration	13.02	13.02	(Reference 5)
Showers per Day	1.39	1.07	(Reference 5)
Showers in Home	1.82	1.21	(Reference 7)
Shower Temperature	105	105	(Reference 8)

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### Aerator Assumptions:

Baseline kitchen & bathroom aerator flowrate	2.20	2.20	per federal minimum standards
Proposed kitchen aerator flowrate	1.50	1.50	per federal minimum standards
Proposed bathroom aerator flowrate	1.00	1.00	per federal minimum standards
Proposed bathroom aerator flowrate	0.50	0.50	per federal minimum standards
Faucet Use for Homes w/o Dishwasher	12.30	9.48	gal/day (Reference 6)
Faucet Use for Homes w/ Dishwasher	7.50	5.78	gal/day (Reference 6)
Houses with Dishwashers	75%	55%	(Reference 7)
Kitchen Sinks in Home	1.00	1.00	Assumed
Bathroom Sinks in Home	2.21	1.31	(Reference 7)
Dish Washing Temperature	120	120	°F (Reference 1)
Hand Washing Temperature	105	105	°F (Reference 8)

Table 1A - Single Family	Showerhead	2nd Showerhead	Kitchen Aerator	Bathroom Aerators 1.0 GPM	Bathroom Aerators 0.5 GPM
GPY_DHW_Savings	2,836	2,325	351	363	515
Total Water Savings/Year - Gallons	3,630	2,976	411	465	659
Coincidence Factor (Reference 8)	64%	64%	124%	124%	124%
O&M Savings	\$25.52	\$20.92	\$2.89	\$3.27	\$4.63

Table 1B - Multifamily	Showerhead	2nd Showerhead	Kitchen Aerator	Bathroom Aerators 1.0 GPM	Bathroom Aerators 0.5 GPM
GPY_DHW_Savings	3,282	695	419	389	551
Total Water Savings/Year - Gallons	4,200	890	482	498	706
Coincidence Factor (Reference 8)	64%	64%	124%	124%	124%
O&M Savings	\$29.53	\$6.26	\$3.39	\$3.50	\$4.96

Table 2 - Incremental Costs	2019	2020
Showerhead	\$3.35	\$3.45
Showerhead Handheld	\$8.65	\$8.91
Showerhead Styled	\$4.25	\$4.38
Kitchen Aerator	\$1.69	\$1.74
Bathroom Aerator - 0.5 GPM	\$1.55	\$1.55
Bathroom Aerator - 1.0 GPM	\$0.54	\$0.55

\*Note that these incremental costs are estimates. Actual incremental costs will be used when they are known.

Table 3	Gas_Split_Factor
Gas Water Heater	100%
Electric Water Heater	0%
Unknown Water Heater	93%

### References:

1. Development of Standardized Deomestic Hot Water Event Schedules for Residential Buildings; R. Hendron and J. Burch; NREL/CP-550-40874
2. Denver Water's 2006 Treated Water Quality Summary Report; <http://www.denverwater.org/docs/assets/9A12FBC5-BCDF-1B42-D1BC5F0B1CE3B115/TreatedWQSummaryReport20061.pdf>
3. DEER Database for Energy Efficient Resources version 2014; [www.deeresources.com](http://www.deeresources.com)
4. Denver Water 2018 Rate Schedule; <http://www.denverwater.org/BillingRates/RatesCharges/2016-rates/>
5. City and County of Denver 2018 Sanitary Sewer Rate Schedule
6. Xcel Energy New Mexico Residential Shower Use Study
7. The Effect of Efficiency Standards on Water Use and Water Heating Energy Use in the U.S.: A Detailed End-use Treatment; J Koomey, C Dunham, J Lutz; LBL-35475
8. Residential Energy Consumption Survey 2009; <http://www.eia.gov/consumption/residential/>
9. 2010 Xcel Energy Colorado Home Use Study (PS Co Service Area)

### Changes from 2017 / 2018 Plan:

1. Adding deemed savings information to Table 1 for Primary and Secondary 0.5 GPM Aerators
2. Updating 2018 estimated incremental costs for showerhead and aerators based on actual 2017 values. (Values are estimates and will be fixed when final costs are completed.)

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

**Product: Water Heating - CO**

**Description:**

Residential natural gas customers receive a cash rebate for purchasing high-efficiency natural gas water heating equipment. Residential electric customers with standard electric water heaters can receive a rebate for replacing it with a heat pump water heater.

**Equations:**

Hot_Water_Energy (Tank-type)	= Qty x Hot_Water_Demand x Water_Heater_Delta_T x Days_Per_Year x Water_Density x Proposed_Tank_Size / Std_Tank_Size
Hot_Water_Energy (Tankless)	= Qty x Hot_Water_Demand x Water_Heater_Delta_T x Days_Per_Year x Water_Density
Water_Heater_Delta_T	= Water_Heater_Temperature - City_Mains_Temperature

**Gas Equations:**

Customer_Dth	= Baseline_Dth - Proposed_Dth
Baseline_Dth	= Hot_Water_Energy / Baseline_Eff_Gas / 1,000,000
Proposed_Dth	= Hot_Water_Energy / Proposed_Eff / 1,000,000
Baseline Efficiency Gas-Fired Storage WH	= coef1 - ( coef2 x Proposed_Tank_Size )

**Electric Equations:**

Customer kWh	= Baseline_kWh - Proposed kWh + Cooling_Benefit - Heating_Penalty
Baseline_kWh	= Hot_Water_Energy / Baseline_Eff_Electric / 3,412
Proposed_kWh	= Hot_Water_Energy / Proposed_Eff / 3,412
Baseline Efficiency Electric-Resistance Storage WH	= coef1 - ( coef2 x Proposed_Tank_Size )
Customer kW	= Baseline_kW - Proposed_kW
Baseline_kW	= Standard_Water_Heater_kW + Cooling_Benefit / Cooling_Hours
Proposed_kW	= Standard_Water_Heater_kW - ( Baseline_kWh - Proposed_kWh ) / 8760
Customer_PcKW	= Customer_kW x Coincidence_Factor

Variable ID	Value	Description
Hot_Water_Demand	64.3	Average gallons per day of hot water use. (Reference 1)
Water_Heater_Temperature	135	Water heater setpoint temperature °F. (Reference 1)
City_Mains_Temperature	51.4	Water temperature of city water entering the water heater °F. (Reference 2)
Conversion from Btu to Dth	1,000,000	1 Dth = 1,000,000 Btuh
Conversion from Btu to Therm	100,000	1 Therm = 100,000 Btuh
Conversion from Btu to kWh	3,412	1 kWh = 3,412 Btuh
Specific Heat of Water	1	Btu/lb/°F
Water_Density	8.33	lb/gal H2O
Days_Per_Year	365	Days per Year
Heating_Penalty	See Table 1	Heating penalty due to heat pump water heater operating during heating season.
Cooling_Benefit	See Table 1	Cooling savings due to heat pump water heater operating during cooling season.
Standard_Water_Heater_kW	4.5	Assumed kW for a typical electric resistance water heater.
Cooling_Hours	957	Number of hours in a TMY3 year above 77°F.
Coincidence_Factor	100%	We are using the average water heater savings over the summer hours.
Proposed_Tank_Size	Customer Input	Storage capacity for tank type water heaters.
Type of Proposed Water Heater	Customer Input	Type of proposed water heater. (i.e. Storage, Tankless, Heat Pump)
Home Heating and Cooling Type for HP Water Heaters	Customer Input	Source for the home's heating and cooling. See Table 1.
Proposed_Eff	Customer Input	Uniform Efficiency Factor for proposed water heater.
Qty	Customer Input	Equipment Quantity
Measure Life	See Table 2	Lifetime of water heaters. (Reference 3)
Incremental Costs	See Table 2	Incremental cost of efficient technology over baseline technology.

**DEEMED SAVINGS TECHNICAL ASSUMPTIONS**

NTG	See Table 2	Net to Gross
coef1	See Table 3	Code-based formula coefficients to determine baseline energy use
coef2	See Table 3	Code-based formula coefficients to determine baseline energy use
Std_Tank_Size	45.0	Reference tank volume storage capacity based on historical program participation.
Water Heater Self-Installation Rate	52%	Percent of Water Heaters that self-installed after retail purchase (Reference 9)

**Table 1 - Secondary Cooling and Heating Benefits (References 6, 7)**

Heating Type	Cooling Type	Cooling_Benefit kWh	Heating_Penalty kWh	O&M \$
Natural Gas	Refrigerant Based	89.3	0	\$ (42.44)
Electric Resistance	Refrigerant Based	89.3	1,593	\$ -
Heat Pump	Refrigerant Based	89.3	706	\$ -
Natural Gas	Non-Refrigerant Based	0.0	0	\$ (42.44)
Electric Resistance	Non-Refrigerant Based	0.0	1,593	\$ -
Heat Pump	Non-Refrigerant Based	0.0	706	\$ -

**Table 2 - Incremental Cost, Lifetime, NTG - References 3, 10, 11**

Water Heater Type	Size	Draw Pattern	Baseline Cost	Incremental Cost	Lifetime	NTG
High Efficiency Tank-Type Water Heater	Volume <= 40 Gallon	MEDIUM	\$ 906.99	\$ 142.42	13	90%
High Efficiency Tank-Type Water Heater	Volume <= 40 Gallon	HIGH	\$ 833.02	\$ 260.86	13	90%
High Efficiency Tank-Type Water Heater	Volume > 40 Gallon	MEDIUM	\$ 714.09	\$ 119.30	13	90%
High Efficiency Tank-Type Water Heater	Volume > 40 Gallon	HIGH	\$ 958.42	\$ 382.64	13	90%
High Efficiency Tankless Water Heater	N/A	MEDIUM	\$ 975.06	\$ 783.49	20	90%
High Efficiency Tankless Water Heater	N/A	HIGH	\$ 1,071.37	\$ 860.63	20	90%
Air Source Heat Pump Water Heater	N/A	NA	\$ 958.62	\$ 611.45	12	100%

**Table 3 - Baseline Efficiency Coefficients Reference 8 ( >= 20gal & <= 55 gal )**

Draw Pattern	Gas (Storage)		Elec (Storage)	
	coef1	coef2	coef1	coef2
Medium	0.6483	0.0017	0.9307	0.0002
High	0.6920	0.0013	0.9349	0.0001

## DEEMED SAVINGS TECHNICAL ASSUMPTIONS

### References:

1. Energy Conservation Program for Consumer Products: Test Procedure for Water Heaters; United States Department of Energy; <http://www.gpo.gov/fdsys/pkg/FR-1998-05-11/pdf/98-12296.pdf>
2. Denver Water's 2006 Treated Water Quality Summary Report;  
<http://www.denverwater.org/docs/assets/9A12FBC5-BCDF-1B42-D1BC5F0B1CE3B115/TreatedWQSummaryReport20061.pdf>
3. Energy Star Residential Water Heaters -Final Criterial Analysis, April 2008.  
[http://www.energystar.gov/ia/partners/prod\\_development/new\\_specs/downloads/water\\_heaters/WaterHeaterAnalysis\\_Final.pdf](http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterAnalysis_Final.pdf)
4. Not Used
5. US Department of Energy; Residential Heat Pump Water Heaters;  
<http://energy.gov/eere/femp/covered-product-category-residential-heat-pump-water-heaters>
6. US Department of Energy; Residential Air Conditioners and Heat Pumps; [http://www1.eere.energy.gov/buildings/appliance\\_standards/product.aspx/productid/75](http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75)
7. US Department of Energy; Residential Furnace Standards. [https://www1.eere.energy.gov/buildings/appliance\\_standards/product.aspx/productid/72#standards](https://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72#standards)
8. US Department of Energy, Residential Water Heater Standards 10 CFR 430.32(d):  
[https://www.ecfr.gov/cgi-bin/text-idx?SID=80dfa785ea350ebee184bb0ae03e7f0&mc=true&node=se10.3.430\\_132&rgn=div8](https://www.ecfr.gov/cgi-bin/text-idx?SID=80dfa785ea350ebee184bb0ae03e7f0&mc=true&node=se10.3.430_132&rgn=div8)
9. EnergyStar - [http://aceee.org/sites/default/files/files/pdf/conferences/hwf/2016/Ryan\\_Session1C\\_HWF16\\_2.22.16\\_0.pdf](http://aceee.org/sites/default/files/files/pdf/conferences/hwf/2016/Ryan_Session1C_HWF16_2.22.16_0.pdf)
10. Equipment Manufacturer Retail Price Information Request ( Q4 - 2017 )
11. NREL - National Residential Efficiency Measure Database, <https://remdb.nrel.gov/measures.php?gld=6&ctld=270>

Measure Description	High Efficiency Product Assumptions				Baseline Product Assumptions			Economic Assumptions				Electric Planning Assumptions						Economic Assumptions		Technical Assumption	2019		2020		NTG (%)	Installation Rate (%)	Realization Rate (%)			
	Electric Measure Description	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period w/o Rebate (yrs)	Incremental Cost Payback Period w/ Rebate (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Cust kWh Saved (\$/kWh)	Rebated Lifetime Cost / Cust kWh Saved (\$/kWh)	Customer kWh Savings (kWh)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)				2019 Units (-)	2020 Participants (-)	2020 Units (-)
Compressed Air Efficiency Study	Leak & Waste Found and Repaired	759,273	5,801	Existing System with Leaks & Waste that have not been repaired	766,071	5,801	5.00	\$4,601	\$0	\$6,597	\$ 0.067	70%	2.49	0.75	39,435	\$0.12	\$0.02	6,798	7,366	\$0.00	\$0.00	100%	26	26	28	28	87%	100%	100%	
Cycling Dryers	New Cycling Dryer	621	7,269	New Non-Cycling Dryer	1,813	7,269	20.00	\$385	\$4,471	\$885	\$ 0.061	41%	1.69	0.99	8,665	\$0.04	\$0.00	1,192	1,292	\$0.00	\$0.00	100%	12	12	14	14	73%	100%	100%	
Dew Point Demand Control	Purge Control for Heatless Desiccant Dryers	17,935	7,221	No Purge Control for Heatless Desiccant Dryers	24,408	7,221	15.00	\$1,176	\$0	\$3,277	\$ 0.061	36%	1.15	0.74	46,742	\$0.03	\$0.00	6,473	7,014	\$0.00	\$0.00	100%	7	7	9	9	73%	100%	100%	
Mist Eliminator Filters	New Mist Eliminator Filter	106,717	7,949	New General Purpose Filter	108,480	7,949	11.00	\$1,000	\$1,757	\$5,157	\$ 0.058	19%	5.77	4.65	14,014	\$0.07	\$0.01	1,763	1,910	\$76.01	\$0.00	100%	2	2	3	3	73%	100%	100%	
No Air Loss Drain	New No-Air Loss Drain	0	7,523	New Electronic Solenoid/Timer Drain	517	7,523	13.00	\$200	\$125	\$323	\$ 0.060	62%	1.39	0.53	3,889	\$0.05	\$0.00	0,517	0,401	\$0.00	\$0.00	72%	17	17	19	19	73%	100%	100%	
VFD Air Compressor New	New VFD Compressor	13,797	2,923	New Modulation or load no-load with less than or equal to 2gal of storage per CFM of Capacity	19,757	2,923	20.00	\$3,700	\$10,469	\$4,977	\$ 0.099	74%	2.87	0.74	17,421	\$0.21	\$0.01	5,960	4,626	\$0.00	\$0.00	72%	30	30	33	33	73%	100%	100%	
VFD Air Compressor HP Reduction	New VFD Compressor of lesser HP than Baseline Unit	16,595	2,830	Existing Modulation or load no-load with less than or equal to 2gal of storage per CFM of Capacity	25,535	2,830	20.00	\$4,500	\$0	\$16,445	\$ 0.102	27%	6.13	4.45	26,432	\$0.17	\$0.01	9,340	7,249	\$0.00	\$0.00	72%	6	6	6	6	73%	100%	100%	
Custom Projects	New Equipment	739,153	5,737	Old or less efficient systems or equipment	766,071	5,737	20.00	\$9,364	\$0	\$53,218	\$ 0.068	18%	5.10	4.20	154,429	\$0.06	\$0.00	26,918	20,892	\$0.00	\$0.00	72%	19	19	19	19	87%	100%	100%	
CO - MS ACCH < 150 tons -10.3 EER 14.5 SEER	Efficient Air-cooled Chiller, Size 106 tons, 10.3 EER, 14.5 SEER at AHRI Standard Operating Conditions	123,853	706	IECC 2015 Code Air Cooled Chiller, Size 106 tons, 10.1 EER, 13.7 SEER at AHRI Standard Operating Conditions	126,306	733	20.00	\$1,329	\$0	\$5,195	\$ 0.125	26%	8.08	6.01	5,142	\$0.26	\$0.01	2,453	2,392	\$0.00	\$0.00	90%	0	0	0	0	89%	100%	100%	
CO - MS ACCH < 150 tons -10.3 EER 15 SEER	Efficient Air-cooled Chiller, Size 106 tons, 10.46 EER, 15.53 SEER at AHRI Standard Operating Conditions	122,108	670	IECC 2015 Code Air Cooled Chiller, Size 106 tons, 10.1 EER, 13.7 SEER at AHRI Standard Operating Conditions	126,490	733	20.00	\$2,662	\$0	\$8,058	\$ 0.111	33%	6.67	4.47	10,905	\$0.24	\$0.01	4,382	4,273	\$0.00	\$0.00	90%	3	18	3	16	89%	100%	100%	
CO - MS ACCH < 150 tons -10.3 EER 16 SEER	Efficient Air-cooled Chiller, Size 85 tons, 10.68 EER, 16.48 SEER at AHRI Standard Operating Conditions	95,269	644	IECC 2015 Code Air Cooled Chiller, Size 85 tons, 10.1 EER, 13.7 SEER at AHRI Standard Operating Conditions	100,693	733	20.00	\$3,178	\$0	\$8,903	\$ 0.117	36%	6.10	3.92	12,455	\$0.26	\$0.01	5,424	5,289	\$0.00	\$0.00	90%	1	5	1	3	89%	100%	100%	
CO - MS ACCH < 150 tons -10.3 EER 18 SEER	Efficient Air-cooled Chiller, Size 149 tons, 11.25 EER, 18.45 SEER at AHRI Standard Operating Conditions	158,720	606	IECC 2015 Code Air Cooled Chiller, Size 149 tons, 10.1 EER, 13.7 SEER at AHRI Standard Operating Conditions	176,792	733	20.00	\$11,160	\$0	\$28,552	\$ 0.137	39%	6.23	3.80	33,404	\$0.33	\$0.02	18,072	17,624	\$0.00	\$0.00	90%	0	0	0	0	89%	100%	100%	
CO - MS ACCH >=150 tons -10.3 EER 14.5 SEER	Efficient Air-cooled Chiller, Size 232 tons, 10.3 EER, 14.5 SEER at AHRI Standard Operating Conditions	269,973	706	IECC 2015 Code Air Cooled Chiller, Size 232 tons, 10.1 EER, 14 SEER at AHRI Standard Operating Conditions	275,319	717	20.00	\$2,897	\$0	\$11,323	\$ 0.184	26%	9.07	6.75	6,803	\$0.43	\$0.02	5,346	5,213	\$0.00	\$0.00	90%	0	0	0	0	89%	100%	100%	
CO - MS ACCH >=150 tons -10.3 EER 15 SEER	Efficient Air-cooled Chiller, Size 232 tons, 10.3 EER, 15 SEER at AHRI Standard Operating Conditions	269,973	683	IECC 2015 Code Air Cooled Chiller, Size 232 tons, 10.1 EER, 14 SEER at AHRI Standard Operating Conditions	275,319	717	20.00	\$5,793	\$0	\$17,538	\$ 0.112	33%	11.99	8.03	13,012	\$0.45	\$0.02	5,346	5,213	\$0.00	\$0.00	90%	0	0	0	0	89%	100%	100%	
CO - MS ACCH >=150 tons -10.3 EER 16 SEER	Efficient Air-cooled Chiller, Size 173 tons, 10.45 EER, 17.45 SEER at AHRI Standard Operating Conditions	198,086	595	IECC 2015 Code Air Cooled Chiller, Size 173 tons, 10.1 EER, 14 SEER at AHRI Standard Operating Conditions	204,950	717	20.00	\$6,469	\$0	\$18,121	\$ 0.079	36%	7.86	5.05	29,088	\$0.22	\$0.01	6,864	6,694	\$0.00	\$0.00	90%	1	4	1	2	89%	100%	100%	
CO - MS ACCH >=150 tons -10.3 EER 18 SEER	Efficient Air-cooled Chiller, Size 242 tons, 11.83 EER, 19.58 SEER at AHRI Standard Operating Conditions	246,037	600	IECC 2015 Code Air Cooled Chiller, Size 242 tons, 10.1 EER, 14 SEER at AHRI Standard Operating Conditions	288,113	717	20.00	\$18,187	\$0	\$46,530	\$ 0.170	39%	4.64	2.83	58,955	\$0.31	\$0.02	42,076	41,033	\$0.00	\$0.00	90%	3	15	3	13	89%	100%	100%	
CO - MS RTUS < 5.4 ton -12.2 EER 15 SEER	Efficient RTU 4.22 tons, 12.8 EER, 15.2 SEER	3,957	712	IECC 2015 Code RTU 4.22 tons, 11.76 EER, 14 SEER	4,301	713	15.00	\$126	\$0	\$414	\$ 0.296	31%	5.60	3.89	249	\$0.51	\$0.03	0,344	0,335	\$0.00	\$0.00	90%	47	350	56	350	89%	100%	100%	
CO - MS RTUS < 5.4 ton -12.2 EER 16 SEER	Efficient RTU 3.53 tons, 12.8 EER, 16.3 SEER	3,311	669	IECC 2015 Code RTU 3.53 tons, 11.76 EER, 14 SEER	3,603	713	15.00	\$177	\$0	\$522	\$ 0.191	34%	7.72	5.11	354	\$0.50	\$0.03	0,292	0,285	\$0.00	\$0.00	90%	4	25	4	25	89%	100%	100%	
CO - MS RTUS < 5.4 ton -12.2 EER 17 SEER	Efficient RTU 3.99 tons, 12.7 EER, 17.1 SEER	3,765	631	IECC 2015 Code RTU 3.99 tons, 11.76 EER, 14 SEER	4,076	713	15.00	\$280	\$0	\$1,351	\$ 0.146	21%	17.47	13.86	530	\$0.53	\$0.04	0,311	0,303	\$0.00	\$0.00	90%	9	60	10	60	89%	100%	100%	
CO - MS RTUS < 5.4 ton -12.2 EER 18 SEER	Efficient RTU 3.76 tons, 13 EER, 19.2 SEER	3,485	574	IECC 2015 Code RTU 3.76 tons, 11.76 EER, 14 SEER	3,840	713	15.00	\$376	\$0	\$3,002	\$ 0.126	13%	32.35	28.30	738	\$0.51	\$0.03	0,355	0,346	\$0.00	\$0.00	90%	1	2	1	2	89%	100%	100%	
CO - MS Split Sys < 5.4 ton -12.2 EER 15 SEER	Efficient Split System A/C 4.22 tons, 12.8 EER, 15.2 SEER	3,957	712	IECC 2015 Code Split System A/C 4.22 tons, 11.16 EER, 13 SEER	4,524	730	15.00	\$126	\$0	\$414	\$ 0.256	31%	3.33	2.31	485	\$0.26	\$0.02	0,567	0,553	\$0.00	\$0.00	90%	0	0	0	1	89%	100%	100%	
CO - MS Split Sys < 5.4 ton -12.2 EER 16 SEER	Efficient Split System A/C 3.53 tons, 12.8 EER, 16.3 SEER	3,311	669	IECC 2015 Code Split System A/C 3.53 tons, 11.18 EER, 13 SEER	3,790	730	15.00	\$177	\$0	\$522	\$ 0.199	34%	4.75	3.14	552	\$0.32	\$0.02	0,479	0,467	\$0.00	\$0.00	90%	1	4	0	4	89%	100%	100%	
CO - MS Split Sys < 5.4 ton -12.2 EER 17 SEER	Efficient Split System A/C 3.99 tons, 12.7 EER, 17.1 SEER	3,765	631	IECC 2015 Code Split System A/C 3.99 tons, 11.16 EER, 13 SEER	4,288	730	15.00	\$280	\$0	\$1,351	\$ 0.166	21%	10.78	8.55	755	\$0.37	\$0.02	0,523	0,510	\$0.00	\$0.00	90%	0	0	0	0	89%	100%	100%	
CO - MS Split Sys < 5.4 ton -12.2 EER 18 SEER	Efficient Split System A/C 3.76 tons, 13 EER, 19.2 SEER	3,485	574	IECC 2015 Code Split System A/C 3.76 tons, 11.16 EER, 13 SEER	4,039	730	15.00	\$376	\$0	\$3,002	\$ 0.145	13%	21.78	19.05	948	\$0.40	\$0.03	0,554	0,540	\$0.00	\$0.00	90%	0	0	0	0	89%	100%	100%	
CO - MS RTUS - 5.5-11.3 ton -11.6 EER 13 SEER	Efficient RTU 7.13 tons, 12.1 EER, 13 SEER	7,095	765	IECC 2015 Code RTU 7.13 tons, 11 EER, 12.6 SEER	7,775	722	20.00	\$143	\$0	\$575	\$ 0.729	25%	4.25	3.19	186	\$0.77	\$0.04	0,680	0,663	\$0.00	\$0.00	90%	34	248	40	248	89%	100%	100%	
CO - MS RTUS - 5.5-11.3 ton -11.6 EER 13.8 SEER	Efficient RTU 7.9 tons, 12.2 EER, 14.2 SEER	7,740	715	IECC 2015 Code RTU 7.9 tons, 11 EER, 12.6 SEER	8,616	722	20.00	\$257	\$0	\$1,032	\$ 0.277	25%	5.43	4.08	687	\$0.37	\$0.02	0,876	0,854	\$0.00	\$0.00	90%	11	75	8	50	89%	100%	100%	
CO - MS RTUS - 5.5-11.3 ton -11.6 EER 14.6 SEER	Efficient RTU 8.59 tons, 12.4 EER, 14.9 SEER	8,283	689	IECC 2015 Code RTU 8.59 tons, 11 EER, 12.6 SEER	9,373	722	20.00	\$387	\$0	\$1,004	\$ 0.230	39%	4.12	2.54	1,060	\$0.36	\$0.02	1,090	1,063	\$0.00	\$0.00	90%	10	70	10	60	89%	100%	100%	
CO - MS RTUS - 5.5-11.3 ton -11.6 EER 18 SEER	Efficient RTU 7.76 tons, 13 EER, 20.8 SEER	7,168	517	IECC 2015 Code RTU 7.76 tons, 11 EER, 12.6 SEER	8,464	722	20.00	\$776	\$0	\$2,218	\$ 0.317	35%	6.74	4.79	2,405	\$0.22	\$0.02	1,296	1,264	\$0.00	\$0.00	90%	2	10	2	8	89%	100%	100%	
CO - MS RTUS - 11.4-19.9 ton -11.6 EER 12.6 SEER	Efficient RTU 14.06 tons, 12.1 EER, 13 SEER	13,951	718	IECC 2015 Code RTU 14.06 tons, 10.8 EER, 12.2 SEER	15,624	684	20.00	\$281	\$0	\$1,515	\$ 0.508	19%	4.45	3.62	670	\$0.42	\$0.02	1,673	1,632	\$0.00	\$0.00	90%	19	135	19	120	89%	100%	100%	
CO - MS RTUS - 11.4-19.9 ton -11.6 EER 13.4 SEER	Efficient RTU 13.84 tons, 12 SEER, 14.6 SEER	13,828	680	IECC 2015 Code RTU 13.84 tons, 10.8 EER, 12.2 SEER	15,373	684	20.00	\$450	\$0	\$2,374	\$ 0.298	19%	7.16	5.80	1,112	\$0.40	\$0.02	1,545	1,507	\$0.00	\$0.00	90%	5	30	4	25	89%	100%	100%	
CO - MS RTUS - 11.4-19.9 ton -11.6 EER 14 SEER	Efficient RTU 16 tons, 12.1 EER, 14.4 SEER	15,870	650	IECC 2015 Code RTU 16 tons, 10.8 EER, 12.2 SEER	17,776	684	20.00	\$720	\$0	\$3,150	\$ 0.231	23%	7.41	5.71	1,843	\$0.39	\$0.02	1,906	1,859	\$0.00	\$0.00	90%	7	50	7	40	89%	100%	100%	
CO - MS RTUS - 11.4-19.9 ton -11.6 EER 17.5 SEER	Efficient RTU 15.08 tons, 12.2 EER, 19.7 SEER	14,820	506	IECC 2015 Code RTU 15.08 tons, 10.8 EER, 12.2 SEER	16,754	684	20.00	\$1,508	\$0	\$4,812	\$ 0.127	31%	9.55	6.56	3,961	\$0.38	\$0.02	1,934	1,886	\$0.00	\$0.00	90%	3	15	2	12	89%	100%	100%	
CO - MS RTUS - 20-63.3 ton -10.3 EER 12 SEER	Efficient RTU 25.03 tons, 11.1 EER, 12.4 SEER	27,100	798	IECC 2015 Code RTU 25.03 tons, 9.8 EER, 11.4 SEER	30,645	767	20.00	\$501	\$0	\$324	\$ 0.393	154%	0.44	-0.24	1,879	\$0.27	\$0.01													

Electric Planning Assumptions																														
Measure Description	High Efficiency Product Assumptions			Baseline Product Assumptions			Economic Assumptions					Stipulated Output					Economic Assumptions		Technical Assumption	2019				2020				NTG (%)	Installation Rate (%)	Realization Rate (%)
	Electric Measure Description	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period (w/o Rebate) (yrs)	Incremental Cost Payback Period (w/ Rebate) (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Cust kWh Saved (\$/kWh)	Rebated Lifetime Cost / Cust kWh Saved (\$/kWh)	Customer kWh Savings (kWh)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)			
CO - MS PTAC >= 7000 - < 15000 BTUH - 11 EER	Efficient Retrofit PTAC 12000 BTUH, 11 EER	1,091	556	IECC 2015 Code PTAC 12000 BTUH, 0 EER	1,438	556	15.00	\$30	\$0	\$172	\$ 0.376	17%	2.38	1.96	193	\$0.16	\$0.01	0.347	0.339	\$0.00	\$0.00	90%	73	542	86	542	89%	100%	100%	
CO - MS PTAC >= 7000 - < 15000 BTUH - 11.5 EER	Efficient Retrofit PTAC 12000 BTUH, 11.5 EER	1,043	556	IECC 2015 Code PTAC 12000 BTUH, 0 EER	1,438	556	15.00	\$60	\$0	\$255	\$ 0.376	24%	3.09	2.36	219	\$0.27	\$0.02	0.395	0.385	\$0.00	\$0.00	90%	121	900	142	900	89%	100%	100%	
CO - MS PTAC >= 7000 - < 15000 BTUH - 12 EER	Efficient Retrofit PTAC 14880 BTUH, 12 EER	1,240	556	IECC 2015 Code PTAC 14880 BTUH, 0 EER	1,925	556	15.00	\$112	\$0	\$467	\$ 0.376	24%	3.26	2.48	381	\$0.29	\$0.02	0.685	0.668	\$0.00	\$0.00	90%	125	929	147	929	89%	100%	100%	
CO - MS PTAC >= 15000 BTUH - 11 EER	Efficient Retrofit PTAC 15000 BTUH, 11 EER	1,364	556	IECC 2015 Code PTAC 15000 BTUH, 7.71 EER	1,947	556	15.00	\$38	\$0	\$215	\$ 0.376	17%	1.77	1.46	324	\$0.12	\$0.01	0.583	0.569	\$0.00	\$0.00	90%	1	1	1	1	89%	100%	100%	
CO - MS PTAC >= 15000 BTUH - 11.5 EER	Efficient Retrofit PTAC 25000 BTUH, 11.5 EER	2,174	556	IECC 2015 Code PTAC 25000 BTUH, 7.71 EER	3,245	556	15.00	\$125	\$0	\$531	\$ 0.376	24%	2.37	1.81	595	\$0.21	\$0.01	1.071	1.044	\$0.00	\$0.00	90%	1	1	1	1	89%	100%	100%	
CO - MS PTAC >= 15000 BTUH - 12 EER	Efficient Retrofit PTAC 29999 BTUH, 12 EER	2,500	556	IECC 2015 Code PTAC 29999 BTUH, 7.71 EER	3,893	556	15.00	\$225	\$0	\$942	\$ 0.376	24%	3.23	2.46	775	\$0.29	\$0.02	1.394	1.359	\$0.00	\$0.00	90%	1	1	1	1	89%	100%	100%	
CO - WSHHP - 0 - 11.25 tons - 13.5 EER	Efficient WSHHP, 2.72 tons, 14.4 EER	2,258	1,881	IECC 2015 Code WSHHP, 2.72 tons, 13 EER	2,506	1,794	20.00	\$136	\$0	\$444	\$ 0.224	31%	7.99	5.55	248	\$0.55	\$0.03	0.248	0.242	\$0.00	\$0.00	90%	114	853	0	0	89%	100%	100%	
CO - WSHHP - 0 - 11.25 tons - 15 EER	Efficient WSHHP, 2.39 tons, 15.3 EER	1,870	1,940	IECC 2015 Code WSHHP, 2.39 tons, 13 EER	2,203	1,794	20.00	\$179	\$0	\$586	\$ 0.240	31%	7.94	5.51	308	\$0.58	\$0.03	0.333	0.325	\$0.00	\$0.00	90%	32	236	0	0	89%	100%	100%	
CO - WSHHP - 0 - 11.25 tons - 16 EER	Efficient WSHHP, 2.57 tons, 16.4 EER	1,876	2,033	IECC 2015 Code WSHHP, 2.57 tons, 13 EER	2,369	1,794	20.00	\$257	\$0	\$840	\$ 0.249	31%	7.73	5.37	436	\$0.59	\$0.03	0.493	0.481	\$0.00	\$0.00	90%	31	227	0	0	89%	100%	100%	
CO - WSHHP - 0 - 11.25 tons - 18 EER	Efficient WSHHP, 2 tons, 18 EER	1,333	2,156	IECC 2015 Code WSHHP, 2 tons, 13 EER	1,846	1,794	20.00	\$300	\$0	\$982	\$ 0.257	31%	8.73	6.06	438	\$0.69	\$0.03	0.513	0.500	\$0.00	\$0.00	90%	1	5	0	0	89%	100%	100%	
CO - ASHC - Low Temp	Anti-Sweat Heater Control on Low Temp Freezer Case	7	8,760	Anti-Sweat Heater running continuously	238	8,760	12.00	\$60	\$0	\$180	\$ 0.056	33%	1.59	1.06	2,020	\$0.03	\$0.00	0.231	0.242	\$0.00	\$0.00	97%	0	0	0	0	100%	100%	100%	
CO - ASHC - Medium Temp	Anti-Sweat Heater Control on Low Temp Refrigeration Case	4	8,760	Anti-Sweat Heater running continuously	121	8,760	12.00	\$60	\$0	\$180	\$ 0.056	33%	3.11	2.08	1,029	\$0.06	\$0.00	0.117	0.123	\$0.00	\$0.00	97%	0	0	0	0	100%	100%	100%	
CO - CFCH - 0 - 149 tons	Centrifugal Chiller Size 102 tons, 0.58 FLV, 0.52 IPLV at customer specified operating conditions	59,160	848	Centrifugal Chiller Meeting IECC 2015 Adjusted to customer specified operating conditions	62,220	853	20.00	\$2,030	\$0	\$18,054	\$ 0.235	11%	26.53	23.55	2,895	\$0.70	\$0.04	3.060	2.984	\$0.00	\$0.00	90%	0	0	0	0	71%	100%	100%	
CO - CFCH - 150 - 299 tons	Centrifugal Chiller Size 225 tons, 0.52 FLV, 0.3246 IPLV at customer specified operating conditions	119,700	577	Centrifugal Chiller Meeting IECC 2015 Adjusted to customer specified operating conditions	123,504	853	20.00	\$8,624	\$0	\$39,825	\$ 0.054	22%	20.19	15.82	36,252	\$0.24	\$0.01	3.804	3.710	\$0.00	\$0.00	90%	1	2	1	2	71%	100%	100%	
CO - CFCH - 300 - 399 tons	Centrifugal Chiller Size 393 tons, 0.46 FLV, 0.35 IPLV at customer specified operating conditions	180,780	720	Centrifugal Chiller Meeting IECC 2015 Adjusted to customer specified operating conditions	220,080	878	20.00	\$21,576	\$0	\$69,561	\$ 0.152	31%	7.22	4.98	63,202	\$0.34	\$0.02	39.300	38.325	\$0.00	\$0.00	90%	1	3	1	3	71%	100%	100%	
CO - CFCH - 400 - 599 tons	Centrifugal Chiller Size 494 tons, 0.46 FLV, 0.35 IPLV at customer specified operating conditions	227,240	720	Centrifugal Chiller Meeting IECC 2015 Adjusted to customer specified operating conditions	276,640	845	20.00	\$25,639	\$0	\$87,438	\$ 0.168	29%	7.42	5.24	70,099	\$0.37	\$0.02	49.400	48.175	\$0.00	\$0.00	90%	1	7	1	5	71%	100%	100%	
CO - CFCH - 600 tons and above	Centrifugal Chiller Size 1140 tons, 0.46562 FLV, 0.32822 IPLV at customer specified operating conditions	530,807	667	Centrifugal Chiller Meeting IECC 2015 Adjusted to customer specified operating conditions	573,898	845	20.00	\$40,070	\$0	\$201,780	\$ 0.097	20%	15.90	12.75	130,773	\$0.31	\$0.02	43.091	42.022	\$0.00	\$0.00	90%	0	0	0	0	71%	100%	100%	
CO - DEPAACC - 10 - 59 Tons	Air-cooled condenser on DX unit served by Reduced Entering Outdoor Air Temperature through Evaporative Pre-cooling per 1 ton of cooling capacity	1,017	975	Standard Air-Cooled Condensing Unit served by untreated ambient Outdoor Air	1,190	975	20.00	\$100	\$0	\$248	\$ 0.229	40%	6.42	3.84	169	\$0.59	\$0.03	0.173	0.169	\$0.00	\$0.00	90%	14	100	12	75	71%	100%	100%	
CO - DEPAACC - 60 - 99 Tons	Air-cooled condenser on DX unit served by Reduced Entering Outdoor Air Temperature through Evaporative Pre-cooling per 1 ton of cooling capacity	1,017	574	Standard Air-Cooled Condensing Unit served by untreated ambient Outdoor Air	1,190	574	20.00	\$100	\$0	\$220	\$ 0.385	45%	6.06	3.31	99	\$1.01	\$0.05	0.173	0.169	\$0.00	\$0.00	90%	21	150	32	200	71%	100%	100%	
CO - DEPAACC - 100 - 139 Tons	Air-cooled condenser on DX unit served by Reduced Entering Outdoor Air Temperature through Evaporative Pre-cooling per 1 ton of cooling capacity	1,017	432	Standard Air-Cooled Condensing Unit served by untreated ambient Outdoor Air	1,190	432	20.00	\$100	\$0	\$209	\$ 0.474	48%	5.91	3.08	75	\$1.34	\$0.07	0.173	0.169	\$0.00	\$0.00	90%	34	250	48	300	71%	100%	100%	
CO - DEPAACC - 140 - 239 Tons	Air-cooled condenser on DX unit served by Reduced Entering Outdoor Air Temperature through Evaporative Pre-cooling per 1 ton of cooling capacity	1,017	545	Standard Air-Cooled Condensing Unit served by untreated ambient Outdoor Air	1,190	545	20.00	\$100	\$0	\$203	\$ 0.383	49%	5.62	2.85	94	\$1.06	\$0.05	0.173	0.169	\$0.00	\$0.00	90%	41	300	56	350	71%	100%	100%	
CO - DEPAACC - 240 and above	Air-cooled condenser on DX unit served by Reduced Entering Outdoor Air Temperature through Evaporative Pre-cooling per 1 ton of cooling capacity	1,017	659	Standard Air-Cooled Condensing Unit served by untreated ambient Outdoor Air	1,190	659	20.00	\$100	\$0	\$190	\$ 0.322	52%	5.18	2.46	114	\$0.88	\$0.04	0.173	0.169	\$0.00	\$0.00	90%	54	400	71	450	71%	100%	100%	
ECM - Low Temp Display Case	Electronically Commutated Motor (ECM)	28	8,672	Shaded Pole Motor	84	8,672	15.00	\$40	\$0	\$141	\$ 0.056	28%	5.10	3.65	489	\$0.08	\$0.01	0.056	0.061	\$0.00	\$0.00	99%	0	0	0	0	100%	100%	100%	
ECM - Medium Temp Display Case	Electronically Commutated Motor (ECM)	24	8,672	Shaded Pole Motor	71	8,672	15.00	\$40	\$0	\$141	\$ 0.056	28%	6.03	4.31	414	\$0.10	\$0.01	0.048	0.051	\$0.00	\$0.00	99%	0	0	0	0	100%	100%	100%	
Low Temp up to 15 in	Electronically Commutated Motor (ECM)	52	8,585	Shaded Pole Motor	162	8,585	15.00	\$70	\$0	\$269	\$ 0.057	26%	5.08	3.75	937	\$0.07	\$0.00	0.109	0.116	\$0.00	\$0.00	98%	9	60	10	60	100%	100%	100%	
Medium Temp up to 15 in	Electronically Commutated Motor (ECM)	44	8,585	Shaded Pole Motor	137	8,585	15.00	\$70	\$0	\$269	\$ 0.057	26%	6.00	4.44	793	\$0.09	\$0.01	0.092	0.098	\$0.00	\$0.00	98%	0	0	0	0	100%	100%	100%	
CO - SSCH < 75 tons	Screw/Scroll Chiller Size 26.4 tons, 0.73 FLV, 0.57 IPLV at AHRI Standard operating conditions	19,378	729	Screw/Scroll Chiller Size 26.4 tons, 0.75 FLV, 0.6 IPLV at AHRI Standard operating conditions	19,800	757	20.00	\$469	\$0	\$3,379	\$ 0.127	14%	30.75	26.48	862	\$0.54	\$0.03	0.422	0.412	\$0.00	\$0.00	90%	1	1	0	0	71%	100%	100%	
CO - SSCH - 75 - 149 tons	Screw/Scroll Chiller Size 132.75 tons, 0.7 FLV, 0.5 IPLV at AHRI Standard operating conditions	93,456	677	Screw/Scroll Chiller Size 132.75 tons, 0.72 FLV, 0.56 IPLV at AHRI Standard operating conditions	95,580	736	20.00	\$2,787	\$0	\$16,992	\$ 0.091	16%	26.26	21.95	7,077	\$0.39	\$0.02	2.124	2.071	\$0.00	\$0.00	90%	1	1	0	0	71%	100%	100%	
CO - SSCH - 150 - 299 tons	Screw/Scroll Chiller Size 225 tons, 0.57 FLV, 0.43 IPLV at AHRI Standard operating conditions	129,263	705	Screw/Scroll Chiller Size 225 tons, 0.66 FLV, 0.54 IPLV at AHRI Standard operating conditions	148,500	774	20.00	\$9,743	\$0	\$15,750	\$ 0.188	62%	3.52	1.34	23,809	\$0.41	\$0.02	19.238	18.760	\$0.00	\$0.00	90%	1	5	1	5	71%	100%	100%	
CO - SSCH 300 tons - 599 tons	Screw/Scroll Chiller Size 400 tons, 0.59 FLV, 0.5 IPLV at AHRI Standard operating conditions	237,600	803	Screw/Scroll Chiller Size 400 tons, 0.61 FLV, 0.52 IPLV at AHRI Standard operating conditions	244,000	806	20.00	\$6,000	\$0	\$28,000	\$ 0.241	21%	19.76	15.53	5,871	\$1.02	\$0.05	6.400	6.241	\$0.00	\$0.00	90%	1	1	0	0	71%	100%	100%	
CO - SSCH >= 600 tons	Screw/Scroll Chiller Size 600 tons, 0.53 FLV, 0.48 IPLV at AHRI Standard operating conditions	315,000	872	Screw/Scroll Chiller Size 600 tons, 0.56 FLV, 0.5 IPLV at AHRI Standard operating conditions	336,000	845	20.00	\$11,280	\$0	\$42,000	\$ 0.466	27%	9.76	7.14	9,240	\$1.22	\$0.06	21.000	20.479	\$0.00	\$0.00	90%	0	0	0	0	71%	100%	100%	
CO - VFDS	Retrofit existing 1200 ton chiller with VSD control to achieve 0.755 FLV, 0.49 IPLV	588,000	866	Existing 1200 ton chiller without VSD control and original performance of 0.72 FLV, 0.69 IPLV	828,000	866	20.00	\$36,000	\$0	\$86,256	\$ 0.254	42%	1.64	0.95	207,840	\$0.17	\$0.01	240.000	-6.241	\$0.00	\$0.00	-2%	0	0	0	0	71%	100%	100%	
Custom Ice Storage Tanks	Custom project to implement Ice Storage	86,688	736	Existing Chiller Plant without Ice Storage	124,783	878	20.00	\$15,238	\$0	\$60,000	\$ 0.192	25%	6.81	5.08	45,821	\$0.33	\$0.02	38.095	24.990	\$0.00	\$0.00	61%	2	25	2	10	89%	100%	100%	
Rx Studies	Varies by Project	0	0	Varies by Project	0	0	0.00	\$2,000	\$0	\$2,667	\$ 0.034	75%	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0.000	0.000	\$0.00	\$0.00	0%	0	0	0	0	100%	100%	100%	
Custom Cooling	Varies by Project	178,072	5,243	Varies by Project	253,268	5,243	17.78	\$25,366	\$335,709	\$123,441	\$ 0.071	21%	4.43	3.52	394,276	\$0.06	\$0.00	75.196	61.594	\$0.00	\$0.00	76%	2	14	2	10	87%			

Electric Planning Assumptions																																	
Measure Description	High Efficiency Product Assumptions				Baseline Product Assumptions			Economic Assumptions					Stipulated Output							Economic Assumptions		Technical Assumption	2019				2020				NTG (%)	Installation Rate (%)	Realization Rate (%)
	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period w/o Rebate (yrs)	Incremental Cost Payback Period w/ Rebate (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Cust kWh Saved (\$/kWh)	Rebated Lifetime cost / Cust kWh Saved (\$/kWh)	Customer kWh Savings (kWh)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)							
Data Center Prescriptive Project. Prescriptive products (e.g. motors, VFDs, chillers) offered through other programs, located in a data center facility, identified by customer.	Data Center Prescriptive Measures - Customer Identified	0	5,999	Existing Data Center Facility or New Facility with Standard Systems	48,798	5,999	19.00	\$49,667	\$0	\$82,593	\$ 0.066	60%	4.27	1.70	292,741	\$0.17	\$0.01	48,798	46.345	\$0.00	\$0.00	88%	2	2	2	2	79%	100%	100%				
Plate & Frame Heat Exchangers for data center specific end-use - Study Identified	Install plate & frame heat exchanger to allow cooling tower to meet cooling load	42,982	8,760	Chiller-based cooling	68,000	8,760	20.00	\$14,400	\$0	\$88,303	\$ 0.056	16%	7.18	6.01	219,162	\$0.07	\$0.00	25,018	0.000	\$0.00	\$0.00	0%	0	0	0	0	100%	100%	100%				
Plate & Frame Heat Exchangers for data center specific end-use - Site Visit Identified	Install plate & frame heat exchanger to allow cooling tower to meet cooling load	42,982	8,760	Chiller-based cooling	68,000	8,760	20.00	\$14,400	\$0	\$88,303	\$ 0.056	16%	7.18	6.01	219,162	\$0.07	\$0.00	25,018	0.000	\$0.00	\$0.00	0%	0	0	0	0	80%	100%	100%				
Plate & Frame Heat Exchangers for data center specific end-use - Customer Identified	Install plate & frame heat exchanger to allow cooling tower to meet cooling load	42,982	8,760	Chiller-based cooling	68,000	8,760	20.00	\$14,400	\$0	\$88,303	\$ 0.056	16%	7.18	6.01	219,162	\$0.07	\$0.00	25,018	0.000	\$0.00	\$0.00	0%	1	1	1	1	45%	100%	100%				
EC Plug Fans - In Unit - New Construction - Study Identified	EC Plug Fan	2,151	8,760	Forward-curved Centrifugal Fan with AC motor	2,693	8,677	20.00	\$700	\$0	\$1,700	\$ 0.057	41%	6.56	3.86	4,527	\$0.15	\$0.01	0.542	0.588	\$0.00	\$0.00	100%	3	12	3	12	100%	100%	100%				
EC Plug Fans - In Unit - New Construction - Site Visit Identified	EC Plug Fan	2,151	8,760	Forward-curved Centrifugal Fan with AC motor	2,693	8,677	20.00	\$700	\$0	\$1,700	\$ 0.057	41%	6.56	3.86	4,527	\$0.15	\$0.01	0.542	0.588	\$0.00	\$0.00	100%	3	21	3	21	80%	100%	100%				
EC Plug Fans - In Unit - New Construction - Customer Identified	EC Plug Fan	2,151	8,760	Forward-curved Centrifugal Fan with AC motor	2,693	8,677	20.00	\$700	\$0	\$1,700	\$ 0.057	41%	6.56	3.86	4,527	\$0.15	\$0.01	0.542	0.588	\$0.00	\$0.00	100%	3	27	3	27	45%	100%	100%				
EC Plug Fans - Below Floor - New Construction - Study Identified	EC Plug Fan	1,867	8,760	Forward-curved Centrifugal Fan with AC motor	2,766	8,630	20.00	\$700	\$0	\$1,700	\$ 0.057	41%	3.96	2.33	7,516	\$0.09	\$0.00	0.899	0.974	\$0.00	\$0.00	100%	2	9	2	9	100%	100%	100%				
EC Plug Fans - Below Floor - New Construction - Site Visit Identified	EC Plug Fan	1,867	8,760	Forward-curved Centrifugal Fan with AC motor	2,766	8,630	20.00	\$700	\$0	\$1,700	\$ 0.057	41%	3.96	2.33	7,516	\$0.09	\$0.00	0.899	0.974	\$0.00	\$0.00	100%	2	16	2	16	80%	100%	100%				
EC Plug Fans - Below Floor - New Construction - Customer Identified	EC Plug Fan	1,867	8,760	Forward-curved Centrifugal Fan with AC motor	2,766	8,630	20.00	\$700	\$0	\$1,700	\$ 0.057	41%	3.96	2.33	7,516	\$0.09	\$0.00	0.899	0.974	\$0.00	\$0.00	100%	2	20	2	20	45%	100%	100%				
Data Center New Construction	Highly efficient data center	2,245,600	1,783	Standard efficiency new data center	3,507,500	3,097	20.00	\$877,649	\$0	\$1,464,186	\$ 0.069	46%	3.07	1.65	6,906,450	\$0.10	\$0.00	1,261,900	1,109,265	\$0.00	\$0.00	81%	1	1	1	1	100%	100%	100%				
Zero & Thin Client Installations	Server & software at data center along with thin-client or zero-client device replaces desktop CPU (VM Ware w/ Wyse thin-client system, Pano-Logic zero-client system), meeting Energy Star 6.0 specification	13	7,424	Desktop computers meeting ENERGY STAR 3.0 specifications	28	7,424	10.00	\$10	\$600	\$117	\$ 0.060	9%	3.16	2.89	114	\$0.09	\$0.01	0.015	0.017	\$30.50	-\$0.27	100%	10	400	10	400	80%	100%	100%				
Computer Server with 400-600W Units with Titanium Rated Power Supply	Titanium Power Supply	165	8,760	Platinum Power Supply	172	8,740	5.00	\$5	\$120	\$32	\$ 0.058	15%	10.16	8.59	55	\$0.09	\$0.02	0.007	0.007	\$0.00	\$0.00	100%	1	10	1	10	80%	100%	100%				
Computer Server with 600-1000W Units with Titanium Rated Power Supply	Titanium Power Supply	248	8,760	Platinum Power Supply	258	8,740	5.00	\$10	\$140	\$38	\$ 0.058	27%	7.87	5.78	83	\$0.12	\$0.02	0.010	0.011	\$0.00	\$0.00	100%	1	10	1	10	80%	100%	100%				
Computer Server with >1000W Units with Titanium Rated Power Supply	Titanium Power Supply	463	8,760	Platinum Power Supply	482	8,740	5.00	\$20	\$170	\$43	\$ 0.058	47%	4.81	2.56	155	\$0.13	\$0.03	0.019	0.020	\$0.00	\$0.00	100%	3	30	3	30	80%	100%	100%				
Average EDA Project - 2019	More Efficient than Code Building	457,462	2,455	Code-Compliant Building	659,597	2,455	20.00	\$110,812	\$0	\$335,881	\$ 0.112	33%	6.05	4.06	496,277	\$0.22	\$0.01	202,135	157,698	\$0.00	\$0.00	72%	64	64	0	0	95%	100%	100%				
Average EDA Project - 2020	More Efficient than Code Building	585,469	2,475	Code-Compliant Building	844,165	2,475	20.00	\$142,021	\$0	\$438,564	\$ 0.111	32%	6.16	4.17	640,183	\$0.22	\$0.01	258,697	201,825	\$0.00	\$0.00	72%	0	0	54	54	95%	100%	100%				
Average EEB Project - 2019	More Efficient than Code Building	122,684	3,270	Code-Compliant Building	181,073	3,270	20.00	\$25,597	\$0	\$61,280	\$ 0.093	42%	3.57	2.08	190,935	\$0.13	\$0.01	58,389	50,197	-\$484.18	\$0.00	79%	40	40	0	0	95%	100%	100%				
Average EEB Project - 2020	More Efficient than Code Building	122,684	3,270	Code-Compliant Building	181,073	3,270	20.00	\$25,597	\$0	\$61,280	\$ 0.093	42%	3.57	2.08	190,935	\$0.13	\$0.01	58,389	50,197	-\$484.18	\$0.00	79%	0	0	40	40	95%	100%	100%				
New Energy Management System - 2019	New EMS for HVAC control	770,127	8,760	None or Obsolete Controls System	786,869	8,760	15.00	\$7,692	\$0	\$63,804	\$ 0.056	12%	6.49	5.71	146,659	\$0.05	\$0.00	16,742	0.523	\$1,595.11	\$0.00	3%	37	37	0	0	87%	100%	100%				
New Energy Management System - 2020	New EMS for HVAC control	770,127	8,760	None or Obsolete Controls System	786,869	8,760	15.00	\$7,091	\$0	\$63,804	\$ 0.056	11%	6.49	5.77	146,659	\$0.05	\$0.00	16,742	0.523	\$1,595.11	\$0.00	3%	0	0	34	34	87%	100%	100%				
Low/No Cost Load Shifting Measure	Shifted to Off Peak Hours	125,000	1,043	Unshifted Peak Load	145,000	1,043	5.00	\$0	\$0	\$0	\$ 0.216	#DIV/0!	0.00	0.00	20,857	\$0.00	\$0.00	20,000	21,671	\$0.00	\$0.00	100%	1	1	3	3	87%	100%	100%				
EC Fan Motor on New Commercial Furnace - Denver/Front Range	ECM Furnace Fan	408	3,579	Non-ECM Fan	819	3,579	15.00	\$100	\$236	\$212	\$ 0.088	47%	1.73	0.92	1,474	\$0.07	\$0.00	0.412	0.240	-\$6.64	\$0.00	100%	1	6	1	6	86%	100%	100%				
EC Fan Motor on New Commercial Furnace with No Cooling - Denver/Front Range	ECM Furnace Fan	280	3,215	Non-ECM Fan	735	3,215	15.00	\$100	\$236	\$212	\$ 0.094	47%	1.63	0.86	1,464	\$0.07	\$0.00	0.455	0.501	-\$6.64	\$0.00	102%	2	3	2	3	86%	100%	100%				
EC Fan Motor on New Commercial Furnace - Alamosa/Mountain	ECM Furnace Fan	350	3,755	Non-ECM Fan	780	3,755	15.00	\$100	\$236	\$212	\$ 0.085	47%	1.66	0.88	1,616	\$0.06	\$0.00	0.430	0.240	-\$9.75	\$0.00	51%	1	1	1	1	86%	100%	100%				
EC Fan Motor on New Commercial Furnace with No Cooling - Alamosa/Mountain	ECM Furnace Fan	278	3,611	Non-ECM Fan	732	3,611	15.00	\$100	\$236	\$212	\$ 0.087	47%	1.60	0.84	1,636	\$0.06	\$0.00	0.453	0.501	-\$9.75	\$0.00	102%	1	3	1	3	86%	100%	100%				
EC Fan Motor on New Commercial Furnace - Grand Junction/Western Slope	ECM Furnace Fan	456	3,717	Non-ECM Fan	851	3,717	15.00	\$100	\$236	\$212	\$ 0.086	47%	1.77	0.94	1,469	\$0.07	\$0.00	0.395	0.240	-\$5.98	\$0.00	56%	1	3	1	3	86%	100%	100%				
EC Fan Motor on New Commercial Furnace with No Cooling - Grand Junction/Western Slope	ECM Furnace Fan	280	3,139	Non-ECM Fan	804	3,139	15.00	\$100	\$236	\$212	\$ 0.095	47%	1.41	0.75	1,643	\$0.06	\$0.00	0.524	0.501	-\$5.98	\$0.00	88%	1	1	1	1	86%	100%	100%				
EC Fan Motor on Existing Commercial Furnace - Denver/Front Range	ECM Furnace Fan	416	3,579	Non-ECM Fan	819	3,579	7.00	\$100	\$0	\$212	\$ 0.088	47%	1.79	0.95	1,446	\$0.07	\$0.01	0.404	0.240	-\$8.23	\$0.00	55%	1	2	1	2	86%	100%	100%				
EC Fan Motor on Existing Commercial Furnace with No Cooling - Denver/Front Range	ECM Furnace Fan	281	3,215	Non-ECM Fan	735	3,215	7.00	\$100	\$0	\$212	\$ 0.094	47%	1.65	0.87	1,461	\$0.07	\$0.01	0.454	0.501	-\$8.23	\$0.00	102%	1	1	1	1	86%	100%	100%				
EC Fan Motor on Existing Commercial Furnace - Alamosa/Mountain	ECM Furnace Fan	357	3,755	Non-ECM Fan	780	3,755	7.00	\$100	\$0	\$212	\$ 0.085	47%	1.72	0.91	1,589	\$0.06	\$0.01	0.423	0.240	-\$12.09	\$0.00	52%	1	1	1	1	86%	100%	100%				
EC Fan Motor on Existing Commercial Furnace with No Cooling - Alamosa/Mountain	ECM Furnace Fan	280	3,611	Non-ECM Fan	732	3,611	7.00	\$100	\$0	\$212	\$ 0.087	47%	1.63	0.86	1,632	\$0.06	\$0.01	0.452	0.501	-\$12.09	\$0.00	102%	1	1	1	1	86%	100%	100%				
EC Fan Motor on Existing Commercial Furnace - Grand Junction/Western Slope	ECM Furnace Fan	465	3,717	Non-ECM Fan	851	3,717	7.00	\$100	\$0	\$212	\$ 0.086	47%	1.84	0.97	1,435	\$0.07	\$0.01	0.386	0.240	-\$7.42	\$0.00	57%	1	1	1	1	86%	100%	100%				
EC Fan Motor on Existing Commercial Furnace with No Cooling - Grand Junction/Western Slope	ECM Furnace Fan	281	3,139	Non-ECM Fan	804	3,139	7.00	\$100	\$0	\$212	\$ 0.095	47%	1.43	0.76	1,641	\$0.06	\$0.01	0.523	0.501	-\$7.42	\$0.00	88%	1	1	1	1	86%	100%	100%				
Infrared	Infrared heater	0	1,966	Non-condensing standard forced-air unit heater	1,016	1,966	15.00	\$158	\$1,051	\$186	\$ 0.131	85%	0.71	0.11	1,998	\$0.08	\$0.01	1,016	0.000	\$0.00	\$0.00	0%	15	20	15	20	86%	100%	100%				
CHW Pre-Rinse Sprayer - electric water heating	1.28 gallons per minute sprayer	216	8,760	1.60 gallons per minute sprayer	270	8,760	5.00	\$45	\$0	\$45	\$ 0.056	100%	0.91	0.00	472	\$0.10	\$0.02	0.054	0.001	\$22.81	\$0.00	3%	10	10	12	12	100%	100%	100%				
Aerator (Restroom) - electric water heating	6 gallons per minute restroom faucet aerator	84	8,760	2.2 gallons per minute faucet	306	8,760	10.00	\$7	\$0	\$7	\$ 0.056	100%	0.03	0.00	1,951	\$0.00	\$0.00	0.223	0.005	\$94.26	\$0.00	2%	10	10	12	12	100%	100%	100%				
Aerator (Kitchen) - electric water heating	1.5 gallons per minute kitchen faucet aerator	70	8,760	2.2 gallons per minute faucet	102	8,760	10.00	\$7	\$0	\$7	\$ 0.056	100%	0.23	0.00	285	\$0.02	\$0.00	0.032	0.000	\$13.75	\$0.00	1%	10	10	12	12	1						

Electric Planning Assumptions																																
Measure Description	High Efficiency Product Assumptions			Baseline Product Assumptions			Economic Assumptions					Stipulated Output							Economic Assumptions		Technical Assumption	2019				2020				NTG (%)	Installation Rate (%)	Realization Rate (%)
	Electric Measure Description	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period w/o Rebate (yrs)	Incremental Cost Payback Period w/ Rebate (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / kWh Saved (\$/kWh)	Rebated Lifetime Cost / kWh Saved (\$/kWh)	Customer kWh Savings (kWh)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)					
LED Parking Garage Wall Pack	LED Wall Pack Fixture	31	8,760	LED Wall Pack Fixture	156	8,760	20.00	\$44	\$0	\$316	\$ 0.056	14%	5.15	4.44	1,094	\$0.04	\$0.00	0.125	0.135	\$0.00	\$0.00	100%	12	134	21	268	74%	100%	100%			
LED Ref and Frz Cases 5' or 6' doors	LED Case Lighting	26	6,233	Fluorescent System	78	6,233	20.00	\$45	\$0	\$164	\$ 0.065	27%	7.78	5.64	324	\$0.14	\$0.01	0.052	0.051	\$0.00	\$0.00	90%	11	106	11	106	74%	100%	100%			
LED Street Lighting	LED Fixture	159	4,511	LED Fixture	353	4,511	20.00	\$54	\$0	\$615	\$ 0.077	9%	9.19	8.38	874	\$0.06	\$0.00	0.194	0.000	\$0.00	\$0.00	0%	3	27	0	0	74%	100%	100%			
LED Troffer Fixture or Kit	LED Troffer Fixture or Kit	36	4,936	Fluorescent Fixture	78	4,936	20.00	\$34	\$0	\$184	\$ 0.073	18%	12.68	10.35	206	\$0.16	\$0.01	0.042	0.034	\$0.00	-\$0.54	75%	494	56,900	415	45,550	74%	100%	100%			
LED/LEC Exit Sign	LED/LEC Exit Sign	2	8,760	Incandescent Exit Sign	37	8,760	20.00	\$25	\$0	\$84	\$ 0.056	30%	5.17	3.63	304	\$0.08	\$0.00	0.035	0.038	\$0.00	-\$0.80	100%	69	1,033	69	1,033	74%	100%	100%			
Networked Lighting Controls	Networked Lighting Controls	33	4,543	Manual Switch	63	4,543	15.00	\$25	\$0	\$99	\$ 0.076	25%	9.98	7.44	134	\$0.19	\$0.01	0.030	0.024	\$0.00	-\$0.34	74%	50	11,000	127	21,000	100%	100%	100%			
Stairwell Fixture	LED Stairwell Lighting Fixture	28	8,760	Fluorescent Fixture	58	8,760	20.00	\$40	\$0	\$277	\$ 0.056	14%	19.74	16.89	262	\$0.15	\$0.01	0.030	0.032	\$0.00	-\$0.67	100%	5	200	5	200	74%	100%	100%			
Standalone Controls	Sensor	156	4,543	Manual Switch	210	4,543	8.00	\$13	\$0	\$129	\$ 0.076	10%	7.15	6.40	245	\$0.05	\$0.01	0.054	0.045	\$0.00	-\$0.64	78%	60	6,500	78	8,400	74%	100%	100%			
Custom Lighting Project	High Efficiency Lighting	2,266	3,441	Existing Lower Efficiency Lighting	7,978	3,441	18.19	\$3,128	\$367	\$7,016	\$ 0.090	48%	4.10	2.27	19,657	\$0.16	\$0.01	5.712	3.719	\$0.00	-\$51.90	60%	267	267	240	240	89%	100%	100%			
LED Area Lighting	LED Fixture	169	4,511	LED Fixture	565	4,511	20.00	\$96	\$0	\$601	\$ 0.077	16%	4.40	3.70	1,786	\$0.05	\$0.00	0.396	0.000	\$0.00	\$0.00	0%	91	1,092	45	546	89%	100%	100%			
LED Exterior Wall Pack	LED Wall Pack Fixture	58	4,511	LED Wall Pack Fixture	264	4,511	20.00	\$48	\$0	\$281	\$ 0.077	17%	3.95	3.28	928	\$0.05	\$0.00	0.206	0.000	\$0.00	\$0.00	0%	197	1,171	98	585	89%	100%	100%			
LED High Bay Fixture or Kit	LED High Bay Fixture or Kit	153	4,255	LED or Fluorescent Fixture	366	4,255	20.00	\$138	\$0	\$339	\$ 0.079	41%	4.88	2.89	906	\$0.15	\$0.01	0.213	0.163	\$0.00	-\$2.35	71%	114	2,462	137	2,954	89%	100%	100%			
LED Interior Fixture	LED Downlight Fixture	21	4,671	Incandescent or CFL Fixture	95	4,671	20.00	\$31	\$0	\$93	\$ 0.075	33%	3.69	2.46	344	\$0.09	\$0.00	0.074	0.053	\$0.00	-\$0.70	67%	64	2,665	83	3,465	89%	100%	100%			
LED Linear Ambient	LED Linear Ambient Fixture	62	4,278	Fluorescent Fixture	121	4,278	20.00	\$33	\$30	\$190	\$ 0.079	17%	9.81	8.13	254	\$0.13	\$0.01	0.059	0.047	\$0.00	-\$0.66	73%	271	5,925	203	4,444	89%	100%	100%			
LED Outdoor Canopy Lighting	LED Canopy Fixture	93	4,511	LED Fixture	348	4,511	20.00	\$48	\$0	\$255	\$ 0.077	19%	2.90	2.36	1,148	\$0.04	\$0.00	0.255	0.000	\$0.00	\$0.00	0%	9	62	5	31	89%	100%	100%			
LED Parking Garage Lighting	LED Parking Garage Fixture	62	8,760	LED Fixture	214	8,760	20.00	\$126	\$0	\$230	\$ 0.056	55%	3.07	1.39	1,335	\$0.09	\$0.00	0.152	0.165	\$0.00	\$0.00	100%	4	33	5	41	89%	100%	100%			
LED Parking Garage Wall Pack	LED Wall Pack Fixture	21	8,760	LED Wall Pack Fixture	95	8,760	20.00	\$36	\$0	\$266	\$ 0.056	13%	7.26	6.28	652	\$0.05	\$0.00	0.074	0.081	\$0.00	\$0.00	100%	3	23	4	29	89%	100%	100%			
LED Ref and Frz Cases 5' or 6' doors	LED Case Lighting	25	4,313	Fluorescent System	81	4,313	20.00	\$45	\$0	\$164	\$ 0.078	27%	8.60	6.24	243	\$0.19	\$0.01	0.056	0.047	\$0.00	\$0.00	77%	3	29	3	29	89%	100%	100%			
LED Street Lighting	LED Fixture	125	4,511	LED Fixture	278	4,511	20.00	\$45	\$0	\$408	\$ 0.077	11%	7.71	6.87	691	\$0.06	\$0.00	0.153	0.000	\$0.00	\$0.00	0%	4	4	4	4	89%	100%	100%			
LED Troffer Fixture or Kit	LED Troffer Fixture or Kit	39	3,856	Fluorescent Fixture	97	3,856	20.00	\$39	\$15	\$175	\$ 0.084	22%	9.64	7.50	224	\$0.17	\$0.01	0.058	0.044	\$0.00	-\$0.59	70%	538	14,987	404	11,241	89%	100%	100%			
LED/LEC Exit Sign	LED/LEC Exit Sign	2	8,760	Incandescent Exit Sign	39	8,760	20.00	\$25	\$0	\$84	\$ 0.056	30%	4.85	3.41	323	\$0.08	\$0.00	0.037	0.040	\$0.00	-\$0.84	100%	99	530	99	530	89%	100%	100%			
Networked Lighting Controls	Networked Lighting Controls	33	4,157	Manual Switch	63	4,157	15.00	\$25	\$0	\$99	\$ 0.080	25%	10.40	7.75	123	\$0.20	\$0.01	0.030	0.018	\$0.00	-\$0.35	56%	10	1,300	20	2,500	100%	100%	100%			
Stairwell Fixture	LED Stairwell Lighting Fixture	28	8,760	Fluorescent Fixture	58	8,760	20.00	\$40	\$0	\$277	\$ 0.056	14%	19.62	16.79	262	\$0.15	\$0.01	0.030	0.032	\$0.00	-\$0.59	100%	2	50	2	50	89%	100%	100%			
Standalone Controls	Sensor	148	4,157	Manual Switch	210	4,157	8.00	\$19	\$0	\$129	\$ 0.080	15%	6.52	5.54	256	\$0.08	\$0.01	0.062	0.052	\$0.00	-\$0.73	78%	60	1,850	60	1,850	89%	100%	100%			
Faucet Aerator (Kitchen), elec water heating	1.5 gallons per minute kitchen faucet aerator	70	8,760	2.2 gallons per minute faucet	102	8,760	10.00	\$0	\$0	\$0	\$ 0.056	100%	0.01	0.00	285	\$0.00	\$0.00	0.032	0.000	\$19.17	\$0.00	1%	10	10	10	10	90%	100%	100%			
LED Interior Lamp	LED Screw-In Lamp	10	3,702	Halogen or Incandescent	50	3,702	5.05	\$3	\$0	\$3	\$ 0.086	100%	0.26	0.00	147	\$0.02	\$0.00	0.040	0.030	\$0.00	-\$0.39	70%	1,300	26,300	1,300	26,300	89%	100%	100%			
Faucet Aerator (Restroom), elec water heating	2.2 gallons per minute restroom faucet aerator	84	8,760	2.2 gallons per minute faucet	306	8,760	10.00	\$1	\$0	\$1	\$ 0.056	100%	0.00	0.00	1,851	\$0.00	\$0.00	0.223	0.005	\$131.47	\$0.00	2%	90	90	90	90	90%	100%	100%			
LED Midstream Interior Lamps	LED Lamp or Retrofit Kit	11	4,350	Halogen, Incandescent, or CFL Lamp	39	4,350	5.24	\$5	\$6	\$11	\$ 0.078	47%	1.14	0.61	122	\$0.04	\$0.01	0.028	0.019	\$0.00	-\$0.30	63%	493	92,263	355	89,571	92%	99%	100%			
LED High Bay Mogul-Based Lamps	LED Screw-Base Lamp	95	4,271	LED Lamp	374	4,271	10.00	\$76	\$60	\$151	\$ 0.079	50%	1.64	0.82	1,189	\$0.06	\$0.01	0.278	0.205	\$0.00	-\$1.67	68%	12	134	17	181	92%	99%	100%			
LED PLUG Based Lamp	LED Plug In Lamp	14	3,147	CFL Lamp	44	3,147	12.00	\$8	\$7	\$12	\$ 0.095	71%	1.34	0.39	96	\$0.09	\$0.01	0.030	0.022	\$0.00	-\$0.25	66%	48	1,867	65	2,514	92%	99%	100%			
LED Tubes (Linear Lamps)	LED Linear Tube	16	4,109	Fluorescent Lamp	29	4,109	12.40	\$5	\$2	\$16	\$ 0.081	32%	3.66	2.50	55	\$0.09	\$0.01	0.013	0.010	\$0.00	-\$0.15	71%	844	109,869	850	110,748	92%	99%	100%			
New Motor Enhanced	NEMA Premium +1% Efficient Motor	21,909	2,780	NEMA Premium	21,909	2,780	20.00	\$204	\$2,758	\$803	\$ 0.103	25%	6.50	4.85	1,202	\$0.17	\$0.01	0.432	0.365	\$0.00	\$0.00	78%	10	102	10	102	65%	100%	100%			
Upgrade Motor Enhanced	NEMA Premium +1% Efficient Motor	23,904	4,302	EPACT Efficient Motor	24,408	4,302	20.00	\$859	\$0	\$3,709	\$ 0.079	23%	21.78	16.73	2,167	\$0.40	\$0.02	0.504	0.426	\$0.00	\$0.00	78%	10	154	10	154	65%	100%	100%			
Variable Frequency Drive	Equipment coupled with an ASD/VFD	28,832	4,510	Equipment without an ASD/VFD	33,926	4,510	15.00	\$2,596	\$8	\$6,370	\$ 0.077	41%	3.62	2.15	22,976	\$0.11	\$0.01	5.094	4.305	\$0.00	\$0.00	78%	91	392	77	392	65%	100%	100%			
VFD on Well Pump	VFD Well Pump	19,696	2,303	Throttled Well Pump	22,096	2,303	15.00	\$2,236	\$0	\$6,467	\$ 0.117	36%	10.92	7.14	5,068	\$0.44	\$0.03	2.200	1.270	\$0.00	\$0.00	53%	24	24	24	24	65%	100%	100%			
CSMC	Motor with Voltage Controller	93,607	4,407	Motor without Voltage Controller	97,273	4,407	20.00	\$1,304	\$0	\$2,745	\$ 0.078	47%	2.19	1.15	16,151	\$0.08	\$0.00	3.665	3.098	\$0.00	\$0.00	78%	2	51	1	51	95%	100%	100%			
CO - Custom Efficiency - Motors	New Equipment	141,400	4,570	Existing or New Inefficient	212,100	4,570	20.00	\$29,076	\$0	\$136,411	\$ 0.076	21%	5.47	4.31	323,122	\$0.09	\$0.00	70,700	58,095	\$0.00	\$357.14	76%	26	26	26	26	65%	100%	100%			
Compressed Air	New Equipment	7,311,859	2,955	Old or less efficient systems or equipment	7,335,083	2,955	20.00	\$8,333	\$0	\$13,844	\$ 0.099	61%	2.01	0.78	68,617	\$0.12	\$0.01	23,224	6,953	\$0.00	\$0.00	28%	6	6	9	9	93%	100%	100%			
Cooling	New Equipment	7,306,365	1,243	Old or less efficient systems or equipment	7,335,083	1,243	15.00	\$8,445	\$0	\$12,796	\$ 0.187	66%	1.91	0.65	35,717	\$0.24	\$0.02	28,728	28,016	\$0.00	\$0.00	90%	9	9	11	11	93%	100%	100%			
Custom	New Equipment	6,975,009	1,158	Old or less efficient systems or equipment	7,335,083	1,158	20.00	\$5,995	\$0	\$28,252	\$ 0.198	21%	0.34	0.27	416,853	\$0.01	\$0.00	360,075														

Measure Description	Electric Planning Assumptions																												
	High Efficiency Product Assumptions				Baseline Product Assumptions				Economic Assumptions				Stipulated Output						Economic Assumptions		Technical Assumption	2019		2020		NTG (%)	Installation Rate (%)	Realization Rate (%)	
	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period w/o Rebate (yrs)	Incremental Cost Payback Period w/ Rebate (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Cust kWh Saved (\$/kWh)	Rebated Lifetime cost /Cust kWh Saved (\$/kWh)	Customer kWh Savings (kWh)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)	2019 Units (-)	2020 Participants (-)				2020 Units (-)
Anti-Sweat Heater Controls, Low Temperature Case	Anti-Sweat Heater Controls	7	8,760	Anti-Sweat Heaters running constantly	238	8,760	12.00	\$60	\$0	\$180	\$ 0.056	33%	1.59	1.06	2,020	\$0.03	\$0.00	0.231	0.242	\$0.00	\$0.00	97%	15	15	15	15	100%	100%	100%
Retrofit of open multi-deck Cooler Cases with solid glass doors (per linear foot of case).	Closed Case with Doors	12	8,760	Open Case with No Doors	72	8,760	12.00	\$30	\$0	\$222	\$ 0.056	14%	7.56	6.54	522	\$0.06	\$0.00	0.060	0.065	\$0.00	\$0.00	100%	6	6	2	2	100%	100%	100%
Retrofit of open multi-deck Freezer Cases with solid glass doors (per linear foot of case).	Closed Case with Doors	39	8,760	Open Case with No Doors	218	8,760	12.00	\$75	\$0	\$330	\$ 0.056	23%	3.73	2.88	1,572	\$0.05	\$0.00	0.179	0.194	\$0.00	\$0.00	100%	6	6	2	2	100%	100%	100%
Demand Controlled Ventilation CO - 5 to less than 7.5 HP	Commercial kitchen ventilation hoods with Demand Controlled Ventilation	10,547	5,069	Commercial kitchen ventilation hoods without Demand Controlled Ventilation	14,160	5,069	20.00	\$1,250	\$0	\$4,077	\$ 0.072	31%	3.10	2.15	18,314	\$0.07	\$0.00	3.613	1.732	\$0.00	\$0.00	44%	12	12	6	6	100%	100%	100%
Demand Controlled Ventilation CO - 7.5 HP or Greater	Commercial kitchen ventilation hoods with Demand Controlled Ventilation	14,597	5,069	Commercial kitchen ventilation hoods without Demand Controlled Ventilation	19,597	5,069	20.00	\$1,298	\$0	\$5,642	\$ 0.072	23%	3.10	2.38	25,347	\$0.05	\$0.00	5.000	2.397	\$0.00	\$0.00	44%	12	12	6	6	100%	100%	100%
Demand Controlled Ventilation CO - Less than 5 HP	Commercial kitchen ventilation hoods with Demand Controlled Ventilation	4,219	5,069	Commercial kitchen ventilation hoods without Demand Controlled Ventilation	5,664	5,069	20.00	\$500	\$0	\$1,631	\$ 0.072	31%	3.10	2.15	7,326	\$0.07	\$0.00	1.445	0.693	\$0.00	\$0.00	44%	12	12	6	6	100%	100%	100%
Commercial Dishwasher - Under Counter & Door, Electric w/ Electric Booster	ENERGY STAR qualified unit	2,827	6,570	Conventional unit as defined by ENERGY STAR	3,972	6,570	12.50	\$250	\$0	\$445	\$ 0.063	56%	0.65	0.28	7,519	\$0.03	\$0.00	1.145	1.061	\$212.53	\$0.00	86%	8	8	2	2	100%	100%	100%
Commercial Dishwasher - Under Counter & Door, Electric w/ Gas Booster	ENERGY STAR qualified unit	1,972	6,570	Conventional unit as defined by ENERGY STAR	2,764	6,570	12.50	\$125	\$0	\$380	\$ 0.063	33%	0.70	0.47	5,203	\$0.02	\$0.00	0.792	0.734	\$212.53	\$0.00	86%	8	8	2	2	100%	100%	100%
Commercial Dishwasher - Under Counter & Door, Electric No Booster	ENERGY STAR qualified unit	2,401	6,570	Conventional unit as defined by ENERGY STAR	3,824	6,570	12.50	\$250	\$0	\$25	\$ 0.063	100%	0.02	-0.21	9,349	\$0.03	\$0.00	1.423	1.320	\$490.18	\$0.00	86%	8	8	2	2	100%	100%	100%
CO-Commercial Dishwashers (Door & Under Counter, Gas w/ Electric Booster)	ENERGY STAR qualified unit	1,330	6,570	Conventional unit as defined by ENERGY STAR	1,857	6,570	12.50	\$125	\$0	\$360	\$ 0.063	35%	0.83	0.54	3,465	\$0.04	\$0.00	0.527	0.489	\$212.53	\$0.00	86%	8	8	2	2	100%	100%	100%
ECM - Medium Temp Display Case	Electronically Commutated Motor (ECM)	24	8,672	Shaded Pole Motor	72	8,672	15.00	\$40	\$0	\$141	\$ 0.056	28%	6.03	4.31	414	\$0.10	\$0.01	0.048	0.051	\$0.00	\$0.00	99%	30	30	15	15	100%	100%	100%
ECM - Low Temp Display Case	Electronically Commutated Motor (ECM)	28	8,672	Shaded Pole Motor	84	8,672	15.00	\$40	\$0	\$141	\$ 0.056	28%	5.11	3.66	489	\$0.08	\$0.01	0.056	0.060	\$0.00	\$0.00	99%	20	20	10	10	100%	100%	100%
ECM - Medium Temp Walk-in, Evap fan <= 15" Diameter	Electronically Commutated Motor (ECM)	44	8,585	Shaded Pole Motor	137	8,585	15.00	\$70	\$0	\$269	\$ 0.057	26%	5.99	4.43	793	\$0.09	\$0.01	0.092	0.098	\$0.00	\$0.00	98%	75	75	65	65	100%	100%	100%
ECM - Low Temp Walk-in, Evap fan <= 15" Diameter	Electronically Commutated Motor (ECM)	52	8,585	Shaded Pole Motor	161	8,585	15.00	\$70	\$0	\$269	\$ 0.057	26%	5.08	3.76	936	\$0.07	\$0.00	0.109	0.116	\$0.00	\$0.00	98%	49	49	45	45	100%	100%	100%
LED Ref and Friz Cases 5' or 6' doors	LED Case Lighting	26	6,233	Fluorescent System	78	6,233	20.00	\$45	\$0	\$164	\$ 0.065	27%	7.78	5.64	324	\$0.14	\$0.01	0.052	0.051	\$0.00	\$0.00	90%	30	30	20	20	100%	100%	100%
Medium-temp Enclosed Reach-In Case (per linear foot)	Medium-temp Reach-In Cases with Doors	21	8,760	Medium-temp Open Reach-In Cases	132	8,760	15.00	\$70	\$0	\$686	\$ 0.056	10%	12.59	11.31	970	\$0.07	\$0.00	0.111	0.120	\$0.00	\$0.00	100%	10	10	10	10	100%	100%	100%
No Heat Case Doors Cooler	No Heat Case Doors	0	8,760	Anti-Sweat Heaters running constantly	121	8,760	10.00	\$85	\$0	\$275	\$ 0.056	31%	4.62	3.19	1,061	\$0.08	\$0.01	0.121	0.131	\$0.00	\$0.00	100%	15	15	15	15	100%	100%	100%
No Heat Case Doors Freezer	No Heat Case Doors	0	8,760	Anti-Sweat Heaters running constantly	238	8,760	10.00	\$75	\$0	\$800	\$ 0.056	9%	6.84	6.20	2,082	\$0.04	\$0.00	0.238	0.257	\$0.00	\$0.00	100%	10	10	10	10	100%	100%	100%
Night Curtains for Reach-In Cases (per linear foot)	Night Curtains on Cases	120	1,825	Open Reach-In Cases	120	2,920	4.00	\$20	\$0	\$42	\$ 0.034	48%	30.89	16.18	131	\$0.15	\$0.04	0.000	0.000	-\$3.16	\$0.00	0%	0	0	0	0	100%	100%	100%
Self Direct	New Equipment	9,708,779	6,044	Old or less efficient systems of equipment	10,000,000	6,044	18.00	\$166,894	\$0	\$594,191	\$ 0.086	28%	4.85	3.49	1,760,260	\$0.09	\$0.01	291,221	282,790	\$6,454.14	\$0.00	90%	4	4	3	3	91%	100%	100%
Company Owned Street Lights Retrofit Option A	LED Fixture	107	4,140	HD Fixture	230	4,140	15.00	\$0	\$0	\$303	\$ 0.080	0%	7.38	7.38	511	\$0.00	\$0.00	0.123	0.000	\$0.00	\$0.00	0%	9	4,985	9	4,985	90%	100%	100%
Company Owned Street Lights New Option A	LED Fixture	107	4,140	HD Fixture	230	4,140	15.00	\$0	\$97	\$156	\$ 0.080	0%	3.79	3.79	511	\$0.00	\$0.00	0.123	0.000	\$0.00	\$0.00	0%	4	485	4	485	90%	100%	100%
Audit Services	Multifamily Building Audit	0	0	None	0	0	0.00	\$196	\$0	\$196	\$ 0.034	100%	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0.000	0.000	\$0.00	\$0.00	0%	14	1,500	0	0	100%	100%	100%
Audit Services	Multifamily Building Audit	0	0	None	0	0	0.00	\$201	\$0	\$201	\$ 0.034	100%	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	0.000	0.000	\$0.00	\$0.00	0%	0	0	15	1,650	100%	100%	100%
Replace incandescent lamps with LEDs	LED lamp	10	986	Average EISA Standard Halogen Bulb	45	986	5.00	\$5	\$0	\$5	\$ 0.121	100%	1.27	0.00	35	\$0.15	\$0.03	0.036	0.005	\$0.00	\$0.00	13%	1,100	118,317	1,210	130,188	100%	100%	100%
Provide new 1.5 gpm showerhead to replace existing 2.5 gpm showerhead in electric DHW heater	1.5 GPM Showerhead	94	8,760	2.5 GPM Showerhead	157	8,760	10.00	\$15	\$0	\$15	\$ 0.121	100%	0.16	0.00	550	\$0.03	\$0.00	0.063	0.044	\$29.53	\$0.00	64%	1	64	1	70	100%	100%	100%
Provide Energy Efficient Kitchen Aerator - 1.5 GPM to replace existing 2.2 gpm aerator in home with electric DHW heater	1.5 GPM Kitchen Faucet Aerator	17	8,760	2.2 GPM Kitchen Faucet Aerator	25	8,760	10.00	\$5	\$0	\$5	\$ 0.121	100%	0.44	0.00	70	\$0.07	\$0.01	0.008	0.011	\$3.39	\$0.00	124%	0	24	0	26	100%	100%	100%
Provide Energy Efficient Bath Faucet Aerator - 1.0 GPM to replace existing 2.2 gpm aerator in home with electric DHW heater	1.0 GPM Bathroom Faucet Aerator	6	8,760	2.2 GPM Bathroom Faucet Aerator	14	8,760	10.00	\$4	\$0	\$4	\$ 0.121	100%	0.37	0.00	65	\$0.06	\$0.01	0.007	0.010	\$3.50	\$0.00	124%	0	30	0	33	100%	100%	100%
Provide Energy Efficient Bath Faucet Aerator - 0.5 GPM to replace existing 2.2 gpm aerator in home with electric DHW heater	0.5 GPM Bathroom Faucet Aerator	3	8,760	2.2 GPM Bathroom Faucet Aerator	14	8,760	10.00	\$4	\$0	\$4	\$ 0.121	100%	0.26	0.00	92	\$0.05	\$0.00	0.011	0.014	\$4.96	\$0.00	124%	0	0	0	0	100%	100%	100%
Exit sign retrofit	LEDOLEC Exit Sign	2	8,760	Incandescent Exit Sign	37	8,760	20.00	\$25	\$0	\$25	\$ 0.056	100%	1.52	0.00	304	\$0.08	\$0.00	0.035	0.038	\$0.00	-\$0.80	100%	0	0	0	0	100%	100%	100%
Average Project	More Efficient than Code Building	27,423	6,700	Code-Compliant Building	34,279	6,700	20.00	\$3,870	\$0	\$9,526	\$ 0.063	41%	3.39	2.01	45,934	\$0.08	\$0.00	6.856	5.092	-\$76.86	\$0.00	69%	1	136	1	136	100%	100%	100%
Weatherization Measures	Upgraded Mechanical Equipment, Lighting, and Envelope	52,453	3,149	Low Efficiency Mechanical Equipment, Lighting, and Envelope	65,566	3,149	17.00	\$22,470	\$0	\$29,015	\$ 0.095	77%	7.49	1.69	41,294	\$0.54	\$0.03	13.113	9.816	-\$40.03	\$0.00	69%	39	39	39	39	100%	100%	100%
Critical Peak Pricing Pilot	Customer participates inCPP Pilot	0		No Participation	343,780		3.00	\$0	\$0	\$0	\$ 0.034	#DIV/0!	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	343,780	372,505	\$0.00	\$0.00	100%	15	15	15	15	100%	100%	100%
Provide new 1.5 gpm showerhead to replace existing 2.5 gpm showerhead in electric DHW heater	1.5 GPM Showerhead	81	8,760	2.5 GPM Showerhead	136	8,760	10.00	\$3	\$0	\$3	\$ 0.121	100%	0.04	0.00	475	\$0.01	\$0.00	0.054	0.038	\$25.52	\$0.00	64%	499	1,740	0	0	99%	60%	100%
Provide new 1.5 gpm showerhead for second shower to replace existing 2.5 gpm showerhead in electric DHW heater	1.5 GPM Showerhead	67	8,760	2.5 GPM Showerhead	111	8,760	10.00	\$3	\$0	\$3	\$ 0.121	100%	0.05	0.00	389	\$0.01	\$0.00	0.044	0.031	\$20.92	\$0.00	64%	434	1,514	0	0	99%	55%	100%
Provide Energy Efficient Kitchen Aerator - 1.5 GPM to replace existing 2.2 gpm aerator in home with electric DHW heater	1.5 GPM Kitchen Faucet Aerator	14	8,760	2.2 GPM Kitchen Faucet Aerator	21	8,760	10.00	\$2	\$0	\$2	\$ 0.121	100%	0.17	0.00	59	\$0.03	\$0.00	0.007	0.009	\$2.89	\$0.00	124%	499	1,740	0	0	99%	40%	100%
Provide Energy Efficient Bath Faucet Aerator - 1.0 GPM to replace existing 2.2 gpm aerator in home with electric DHW heater	1.0 GPM Bathroom Faucet Aerator	6	8,760	2.2 GPM Bathroom Faucet Aerator	13	8,760	10.00	\$1	\$0	\$1	\$ 0.121	100%	0.05	0.00	61	\$0.01	\$0.00	0.007	0.009	\$3.27	\$0.00	124%	170	592	0	0	99%	40%	100%
Provide Energy Efficient Bath Faucet Aerator - 0.5 GPM to replace existing 2.2 gpm aerator in home with electric DHW heater	0.5 GPM Bathroom Faucet Aerator	3	8,760	2.2 GPM Bathroom Faucet Aerator	13	8,760	10.00	\$2	\$0	\$2	\$ 0.121	100%	0.10	0.00	86	\$0.02	\$0.00	0.010	0.013	\$4.63	\$0.00	124%	329	1,148	0	0	99%	40%	100%
Provide Energy Efficient Bath Faucet Aerator - 1.0 GPM for second faucet to replace existing 2.2 gpm aerator in home with electric DHW heater	1.0 GPM Bathroom Faucet Aerator	6	8,760	2.2 GPM Bathroom Faucet Aerator	13	8,760	10.00	\$1	\$0	\$1	\$ 0.121																		

Measure Description		High Efficiency Product Assumptions		Baseline Product Assumptions		Economic Assumptions						Stipulated Output						Economic Assumptions		Technical Assumption	2019				2020				NTG (%)	Installation Rate (%)	Realization Rate (%)		
		Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period (w/o Rebate) (yrs)	Incremental Cost Payback Period (w/ Rebate) (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Cust kWh Saved (\$/kWh)	Rebated Lifetime Cost / Cust kWh Saved (\$/kWh)	Customer kWh Savings (kWh)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)	2021 Participants (-)	2021 Units (-)	2022 Participants (-)	2022 Units (-)	2023 Participants (-)	2023 Units (-)
Envelope Measures with 20% improvement over local code - Combo Customers IECC 2009 or older		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3614 and Percent BTC 22.77%	4,958	1,850	Reference Home Based upon Local Code	5,380	1,850	20.00	\$205	\$0	\$695	\$ 0.121	30%	7.37	5.19	781	\$0.26	\$0.01	0.422	0.399	\$0.00	\$0.00	86%	330	397	113	269	92%	100%	100%			
Envelope Measures with 25% improvement over local code - Combo Customers IECC 2009 or older		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3931 and Percent BTC 27.45%	6,092	1,599	Reference Home Based upon Local Code	6,748	1,599	20.00	\$288	\$0	\$950	\$ 0.121	30%	7.50	5.23	1,049	\$0.27	\$0.01	0.656	0.630	\$0.00	\$0.00	87%	209	252	72	170	92%	100%	100%			
Envelope Measures with 30% improvement over local code - Combo Customers IECC 2009 or older		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4381 and Percent BTC 31.82%	7,570	1,427	Reference Home Based upon Local Code	8,522	1,427	20.00	\$363	\$0	\$1,224	\$ 0.121	30%	7.46	5.25	1,359	\$0.27	\$0.01	0.952	0.934	\$0.00	\$0.00	89%	51	61	18	42	92%	100%	100%			
Envelope Measures with 35% improvement over local code - Combo Customers IECC 2009 or older		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 5040 and Percent BTC 38.55%	8,114	1,313	Reference Home Based upon Local Code	9,360	1,313	20.00	\$493	\$0	\$1,812	\$ 0.121	27%	9.17	6.68	1,636	\$0.30	\$0.02	1.246	1.163	\$0.00	\$0.00	85%	7	8	3	6	92%	100%	100%			
Envelope Measures with 40% improvement over local code - Combo Customers IECC 2009 or older		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3612 and Percent BTC 44.02%	5,843	1,544	Reference Home Based upon Local Code	7,328	1,544	20.00	\$706	\$0	\$2,200	\$ 0.121	32%	7.95	5.40	2,293	\$0.31	\$0.02	1.485	1.063	\$0.00	\$0.00	65%	1	1	0	0	92%	100%	100%			
Envelope Measures with 10% improvement over local code - Combo Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3409 and Final HERS 12.59%	2,800	3,569	Reference Home Based upon Local Code	3,045	3,569	20.00	\$148	\$0	\$667	\$ 0.121	22%	6.31	4.91	874	\$0.17	\$0.01	0.245	0.198	\$0.00	\$0.00	74%	737	887	393	932	92%	100%	100%			
Envelope Measures with 15% improvement over local code - Combo Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3371 and Final HERS 17.2%	3,513	2,975	Reference Home Based upon Local Code	3,920	2,975	20.00	\$218	\$0	\$1,233	\$ 0.121	18%	8.44	6.94	1,211	\$0.18	\$0.01	0.407	0.370	\$0.00	\$0.00	83%	512	616	273	647	92%	100%	100%			
Envelope Measures with 20% improvement over local code - Combo Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3614 and Final HERS 21.88%	3,981	2,646	Reference Home Based upon Local Code	4,464	2,646	20.00	\$298	\$0	\$2,001	\$ 0.121	15%	12.96	11.04	1,278	\$0.23	\$0.01	0.483	0.457	\$0.00	\$0.00	86%	97	117	52	123	92%	100%	100%			
Envelope Measures with 25% improvement over local code - Combo Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3931 and Final HERS 26.9%	3,237	2,934	Reference Home Based upon Local Code	3,880	2,934	20.00	\$514	\$0	\$3,616	\$ 0.121	14%	15.87	13.62	1,887	\$0.27	\$0.01	0.643	0.618	\$0.00	\$0.00	87%	21	25	11	27	92%	100%	100%			
Envelope Measures with 30% improvement over local code - Combo Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4381 and Final HERS 32.08%	3,336	2,102	Reference Home Based upon Local Code	3,836	2,102	20.00	\$514	\$0	\$3,761	\$ 0.121	14%	29.64	25.59	1,051	\$0.49	\$0.02	0.500	0.495	\$0.00	\$0.00	90%	20	24	10	24	92%	100%	100%			
Envelope Measures with 35% improvement over local code - Combo Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 5040 and Final HERS 38.47%	2,538	4,135	Reference Home Based upon Local Code	3,238	4,135	20.00	\$922	\$0	\$6,610	\$ 0.121	14%	18.91	16.28	2,894	\$0.32	\$0.02	0.700	0.653	\$0.00	\$0.00	85%	9	11	4	10	92%	100%	100%			
Envelope Measures with 40% improvement over local code - Combo Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3612 and Final HERS 42.35%	1,541	5,191	Reference Home Based upon Local Code	2,241	5,191	20.00	\$1,302	\$0	\$9,087	\$ 0.121	14%	20.71	17.74	3,634	\$0.36	\$0.02	0.700	0.501	\$0.00	\$0.00	65%	0	0	0	1	92%	100%	100%			
Envelope Measures with 10% improvement over local code - Electric Only Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3258 and Final HERS 12.5%	4,117	5,000	Reference Home Based upon Local Code	4,683	5,000	20.00	\$650	\$0	\$2,293	\$ 0.121	28%	6.71	4.81	2,830	\$0.23	\$0.01	0.566	0.190	\$0.00	\$0.00	31%	44	44	44	44	92%	100%	100%			
Envelope Measures with 15% improvement over local code - Electric Only Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3258 and Final HERS 17.5%	3,882	5,000	Reference Home Based upon Local Code	4,683	5,000	20.00	\$800	\$0	\$4,291	\$ 0.121	19%	8.87	7.22	4,004	\$0.20	\$0.01	0.801	0.394	\$0.00	\$0.00	45%	5	5	5	5	92%	100%	100%			
Envelope Measures with 20% improvement over local code - Electric Only Customers IECC 2012 or Higher		Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3258 and Final HERS 20.9%	3,813	5,000	Reference Home Based upon Local Code	4,683	5,000	20.00	\$1,000	\$0	\$8,333	\$ 0.121	12%	15.87	13.96	4,350	\$0.23	\$0.01	0.870	0.475	\$0.00	\$0.00	50%	1	1	1	1	92%	100%	100%			
Energy Star Clothes Washer - Combo Customers w/ Electric DHW		Energy Star Clothes Washer	370	295	Standard Clothes Washer	477	295	11.00	\$30	\$0	\$30	\$ 0.121	100%	2.48	0.00	32	\$0.95	\$0.09	0.107	0.004	\$8.30	\$0.00	3%	1	1	0	1	92%	100%	100%			
Energy Star Clothes Washer - Combo Customers w/ Gas DHW		Energy Star Clothes Washer	111	295	Standard Clothes Washer	132	295	11.00	\$11	\$0	\$11	\$ 0.121	100%	1.21	0.00	6	\$1.74	\$0.16	0.021	0.001	\$8.30	\$0.00	3%	139	168	74	176	92%	100%	100%			
100% High Efficiency Lighting in IECC 2012 or IECC 2015 Homes LEDs - 2019		LED Bulb Purchase - A-Line	10	986	Incandescent Equivalent (Post-EISA)	45	986	5.00	\$1	\$1	\$2	\$ 0.121	58%	0.41	0.17	35	\$0.03	\$0.01	0.036	0.005	\$0.00	\$0.00	13%	1,377	1,658	0	0	92%	100%	100%			
2009 IECC or lower with LEDs - Minimum 20 lamps - 2019		LED Bulb Purchase - A-Line	10	986	Incandescent Equivalent (Post-EISA)	45	986	5.00	\$1	\$1	\$2	\$ 0.121	58%	0.41	0.17	35	\$0.03	\$0.01	0.036	0.005	\$0.00	\$0.00	13%	283	341	0	0	92%	100%	100%			
100% High Efficiency Lighting in IECC 2012 or IECC 2015 Homes LEDs - 2020		LED Bulb Purchase - A-Line	10	986	Incandescent Equivalent (Post-EISA)	45	986	4.00	\$1	\$1	\$2	\$ 0.121	58%	0.41	0.17	35	\$0.03	\$0.01	0.036	0.005	\$0.00	\$0.00	13%	0	0	734	1,740	92%	100%	100%			
2009 IECC or lower with LEDs - Minimum 20 lamps - 2020		LED Bulb Purchase - A-Line	10	986	Incandescent Equivalent (Post-EISA)	45	986	4.00	\$1	\$1	\$2	\$ 0.121	58%	0.41	0.17	35	\$0.03	\$0.01	0.036	0.005	\$0.00	\$0.00	13%	0	0	151	358	92%	100%	100%			
Medium Draw Heat Pump Water Heater - Refrigerant Based Cooling & Electric Resistance Heat (30-50 Gallon)		High Efficiency Heat Pump Water Heater	4,018	387	Minimum Efficiency Electric Water Heater	4,593	931	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.86	0.64	2,721	\$0.15	\$0.01	0.576	0.633	\$0.00	\$0.00	100%	0	0	0	0	92%	100%	100%			
Medium Draw Heat Pump Water Heater - Refrigerant Based Cooling & ASHP Heat (30-50 Gallon)		High Efficiency Heat Pump Water Heater	4,026	405	Minimum Efficiency Electric Water Heater	4,593	1,124	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.43	0.50	3,534	\$0.11	\$0.01	0.567	0.624	\$0.00	\$0.00	100%	0	1	2	5	92%	100%	100%			
Medium Draw Heat Pump Water Heater - Refrigerant Based Cooling & Natural Gas Heat (30-50 Gallon)		High Efficiency Heat Pump Water Heater	4,026	405	Minimum Efficiency Electric Water Heater	4,593	1,278	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.19	0.41	4,240	\$0.09	\$0.01	0.567	0.624	\$0.00	\$0.00	100%	0	12	8	19	92%	100%	100%			
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & Electric Resistance Heat (30-50 Gallon)		High Efficiency Heat Pump Water Heater	4,015	382	Minimum Efficiency Electric Water Heater	4,500	931	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.91	0.66	2,654	\$0.15	\$0.01	0.485	0.534	\$0.00	\$0.00	100%	0	0	0	0	92%	100%	100%			
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & ASHP Heat (30-50 Gallon)		High Efficiency Heat Pump Water Heater	4,018	388	Minimum Efficiency Electric Water Heater	4,500	1,128	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.44	0.50	3,514	\$0.11	\$0.01	0.482	0.530	\$0.00	\$0.00	100%	0	0	0	0	92%	100%	100%			
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & Natural Gas Heat (30-50 Gallon)		High Efficiency Heat Pump Water Heater	4,015	382	Minimum Efficiency Electric Water Heater	4,500	1,285	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.19	0.41	4,246	\$0.09	\$0.01	0.485	0.533	\$0.00	\$0.00	100%	0	3	3	6	92%	100%	100%			
Install Energy Star certified smart thermostat - ELECTRIC ONLY		Average Single Family House with Energy Star Smart Thermostat	2,621	573	Average Single Family House with Standard Thermostat	2,912	573	10.00	\$50	\$0	\$137	\$ 0.121	36%	6.80	4.32	167	\$0.30	\$0.03	0.291	0.244	\$0.00	\$0.00	76%	42	50	21	50	92%	100%	100%			
Install Energy Star certified smart thermostat - COMBO		Average Single Family House with Energy Star Smart Thermostat	2,621	573	Average Single Family House with Standard Thermostat	2,912	573	10.00	\$32	\$0	\$137	\$ 0.121	23%	6.80	5.22	167	\$0.19	\$0.02	0.291	0.244	\$0.00	\$0.00	76%	407	490	302	715	92%	100%	100%			
Energy Star Radon Fans		Energy Star Radon Fan - Radonaway RP140	17	8,760	Radonaway RP145	48	8,760	10.00	\$20	\$139	-\$4	\$ 0.121	-500%	-0.12	-0.73	273	\$0.07	\$0.01	0.031	0.034	\$0.00	\$0.00	100%	279	336	142	336	92%	100%	100%			
Standard evaporative cooler - replacement		3 Ton Evaporative Cooler	380	549	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	549	15.00	\$200	\$3,811	-\$2,943	\$ 0.121	-7%	-16.94	-18.09	1,603	\$0.12	\$0.01	2,920	2,249	-\$19.80	\$0.00	70%	968	968	1,048	1,048	70%	100%	100%			
Standard evaporative cooler - non-replacement		3 Ton Evaporative Cooler	380	549	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	549	15.00	\$400	\$3,811	-\$2,943	\$ 0.121	-14%	-16.94	-19.24	1,603	\$0.25	\$0.02	2,920	2,249	-\$19.80	\$0.00	70%	466	466	505	505	70%	100%	100%			
Premium evaporative cooler - replacement		High Effic. Evaporative Cooler 3 Tons	380	549	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	549	15.00	\$600	\$3,811	-\$1,032	\$ 0.121	-58%	-5.57	-8.81	1,603	\$0.37	\$0.02	2,920	2,249	-\$8.32	\$0.00	70%	304	304	329	329	70%	100%	100%			
Premium evaporative cooler - non-replacement		High Effic. Evaporative Cooler 3 Tons	380	549	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	549	15.00	\$800	\$3,811	-\$1,032	\$ 0.121	-77%	-5.57	-9.89	1,603	\$0.50	\$0.03	2,920	2,249	-\$8.32	\$0.00	70%	194	194	210	210	70%	100%	100%			

Electric Planning Assumptions																																
Measure Description	High Efficiency Product Assumptions			Baseline Product Assumptions			Economic Assumptions					Stipulated Output							Economic Assumptions		Technical Assumption	2019				2020				NTG (%)	Installation Rate (%)	Realization Rate (%)
	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period w/o Rebate (yrs)	Incremental Cost Payback Period w/ Rebate (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Customer kWh Saved (\$/kWh)	Rebated Lifetime Cost / Customer kWh Saved (\$/kWh)	Customer kWh Savings (kWh)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)						
Multi-ducted premium evaporative cooler - non-replacement	Integrated HVAC with Hi Effic Evap System	745	389	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	389	15.00	\$1,200	\$3,811	\$210	\$ 0.121	571%	1.88	-8.87	993	\$1.21	\$0.08	2,655	1,968	-\$8.32	\$0.00	70%	0	0	0	0	90%	100%	100%			
Standard Efficiency AC with Qi	Residential Air Conditioner - Non-Qualifying Efficiency + Qi (Nominal 13.18 SEER & 2.39 Tons)	3,012	688	Residential Air Conditioner - Non-Qualifying Efficiency w/o Qi	3,356	760	18.00	\$300	\$0	\$167	\$ 0.121	180%	2.89	-2.30	479	\$0.63	\$0.03	0,344	0,340	\$0.00	\$0.00	90%	799	799	940	940	68%	100%	100%			
High Efficiency AC with Qi	Residential Air Conditioner - Qualifying Efficiency + Qi (Nominal 15.85 SEER & 1.98 Tons)	2,453	648	Residential Air Conditioner - Non-Qualifying Efficiency w/o Qi	3,108	741	18.00	\$500	\$0	\$787	\$ 0.121	64%	9.16	3.34	711	\$0.70	\$0.04	0,654	0,648	\$0.00	\$0.00	90%	2,334	2,334	3,369	3,369	68%	100%	100%			
Standard Efficiency AC with Qi	Residential Air Conditioner - Non-Qualifying Efficiency + Qi (Nominal 14.51 SEER & 3 Tons)	3,220	576	Residential Air Conditioner - Non-Qualifying Efficiency w/o Qi	3,220	623	18.00	\$300	\$0	\$167	\$ 0.121	180%	9.24	-7.36	150	\$2.00	\$0.11	0,000	0,000	\$0.00	\$0.00	90%	1	1	1	1	68%	100%	100%			
High Efficiency AC with Qi	Residential Air Conditioner - Qualifying Efficiency + Qi (Nominal 16.3 SEER & 3 Tons)	2,800	531	Residential Air Conditioner - Non-Qualifying Efficiency w/o Qi	3,152	613	18.00	\$500	\$0	\$1,087	\$ 0.121	46%	20.16	10.88	447	\$1.12	\$0.06	0,352	0,348	\$0.00	\$0.00	90%	14	14	14	14	68%	100%	100%			
High Efficiency Mini-Split Heat Pump	Residential Mini-Split Heat Pump (Nominal 18.72 SEER & 2.03 Tons)	2,042	1,614	Residential Mini-Split Heat Pump - Code Minimum	3,014	1,236	18.00	\$300	\$0	\$947	\$ 0.121	32%	18.22	12.44	431	\$0.70	\$0.04	0,972	0,962	\$0.00	\$0.00	90%	632	632	1,046	1,046	100%	100%	100%			
High Efficiency GSHP with Qi	Residential Closed Loop GSHP + Qi (Nominal 14.1 EER Cooling & 3.3 COP Heating & 36000 BTU/h)	4,263	1,444	Residential Air-Source Heat Pump - Non-Qualifying Efficiency w/o Qi	5,862	1,306	20.00	\$1,200	\$0	\$2,440	\$ 0.121	49%	13.48	6.85	1,499	\$0.80	\$0.04	1,599	0,660	\$0.00	\$0.00	38%	1	1	1	1	100%	100%	100%			
High Efficiency GSHP with Qi	Residential Closed Loop GSHP + Qi (Nominal 14.1 EER Cooling & 3.3 COP Heating & 36000 BTU/h)	4,263	5,657	Ducted Electric Resistance Htg - w/o Qi	14,420	3,231	20.00	\$1,200	\$0	\$2,453	\$ 0.121	49%	0.90	0.46	22,469	\$0.05	\$0.00	10,157	0,847	\$0.00	\$0.00	8%	1	1	1	1	100%	100%	100%			
Enhanced Fan Time Delay for Retrofit	3 T, 11 SEER Non-Qi Unit with Enhanced Evaporator Fan Time Delay	0	562	11 SEER Qi Unit	130	562	7.50	\$35	\$0	\$100	\$ 0.121	35%	11.34	7.37	73	\$0.48	\$0.06	0,130	0,129	\$0.00	\$0.00	90%	1	1	1	1	100%	100%	100%			
EC Fan Motor on new Residential Furnace with AC	ECM Furnace Fan	456	4,192	Non-ECM Fan	649	4,192	18.00	\$100	\$356	\$235	\$ 0.121	43%	2.73	1.57	809	\$0.12	\$0.01	0,193	0,168	-\$11.76	\$0.00	79%	6,300	6,325	640	643	94%	100%	100%			
EC Fan Motor on new Residential Furnace no AC	ECM Furnace Fan	364	3,356	Non-ECM Fan	569	3,356	18.00	\$65	\$356	\$235	\$ 0.121	28%	3.30	2.38	688	\$0.09	\$0.01	0,205	0,068	-\$11.76	\$0.00	30%	900	915	63	64	94%	100%	100%			
LED Bulb - A-Line	LED Bulb Purchase - A-Line	10	986	Incandescent Equivalent (Post-EISA)	45	986	5.00	\$1	\$1	\$2	\$ 0.121	77%	0.41	0.10	35	\$0.04	\$0.01	0,036	0,005	\$0.00	\$0.00	13%	188,571	2,451,424	0	0	61%	99%	100%			
LED Bulb - A-Line	LED Bulb Purchase - A-Line	10	3,866	Incandescent Equivalent (Post-EISA)	45	3,866	4.20	\$1	\$1	\$2	\$ 0.084	77%	0.15	0.04	138	\$0.01	\$0.00	0,036	0,026	\$0.00	\$0.00	67%	6,018	156,474	0	0	61%	99%	100%			
LED Bulb - Specialty	LED Bulb Purchase - Specialty	11	986	Incandescent Equivalent (Exempt/Post-EISA)	77	986	13.93	\$1	\$3	\$2	\$ 0.121	77%	0.24	0.06	65	\$0.02	\$0.00	0,066	0,009	\$0.00	\$0.00	13%	27,702	360,123	0	0	61%	99%	100%			
LED Bulb - Specialty	LED Bulb Purchase - Specialty	11	3,866	Incandescent Equivalent (Exempt/Post-EISA)	77	3,866	5.33	\$1	\$3	\$2	\$ 0.084	77%	0.09	0.02	255	\$0.01	\$0.00	0,066	0,048	\$0.00	\$0.00	67%	884	22,987	0	0	61%	99%	100%			
LED Tubes (Linear Lamps)	LED Linear Tube	15	986	Fluorescent Lamp	31	986	20.00	\$2	\$2	\$12	\$ 0.121	17%	6.30	5.25	16	\$0.13	\$0.01	0,016	0,002	\$0.00	\$0.00	13%	24,088	48,175	0	0	100%	99%	100%			
LED Tubes (Linear Lamps)	LED Linear Tube	15	3,866	Fluorescent Lamp	31	3,866	13.12	\$2	\$2	\$12	\$ 0.084	17%	2.32	1.93	62	\$0.03	\$0.00	0,016	0,012	\$0.00	\$0.00	67%	118	3,075	0	0	100%	99%	100%			
LED Bulb - A-Line	LED Bulb Purchase - A-Line	10	986	Incandescent Equivalent (Post-EISA)	45	986	4.00	\$1	\$1	\$2	\$ 0.121	77%	0.41	0.10	35	\$0.04	\$0.01	0,036	0,005	\$0.00	\$0.00	13%	0	0	140,277	1,823,600	61%	99%	100%			
LED Bulb - A-Line	LED Bulb Purchase - A-Line	10	3,866	Incandescent Equivalent (Post-EISA)	45	3,866	3.30	\$1	\$1	\$2	\$ 0.084	77%	0.15	0.04	138	\$0.01	\$0.00	0,036	0,026	\$0.00	\$0.00	67%	0	0	4,477	116,400	61%	99%	100%			
LED Bulb - Specialty	LED Bulb Purchase - Specialty	11	986	Incandescent Equivalent (Exempt/Post-EISA)	77	986	13.50	\$1	\$3	\$2	\$ 0.121	77%	0.24	0.06	65	\$0.02	\$0.00	0,066	0,009	\$0.00	\$0.00	13%	0	0	22,271	289,520	61%	99%	100%			
LED Bulb - Specialty	LED Bulb Purchase - Specialty	11	3,866	Incandescent Equivalent (Exempt/Post-EISA)	77	3,866	4.89	\$1	\$3	\$2	\$ 0.084	77%	0.09	0.02	255	\$0.01	\$0.00	0,066	0,048	\$0.00	\$0.00	67%	0	0	711	18,480	61%	99%	100%			
LED Tubes (Linear Lamps)	LED Linear Tube	15	986	Fluorescent Lamp	31	986	20.00	\$2	\$2	\$12	\$ 0.121	17%	6.30	5.25	16	\$0.13	\$0.01	0,016	0,002	\$0.00	\$0.00	13%	0	0	48,175	96,350	100%	99%	100%			
LED Tubes (Linear Lamps)	LED Linear Tube	15	3,866	Fluorescent Lamp	31	3,866	13.12	\$2	\$2	\$12	\$ 0.084	17%	2.32	1.93	62	\$0.03	\$0.00	0,016	0,012	\$0.00	\$0.00	67%	0	0	237	6,150	100%	99%	100%			
Attic Insulation in Electrically Heated and non-cooled Home	Existing Home with R9 Attic Insulation added to achieve R-54	466	1,159	Existing home with R9 attic insul and average heating efficiency of 1.51 COP	2,343	1,159	20.00	\$329	\$0	\$1,508	\$ 0.121	22%	5.74	4.49	2,175	\$0.15	\$0.01	1,877	0,000	\$0.00	\$0.00	0%	1	1	1	2	116%	100%	100%			
Attic Insulation in Electrically Heated and Cooled Home	Existing Home with R9 Attic Insulation added to achieve R-54	466	1,242	Existing home with R9 attic insul and average heating efficiency of 1.51 COP and cooling efficiency of 3.93 COP	2,343	1,242	20.00	\$400	\$0	\$1,508	\$ 0.121	27%	5.36	3.94	2,330	\$0.17	\$0.01	1,877	0,519	\$0.00	\$0.00	25%	1	1	1	2	116%	100%	100%			
Attic Insulation in Natural Gas Heated and Electrically Cooled Home	Existing Home with R9 Attic Insulation added to achieve R-54	117	329	Existing home with R9 attic insul and average cooling efficiency of 3.93 COP	589	329	20.00	\$229	\$0	\$785	\$ 0.121	29%	41.87	29.64	155	\$1.48	\$0.07	0,472	0,519	\$0.00	\$0.00	100%	130	215	113	215	116%	100%	100%			
Tier 2 Air Sealing & Bypass Sealing for minimum 20% ACH Reduction in Electrically Heated and non-cooled Home	Home with Tier 2 Air Sealing: CFM50 reading of 2324	5,496	1,159	Baseline home with CFM50 rating of 3223	8,134	1,159	10.00	\$247	\$0	\$960	\$ 0.121	26%	2.60	1.93	3,058	\$0.08	\$0.01	2,639	0,000	\$0.00	\$0.00	0%	1	1	1	2	116%	100%	100%			
Tier 2 Air Sealing & Bypass Sealing for minimum 20% ACH Reduction in Electrically Heated and Cooled Home	Home with Tier 2 Air Sealing: CFM50 reading of 2324	5,534	1,194	Baseline home with CFM50 rating of 3223	8,173	1,194	10.00	\$310	\$0	\$960	\$ 0.121	32%	2.52	1.71	3,150	\$0.10	\$0.01	2,639	0,307	\$0.00	\$0.00	11%	1	1	1	2	116%	100%	100%			
Tier 2 Air Sealing & Bypass Sealing for minimum 20% ACH Reduction in Natural Gas Heated and Electrically Cooled Home	Home with Tier 2 Air Sealing: CFM50 reading of 2324	722	329	Baseline home with CFM50 rating of 3223	1,001	329	10.00	\$42	\$0	\$436	\$ 0.121	10%	39.31	35.56	92	\$0.45	\$0.05	0,279	0,307	\$0.00	\$0.00	100%	78	130	69	130	116%	100%	100%			
Tier 3 Air Sealing & Bypass Sealing for minimum 30% ACH Reduction in Electrically Heated and non-cooled Home	Home with Tier 3 Air Sealing: CFM50 reading of 2076	6,188	1,159	Baseline home with CFM50 rating of 3641	10,841	1,159	10.00	\$92	\$0	\$955	\$ 0.121	10%	1.47	1.33	5,392	\$0.02	\$0.00	4,652	0,000	\$0.00	\$0.00	0%	1	1	1	2	116%	100%	100%			
Tier 3 Air Sealing & Bypass Sealing for minimum 30% ACH Reduction in Electrically Heated and Cooled Home	Home with Tier 3 Air Sealing: CFM50 reading of 2076	6,188	1,193	Baseline home with CFM50 rating of 3641	10,841	1,193	10.00	\$400	\$0	\$955	\$ 0.121	42%	1.43	0.83	5,550	\$0.07	\$0.01	4,652	0,528	\$0.00	\$0.00	10%	1	1	1	2	116%	100%	100%			
Tier 3 Air Sealing & Bypass Sealing for minimum 30% ACH Reduction in Natural Gas Heated and Electrically Cooled Home	Home with Tier 3 Air Sealing: CFM50 reading of 2076	638	329	Baseline home with CFM50 rating of 3641	1,117	329	10.00	\$99	\$0	\$436	\$ 0.121	23%	22.88	17.70	158	\$0.62	\$0.06	0,479	0,528	\$0.00	\$0.00	100%	78	130	69	130	116%	100%	100%			
Wall Insulation from R-0 to R11 in Electrically Heated and non-cooled Home	R-11 insulation in wall cavity	2,507	1,159	Empty Wall Cavity	6,420	1,159	20.00	\$200	\$0	\$1,936	\$ 0.121	10%	3.53	3.17	4,536	\$0.04	\$0.00	3,913	0,000	\$0.00	\$0.00	0%	1	1	1	1	116%	100%	100%			
Wall Insulation from R-0 to R11 in Electrically Heated and Cooled Home	R-11 insulation in wall cavity	2,163	1,230	Empty Wall Cavity	6,420	1,230	20.00	\$384	\$0	\$1,936	\$ 0.121	19%	3.06	2.49	5,238	\$0.07	\$0.00	4,257	1,016	\$0.00	\$0.00	22%	1	1	1	1	116%	100%	100%			
Wall Insulation from R-0 to R11 in Natural Gas Heated and Electrically Cooled Home	R-11 insulation in wall cavity	469	329	Empty Wall Cavity	1,382	329	20.00	\$231	\$0	\$1,011	\$ 0.121	23%	27.55	21.25	304	\$0.76	\$0.04	0,923	1,016	\$0.00	\$0.00	100%	60	100	53	100	116%	100%	100%			
EC Fan Motor on new Residential Furnace with AC	ECM Furnace Fan	456	4,192	Non-ECM Fan	649	4,192	18.00	\$125	\$356	\$235	\$ 0.121	53%	2.73	1.28	809	\$0.15	\$0.01	0,193	0,168	-\$11.76	\$0.00	79%	2	3	0	0	116%	100%	100%			
EC Fan Motor on new Residential Furnace no AC	ECM Furnace Fan	364	3,356	Non-ECM Fan	569	3,356	18.00	\$80	\$356	\$235	\$ 0.121	34%	3.30	2.17	688	\$0.12	\$0.01	0,205	0,068	-\$11.76	\$0.00	30%	2	3	0	0	116%	100%	100%			
0	0	0	0	0	0	0	0.00																									

Measure Description	Electric Planning Assumptions																						Economic Assumptions			Technical Assumption			2019		2020		NTG (%)	Installation Rate (%)	Realization Rate (%)
	High Efficiency Product Assumptions				Baseline Product Assumptions				Economic Assumptions				Stipulated Output				Economic Assumptions		2019		2020														
	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period w/ Rebate (yrs)	Incremental Cost Payback Period w/ Rebate (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Cust kWh Saved (\$/kWh)	Rebated Lifetime cost / Cust kWh Saved (\$/kWh)	Customer kWh Savings (kWh)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)									
Evaporative Cooling Replacing 13 SEER central A/C (Tier 1) 1st Time Install (Denver/Front Range)	3 Ton Evaporative Cooler	380	549	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	549	15.00	\$275	\$3,811	-\$2,943	\$ 0.121	-9%	-16.94	-18.52	1,603	\$0.17	\$0.01	2,920	2,249	-\$19.80	\$0.00	70%	0	0	1	1	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER A/C 3 ton; (Tier 2) Replacement (Denver/Front Range)	High Effic. Evaporative Cooler 3 Tons	380	549	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	549	15.00	\$525	\$3,811	-\$1,032	\$ 0.121	-51%	-5.57	-8.41	1,603	\$0.33	\$0.02	2,920	2,249	-\$8.32	\$0.00	70%	1	1	1	2	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER A/C 3 ton; (Tier 2) 1st Time Install (Denver/Front Range)	High Effic. Evaporative Cooler 3 Tons	380	549	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	549	15.00	\$625	\$3,811	-\$1,032	\$ 0.121	-61%	-5.57	-8.95	1,603	\$0.39	\$0.03	2,920	2,249	-\$8.32	\$0.00	70%	0	0	1	1	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER central A/C 3 ton; (Tier 3) Replacement (Denver/Front Range)	Integrated HVAC with Hi Effic. Evap. System	745	549	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	549	15.00	\$1,000	\$3,811	\$210	\$ 0.121	476%	1.30	-4.90	1,403	\$0.71	\$0.05	2,555	1,968	-\$8.32	\$0.00	70%	1	1	1	1	116%	100%	100%						
Evaporative Cooling Replacing 13 SEER central A/C (Tier 1) Replacement (Grand Junction/Western Slope)	3 Ton Evaporative Cooler	380	578	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	578	15.00	\$125	\$3,811	-\$2,943	\$ 0.121	-4%	-16.00	-16.68	1,688	\$0.07	\$0.00	2,920	2,249	-\$19.80	\$0.00	70%	1	1	1	2	116%	100%	100%						
Evaporative Cooling Replacing 13 SEER central A/C (Tier 1) 1st Time Install (Grand Junction/Western Slope)	3 Ton Evaporative Cooler	380	578	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	578	15.00	\$275	\$3,811	-\$2,943	\$ 0.121	-9%	-16.00	-17.49	1,688	\$0.16	\$0.01	2,920	2,249	-\$19.80	\$0.00	70%	0	0	1	1	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER A/C 3 ton; (Tier 2) Replacement (Grand Junction/Western Slope)	High Effic. Evaporative Cooler 3 Tons	380	578	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	578	15.00	\$525	\$3,811	-\$1,032	\$ 0.121	-51%	-5.28	-7.97	1,688	\$0.31	\$0.02	2,920	2,249	-\$8.32	\$0.00	70%	1	1	1	2	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER A/C 3 ton; (Tier 2) 1st Time Install (Grand Junction/Western Slope)	High Effic. Evaporative Cooler 3 Tons	380	578	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	578	15.00	\$625	\$3,811	-\$1,032	\$ 0.121	-61%	-5.28	-8.48	1,688	\$0.37	\$0.02	2,920	2,249	-\$8.32	\$0.00	70%	0	0	1	1	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER central A/C 3 ton; (Tier 3) Replacement (Grand Junction/Western Slope)	Integrated HVAC with Hi Effic. Evap. System	745	578	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	578	15.00	\$1,000	\$3,811	\$210	\$ 0.121	476%	1.24	-4.65	1,477	\$0.68	\$0.05	2,555	1,968	-\$8.32	\$0.00	70%	1	1	1	1	116%	100%	100%						
Evaporative Cooling Replacing 13 SEER central A/C (Tier 1) Replacement (Alamosa/Mountain Areas)	3 Ton Evaporative Cooler	380	389	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	389	15.00	\$125	\$3,811	-\$2,943	\$ 0.121	-4%	-25.10	-26.16	1,135	\$0.11	\$0.01	2,920	2,249	-\$19.80	\$0.00	70%	1	1	1	2	116%	100%	100%						
Evaporative Cooling Replacing 13 SEER central A/C (Tier 1) 1st Time Install (Alamosa/Mountain Areas)	3 Ton Evaporative Cooler	380	389	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	389	15.00	\$275	\$3,811	-\$2,943	\$ 0.121	-9%	-25.10	-27.44	1,135	\$0.24	\$0.02	2,920	2,249	-\$19.80	\$0.00	70%	0	0	1	1	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER A/C 3 ton; (Tier 2) Replacement (Alamosa/Mountain Areas)	High Effic. Evaporative Cooler 3 Tons	380	389	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	389	15.00	\$525	\$3,811	-\$1,032	\$ 0.121	-51%	-8.02	-12.09	1,135	\$0.46	\$0.03	2,920	2,249	-\$8.32	\$0.00	70%	1	1	1	2	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER A/C 3 ton; (Tier 2) 1st Time Install (Alamosa/Mountain Areas)	High Effic. Evaporative Cooler 3 Tons	380	389	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	389	15.00	\$625	\$3,811	-\$1,032	\$ 0.121	-61%	-8.02	-12.87	1,135	\$0.55	\$0.04	2,920	2,249	-\$8.32	\$0.00	70%	0	0	1	1	116%	100%	100%						
High Efficiency Evaporative Replacing 13 SEER central A/C 3 ton; (Tier 3) Replacement (Alamosa/Mountain Areas)	Integrated HVAC with Hi Effic. Evap. System	745	389	3T SEER 13 EER 11.18 w/o Quality Installation	3,300	389	15.00	\$1,000	\$3,811	\$210	\$ 0.121	476%	1.88	-7.08	993	\$1.01	\$0.07	2,555	1,968	-\$8.32	\$0.00	70%	1	1	1	1	116%	100%	100%						
Install and program a new Setback Thermostat	Energy Star Programmable thermostat (set back 1.33 F derived from REC2009 data)	2,990	580	standard thermostat - manually adjusted	3,130	592	10.00	\$18	\$0	\$26	\$ 0.121	70%	1.84	0.55	118	\$0.16	\$0.02	0.140	0.118	\$0.00	\$0.00	76%	10	16	9	18	116%	100%	100%						
Install Energy Star certified smart thermostat - ELECTRIC ONLY	Average Single Family House with Energy Star Smart Thermostat	2,621	573	Average Single Family House with Standard Thermostat	2,912	573	10.00	\$50	\$0	\$137	\$ 0.121	36%	6.80	4.32	167	\$0.30	\$0.03	0.291	0.244	\$0.00	\$0.00	76%	3	5	40	75	100%	100%	100%						
Install Energy Star certified smart thermostat - COMBO	Average Single Family House with Energy Star Smart Thermostat	2,621	573	Average Single Family House with Standard Thermostat	2,912	573	10.00	\$32	\$0	\$137	\$ 0.121	23%	6.80	5.22	167	\$0.19	\$0.02	0.291	0.244	\$0.00	\$0.00	76%	9	15	8	15	100%	100%	100%						
Electric Heat Homes Without Cooling	Home with additional insulation	2,018	1,159	Home with R20 or less existing insulation	4,296	1,159	20.00	\$267	\$0	\$1,232	\$ 0.121	22%	3.86	3.03	2,640	\$0.10	\$0.01	2,278	0.000	\$0.00	\$0.00	0%	26	46	26	46	89%	100%	100%						
Electric Heat Homes With Cooling	Home with additional insulation	1,269	1,488	Home with R20 or less existing insulation	3,549	1,488	20.00	\$294	\$0	\$1,468	\$ 0.121	20%	3.58	2.86	3,393	\$0.09	\$0.00	2,281	0.572	\$0.00	\$0.00	23%	5	8	5	8	89%	100%	100%						
Gas Heat Homes With Cooling, Combo Customer	Home with additional insulation	480	329	Home with R20 or less existing insulation	1,044	329	20.00	\$199	\$0	\$854	\$ 0.121	23%	38.14	29.26	185	\$1.07	\$0.05	0.564	0.620	\$0.00	\$0.00	100%	231	406	231	406	89%	100%	100%						
Electric Heat Homes Without Cooling	R-11 insulation	2,927	1,159	Baseline assumes R-0 in wall cavities as existing level	4,296	1,159	20.00	\$120	\$0	\$803	\$ 0.121	15%	4.19	3.56	1,587	\$0.08	\$0.00	1,369	0.000	\$0.00	\$0.00	0%	1	2	1	2	89%	100%	100%						
Electric Heat Homes With Cooling	R-11 insulation	2,524	1,488	Baseline assumes R-0 in wall cavities as existing level	3,549	1,488	20.00	\$145	\$0	\$1,337	\$ 0.121	11%	7.26	6.47	1,525	\$0.10	\$0.00	1,025	0.358	\$0.00	\$0.00	32%	1	2	1	2	89%	100%	100%						
Gas Heat Homes With Cooling, Combo Customer	R-11 insulation	369	329	Baseline assumes R-0 in wall cavities as existing level	1,044	329	20.00	\$190	\$0	\$729	\$ 0.121	25%	27.19	20.47	222	\$0.81	\$0.04	0.675	0.743	\$0.00	\$0.00	100%	24	42	24	42	89%	100%	100%						
Electric Heat Homes Without Cooling	Home with Tier 2 Air Sealing	6,072	1,159	Existing Home Without Air Sealing	8,000	1,159	10.00	\$97	\$0	\$686	\$ 0.121	14%	2.54	2.18	2,235	\$0.04	\$0.00	1,928	0.000	\$0.00	\$0.00	0%	14	24	14	24	89%	100%	100%						
Electric Heat Homes With Cooling	Home with Tier 2 Air Sealing	6,808	1,488	Existing Home Without Air Sealing	8,000	1,488	10.00	\$100	\$0	\$1,200	\$ 0.121	8%	5.60	5.14	1,774	\$0.06	\$0.01	1,192	0.241	\$0.00	\$0.00	18%	2	4	2	4	89%	100%	100%						
Gas Heat Homes With Cooling, Combo Customer	Home with Tier 2 Air Sealing	3,773	329	Existing Home Without Air Sealing	4,000	329	10.00	\$56	\$0	\$286	\$ 0.121	20%	31.72	25.47	75	\$0.76	\$0.08	0.227	0.250	\$0.00	\$0.00	100%	114	200	114	200	89%	100%	100%						
Electric Heat Homes Without Cooling	Home with Tier 3 Air Sealing	4,568	1,159	Existing Home Without Air Sealing	8,000	1,159	10.00	\$239	\$0	\$1,047	\$ 0.121	23%	2.18	1.68	3,977	\$0.05	\$0.01	3,432	0.000	\$0.00	\$0.00	0%	11	19	11	19	89%	100%	100%						
Electric Heat Homes With Cooling	Home with Tier 3 Air Sealing	1,889	1,488	Existing Home Without Air Sealing	8,000	1,488	10.00	\$196	\$0	\$353	\$ 0.121	58%	0.32	0.14	9,093	\$0.02	\$0.00	6,111	0.918	\$0.00	\$0.00	14%	2	3	2	3	89%	100%	100%						
Gas Heat Homes With Cooling, Combo Customer	Home with Tier 3 Air Sealing	3,525	329	Existing Home Without Air Sealing	4,000	329	10.00	\$115	\$0	\$333	\$ 0.121	35%	17.63	11.52	156	\$0.74	\$0.07	0.475	0.522	\$0.00	\$0.00	100%	99	174	99	174	89%	100%	100%						
Install new cellular shades instead of new roller shades	New Cellular Shades	77	1,140	New Roller Shades	81	1,140	13.70	\$16	\$42	\$23	\$ 0.121	71%	37.40	10.87	5	\$3.20	\$0.23	0.004	0.005	\$0.00	\$0.00	100%	14,963	14,963	16,388	16,388	89%	100%	100%						
Install new cellular shades instead of new roller shades	New Cellular Shades	77	3,240	New Roller Shades	81	3,240	13.70	\$20	\$42	\$28	\$ 0.121	71%	16.02	4.66	15	\$1.37	\$0.10	0.004	0.005	\$0.00	\$0.00	100%	788	788	863	863	89%	100%	100%						
Remove second refrigerator from service and recycle	removal of second refrigerator	0	0	existing secondary unit - age mostly >10 years	145	5,592	8.00	\$50	\$0	\$0	\$ 0.121	#DIV/0!	0.00	-0.51	811	\$0.06	\$0.01	0.145	0.102	\$0.00	\$0.00	64%	2,800	2,800	2,800	2,800	64%	100%	100%						
Removal of primary refrigerator	removal of primary refrigerator	0	0	existing primary unit - age mostly >10 years	168	5,592	6.91	\$50	\$0	\$0	\$ 0.121	#DIV/0!	0.00	-0.44	939	\$0.05	\$0.01	0.168	0.118	\$0.00	\$0.00	64%	2,800	2,800	2,800	2,800	53%	100%	100%						
Removal of freezer	removal of freezer	0	0	existing freezer unit - age mostly >10 years	192	5,592	5.63	\$50	\$0	\$0	\$ 0.121	#DIV/0!	0.00	-0.38	1,076	\$0.05	\$0.01	0.192	0.135	\$0.00	\$0.00	64%	1,400	1,400	1,400	1,400	53%	100%	100%						
Room AC Recycling	Removal of room Air Conditioner	0	0	Existing 10,000 BTU/h Room Air Conditioner	1,020	416	3.00	\$0	\$0	\$0	\$ 0.121	#DIV/0!	0.00	0.00	424	\$0.00	\$0.00	1,020	1.011	\$0.00	\$0.00	90%	0	250	0	500	57%	100%	100%						
Residential AC Switch	Utility load control with Smart Switch	0	1	No control, no switch	2,715	1	15.00	\$0	\$0	\$0	\$ 0.121	#DIV/0!	0.00	0.00	4	\$0.00	\$0.00	2,715	1.023	\$0.00	\$0.00	34%	6,000	6,300	6,000	6,300	100%	100%	100%						
Smart Thermostat - DR - Direct Install	Utility Load Control for control period with smart thermostat	0	1	No control, no smart thermostat	2,715	1	10.00	\$225	\$0	\$225	\$ 0.121	100%	465.83	0.00	4	\$56.25	\$5.63	2,715	1,281	\$0.00	\$0.00	43%	1,000	1,050	1,000	1,050	100%	100%	100%						

Electric Planning Assumptions																													
Measure Description	High Efficiency Product Assumptions			Baseline Product Assumptions			Economic Assumptions					Stipulated Output							Economic Assumptions		Technical Assumption	2019		2020		NTG (%)	Installation Rate (%)	Realization Rate (%)	
	Efficient Product Description / Rating	Efficient Product Consumption (watts)	Efficient Hours of Operation (hrs/yr)	Baseline Product Description / Rating	Baseline Product Consumption (watts)	Baseline Hours of Operation (hrs/yr)	Measure Lifetime (years)	Rebate Amount (\$)	Average Baseline Product Cost (\$)	Incremental Cost of Efficient Product (\$)	Assumed Energy Cost (\$/kWh)	Rebate as a % of Incremental Cost (%)	Incremental Cost Payback Period w/o Rebate (yrs)	Incremental Cost Payback Period w/ Rebate (yrs)	Annual Customer kWh Savings (kWh/yr)	Rebated Cost / Cust kWh Saved (\$/kWh)	Rebated Lifetime cost /Cust kWh Saved (\$/kWh)	Customer kW Savings (kW)	Generator Peak kW Savings (kW)	Non-Energy O&M Savings (\$)	Energy O&M Savings (\$)	Coincidence Factor (%)	2019 Participants (-)	2019 Units (-)	2020 Participants (-)				2020 Units (-)
Medium Draw Heat Pump Water Heater - Refrigerant Based Cooling & ASHP Heat (30-50 Gallon)	High Efficiency Heat Pump Water Heater	4,026	405	Minimum Efficiency Electric Water Heater	4,593	1,124	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.43	0.50	3,534	\$0.11	\$0.01	0.567	0.624	\$0.00	\$0.00	100%	182	182	182	182	100%	100%	100%
Medium Draw Heat Pump Water Heater - Refrigerant Based Cooling & Natural Gas Heat (30-50 Gallon)	High Efficiency Heat Pump Water Heater	4,026	405	Minimum Efficiency Electric Water Heater	4,593	1,278	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.30	0.45	4,240	\$0.09	\$0.01	0.567	0.624	-\$42.44	\$0.00	100%	181	181	181	181	100%	100%	100%
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & Electric Resistance Heat (30-50 Gallon)	High Efficiency Heat Pump Water Heater	4,015	382	Minimum Efficiency Electric Water Heater	4,500	931	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.91	0.66	2,654	\$0.15	\$0.01	0.485	0.534	\$0.00	\$0.00	100%	68	68	68	68	100%	100%	100%
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & ASHP Heat (30-50 Gallon)	High Efficiency Heat Pump Water Heater	4,018	388	Minimum Efficiency Electric Water Heater	4,500	1,128	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.44	0.50	3,514	\$0.11	\$0.01	0.482	0.530	\$0.00	\$0.00	100%	181	181	181	181	100%	100%	100%
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & Natural Gas Heat (30-50 Gallon)	High Efficiency Heat Pump Water Heater	4,015	382	Minimum Efficiency Electric Water Heater	4,500	1,285	12.00	\$400	\$959	\$611	\$ 0.121	65%	1.30	0.45	4,246	\$0.09	\$0.01	0.485	0.533	-\$42.44	\$0.00	100%	91	91	91	91	100%	100%	100%
Medium Draw Heat Pump Water Heater - Refrigerant Based Cooling & Electric Resistance Heat (30-50 Gallon) + CEA/ANSI Communications Port	High Efficiency Heat Pump Water Heater	4,018	387	Minimum Efficiency Electric Water Heater	4,593	931	12.00	\$500	\$959	\$611	\$ 0.121	82%	1.86	0.34	2,721	\$0.18	\$0.02	0.578	0.633	\$0.00	\$0.00	100%	23	23	23	23	100%	100%	100%
Medium Draw Heat Pump Water Heater - Refrigerant Based Cooling & ASHP Heat (30-50 Gallon) + CEA/ANSI Communications Port	High Efficiency Heat Pump Water Heater	4,026	405	Minimum Efficiency Electric Water Heater	4,593	1,124	12.00	\$500	\$959	\$611	\$ 0.121	82%	1.43	0.26	3,534	\$0.14	\$0.01	0.567	0.624	\$0.00	\$0.00	100%	136	136	136	136	100%	100%	100%
Medium Draw Heat Pump Water Heater - Refrigerant Based Cooling & Natural Gas Heat (30-50 Gallon) + CEA/ANSI Communications Port	High Efficiency Heat Pump Water Heater	4,026	405	Minimum Efficiency Electric Water Heater	4,593	1,278	12.00	\$500	\$959	\$611	\$ 0.121	82%	1.30	0.24	4,240	\$0.12	\$0.01	0.567	0.624	-\$42.44	\$0.00	100%	136	136	136	136	100%	100%	100%
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & Electric Resistance Heat (30-50 Gallon) + CEA/ANSI Communications Port	High Efficiency Heat Pump Water Heater	4,015	382	Minimum Efficiency Electric Water Heater	4,500	931	12.00	\$500	\$959	\$611	\$ 0.121	82%	1.91	0.35	2,654	\$0.19	\$0.02	0.485	0.534	\$0.00	\$0.00	100%	45	45	45	45	100%	100%	100%
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & ASHP Heat (30-50 Gallon) + CEA/ANSI Communications Port	High Efficiency Heat Pump Water Heater	4,018	388	Minimum Efficiency Electric Water Heater	4,500	1,128	12.00	\$500	\$959	\$611	\$ 0.121	82%	1.44	0.26	3,514	\$0.14	\$0.01	0.482	0.530	\$0.00	\$0.00	100%	113	113	113	113	100%	100%	100%
Medium Draw Heat Pump Water Heater - Non-Refrigerant Based Cooling & Natural Gas Heat (30-50 Gallon) + CEA/ANSI Communications Port	High Efficiency Heat Pump Water Heater	4,015	382	Minimum Efficiency Electric Water Heater	4,500	1,285	12.00	\$500	\$959	\$611	\$ 0.121	82%	1.30	0.24	4,246	\$0.12	\$0.01	0.485	0.533	-\$42.44	\$0.00	100%	91	91	91	91	100%	100%	100%

Gas Planning Assumptions

Natural Gas Measure Description	High Efficiency Product Description / Rating	High Efficiency Product Consumption (Dth/yr)	Baseline Product Description / Rating	Baseline Product Consumption (Dth/yr)	Life of Product (years)	Average Rebate Amount	Average Baseline Product Cost	Average Incremental Cost of Efficient Product	Assumed Energy Cost (\$/Dth)	Rebate as a % of Incremental Cost	Incremental Cost Payback Period w/o Rebate	Incremental Cost Payback Period with Rebate	Average Annual Customer Dth Savings	Average rebated cost per Dth Saved	Average rebated Lifetime cost per Dth Saved	Non-Energy O&M Savings	Energy O&M Savings	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)	NTG (%)	Installation Rate (%)	Realization Rate (%)
CO - Custom Efficiency - Gas	New equipment	7,133	Old or less efficient systems or equipment	8,916	20	\$8,209	\$0	\$65,590	\$5.24	13%	6	5	1,783	\$4.60	\$0.23	\$1,228	\$0	2	2	3	3	87%	100%	100%
Average EDA Project - 2019	More Efficient than Code Building	4,226	Code-Compliant Building	6,093	20	\$7,469	\$0	\$82,767	\$5.24	9%	8	8	1,867	\$4.00	\$0.20	\$0	\$0	38	38	0	0	99%	100%	100%
Average EDA Project - 2020	More Efficient than Code Building	5,657	Code-Compliant Building	8,157	20	\$9,998	\$0	\$108,069	\$5.24	9%	8	7	2,500	\$4.00	\$0.20	\$0	\$0	0	0	17	17	99%	100%	100%
Average EEB Project - 2019	More Efficient than Code Building	900	Code-Compliant Building	1,302	20	\$3,951	\$0	\$21,894	\$5.24	18%	11	9	402	\$9.84	\$0.49	-\$57	\$0	22	22	0	0	97%	100%	100%
Average EEB Project - 2020	More Efficient than Code Building	900	Code-Compliant Building	1,302	20	\$3,951	\$0	\$21,894	\$5.24	18%	11	9	402	\$9.84	\$0.49	-\$57	\$0	0	0	22	22	97%	100%	100%
New Energy Management System	New EMS for HVAC control	12,013	obsolete EMS	12,914	15	\$3,604	\$0	\$29,771	\$5.24	12%	5	5	901	\$4.00	\$0.27	\$744	\$0	9	9	8	8	90%	100%	100%
Non-condensing Hot Water Boiler, New 175 MBTUH; for space heating only	85% Efficient Boiler	135	80% Efficient Boiler	143	20	\$123	\$3,000	\$500	\$5.24	25%	11	9	8	\$14.56	\$0.73	\$0	\$0	1	1	1	1	86%	100%	100%
Non-condensing Hot Water Boiler, New 500 MBTUH; for space heating only	85% Efficient Boiler	384	80% Efficient Boiler	409	20	\$350	\$5,000	\$4,000	\$5.24	9%	32	29	24	\$14.56	\$0.73	\$0	\$0	6	6	6	6	86%	100%	100%
Non-condensing Hot Water Boiler, New 1 MMBTUH; for space and domestic water heating	85% Efficient Boiler	1,443	80% Efficient Boiler	1,533	20	\$700	\$7,300	\$4,400	\$5.24	16%	9	8	90	\$7.76	\$0.39	\$0	\$0	4	4	4	4	86%	100%	100%
Non-condensing Hot Water Boiler, New 2 MMBTUH; for space and domestic water heating	85% Efficient Boiler	2,886	80% Efficient Boiler	3,066	20	\$1,400	\$12,000	\$5,000	\$5.24	28%	5	4	180	\$7.76	\$0.39	\$0	\$0	1	1	1	1	86%	100%	100%
Non-condensing Hot Water Boiler, New 4 MMBTUH; for space and domestic water heating	85% Efficient Boiler	5,772	82% Efficient Boiler	5,983	20	\$2,800	\$24,000	\$10,000	\$5.24	28%	9	7	211	\$13.26	\$0.66	\$0	\$0	1	1	1	1	86%	100%	100%
Non-condensing Hot Water Boiler, New 6 MMBTUH; for space and domestic water heating	85% Efficient Boiler	8,658	82% Efficient Boiler	8,975	20	\$4,200	\$36,000	\$15,000	\$5.24	28%	9	7	317	\$13.26	\$0.66	\$0	\$0	0	0	1	1	86%	100%	100%
Non-condensing Hot Water Boiler, New 8 MMBTUH; for space and domestic water heating	85% Efficient Boiler	11,544	82% Efficient Boiler	11,966	20	\$5,600	\$48,000	\$20,000	\$5.24	28%	9	7	422	\$13.26	\$0.66	\$0	\$0	0	0	1	1	86%	100%	100%
Condensing Hot Water Boiler, New 175 MBTUH; for space heating only	92% Efficient Boiler	135	80% Efficient Boiler	153	20	\$525	\$3,000	\$1,600	\$5.24	33%	17	11	19	\$28.37	\$1.42	\$0	\$0	10	12	10	12	86%	100%	100%
Condensing Hot Water Boiler, New 500 MBTUH; for space heating only	92% Efficient Boiler	384	80% Efficient Boiler	437	20	\$1,500	\$5,000	\$6,200	\$5.24	24%	22	17	53	\$28.37	\$1.42	\$0	\$0	4	4	4	4	86%	100%	100%
Condensing Hot Water Boiler, New 1 MMBTUH; for space and domestic water heating	92% Efficient Boiler	1,443	80% Efficient Boiler	1,641	20	\$3,000	\$7,300	\$7,700	\$5.24	39%	7	5	198	\$15.12	\$0.76	\$0	\$0	49	53	58	62	86%	100%	100%
Condensing Hot Water Boiler, New 2 MMBTUH; for space and domestic water heating	92% Efficient Boiler	2,886	80% Efficient Boiler	3,283	20	\$6,000	\$12,000	\$14,500	\$5.24	41%	7	4	397	\$15.12	\$0.76	\$0	\$0	4	4	4	4	86%	100%	100%
Condensing Hot Water Boiler, New 4 MMBTUH; for space and domestic water heating	92% Efficient Boiler	5,772	82% Efficient Boiler	6,405	20	\$12,000	\$24,000	\$29,000	\$5.24	41%	9	5	633	\$18.94	\$0.95	\$0	\$0	2	2	2	2	86%	100%	100%
Condensing Hot Water Boiler, New 6 MMBTUH; for space and domestic water heating	92% Efficient Boiler	8,658	82% Efficient Boiler	9,608	20	\$18,000	\$36,000	\$43,500	\$5.24	41%	9	5	950	\$18.94	\$0.95	\$0	\$0	0	0	1	1	86%	100%	100%
Condensing Hot Water Boiler, New 8 MMBTUH; for space and domestic water heating	92% Efficient Boiler	11,544	82% Efficient Boiler	12,811	20	\$24,000	\$48,000	\$58,000	\$5.24	41%	9	5	1,267	\$18.94	\$0.95	\$0	\$0	0	0	1	1	86%	100%	100%
Commercial Hot Water Heater Condensing; 160 MBTUH	96% Efficient Water Heater	164	80% Efficient Water Heater	201	15	\$640	\$3,512	\$1,018	\$5.24	63%	5	2	37	\$17.07	\$1.14	\$0	\$0	6	7	6	7	86%	100%	100%
Commercial Hot Water Heater Condensing; 199.9 MBTUH	96% Efficient Water Heater	203	80% Efficient Water Heater	248	15	\$800	\$3,450	\$1,000	\$5.24	80%	4	1	45	\$17.67	\$1.18	\$0	\$0	7	8	7	8	86%	100%	100%
Commercial Hot Water Heater Condensing; 300 MBTUH	96% Efficient Water Heater	300	80% Efficient Water Heater	365	15	\$1,200	\$5,959	\$1,728	\$5.24	69%	5	2	65	\$18.54	\$1.24	\$0	\$0	7	9	7	9	86%	100%	100%
Commercial Tankless Water Heater - Condensing; 150 MBTUH	95% Efficient Water Heater	146	80% Efficient Storage Water Heater	188	15	\$600	\$4,284	\$1,242	\$5.24	48%	6	3	42	\$14.34	\$0.96	\$0	\$0	4	5	4	5	86%	100%	100%
Commercial Tankless Water Heater - Condensing; 199.9 MBTUH	97% Efficient Water Heater	195	80% Efficient Storage Water Heater	250	15	\$800	\$3,450	\$1,000	\$5.24	80%	3	1	56	\$14.33	\$0.96	\$0	\$0	10	12	10	12	86%	100%	100%
Pipe Insulation Hot Water System	100 Ft of Pipe with new insulation	10	100 Ft of Pipe with no or old insulation	87	15	\$1,961	\$0	\$2,307	\$5.24	85%	6	1	76	\$25.65	\$1.71	\$0	\$0	3	4	3	4	86%	100%	100%
Pipe Insulation Steam System	100 Ft of Pipe with new insulation	13	100 Ft of Pipe with no or old insulation	137	15	\$3,540	\$0	\$3,161	\$5.24	112%	5	-1	124	\$28.48	\$1.90	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Outdoor Air Reset assumed on 1-HW boiler at 80% eff 175 Mbtuh	83% Efficient Boiler	217	80% Efficient existing boiler	225	20	\$44	\$0	\$1,000	\$5.24	4%	23	22	8	\$5.38	\$0.27	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Outdoor Air Reset assumed on 1-HW boiler at 80% eff 500 Mbtuh	83% Efficient Boiler	620	80% Efficient existing boiler	643	20	\$125	\$0	\$1,000	\$5.24	13%	8	7	23	\$5.38	\$0.27	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Outdoor Air Reset assumed on 1-HW boiler at 80% eff 1 MMButh	83% Efficient Boiler	1,239	80% Efficient existing boiler	1,286	20	\$250	\$0	\$1,000	\$5.24	25%	4	3	46	\$5.38	\$0.27	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Outdoor Air Reset assumed on 1-HW boiler at 80% eff 2 MMButh	83% Efficient Boiler	2,478	80% Efficient existing boiler	2,571	20	\$500	\$0	\$1,000	\$5.24	50%	2	1	93	\$5.38	\$0.27	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Stack Dampers assumed on 1-HW boiler at 80% eff 175 Mbtuh	81% Efficient Boiler	222	80% Efficient existing boiler	225	12	\$44	\$0	\$500	\$5.24	9%	34	31	3	\$15.75	\$1.31	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Stack Dampers assumed on 1-HW boiler at 80% eff 500 Mbtuh	81% Efficient Boiler	635	80% Efficient existing boiler	643	12	\$125	\$0	\$500	\$5.24	25%	12	9	8	\$15.75	\$1.31	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Stack Dampers assumed on 1-HW boiler at 80% eff 1 MMButh	81% Efficient Boiler	1,270	80% Efficient existing boiler	1,286	12	\$250	\$0	\$1,000	\$5.24	25%	12	9	16	\$15.75	\$1.31	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Stack Dampers assumed on 1-HW boiler at 80% eff 2 MMButh	81% Efficient Boiler	2,540	80% Efficient existing boiler	2,571	12	\$500	\$0	\$1,000	\$5.24	50%	6	3	32	\$15.75	\$1.31	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Modulating Burner Controls, >=5 to 1 turn down assumed on 1-HW boiler at 80% eff 175 Mbtuh	83% Efficient Boiler	217	80% Efficient existing boiler	225	20	\$131	\$0	\$3,808	\$5.24	3%	89	86	8	\$16.14	\$0.81	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Modulating Burner Controls, >=5 to 1 turn down assumed on 1-HW boiler at 80% eff 500 Mbtuh	83% Efficient Boiler	620	80% Efficient existing boiler	643	20	\$375	\$0	\$3,808	\$5.24	10%	31	28	23	\$16.14	\$0.81	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Modulating Burner Controls, >=5 to 1 turn down assumed on 1-HW boiler at 80% eff 1 MMButh	83% Efficient Boiler	1,239	80% Efficient existing boiler	1,286	20	\$750	\$0	\$8,422	\$5.24	9%	35	32	46	\$16.14	\$0.81	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Modulating Burner Controls, >=5 to 1 turn down assumed on 1-HW boiler at 80% eff 2 MMButh	83% Efficient Boiler	2,478	80% Efficient existing boiler	2,571	20	\$1,500	\$0	\$8,422	\$5.24	18%	17	14	93	\$16.14	\$0.81	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Steam Traps Low Pressure - average of 10 and 15 PSI	New Steam Traps	2,441	Existing Boiler, malfunctioning steam traps	2,481	10	\$50	\$0	\$200	\$5.24	25%	1	1	40	\$1.25	\$0.13	\$0	\$0	0	0	0	0	86%	100%	100%
C&I Gas Boiler - Steam Traps High Pressure - average of 50 PSI and 65 PSI	New Steam Traps	2,392	Existing Boiler, malfunctioning steam traps	2,481	4	\$50	\$0	\$200	\$5.24	25%	0	0	89	\$0.56	\$0.14	\$0	\$0	0	0	0	0	86%	100%	100%
Non-Condensing Power Vent (83% efficiency)	Non-condensing power vent unit heater	200	Non-condensing standard forced-air unit heater	208	20	\$75	\$1,051	\$202	\$5.24	37%	5	3	8	\$9.99	\$0.50	\$0	\$0	5	10	7	14	86%	100%	100%
Condensing (>90% efficiency)	Condensing power vent unit heater	185	Non-condensing standard forced-air unit heater	208	20	\$208	\$1,051	\$1,254	\$5.24	17%	10	9	23	\$9.00	\$0.45	\$0	\$0	2	4	2	4	86%	100%	100%
Infrared	Infrared heater	184	Non-condensing standard forced-air unit heater	208	15	\$87	\$1,051	\$204	\$5.24	43%	2	1	24	\$3.55	\$0.24	\$0	\$0	15	20	15	20	86%	100%	100%
Ozone Washer Extractor =Washer <100bs (65Lb)	Ozone laundry generator	46	New ozone laundry system(Venturi Injection or Bubble Diffusion) is added-on to new or existing commercial washing machine using hot water heated with natural gas	246	10	\$0	\$0	\$8,750	\$5.24	0%	5	5	200	\$0.00	\$0.00	\$707	\$0	4	4	5	6	86%	100%	100%

Gas Planning Assumptions

Natural Gas Measure Description	High Efficiency Product Description / Rating	High Efficiency Product Consumption (Dth/yr)	Baseline Product Description / Rating	Baseline Product Consumption (Dth/yr)	Life of Product (years)	Average Rebate Amount	Average Baseline Product Cost	Average Incremental Cost of Efficient Product	Assumed Energy Cost (\$/Dth)	Rebate as a % of Incremental Cost	Incremental Cost Payback Period w/o Rebate	Incremental Cost Payback Period with Rebate	Average Annual Customer Dth Savings	Average rebated cost per Dth Saved	Average rebated Lifetime cost per Dth Saved	Non-Energy O&M Savings	Energy O&M Savings	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)	NTG (%)	Installation Rate (%)	Realization Rate (%)
Ozone Washer Extractor Washer >100lbs<4990lbs (125lb)	Ozone laundry generator	90	New ozone laundry system(Venturi Injection or Bubble Diffusion) is added-on to new or existing commercial washing machine using hot water heated with natural gas	474	10	\$0	\$0	\$15,500	\$5.24	0%	5	5	384	\$0.00	\$0.00	\$1,359	\$0	4	5	7	8	86%	100%	100%
Ozone Washer Extractor Washer >100lbs<4990lbs (150lb)	Ozone laundry generator	109	New ozone laundry system(Venturi Injection or Bubble Diffusion) is added-on to new or existing commercial washing machine using hot water heated with natural gas	569	10	\$0	\$0	\$15,500	\$5.24	0%	4	4	460	\$0.00	\$0.00	\$1,631	\$0	4	4	5	6	86%	100%	100%
Ozone Washer Extractor Washer =>500lbs (400lbs)	Ozone laundry generator	288	New ozone laundry system(Venturi Injection or Bubble Diffusion) is added-on to new or existing commercial washing machine using hot water heated with natural gas	1,516	10	\$0	\$0	\$27,500	\$5.24	0%	3	3	1,228	\$0.00	\$0.00	\$4,349	\$0	1	1	2	2	86%	100%	100%
Direct Install Pipe Insulation - Hot Water System	100 Ft of Pipe with new insulation	10	100 Ft of Pipe with no or old insulation	87	15	\$612	\$0	\$612	\$5.24	100%	2	0	76	\$8.00	\$0.53	\$0	\$0	5	5	6	6	100%	100%	100%
Direct Install Pipe Insulation - Steam System	100 Ft of Pipe with new insulation	13	100 Ft of Pipe with no or old insulation	137	15	\$994	\$0	\$994	\$5.24	100%	2	0	124	\$8.00	\$0.53	\$0	\$0	5	5	6	6	100%	100%	100%
CHW Pre-Rinse Sprayer - gas water heating	1.28 gallons per minute sprayer	8	1.60 gallons per minute sprayer	10	5	\$45	\$0	\$45	\$5.24	100%	1	0	2	\$22.80	\$4.56	\$23	\$0	10	10	12	12	100%	100%	100%
Faucet Aerator (Restroom), gas water heating	.5 gallons per minute restroom faucet aerator	3	2.2 gallons per minute faucet	11	10	\$7	\$0	\$7	\$5.24	100%	0	0	8	\$0.82	\$0.08	\$94	\$0	10	10	12	12	100%	100%	100%
Faucet Aerator (Kitchen), gas water heating	1.5 gallons per minute kitchen faucet aerator	3	2.2 gallons per minute faucet	4	10	\$7	\$0	\$7	\$5.24	100%	0	0	1	\$5.63	\$0.56	\$14	\$0	10	10	12	12	100%	100%	100%
Recommissioning Study	Study Potential Recommissioning measures	0	Existing Facility	0	7	\$2,508	\$0	\$6,762	\$5.24	37%	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	\$0	\$0	6	6	6	6	90%	100%	100%
Recommissioning Study Measure Implementation (>1yr Payback)	Implemented Recommissioning measures	72	Existing Facility	77	7	\$1	\$0	\$826	\$5.24	0%	31	31	5	\$0.11	\$0.02	\$0	\$0	1	1	1	1	90%	100%	100%
Recommissioning Study Measure Implementation (<1yr Payback)	Implemented Recommissioning measures	8,002	Existing Facility	8,559	7	\$0	\$0	\$651	\$5.24	0%	0	0	556	\$0.00	\$0.00	\$0	\$0	5	5	4	4	90%	100%	100%
Building Tune-up Study	Study Potential Recommissioning measures	0	Existing Facility	0	7	\$314	\$0	\$331	\$5.24	95%	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!	\$0	\$0	4	4	4	4	90%	100%	100%
Building Tune-up Measure Implementation	Implemented Recommissioning measures	1,870	Existing Facility	2,000	7	\$0	\$0	\$0	\$5.24	#DIV/0!	0	0	130	\$0.00	\$0.00	\$0	\$0	1	1	0	0	90%	100%	100%
Recommissioning Building Operator Certification - Combo Customers	Energy Use After Class	8,456	Energy Usage Before Class	8,559	5	\$212	\$0	\$847	\$5.24	25%	2	1	103	\$2.07	\$0.41	\$0	\$0	10	10	10	10	90%	100%	100%
Recommissioning Fast Track Implementation	Implemented Recommissioning measures	978	Existing Facility	1,046	7	\$48	\$0	\$238	\$5.24	20%	1	1	68	\$0.70	\$0.10	\$0	\$0	1	1	1	1	90%	100%	100%
CHW Pre-Rinse Sprayer - Gas Water Heating	1.28 gallons per minute sprayer	19	1.60 gallons per minute sprayer	24	5	\$45	\$0	\$45	\$5.24	100%	0	0	5	\$9.24	\$1.85	\$79	\$0	5	5	6	6	100%	100%	100%
Faucet Aerator - Restroom, Gas Water Heating	.5 gallons per minute restroom faucet aerator	1	2.2 gallons per minute faucet	5	9	\$8	\$0	\$8	\$5.24	100%	0	0	3	\$2.31	\$0.26	\$56	\$0	19	19	21	21	100%	100%	100%
Faucet Aerator - Kitchen, Gas Water Heating	1.5 gallons per minute kitchen faucet aerator	4	2.2 gallons per minute faucet	7	9	\$8	\$0	\$8	\$5.24	100%	0	0	2	\$3.85	\$0.43	\$24	\$0	4	4	5	5	100%	100%	100%
Retrofit of open multi-deck Cooler Cases with solid glass doors (per linear foot of case), Combo customer.	Closed Case with Doors	1	Open Case with No Doors	8	12	\$50	\$0	\$276	\$5.24	18%	8	7	7	\$7.61	\$0.63	\$0	\$0	3	3	1	1	100%	100%	100%
Retrofit of open multi-deck Freezer Cases with solid glass doors (per linear foot of case), Combo Customer.	Closed Case with Doors	2	Open Case with No Doors	10	12	\$75	\$0	\$168	\$5.24	45%	4	2	8	\$9.25	\$0.77	\$0	\$0	3	3	1	1	100%	100%	100%
Demand Controlled Ventilation CO - 5 to less than 7.5 HP	Commercial kitchen ventilation hoods with Demand Controlled Ventilation	2,934	Commercial kitchen ventilation hoods without Demand Controlled Ventilation	3,358	20	\$1,563	\$0	\$10,200	\$5.24	15%	5	4	425	\$3.68	\$0.18	\$0	\$0	12	12	4	4	100%	100%	100%
Demand Controlled Ventilation CO - 7.5 HP or Greater	Commercial kitchen ventilation hoods with Demand Controlled Ventilation	4,060	Commercial kitchen ventilation hoods without Demand Controlled Ventilation	4,648	20	\$2,163	\$0	\$14,117	\$5.24	15%	5	4	588	\$3.68	\$0.18	\$0	\$0	12	12	5	5	100%	100%	100%
Demand Controlled Ventilation CO - Less than 5 HP	Commercial kitchen ventilation hoods with Demand Controlled Ventilation	1,173	Commercial kitchen ventilation hoods without Demand Controlled Ventilation	1,343	20	\$625	\$0	\$4,080	\$5.24	15%	5	4	170	\$3.68	\$0.18	\$0	\$0	12	12	4	4	100%	100%	100%
CO-Commercial Dishwashers (Door & Under Counter- Electric w/ Gas Booster)	ENERGY STAR qualified unit	23	Conventional unit as defined by ENERGY STAR	33	13	\$125	\$0	\$65	\$5.24	193%	0	0	10	\$12.91	\$1.03	\$213	\$0	8	8	2	2	100%	100%	100%
CO-Commercial Dishwashers (Door & Under Counter- Gas w/ Electric Booster)	ENERGY STAR qualified unit	41	Conventional unit as defined by ENERGY STAR	58	6	\$125	\$0	\$85	\$5.24	146%	0	0	17	\$7.38	\$1.18	\$213	\$0	8	8	2	2	100%	100%	100%
CO-Commercial Dishwashers (Door & Under Counter- Gas w/ Gas Booster)	ENERGY STAR qualified unit	65	Conventional unit as defined by ENERGY STAR	91	3	\$250	\$0	\$445	\$5.24	56%	1	1	27	\$9.39	\$3.00	\$213	\$0	8	8	2	2	100%	100%	100%
CO-Commercial Dishwashers (Door & Under Counter- Gas No Booster)	ENERGY STAR qualified unit	55	Conventional unit as defined by ENERGY STAR	94	2	\$250	\$0	\$25	\$5.24	1000%	0	0	39	\$6.40	\$3.07	\$490	\$0	8	8	2	2	100%	100%	100%
Provide new 1.5 gpm showerhead to replace existing 2.5 gpm showerhead in natural gas DHW unit home	1.5 GPM Showerhead	3	2.5 GPM Showerhead	5	10	\$3	\$0	\$3	\$6.09	100%	0	0	2	\$1.65	\$0.17	\$26	\$0	6,632	23,259	0	0	99%	60%	100%
Provide new 1.5 gpm showerhead for second shower to replace existing 2.5 gpm showerhead in natural gas DHW unit home	1.5 GPM Showerhead	2	2.5 GPM Showerhead	4	10	\$3	\$0	\$3	\$6.09	100%	0	0	2	\$2.02	\$0.20	\$21	\$0	5,770	20,236	0	0	99%	55%	100%
Provide Energy Efficient Kitchen Aerator - 1.5 GPM to replace existing 2.2 gpm aerator in home with natural gas DHW heater	1.5 GPM Kitchen Faucet Aerator	1	2.2 GPM Kitchen Faucet Aerator	1	10	\$2	\$0	\$2	\$6.09	100%	0	0	0	\$6.73	\$0.67	\$3	\$0	6,632	23,259	0	0	99%	40%	100%
Provide Energy Efficient Bath Faucet Aerator - 1.0 GPM to replace existing 2.2 gpm aerator in home with natural gas DHW heater	1.0 GPM Bathroom Faucet Aerator	0	2.2 GPM Bathroom Faucet Aerator	0	10	\$1	\$0	\$1	\$6.09	100%	0	0	0	\$2.08	\$0.21	\$3	\$0	2,255	7,908	0	0	99%	40%	100%
Provide Energy Efficient Bath Faucet Aerator - 0.5 GPM to replace existing 2.2 gpm aerator in home with gas DHW heater	0.5 GPM Bathroom Faucet Aerator	0	2.2 GPM Bathroom Faucet Aerator	0	10	\$2	\$0	\$2	\$6.09	100%	0	0	0	\$4.21	\$0.42	\$5	\$0	4,403	15,351	0	0	99%	40%	100%
Provide Energy Efficient Bath Faucet Aerator - 1.0 GPM for second faucet to replace existing 2.2 gpm aerator in home with natural gas DHW heater	1.0 GPM Bathroom Faucet Aerator	0	2.2 GPM Bathroom Faucet Aerator	0	10	\$1	\$0	\$1	\$6.09	100%	0	0	0	\$2.08	\$0.21	\$3	\$0	1,962	6,880	0	0	99%	35%	100%
Provide Energy Efficient Bath Faucet Aerator - 0.5 GPM to replace existing 2.2 gpm aerator in home with gas DHW heater	0.5 GPM Bathroom Faucet Aerator	0	2.2 GPM Bathroom Faucet Aerator	0	10	\$2	\$0	\$2	\$6.09	100%	0	0	0	\$4.21	\$0.42	\$5	\$0	3,831	13,356	0	0	99%	35%	100%
Provide new 1.5 gpm showerhead to replace existing 2.5 gpm showerhead in natural gas DHW unit home	1.5 GPM Showerhead	3	2.5 GPM Showerhead	5	10	\$3	\$0	\$3	\$6.09	100%	0	0	2	\$1.70	\$0.17	\$26	\$0	0	0	6,632	23,259	99%	60%	100%
Provide new 1.5 gpm showerhead for second shower to replace existing 2.5 gpm showerhead in natural gas DHW unit home	1.5 GPM Showerhead	2	2.5 GPM Showerhead	4	10	\$3	\$0	\$3	\$6.09	100%	0	0	2	\$2.08	\$0.21	\$21	\$0	0	0	5,770	20,236	99%	55%	100%
Provide Energy Efficient Kitchen Aerator - 1.5 GPM to replace existing 2.2 gpm aerator in home with natural gas DHW heater	1.5 GPM Kitchen Faucet Aerator	1	2.2 GPM Kitchen Faucet Aerator	1	10	\$2	\$0	\$2	\$6.09	100%	0	0	0	\$6.93	\$0.69	\$3	\$0	0	0	6,632	23,259	99%	40%	100%

Gas Planning Assumptions

Natural Gas Measure Description	High Efficiency Product Description / Rating	High Efficiency Product Consumption (Dth/yr)	Baseline Product Description / Rating	Baseline Product Consumption (Dth/yr)	Life of Product (years)	Average Rebate Amount	Average Baseline Product Cost	Average Incremental Cost of Efficient Product	Assumed Energy Cost (\$/Dth)	Rebate as a % of Incremental Cost	Incremental Cost Payback Period w/o Rebate	Incremental Cost Payback Period with Rebate	Average Annual Customer Dth Savings	Average rebated cost per Dth Saved	Average rebated Lifetime cost per Dth Saved	Non-Energy O&M Savings	Energy O&M Savings	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)	NTG (%)	Installation Rate (%)	Realization Rate (%)
Provide Energy Efficient Bath Faucet Aerator - 1.0 GPM to replace existing 2.2 gpm aerator in home with natural gas DHW heater	1.0 GPM Bathroom Faucet Aerator	0	2.2 GPM Bathroom Faucet Aerator	0	10	\$1	\$0	\$1	\$6.09	100%	0	0	0	\$2.12	\$0.21	\$3	\$0	0	0	2,255	7,908	99%	40%	100%
Provide Energy Efficient Bath Faucet Aerator - 0.5 GPM to replace existing 2.2 gpm aerator in home with gas DHW heater	0.5 GPM Bathroom Faucet Aerator	0	2.2 GPM Bathroom Faucet Aerator	0	10	\$2	\$0	\$2	\$6.09	100%	0	0	0	\$4.21	\$0.42	\$5	\$0	0	0	4,403	15,351	99%	40%	100%
Provide Energy Efficient Bath Faucet Aerator - 1.0 GPM for second faucet to replace existing 2.2 gpm aerator in home with natural gas DHW heater	1.0 GPM Bathroom Faucet Aerator	0	2.2 GPM Bathroom Faucet Aerator	0	10	\$1	\$0	\$1	\$6.09	100%	0	0	0	\$2.12	\$0.21	\$3	\$0	0	0	1,962	6,880	99%	35%	100%
Provide Energy Efficient Bath Faucet Aerator - 0.5 GPM to replace existing 2.2 gpm aerator in home with gas DHW heater	0.5 GPM Bathroom Faucet Aerator	0	2.2 GPM Bathroom Faucet Aerator	0	10	\$2	\$0	\$2	\$6.09	100%	0	0	0	\$4.21	\$0.42	\$5	\$0	0	0	3,831	13,356	99%	35%	100%
Envelope Measures with 10% improvement over local code - Combo Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 2321 and Percent BTC 13.04%	72	Reference Home Based upon Local Code	85	20	\$134	\$0	\$448	\$6.09	30%	6	4	13	\$10.28	\$0.51	\$0	\$0	96	117	59	79	92%	100%	100%
Envelope Measures with 15% improvement over local code - Combo Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 2898 and Percent BTC 18.1%	77	Reference Home Based upon Local Code	98	20	\$243	\$0	\$778	\$6.09	31%	6	4	21	\$11.59	\$0.58	\$0	\$0	231	283	143	191	92%	100%	100%
Envelope Measures with 20% improvement over local code - Combo Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3468 and Percent BTC 22.77%	80	Reference Home Based upon Local Code	110	20	\$340	\$0	\$1,099	\$6.09	31%	6	4	30	\$11.30	\$0.57	\$0	\$0	325	397	202	269	92%	100%	100%
Envelope Measures with 25% improvement over local code - Combo Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3588 and Percent BTC 27.45%	80	Reference Home Based upon Local Code	119	20	\$420	\$0	\$1,365	\$6.09	31%	6	4	39	\$10.68	\$0.53	\$0	\$0	206	252	127	170	92%	100%	100%
Envelope Measures with 30% improvement over local code - Combo Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4060 and Percent BTC 31.82%	84	Reference Home Based upon Local Code	136	20	\$496	\$0	\$1,665	\$6.09	30%	5	4	52	\$9.52	\$0.48	\$0	\$0	50	61	31	42	92%	100%	100%
Envelope Measures with 35% improvement over local code - Combo Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4040 and Percent BTC 36.55%	79	Reference Home Based upon Local Code	140	20	\$610	\$0	\$2,008	\$6.09	30%	5	4	61	\$10.02	\$0.50	\$0	\$0	7	8	4	6	92%	100%	100%
Envelope Measures with 40% improvement over local code - Combo Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3649 and Percent BTC 44.02%	52	Reference Home Based upon Local Code	110	20	\$802	\$0	\$2,390	\$6.09	34%	7	5	58	\$13.90	\$0.70	\$0	\$0	1	1	0	0	92%	100%	100%
Envelope Measures with 10% improvement over local code - Gas Only Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 2036 and Percent BTC 12.43%	72	Reference Home Based upon Local Code	85	20	\$200	\$0	\$292	\$6.09	69%	4	1	13	\$15.19	\$0.76	\$0	\$0	42	51	25	34	92%	100%	100%
Envelope Measures with 15% improvement over local code - Gas Only Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 2831 and Percent BTC 17.53%	81	Reference Home Based upon Local Code	103	20	\$350	\$0	\$605	\$6.09	58%	4	2	22	\$15.64	\$0.78	\$0	\$0	100	122	61	82	92%	100%	100%
Envelope Measures with 20% improvement over local code - Gas Only Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3326 and Percent BTC 22.85%	80	Reference Home Based upon Local Code	110	20	\$500	\$0	\$962	\$6.09	52%	5	2	31	\$16.37	\$0.82	\$0	\$0	139	170	86	115	92%	100%	100%
Envelope Measures with 25% improvement over local code - Gas Only Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3694 and Percent BTC 27.44%	82	Reference Home Based upon Local Code	123	20	\$650	\$0	\$1,224	\$6.09	53%	5	2	41	\$15.92	\$0.80	\$0	\$0	88	107	55	73	92%	100%	100%
Envelope Measures with 30% improvement over local code - Gas Only Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4142 and Percent BTC 31.57%	86	Reference Home Based upon Local Code	138	20	\$800	\$0	\$1,518	\$6.09	53%	5	2	53	\$15.21	\$0.76	\$0	\$0	22	27	13	17	92%	100%	100%
Envelope Measures with 35% improvement over local code - Gas Only Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3508 and Percent BTC 36.75%	76	Reference Home Based upon Local Code	137	20	\$1,000	\$0	\$1,763	\$6.09	57%	5	2	60	\$16.58	\$0.83	\$0	\$0	3	4	1	2	92%	100%	100%
Envelope Measures with 40% improvement over local code - Gas Only Customers - IECC 2009 or older	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3890 and Percent BTC 42.35%	50	Reference Home Based upon Local Code	95	20	\$1,400	\$0	\$2,088	\$6.09	67%	8	3	45	\$31.39	\$1.57	\$0	\$0	0	0	0	0	92%	100%	100%
Envelope Measures with 10% improvement over local code - Combo Customers - IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3993 and Percent BTC 12.59%	88	Reference Home Based upon Local Code	102	20	\$161	\$0	\$724	\$6.09	22%	8	6	15	\$11.11	\$0.56	\$0	\$0	726	887	699	932	92%	100%	100%
Envelope Measures with 15% improvement over local code - Combo Customers - IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4009 and Percent BTC 17.2%	80	Reference Home Based upon Local Code	100	20	\$205	\$0	\$1,159	\$6.09	18%	10	8	20	\$10.32	\$0.52	\$0	\$0	504	616	485	647	92%	100%	100%
Envelope Measures with 20% improvement over local code - Combo Customers - IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4202 and Percent BTC 21.88%	73	Reference Home Based upon Local Code	99	20	\$322	\$0	\$2,169	\$6.09	15%	14	12	26	\$12.33	\$0.62	\$0	\$0	96	117	92	123	92%	100%	100%
Envelope Measures with 25% improvement over local code - Combo Customers - IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3954 and Percent BTC 26.5%	70	Reference Home Based upon Local Code	101	20	\$472	\$0	\$3,325	\$6.09	14%	17	15	31	\$15.08	\$0.75	\$0	\$0	20	25	20	27	92%	100%	100%
Envelope Measures with 30% improvement over local code - Combo Customers 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3610 and Percent BTC 32.08%	59	Reference Home Based upon Local Code	94	20	\$786	\$0	\$5,751	\$6.09	14%	27	23	35	\$22.20	\$1.11	\$0	\$0	20	24	18	24	92%	100%	100%
Envelope Measures with 35% improvement over local code - Combo Customers - IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4666 and Percent BTC 38.47%	62	Reference Home Based upon Local Code	114	20	\$1,078	\$0	\$7,734	\$6.09	14%	25	21	52	\$20.90	\$1.04	\$0	\$0	9	11	7	10	92%	100%	100%
Envelope Measures with 40% improvement over local code - Combo Customers - IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3890 and Percent BTC 42.35%	50	Reference Home Based upon Local Code	95	20	\$1,248	\$0	\$8,709	\$6.09	14%	32	27	45	\$27.98	\$1.40	\$0	\$0	0	0	1	1	92%	100%	100%
Envelope Improvement 10% improvement over local code - Gas Only Customers IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3796 and Percent BTC 12.53%	84	Reference Home Based upon Local Code	97	20	\$250	\$0	\$564	\$6.09	44%	7	4	13	\$19.09	\$0.95	\$0	\$0	311	380	299	399	92%	100%	100%

Gas Planning Assumptions

Natural Gas Measure Description	High Efficiency Product Description / Rating	High Efficiency Product Consumption (Dth/yr)	Baseline Product Description / Rating	Baseline Product Consumption (Dth/yr)	Life of Product (years)	Average Rebate Amount	Average Baseline Product Cost	Average Incremental Cost of Efficient Product	Assumed Energy Cost (\$/Dth)	Rebate as a % of Incremental Cost	Incremental Cost Payback Period w/o Rebate	Incremental Cost Payback Period with Rebate	Average Annual Customer Dth Savings	Average rebated cost per Dth Saved	Average rebated Lifetime cost per Dth Saved	Non-Energy O&M Savings	Energy O&M Savings	2019 Participants (-)	2019 Units (-)	2020 Participants (-)	2020 Units (-)	NTG (%)	Installation Rate (%)	Realization Rate (%)
Envelope Improvement 15% improvement over local code - Gas Only Customers IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4030 and Percent BTC 17.08%	85	Reference Home Based upon Local Code	105	20	\$400	\$0	\$1,101	\$6.09	36%	9	6	21	\$19.51	\$0.98	\$0	\$0	216	264	208	277	92%	100%	100%
Envelope Improvement 20% improvement over local code - Gas Only Customers IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 4116 and Percent BTC 21.32%	78	Reference Home Based upon Local Code	104	20	\$600	\$0	\$1,959	\$6.09	31%	12	8	27	\$22.29	\$1.11	\$0	\$0	42	51	40	53	92%	100%	100%
Envelope Improvement 25% improvement over local code - Gas Only Customers IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3384 and Percent BTC 26.94%	75	Reference Home Based upon Local Code	110	20	\$900	\$0	\$3,029	\$6.09	30%	14	10	35	\$25.50	\$1.27	\$0	\$0	9	11	8	11	92%	100%	100%
Envelope Improvement 30% improvement over local code - Gas Only Customers IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3890 and Percent BTC 33.27%	59	Reference Home Based upon Local Code	95	20	\$1,300	\$0	\$6,327	\$6.09	21%	29	23	36	\$36.52	\$1.83	\$0	\$0	8	10	8	11	92%	100%	100%
Envelope Improvement 35% improvement over local code - Gas Only Customers IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3890 and Percent BTC 39.64%	54	Reference Home Based upon Local Code	95	20	\$2,000	\$0	\$8,307	\$6.09	24%	34	26	41	\$49.26	\$2.46	\$0	\$0	3	4	4	5	92%	100%	100%
Envelope Improvement 40% improvement over local code - Gas Only Customers IECC 2012 & newer	Energy Efficient Home Based Upon REMRate model by House Rater with Average Size 3890 and Percent BTC 42.35%	50	Reference Home Based upon Local Code	95	20	\$2,550	\$0	\$8,709	\$6.09	29%	32	23	45	\$57.17	\$2.86	\$0	\$0	0	0	0	0	92%	100%	100%
Energy Star Clothes Washer - Combo Customers w/ Gas DHW	Energy Star Clothes Washer	0	Standard Clothes Washer	0	11	\$19	\$0	\$19	\$6.09	100%	2	0	0	\$165.16	\$15.01	\$8	\$0	137	168	132	176	92%	100%	100%
Energy Star Clothes Washer - Gas Only Customers w/ Gas DHW	Energy Star Clothes Washer	0	Standard Clothes Washer	0	11	\$30	\$0	\$19	\$6.09	158%	2	-1	0	\$260.79	\$23.71	\$8	\$0	59	72	57	76	92%	100%	100%
Install Energy Star certified smart thermostat - COMBO	Average Single Family House with EnergyStar Smart Thermostat	55	Average Single Family House with Standard Thermostat	60	10	\$18	\$0	\$78	\$6.09	23%	3	2	5	\$3.76	\$0.38	\$0	\$0	401	490	536	715	92%	100%	100%
Install Energy Star certified smart thermostat - GAS ONLY	Average Single Family House with EnergyStar Smart Thermostat	55	Average Single Family House with Standard Thermostat	60	10	\$50	\$0	\$78	\$6.09	64%	3	1	5	\$10.38	\$1.04	\$0	\$0	131	160	176	235	92%	100%	100%
95% Efficient Furnace	96.4% AFUE Furnace without ECM	99	80% AFUE Federal Standard Efficiency Furnace	119	18	\$300	\$3,688	\$1,460	\$6.09	21%	12	9	20	\$14.85	\$0.83	\$0	\$0	3,620	3,620	3,620	3,620	86%	100%	100%
Attic Insulation in Natural Gas Heated and Electrically Cooled Home Combo Customer	Existing Home with Attic Insulation added to achieve R-54	4	Existing home with R9 attic insul average heating efficiency of 78% AFUE and average cooling efficiency of 3.93 COP	18	20	\$211	\$0	\$723	\$6.09	29%	8	6	15	\$14.54	\$0.73	\$0	\$0	89	215	89	215	116%	100%	100%
Attic Insulation in Natural Gas Heated and non-cooled Home	Existing Home with Attic Insulation added to achieve R-54	4	Existing home with R9 attic insul and average heating efficiency of 78% AFUE	18	20	\$351	\$0	\$1,508	\$6.09	23%	17	13	15	\$24.16	\$1.21	\$0	\$0	48	116	48	116	116%	100%	100%
Tier 2 Air Sealing & Bypass Sealing for minimum 20% ACH Reduction in Natural Gas Heated and non-cooled Home	Home with Tier 2 Air Sealing: CFM50 rating of 2324	31	Baseline home with CFM50 rating of 3223	44	10	\$154	\$0	\$960	\$6.09	16%	13	11	12	\$12.68	\$1.27	\$0	\$0	20	49	20	49	116%	100%	100%
Tier 2 Air Sealing & Bypass Sealing for minimum 20% ACH Reduction in Natural Gas Heated and Electric Cooled Home	Home with Tier 2 Air Sealing: CFM50 rating of 2324	31	Baseline home with CFM50 rating of 3223	44	10	\$169	\$0	\$525	\$6.09	32%	7	5	12	\$13.96	\$1.40	\$0	\$0	54	130	54	130	116%	100%	100%
Tier 3 Air Sealing & Bypass Sealing for minimum 30% ACH Reduction in Natural Gas Heated and non-cooled Home	Home with Tier 3 Air Sealing: CFM50 rating of 2078	27	Baseline home with CFM50 rating of 3641	48	10	\$194	\$0	\$955	\$6.09	20%	8	6	21	\$9.42	\$0.94	\$0	\$0	33	80	33	80	116%	100%	100%
Tier 3 Air Sealing & Bypass Sealing for minimum 30% ACH Reduction in Natural Gas Heated and Electric Cooled Home	Home with Tier 3 Air Sealing: CFM50 rating of 2078	27	Baseline home with CFM50 rating of 3641	48	10	\$177	\$0	\$519	\$6.09	34%	4	3	21	\$8.57	\$0.86	\$0	\$0	54	130	54	130	116%	100%	100%
Wall Insulation from R-0 to R11 in Natural Gas Heated and non-cooled Home	R-11 insulation in wall cavity	14	Empty Wall Cavity	42	20	\$364	\$0	\$1,936	\$6.09	19%	11	9	28	\$12.92	\$0.65	\$0	\$0	29	71	29	71	116%	100%	100%
Wall Insulation from R-0 to R11 in Natural Gas Heated and Electrically Cooled Home	R-11 insulation in wall cavity	14	Empty Wall Cavity	42	20	\$174	\$0	\$925	\$6.09	19%	5	4	28	\$6.17	\$0.31	\$0	\$0	41	100	41	100	116%	100%	100%
95% Efficient Furnace	96.4% AFUE Furnace without ECM	99	80% AFUE Federal Standard Efficiency Furnace	119	18	\$400	\$3,688	\$1,460	\$6.09	27%	12	9	20	\$19.80	\$1.10	\$0	\$0	6	14	6	14	116%	100%	100%
Energy Star Clothes Washer - Combo Customers w/ Gas DHW	Energy Star Clothes Washer	0	Standard Clothes Washer	0	11	\$19	\$0	\$19	\$6.09	100%	3	0	0	\$165.38	\$15.03	\$5	\$0	0	1	0	1	116%	100%	100%
Energy Star Clothes Washer - Gas Only Customers w/ Gas DHW	Energy Star Clothes Washer	0	Standard Clothes Washer	0	11	\$30	\$0	\$19	\$6.09	158%	3	-2	0	\$260.79	\$23.71	\$5	\$0	0	1	0	1	116%	100%	100%
Install and program a new Setback Thermostat	Energy Star Programmable thermostat (assume 2.4 F set back during heating per 2009 RECS Data Analysis)	62	standard thermostat - manually adjusted	66	10	\$17	\$0	\$24	\$6.09	70%	1	0	4	\$3.99	\$0.40	\$0	\$0	7	18	7	18	116%	100%	100%
Tank-Type Water Heater - High Draw Pattern (30-50 Gallon)	High Efficiency Tank-Type Water Heater	26	Minimum Efficiency Tank-Type Water Heater	28	13	\$100	\$950	\$374	\$6.09	27%	23	17	3	\$37.82	\$2.91	\$0	\$0	1	2	1	2	100%	100%	100%