VOLUME 5

DEMAND-SIDE RESOURCE ANALYSIS

THE EMPIRE DISTRICT ELECTRIC COMPANY

4 CSR 240-22.050

File No. EO-2016-0223

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22.0.050 DEMAND-SIDE RESOURCE ANALYSIS

DEMAND-SIDE RESOURCE ANALYSIS

PURPOSE: This rule specifies the principles by which potential demand-side resource options shall be developed and analyzed for cost effectiveness, with the goal of achieving all cost-effective demand-side savings. It also requires the selection of demand-side candidate resource options that are passed on to integrated resource analysis in 4 CSR 240-22.060 and an assessment of their maximum achievable potentials, technical potentials, and realistic achievable potentials.

SECTION 1 POTENTIAL DEMAND-SIDE RESOURCES

(1) The utility shall identify a set of potential demand-side resources from which demand-side candidate resource options will be identified for the purposes of developing the alternative resource plans required by 4 CSR 240-22.060(3). A potential demand-side resource consists of a demand-side program designed to deliver one (1) or more energy efficiency and energy management measures or a demand-side rate. The utility shall select the set of potential demand-side resources and describe and document its selection—

1.1 Describe and Document Selections

(A) To provide broad coverage of—

Appropriate market segments within each major class;

Empire District Electric ("Empire" or "EDE") engaged Applied Energy Group ("AEG") to conduct a Demand-Side Management (DSM) Potential Study to assess the future potential for savings through its programs and to identify refinements that will enhance savings.

The first step in the analysis was to assess Empire's market. The market assessment defined the market segments (building types, end uses, and other dimensions) that are relevant in the Empire service territory. The segmentation scheme for this project is presented in Table 1.

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Table 1 Overview of Empire Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, Nonresidential
2	Segment	Residential: Single Family, Multifamily, Single Family Low Income, and Multifamily Low Income Nonresidential: Small and Large
3	Vintage	Existing and new construction
4	End use	Cooling, lighting, water heat, motors, etc. (as appropriate)
5	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, motors by application, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

With the segmentation scheme defined, AEG then performed a high-level market characterization of electricity sales in the base year, 2014, to allocate sales to each customer segment. AEG used Empire data and secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count, energy consumption, and peak demand matched the Empire system totals from 2014 billing data. This information provided control totals at a sector level for calibrating the LoadMAP model to known data for the base-year.

The total number of households and electricity sales for the service territory were obtained from Empire's customer database. In 2014, there were 141,838 households in the Empire service territory that used a total of 1,958 GWh with peak demand of 641 MW. AEG allocated these totals into four residential segments, identified from the 2015 Residential Customer Energy Survey completed by Opinion Research Specialists, LLC (shown in Table 2). A total of 2,750 residential customers within Empire's Missouri, Arkansas, Kansas and Oklahoma service territory completed the six-page questionnaire. The survey included questions on general household characteristics, space and water heating equipment, cooling equipment, appliances, electronics, and energy efficiency actions.

Table 2 Residential Market Characterization (2014)

Segment	Number of Customers	Electricity Sales (GWh)	% of Total Usage	Avg. Use/ Customer (kWh)	Peak Demand Summer (MW)
Single Family, Non Low Income	98,601	1,485	76%	15,056	**487**
Multi Family, Non Low Income	6,802	56	3%	8,187	**16**
Single Family, Low Income	30,688	378	19%	12,305	**127**
Multi Family, Low Income	5,747	40	2%	6,922	**12**
Total	**141,838**	**1,958**	**100%**	**13,802**	**641**

AEG utilized commercial and industrial customer billing data and secondary sources to develop the commercial and industrial market segments, shown in Table 3. The nonresidential sector excludes

customers that opt-out of Empire's DSM tariff (as of September 2015) and is segmented into small and large nonresidential segments based upon a 1,000 MWh annual use threshold. Customers with usage equal to and above the threshold were characterized as large nonresidential, all other customers were considered small nonresidential.

Table 3 Nonresidential Market Characterization (2014)

Segment	Electricity Sales (GWh)	% of Total Usage	Avg. Use / Square Foot (kWh)	Summer Peak Demand (MW)
Small Nonresidential	1,157	60%	11.0	237
Large Nonresidential	757	40%	42.0	205
Total	**1,914**	**100%**	**15.6**	442

All significant decision-makers, including at least those who choose building design features and thermal integrity levels, equipment and appliance efficiency levels, and utilization levels of the energy-using capital stock; and

Empire's energy efficiency personnel regularly interface and communicate with a variety of trade allies, Community Action Program ("CAP") agencies, contractors for implementation, consulting, evaluation, marketers, regulatory stakeholders, and customers from all classes in all matters related to Empire's active portfolios of residential, commercial and industrial energy efficiency programs in Arkansas, Missouri and for The Empire District Gas Company. The table below represents an exhaustive—but not necessarily comprehensive—list of agencies and people with which Empire interacts regarding demand-side issues and could potentially consider "Decision Makers", as defined by the IRP Regulatory Stakeholder Group.

Table 4 Empire Decision-Makers

Category	Group
Customers	Current and Prospective Residential Electric Customers
	Current and Prospective Commercial Electric Customers
	Current and Prospective Industrial Electric Customers
	Current and Prospective Residential Gas Customers
	Current and Prospective Commercial Gas Customers
	Current and Prospective Industrial Gas Customers
	Current and Prospective Residential Solar Customers
	Current and Prospective Commercial Solar Customers
	Current and Prospective Industrial Solar Customers
	Current and Prospective Residential Landlords/Property Owners
	Current and Prospective Commercial Landlords/Property Owners
	Large Commercial and Industrial Customers Requesting "Opt-Out"
	Large Commercial and Industrial Customers with Curtailment Contracts
	Large Commercial and Industrial Customers For Voluntary Curtailments
Regulatory and/or Governmental	Missouri Public Service Commission Staff
	Missouri Office of the Public Counsel
	Missouri Department of Economic Development-Division of Energy

Category	Group
Stakeholders	Missouri-based Environmental Advocates
	Missouri-based Customer Advocates
	Municipal Governments advocating for Empire Retail Customers
	Municipal Governments advocating for Empire Wholesale Customers
	Arkansas Public Service Commission Staff
	The Arkansas Energy Office
	Arkansas Community Action Agency Association
	The office of the Arkansas Attorney General
	Arkansas-based Environmental Advocates
	Arkansas-based Customer Advocates
	Kansas Public Service Commission Staff
	Oklahoma Public Service Commission Staff
	Contracted Consultants of any of the above agencies
	Outside/Contracted Legal Counsel of any of the above agencies
	Peer Investor-Owned Electric and Gas Utilities
	Peer Rural Electric Cooperatives
	Peer Rural Electric Cooperative Associations
	Peer Municipal Utility Companies
Contractors	Implementation Contractors
	Evaluation, Measurement, & Verification Contractors
	Energy Efficiency Program Design Contractors
	Consulting Contractors for Energy Efficiency
	Marketing Contractors
	Product Vendors for DSM and Solar Programs
	Outside/Contracted Legal Counsel for Regulatory Support
Trade Allies	Residential and Commercial Building Contractors
	Residential and Commercial Energy Raters
	Residential and Commercial Energy Auditors
	Non-Profit/Public Commercial and Industrial Energy Auditors
	Residential and Commercial HVAC Contractors
	Residential and Commercial Plumbing Contractors (Gas)
	Commercial Lighting Vendors
	Residential and Commercial Solar Contractors
	Local/Regional Homeowner's Associations
	Local/Regional Real Estate Agents
Community Action Agencies	Economic Security Corporation (of SW Missouri)
	Ozarks Area Community Action Corporation
	West Central Community Action Agency
	Community Services, Inc. of Northwest Missouri
	Green Hills Community Action Agency
	Missouri Valley Community Action Agency
	The Office of Human Concern (of NW Arkansas)
	Central Arkansas Development Council

All major end uses, including at least the end uses which are to be considered in the utility's load analysis as listed in 4 CSR 240-22.030(4)(A)1.;

Empire engaged AEG to conduct a DSM Potential Study. AEG analyzed potential demand-side resources for all major end uses as identified by the Residential Customer Energy Survey and secondary sources. The major end uses considered include:

- Residential sector: cooling, space heating, water heating, interior lighting, exterior lighting, appliances, electronics, and miscellaneous.
- Commercial and Industrial sector: space heat, space cooling, ventilation, water heating, refrigeration, interior and exterior lighting, office equipment, food preparation, motors, process, and miscellaneous.[1]

1.2 Designing Effective Potential Demand-Side Programs

(B) To fulfill the goal of achieving all cost-effective demand-side savings, the utility shall design highly effective potential demand-side programs consistent with subsection (1)(A) that broadly cover the full spectrum of cost-effective end-use measures for all customer market segments;

Empire engaged AEG to conduct a Demand-Side Management Potential Study. AEG developed nine program design scenarios to assess the optimal demand-side programs to propose for implementation. The recommended demand-side management programs for 2017-2019 include:

- Residential Lighting
- Whole House Efficiency
- Residential Behavioral
- Low Income Whole House Efficiency
- Low Income Weatherization
- Commercial & Industrial Rebate

These programs are detailed in the tables below (also see Appendices 5A and 5B).

[1] CHP is analyzed as a supply-side resource.

Additional programs were added to the portfolio after 2019 as measures and programs become cost-effective.

Residential Appliance Recycling (2023-2035). The program incentivizes residential customers to remove inefficient refrigerators / freezers from the electric system and dispose of them in an environmentally safe and responsible manner. The refrigerators / freezers, which are picked-up free of charge, must be in working condition, between 10 and 32 cubic feet in size, and a 2001 model or older. Customers receive a $50 incentive for each unit recycled. Room air conditioners may be picked-up free of charge during a scheduled trip for a qualifying refrigerator / freezer. Customers are limited to 2 refrigerator / freezer rebates and 2 room air conditioners per household per year.

Low Income Behavioral (2020-2035). The program provides individualized energy use information to low income customers while simultaneously offering recommendations on how to save energy and money by making small changes to energy consuming behaviors. Energy reports will be periodically mailed/emailed to customer households to increase self-awareness and a provide peer comparison of their energy usage.

Strategic Energy Management (2031-2035). The program is a systematic approach to delivering persistent energy savings to organizations by integrating energy management into regular business practices. Companies will be placed into groups that work alongside each other for one year or longer, coming together in periodic workshops. The group setting enhances participant action as they strive to perform in front of their peers. Structured groups are composed of 5 to 12 participants that are often located in the same geographical area, sharing best practices and learning together. The group is typically filled with participants from non-competing industries; however, upon mutual agreement, competitors may participate in the same group.

C&I Retrocommissioning (2030-2035). The program provides financial assistance for projects that optimize system energy use and overall efficiency through the calibration, maintenance, and optimization of current systems within a facility. Customer incentives will help fund studies, equipment upgrades and re-commissioning efforts.

Residential Demand Load Control (2021-2035). The program entails control of eligible cooling units for the summer peak season, space heating units for the winter peak season and electric water heaters for the summer and winter peak seasons. A switch is placed on the customer's equipment. During a peak event, a signal is sent to the switch and the equipment is cycled on/off to reduce consumption.

Curtailment Agreement (2029-2035). Participating customers agree to reduce their demand by a specific amount or curtail their consumption to a pre-specified level. In return, they receive a fixed

incentive payment in the form of capacity credits or reservation payments. Customers are paid to be on call even though actual load curtailments may not occur. The amount of the capacity payment varies with the load commitment and the length of the contract. Penalties may be assessed for under-performance or non-performance. Events may be called on a day-of or day-ahead basis as conditions warrant. This option is typically delivered by third party load aggregators and is most attractive for customers with maximum demand greater than 100 kW with flexible operations.

Residential Lighting Program

<table>
<tr><td>Objective</td><td>Increase the penetration of efficient lighting and secure energy savings by incentivizing the purchase of efficient lighting.</td></tr>
<tr><td>Target Market</td><td>Residential customers as well as lighting manufacturers and local retailers.</td></tr>
<tr><td>Description</td><td>Customers will receive an instant incentive at the point-of-purchase for the purchase of qualified LEDs. Incentives will vary depending upon the type of lighting, manufacturer and the associated retail cost.</td></tr>
<tr><td>Implementation</td><td>Empire will engage a third-party contractor to implement the program. The contractor will provide the necessary services to effectively implement the program and obtain the energy savings goals while adhering to the budget.
The implementation contractor will:
Establish and maintain relationships with lighting manufacturers and retailers throughout Empire’s service territory.
Provide in-store promotional materials and retail sales staff training.
Track program performance, audit sales data, and process payments to retailers/manufacturers.
Periodically report program activities, progress towards goals and opportunities for improvement.
Empire will work with the implementation contractor to market the program to customers and educate retailer sales staff. Marketing to increase customer awareness may include, but not be limited to bill inserts, newspaper advertisements, internet placement and point-of-purchase materials (e.g. hang tags, posters, etc.).
Upstream programs simplify the participation process, eliminating the need for customers to complete and submit a rebate application. However, upstream programs typically have higher free ridership and leakage outside of the service territory. A number of steps will be taken to reduce free ridership and leakage while increasing spillover, including:
Empire will work with the implementation contractor to select retailers located well within the service territory to reduce leakage.
Incentives will be modified as needed to respond to the market price of qualifying light bulbs, with a goal of the incentive being no higher than 50% of the incremental cost.
Cross-market the program with Empire’s other DSM programs to increase spillover.</td></tr>
<tr><td>Eligible Measures and Incentives</td><td>Residential customers will be eligible for instant, point-of-purchase rebates on LEDs and Specialty LEDs. Incentives may be modified to respond to the market.
<table>
<tr><th>Measure</th><th>Unit</th><th>Incentive per Unit</th></tr>
<tr><td>LED</td><td>per Bulb</td><td>$4.00</td></tr>
<tr><td>Specialty LED</td><td>per Bulb</td><td>$2.50</td></tr>
</table></td></tr>
<tr><td>Estimated Participation</td><td>The table presents number of bulbs purchased. The analysis assumed that each customer would purchase 6 bulbs, on average.
<table>
<tr><th>Measure</th><th>2017</th><th>2018</th><th>2019</th></tr>
<tr><td>LED</td><td>5,500</td><td>11,000</td><td>11,000</td></tr>
<tr><td>Specialty LED</td><td>700</td><td>1,400</td><td>1,400</td></tr>
</table></td></tr>
</table>

Estimated Savings

Net MWh Savings			Net MW Savings		
2017	2018	2019	2016	2017	2018
116	232	232	0.01	0.02	0.02

Estimated Budget

	2017	2018	2019
Incentives	$23,750	$47,500	$47,500
Delivery	$9,300	$18,600	$18,600
Administration	$661	$1,322	$1,322
Education & Marketing	$1,653	$3,305	$3,305
Evaluation	$1,768	$3,536	$3,536
Total	**$37,132**	**$74,263**	**$74,263**

Cost Effectiveness

	2017	2018	2019
TRC	1.38	1.52	1.66
UCT	1.64	1.81	1.98
PCT	7.01	7.11	7.24
RIM	0.34	0.37	0.40
SCT	1.38	1.52	1.66

Whole House Efficiency

Objective	Encourage whole-house improvements to existing homes by enhancing home energy audits and promoting comprehensive retrofit services.
Target Market	Residential customers that own or rent a residence, including owners of rental properties and new construction, as well as HVAC contractors.
Description	The program will consist of two tiers: Tier 1: Direct Install. Customers will receive an in-home energy audit and installation of low-cost measures at no cost. The energy audit will identify potential efficiency improvements. The measures to be installed may include an LED, faucet aerator, low-flow showerhead, water heater tank wrap, and hot water pipe insulation. Tier 2: Rebates. Customers are eligible for incentives for the purchase and installation of qualifying measures. Customers are not required to participate in Tier 1. Qualifying measures include: • Air/Duct Sealing and Insulation • ENERGY STAR Windows • Central Air Conditioners/Air Source Heat Pumps • Programmable Thermostat • Furnace Blower Motor • Heat Pump Water Heater • ENERGY STAR Appliances Customers that rent a residence must receive the written approval of the homeowner/landlord to participate in the program.
Implementation	Empire will engage a third-party contractor to implement the program. An implementation contractor will: • Hire staff/engage local contractors to conduct audits and direct measure installation. • Engage customers and schedule home energy audit appointments. • Provide customer service support. • Establish relationships with local HVAC contractors to work with the program installing energy efficient HVAC equipment and insulation measures. • Process rebate applications, including review and verification of applications and payment of customer rebates. • Track program performance, including customer and contractor participation as well as quality assurance/quality control (QA/QC). • Periodically report program progress. Empire will work with the implementation contractor to market the program to residential customers and contractors. The implementation contractor will develop partnerships with contractors through education and training seminars, presentations at Chamber of Commerce meetings, and other informational events. Customer marketing activities may include, but not be limited to bill inserts, newspaper advertisements, email blasts, bill messaging and community events. It is important that the measures are properly installed and customer satisfaction is high. Empire and/or the implementation contractor should conduct QA/QC of a random group of completed projects by project type and contractor. The QA/QC process should include verification of the equipment installed and customer satisfaction with the contractor and the program.

Eligible Measures and Incentives

The direct install portion (Tier 1) will be provided at no cost to the customer. Incentives may be modified to respond to the market.

Measure	Unit	Incentive per Unit
Air Sealing	per unit	$0.80 per sq. ft., up to $300
Attic Insulation R-38	per unit	$0.30 per sq. ft., up to $500
Wall Insulation R-11	per unit	$0.30 per sq. ft., up to $150
Foundation Insulation R-13	per unit	$0.30 per sq. ft., up to $150
Floor Insulation R-30	per unit	$0.30 per sq. ft., up to $150
Duct Installation & Sealing	per unit	$0.10 per sq. ft., up to $150
ENERGY STAR Windows	per unit	$75 per window., up to $750
CAC SEER 15 / ASHP SEER 15, HSPF 8.5	per unit	$250
CAC SEER 16 / ASHP SEER 16, HSPF 9	per unit	$350
CAC SEER 17 / ASHP SEER 18, HSPF 10	per unit	$450
Programmable Thermostat	per unit	$15
Furnace Blower Motor	per unit	$50
ENERGY STAR Dehumidifier	per unit	$30
ENERGY STAR Air Purifier	per unit	$30

Estimated Participation

Measure	2017	2018	2019
Home Audit & Direct Install	150	400	500
Air Sealing	60	160	200
Attic Insulation R-38	60	160	200
Foundation Insulation R-13	20	50	60
Floor Insulation R-30	20	50	60
Duct Installation & Sealing	25	60	80
ENERGY STAR Windows	15	40	50
CAC SEER 15, EER 12.5	35	74	78
CAC SEER 16, EER 13	22	46	48
CAC SEER 17, EER 13	4	8	8
ASHP SEER 15, HSPF 8.5	100	210	221
ASHP SEER 16, HSPF 9	15	32	34
ASHP SEER 18, HSPF 10	10	21	22
Programmable Thermostat	50	180	260
Furnace Blower Motor	10	34	50
ENERGY STAR Dehumidifier	110	240	270
ENERGY STAR Air Purifier	100	220	240

Estimated Savings

Net MWh Savings			Net MW Savings		
2017	2018	2019	2016	2017	2018
407	997	1,208	0.09	0.23	0.28

Estimated Budget

	2017	2018	2019
Incentives	$117,805	$275,980	$323,700
Delivery	$80,700	$201,875	$245,125
Administration	$39,701	$95,571	$113,765
Education & Marketing	$29,776	$71,678	$85,324
Evaluation	$13,399	$32,255	$38,396
Total	**$281,381**	**$677,359**	**$806,310**

Cost Effectiveness				
	2017	2018	2019
TRC	1.24	1.39	1.52
UCT	1.77	1.95	2.11
PCT	4.19	4.51	4.76
RIM	0.44	0.47	0.49
SCT	1.24	1.39	1.52

Residential Behavioral

Objective	Reduce consumption via socially- and information-driven behavioral change and raise general awareness of energy efficiency.
Target Market	Residential single family homes.
Description	Provide individualized energy use information to customers while simultaneously offering recommendations on how to save energy and money by making small changes to energy consuming behaviors. Energy reports will be periodically mailed/emailed to customer households to increase self-awareness and provide peer comparison of their energy usage. Social competitiveness increases behaviors to reduce energy consumption.
Implementation	Empire will select an implementation contractor that specializes in developing and issuing residential energy reports. The implementation contractor will utilize experimental design to select report recipients and a control group, design the reports and develop customized energy reduction tips with input from Empire. The program will cross-promote and market Empire's DSM portfolio.
Eligible Measures and Incentives	Customers receive personalized energy reports, but there is no monetary incentive.
Estimated Participation	2017: 15,000; 2018: 30,000; 2019: 30,000
Estimated Savings	The average savings per household is a planning estimate, the implementation contractor will aim to achieve the total net savings provided in the table.
Estimated Budget	Customers do not receive a monetary incentive. The delivery budget includes the administration as well as the education and marketing budgets.
Cost Effectiveness	

Net MWh Savings			Net MW Savings		
2017	2018	2019	2016	2017	2018
600	1,200	1,200	0.09	0.17	0.17

	2017	2018	2019
Delivery	$36,000	$72,000	$72,000
Administration	$720	$1,440	$1,440
Evaluation	$1,836	$3,672	$3,672
Total	**$38,556**	**$77,112**	**$77,112**

	2017	2018	2019
TRC	1.14	1.38	1.60
UCT	1.14	1.38	1.60
PCT	n/a	n/a	n/a
RIM	0.22	0.27	0.31
SCT	1.14	1.38	1.60

Low Income Whole House Efficiency

Objective	Deliver long-term energy savings and bill reductions to low-income customers.
Target Market	Residential low income homeowners and renters.
Description	The program will consist of two tiers: Tier 1: Direct Install. Customers will receive an in-home energy audit and installation of low-cost measures at no cost. The energy audit will identify potential efficiency improvements. The measures to be installed may include an LED, faucet aerator, low-flow showerhead, water heater tank wrap, and hot water pipe insulation. Tier 2: Rebates. Customers are eligible for incentives for the purchase and installation of qualifying measures. Customers are not required to participate in Tier 1. Qualifying measures include: • Air/Duct Sealing and Insulation • ENERGY STAR Windows • Central Air Conditioners/Air Source Heat Pumps • Programmable Thermostat • Furnace Blower Motor • Heat Pump Water Heater • ENERGY STAR Appliances Customers that rent a residence must receive the written approval of the homeowner/landlord to participate in the program.
Implementation	Empire will engage a third-party contractor to implement the program that will: • Hire staff/engage local contractors to conduct audits and direct measure installation. • Engage customers and schedule home energy audit appointments. • Provide customer service support. • Establish relationships with local HVAC contractors to work with the program installing energy efficient HVAC equipment and insulation measures. • Process rebate applications, including review and verification of applications and payment of customer rebates. • Track program performance, including customer and contractor participation as well as quality assurance/quality control (QA/QC). • Periodically report program progress. Empire will work with the implementation contractor to market the program to residential customers and contractors. The implementation contractor will develop partnerships with contractors through education and training seminars, presentations at Chamber of Commerce meetings, and other informational events. Customer marketing activities may include, but not be limited to bill inserts, newspaper advertisements, email blasts, bill messaging and community events. It is important that the measures are properly installed and customer satisfaction is high. Empire and/or the implementation contractor should conduct QA/QC of a random group of completed projects by project type and contractor. The QA/QC process should include verification of the equipment installed and customer satisfaction with the contractor and the program.

Eligible Measures and Incentives

The direct install portion (Tier 1) will be provided at no cost to the customer. Incentives may be modified to respond to the market.

Measure	Unit	Incentive per Unit
Air Sealing	per unit	$1.50 per sq. ft., up to $600
Attic Insulation R-38	per unit	$0.60 per sq. ft., up to $800
Wall Insulation R-11	per unit	$0.50 per sq. ft., up to $300
Foundation Insulation R-13	per unit	$0.50 per sq. ft., up to $300
Floor Insulation R-30	per unit	$0.50 per sq. ft., up to $300
Duct Installation & Sealing	per unit	$0.20 per sq. ft., up to $300
ENERGY STAR Windows	per unit	$150 per window, up to $1,500
CAC SEER 15 / ASHP SEER 15, HSPF 8.5	per unit	$500
CAC SEER 16 / ASHP SEER 16, HSPF 9	per unit	$700
CAC SEER 17 / ASHP SEER 18, HSPF 10	per unit	$900
Programmable Thermostat	per unit	$30
Furnace Blower Motor	per unit	$100
ENERGY STAR Dehumidifier	per unit	$60
ENERGY STAR Air Purifier	per unit	$60
ENERGY STAR Refrigerator	per unit	$60

Estimated Participation

Measure	2017	2018	2019
Home Audit & Direct Install	20	40	40
Air Sealing	15	30	30
Attic Insulation R-38	10	20	20
Duct Installation & Sealing	5	20	10
ENERGY STAR Windows	5	10	10
CAC SEER 15, EER 12.5	10	20	20
ASHP SEER 15, HSPF 8.5	10	20	20
Programmable Thermostat	5	10	10
ENERGY STAR Dehumidifier	5	10	10
ENERGY STAR Air Purifier	10	20	20
ENERGY STAR Refrigerator	20	40	40

Estimated Savings

Net MWh Savings			Net MW Savings		
2017	2018	2019	2016	2017	2018
47	101	95	0.01	0.03	0.02

Estimated Budget

	2017	2018	2019
Incentives	$30,970	$64,940	$61,940
Delivery	$10,000	$20,750	$20,000
Administration	$4,097	$8,569	$8,194
Education & Marketing	$6,146	$12,854	$12,291
Evaluation	$2,561	$5,356	$5,121
Total	**$53,774**	**$112,469**	**$107,546**

Cost Effectiveness

	2017	2018	2019
TRC	1.18	1.27	1.35
UCT	1.06	1.17	1.22
PCT	4.97	4.97	5.13
RIM	0.39	0.41	0.43
SCT	1.18	1.27	1.35

Low Income Weatherization

<table>
<tr><td>Objective</td><td>Deliver long-term energy savings and bill reductions to low-income customers.</td></tr>
<tr><td>Target Market</td><td>Low-income residential homeowners and renters.</td></tr>
<tr><td>Description</td><td>The program reduces energy costs for eligible low income homeowners and renters through increased home efficiency, at no cost to the participant. Home efficiency is improved through the installation of energy saving measures, such as insulation, caulking, weather stripping and heating system repair or replacement. The program supplements the federal Low Income Weatherization Assistance Program.</td></tr>
<tr><td>Implementation</td><td>Empire customers work with one of the Missouri Weatherization Agencies to participate:
Economic Security Corporation of Southwest Area
Ozarks Area Community Action Corporation
West Central Missouri Community Action Agency
The Missouri Weatherization Agencies offer cost-effective implementation, which allows most of the program budget to go directly to the purchase and installation of efficient equipment.
The Missouri Weatherization Agencies have primary responsibility for promoting the program. Empire will supplement statewide marketing efforts, promoting the program through community events and organizations, including schools, churches and nonprofit organizations within the service territory.</td></tr>
<tr><td>Eligible Measures and Incentives</td><td>The program supplements the federal Low Income Weatherization Assistance Program.</td></tr>
<tr><td>Estimated Participation</td><td><table><tr><th>2017</th><th>2018</th><th>2019</th></tr><tr><td>150</td><td>300</td><td>300</td></tr></table></td></tr>
<tr><td>Estimated Savings</td><td><table><tr><th colspan="3">Net MWh Savings</th><th colspan="3">Net MW Savings</th></tr><tr><th>2017</th><th>2018</th><th>2019</th><th>2016</th><th>2017</th><th>2018</th></tr><tr><td>308</td><td>616</td><td>616</td><td>0.11</td><td>0.22</td><td>0.22</td></tr></table></td></tr>
<tr><td>Estimated Budget</td><td>The program budget is accounted for separately from the DSM programs. The DSM program expenditures are recovered via Empire’s DSIM charge. However, the Low Income Weatherization program expenditures are amortized and recovered through general rates.</td></tr>
<tr><td>Cost Effectiveness</td><td>n/a</td></tr>
</table>

Commercial and Industrial Rebate

Objective	Encourage purchase and installation of energy efficient equipment by providing incentives to lower the cost of purchasing efficient equipment for commercial and industrial facilities.
Target Market	Commercial and industrial customers
Description	The program provides incentives to lower the cost of purchasing energy efficient equipment for commercial and industrial facilities. The program consists of prescriptive and custom rebates. **Prescriptive**. Pre-qualified prescriptive rebates are available for new construction and retrofit projects. **Custom**. Equipment that does not qualify for a prescriptive rebate will be eligible for a custom rebate. Applications must be pre-approved by Empire before equipment is purchased and installed and must produce a Total Resource Cost Test benefit-cost ratio of at least 1.0. A $50,000 incentive cap is imposed per facility per program year. However, if funds are still available in the last three months of the program year, the cap may be exceeded. Multiple rebate applications for different measures may be submitted.
Implementation	Empire will engage a third-party implementation contractor. The contractor will be responsible for: • Process customer applications, verify customer and project eligibility (including pre-approval of custom projects) and process customer rebates. • Conduct QA/QC to verify equipment installation. • Provide customer service support. • Track program performance. • Periodically report progress towards program goals and opportunities for improvement. The program will be marketed through partnerships with Empire trade allies as well as newspaper advertisements, email blasts or targeted mailings to customers and contractors, bill inserts, and advertising in HVAC trade publications. One key barrier to participation is ensuring that enough vendors are properly educated to allow them to actively engage customers. Therefore, Empire will work closely with trade allies to ensure they understand and promote the program. The measure list and incentive levels may be updated annually to reflect changes to the market. Incentives will be modified as needed to respond to market prices, with a goal of the incentive being no higher than 50% of the incremental cost. Proper incentives can reduce free ridership while still encouraging customers to participate in the program.

Eligible Measures and Incentives

Custom rebates will be $0.10 per first-year kWh savings. Prescriptive rebates are presented in the table below. Incentives may be modified to respond to the market.

Measure	Unit	Incentive per Unit
Room Air Conditioner (12 EER)	per unit	$40
Packaged Terminal Air Conditioner	per unit	$40
Variable Speed Drive	per unit	$500
ENERGY STAR Steamer	per unit	$750
ENERGY STAR Dishwasher	per unit	$400
ENERGY STAR Hot Food Holding Cabinets	per unit	$500
ENERGY STAR Ice Maker (2018)	per unit	$60
ENERGY STAR Electric Convention Oven	per unit	$400
ENERGY STAR Electric Fryer	per unit	$100
Evaporator Fan Control	per unit	$125
Strip Curtain for Walk-In Cooler/Freezer	per unit	$125
Night Covers for Open Refrigerated Display Cases	per unit	$175
Door Heater Controls	per unit	$125
Refrigeration Economizer	per unit	$800
Directional LED Bulb	per unit	$15
High Bay Fluorescent Fixture (HP T8)	per unit	$75
High Bay Fluorescent Fixture w/ HE Electronic Ballast (T5)	per unit	$30
LED High & Low-Bay Fixture	per unit	$100
LED Exit Sign	per unit	$15
LED Recessed Fixture	per unit	$15
Lighting Optimization - Remove 4ft Lamp from T8 System	per unit	$6
Lighting Optimization - Remove 8ft Lamp from T8 System	per unit	$8
LED Wall Mounted Area Lights (<30W)	per unit	$60
LED Refrigerator Case Light	per unit	$50
Photocell Occupancy Sensor	per unit	$25
Wall-Mount Occupancy Sensor	per unit	$20

Estimated Participation

	2017	2018	2019
Prescriptive	174	429	466
Custom	20	45	50

Estimated Savings

	Net MWh Savings			Net MW Savings		
	2017	2018	2019	2016	2017	2018
Prescriptive Program	1,413	3,147	3,294	0.17	0.39	0.40
Custom Program	111	250	278	0.02	0.05	0.05

Estimated Budget

Prescriptive

	2017	2018	2019
Incentives	$177,810	$398,325	$423,710
Delivery	$34,760	$85,720	$93,280
Administration	$21,257	$48,405	$51,699
Education & Marketing	$25,508	$58,085	$62,039
Evaluation	$12,967	$29,527	$31,536
Total	$272,302	$620,062	$662,264

Custom

	2017	2018	2019
Incentives	$15,000	$33,750	$37,500
Delivery	$5,000	$11,250	$12,500
Administration	$2,000	$4,500	$5,000
Education & Marketing	$2,400	$5,400	$6,000
Evaluation	$1,220	$2,745	$3,050
Total	$25,620	$57,645	$64,050

Cost Effectiveness

Prescriptive

	2017	2018	2019
TRC	2.19	2.34	2.52
UCT	3.33	3.55	3.80
PCT	7.64	7.68	7.79
RIM	0.52	0.56	0.59
SCT	2.19	2.34	2.52

Custom

	2017	2018	2019
TRC	2.19	2.34	2.52
UCT	3.33	3.55	3.80
PCT	7.64	7.68	7.79
RIM	0.52	0.56	0.59
SCT	2.19	2.34	2.52

1.3 Demand-Side Rates

(C) To include demand-side rates for all customer market segments;

There are four common types of demand-side rates:

- **Time-of-Use**. Customers pay a higher price during the designated peak period and lower prices during off-peak periods. The designated peak and off-peak periods are typically defined by the season, day and time of day. Requires interval meter.
- **Critical Peak Price**. Customers pay higher peak period prices during the few days a year when wholesale prices are the highest and pay a discounted off-peak price for the remainder of the year. Requires interval meter.
- **Peak Time Rebate**. Customers are paid for load reductions during a peak period. There is no rate discount during non-event hours. Requires smart meter and method for estimating customer's baseline usage.
- **Real Time Pricing**. Customers pay for energy at a rate that is linked to the hourly market price for electricity. Depending on their size, participants are typically made aware of the hourly prices on either a day-ahead or hour-ahead basis. Typically, only the largest customers —above one megawatt of load — face hour-ahead prices. Requires interval meter.

These demand-side rate options have similar demand savings impacts but the implementation costs can vary significantly. AEG focused on the demand-side rate option with the lowest implementation cost, Critical Peak Pricing (CPP). As shown later in the filing, CPP was not found to be cost-effective at any time during the 20-year timeframe. Therefore, the remaining three demand-side rate options were not analyzed.

AEG also considered a residential Inclining Block Rate (IBR). IBR is considered a conservation rate that applies a differing rates based on customer usage. The rate increases as the amount of electricity consumed increases. Typically, the rate is separated into two blocks or tiers by a kWh threshold, the first block below the threshold is charged one rate and the second block above the threshold is charged another higher rate. Unlike other DR and rate based options, this option has low to zero operation, maintenance and incentive costs. However, introducing this rate option requires a significant amount of rate making and regulatory changes that cannot be captured within the modeling.

Table 5 shows the eligible customer classes for the demand-side rates analyzed, briefly indicates the load control mechanism, and the associated reliability. These options are not currently offered by Empire.

Table 5 Demand-Side Rate Options

Option	Eligibility	Mechanism	Reliability[2]
Critical Peak Pricing	All segments	Higher rate for a particular block of hours that occurs every day	Non-firm
Inclining Block Rate	Residential	Applies a rate(s) to a customer's bill if they exceed certain thresholds.	Non-firm

1.4 Multiple Designs

(D) To consider and assess multiple designs for demand-side programs and demand-side rates, selecting the optimal designs for implementation, and modifying them as necessary to enhance their performance; and

Empire engaged AEG to conduct a Demand-Side Management Potential Study in Empire's Missouri service territory. AEG considered five energy efficiency portfolios based on the cost-effective measures. Each of these portfolios was considered during the integration phase of Empire's IRP process to determine which DSM portfolio was the optimal decision based upon Empire's supply options.

- **RAP- Portfolio**. Alternative demand-side portfolio designed to represent one-half of the RAP Program Design portfolio participation.
- **RAP Program Design Portfolio**. The Realistic Achievable Potential (RAP) candidates from the DSM Potential Study that Empire proposes passing to the integration phase. This portfolio reflects expected program participation given barriers to customer acceptance and non-ideal implementation conditions. These measures are delivered under less than ideal market conditions.
- **RAP+ Portfolio**. Alternative demand-side portfolio designed to represent the midpoint between the RAP Program Design and MAP Program Design portfolios.
- **MAP Program Design Portfolio**. The Maximum Achievable Potential (MAP) candidates from the DSM Potential Study that Empire proposes passing into the integration phase. This

[2] Reliability refers to the customer's commitment to the specific program, it is not related to the technology that calls the events.

portfolio reflects expected program participation given ideal market implementation and few barriers to customer adoption. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with dealers and delivery partners. Under this scenario, incentives represent a substantial portion of the incremental cost combined with high administrative and marketing costs.

- **Aggressive Capacity Portfolio**. Alternative demand-side portfolio designed to utilize demand-side resources to meet additional future capacity.

Empire provided five commodity cost scenarios:

- No CO_2 assumes no carbon cost
- Low CO_2
- Mid CO_2
- High CO_2
- Weighted CO_2 is a weighted average of the four commodity cost scenarios, assuming 10% No CO_2, 25% Low CO_2, 50% Mid CO_2 and 15% High CO_2.

The energy efficiency portfolios described above were screened using the weighted CO2 avoided cost. The RAP Program Design Portfolio was also screened utilizing the remaining four avoided costs.

1.5 Effects of Improved Technologies

(E) To include the effects of improved technologies expected over the planning horizon to—

Reduce or manage energy use; or

Empire filed an application for variance, approved on July 2, 2015, for 4 CSR 240-22.050 (1) (E). Per the approved variance, Empire addressed technology improvements by assessing the effect of impact and incremental cost trends on measure cost-effectiveness over the planning horizon. Empire included the effects of known improved technologies, accounting for proposed and approved changes in federal equipment standards as well as ENERGY STAR® and CEE efficiency requirements. Emerging technologies with unpredictable savings or barriers to market availability were not included.

Improve the delivery of demand-side programs or demand-side rates.

Empire filed an application for variance, approved on July 2, 2015, for 4 CSR 240-22.050 (1) (E). Per the approved variance, Empire addressed delivery improvements over the planning horizon. Empire included the effects of known improvements and proposed improvements. Empire does not have a current timeline for improving advanced meters at this time.

SECTION 2 DEMAND-SIDE RESEARCH

(2) The utility shall conduct, describe, and document market research studies, customer surveys, pilot demand-side programs, pilot demand-side rates, test marketing programs, and other activities as necessary to estimate the maximum achievable potential, technical potential, and realistic achievable potential of potential demand-side resource options for the utility and to develop the information necessary to design and implement cost-effective demand-side programs and demand-side rates. These research activities shall be designed to provide a solid foundation of information applicable to the utility about how and by whom energy-related decisions are made and about the most appropriate and cost-effective methods of influencing these decisions in favor of greater long-run energy efficiency and energy management impacts. The utility may compile existing data or adopt data developed by other entities, including government agencies and other utilities, as long as the utility verifies the applicability of the adopted data to its service territory. The utility shall provide copies of completed market research studies, pilot programs, pilot rates, test marketing programs, and other studies as required by this rule and descriptions of those studies that are planned or in progress and the scheduled completion dates.

Empire filed an application for variance, approved on July 2, 2015, for 4 CSR 240-3.164 (2) (A). Per the approved variance, Empire collected primary data for the residential sector to inform the 2016 market potential study. The cost of primary data collection varies by the number of surveys and on-site visits completed. Time and cost constraints were weighed against the usefulness of the data to prioritize data collection activities. Based upon these constraints, Empire commissioned a Residential Customer Energy Survey in 2015 and supplemented the potential study with secondary data sources as needed.

The Residential Customer Energy Survey was designed, administered and analyzed by Opinion Research Specialists, LLC of Springfield, Missouri. A random sample of 4,000 residential customers, segmented by population and energy usage, within Empire Electric's Missouri, Arkansas, Kansas and Oklahoma service territory received six-page questionnaires and cover letters. The survey included questions on general household characteristics, heating and cooling equipment, appliances, water usage, and energy management. Total respondents included 2,750 completed mail and online questionnaires. Overall survey results have a margin of error of approximately +/- 2% at the 95% confidence interval.

For the DSM Potential Study, AEG used its Load Management Analysis and Planning tool (LoadMAP™) version 4.0 to develop the baseline projection and potential estimates. AEG developed LoadMAP in 2007 and has enhanced it over time, using it for more than 50 studies in the past five years. Built in Microsoft Excel®, the LoadMAP framework is both accessible and transparent and has the following key features.[3]

LoadMAP™ Data Sources

Below is a discussion of the potential study data sources. In general, data was adapted to local conditions, for example, by using local sources for measure data and local weather for building simulations.

Empire Data

Our highest priority data sources for this study were those that were specific to Empire.

- *Empire 2014 nonresidential billing data*
- *Load forecasts*: most recent load and peak forecasts, an economic growth forecast by sector, and retail electricity price history and forecasts.
- *Economic information:* avoided cost forecasts, a discount rate, and line loss factor.
- *Residential saturation survey*: 2015 Residential Customer Energy Survey completed by Opinion Research Specialists, LLC.
- *Empire current and historical DSM program data*

AEG Data

AEG maintains several databases and modeling tools for potential studies. Relevant data from these tools has been incorporated into the analysis and deliverables for this study.

- *AEG Energy Market Profiles:* For more than 10 years, AEG staff has maintained profiles of end-use consumption for the residential and nonresidential sectors. These profiles include market size, fuel shares, unit consumption estimates, and annual energy use, customer segment and end use for 10 regions in the U.S. The Energy Information Administration surveys (RECS, CBECS and MECS) as well as state-level statistics and local customer research provide the foundation for these regional profiles.
- *Building Energy Simulation Tool (BEST)*: a derivative of the DOE 2.2 building simulation model, used to estimate base-year UECs and EUIs as well as HVAC-related measure savings.

[3] See the Empire District Electric Company DSM Market Potential Study for the full report.

- *AEG's EnergyShape™*: Database of residential and non-residential end-use load shapes.
- *AEG's Database of Energy Efficiency Measures (DEEM)*: AEG maintains an extensive database of measure data from national, state and utility technical reference manuals and evaluations from around the country.

Energy Efficiency Measure Data

Several sources of data were used to characterize the energy efficiency measures. We used recent studies performed for the Midwest, supplemented by AEG data (described above) and the following national and well-vetted regional data sources:

- **Appliance and Equipment Standards**. The study utilized data from the U.S. Department of Energy,[4] Energy Star[5] and the Consortium for Energy Efficiency[6] to determine baseline savings as well as efficient savings for Energy Star and Consortium for Energy Efficiency qualifying measures.
- Illinois Statewide Technical Reference Manual for Energy Efficiency. Version 4.0 Effective June 1, 2015.
- Arkansas Public Service Commission. Arkansas Technical Reference Manual. Version 4.0 (August 29, 2014).
- State of Minnesota. Technical Reference Manual for Energy Conservation Improvement Programs. Version 1.3. Effective January 1, 2016 – December 31, 2016.
- Michigan Public Service Commission (2015). Michigan Energy Measures Database. Prepared by Morgan Marketing Partners.
- Ameren Missouri 2014 Integrated Resource Plan. Appendix A – Technical Resource Manual.
- ComEd. ComEd Programs NTG Approach for EPY8.[7]

The tables below note how the data above was applied to the market profiles, baseline projection and potential estimates, and measure characteristics.

[4] U.S. Department of Energy. Current Rulemakings and Notices. http://energy.gov/eere/buildings/current-rulemakings-and-notices
[5] Energy Star. Product Specifications and Partner Commitments Search. http://www.energystar.gov/products/spec/
[6] Consortium for Energy Efficiency. Program Resources. https://www.cee1.org/
[7] http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/ComEd_EPY8_NTG_Summary_2015-01-13.pdf

Table 6 Data Applied for the Market Profiles

Model Inputs	Description	Key Sources
Market size	Base-year residential dwellings and nonresidential floor space	Empire billing data Empire RASS survey AEO 2015
Annual intensity	**Residential**: Annual use per household **Nonresidential**: Annual use per square foot	Empire billing data Empire RASS survey AEG's Energy Market Profiles AEO 2015 Other recent potential studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology Percentage of commercial floor space with equipment/technology	Empire RASS survey AEG's Energy Market Profiles Other recent potential studies
UEC/EUI for each end-use technology	UEC: Annual electricity use in homes and buildings that have the technology EUI: Annual electricity use per square foot for a technology in floor space that has the technology	Recent Midwest studies HVAC uses: BEST simulations using prototypes developed for Missouri Engineering analysis
Appliance/equipment age distribution	Age distribution for each technology	Empire RASS survey EIA Data (CBECs, RECs) Recent AEG studies
Efficiency options for each technology	List of available efficiency options and annual energy use for each technology	AEG DEEM AEO 2015 DEER NWPCC workbooks, RTF Previous studies
Peak factors	Share of technology energy use that occurs during the peak hour	Empire system peak data EnergyShape database

Table 7 Data Needs for the Baseline Projection and Potentials Estimation in LoadMAP

Model Inputs	Description	Key Sources
Customer growth forecasts	Forecasts of new construction in residential and nonresidential sectors	Empire load forecast Empire customer growth forecast AEO 2015 economic growth forecast
Equipment purchase shares for baseline projection	For each equipment/technology, purchase shares for each efficiency level; specified separately for existing equipment replacement and new construction	AEO 2015 regional technology forecast assumptions[8] Appliance/efficiency standards analysis Empire program results
Electricity prices	Forecast of average energy and capacity avoided costs and retail prices	Empire forecast data

[8] We developed baseline purchase decisions using the Energy Information Agency's *Annual Energy Outlook* report, which utilizes the National Energy Modeling System (NEMS) to produce a self-consistent supply and demand economic model. We calibrated equipment purchase options to match manufacturer shipment data for recent years and then held values constant for the study period. This removes any effects of naturally occurring conservation or effects of future EE programs that may be embedded in the AEO forecasts.

Table 8 Data Needs for the Measure Characteristics in LoadMAP

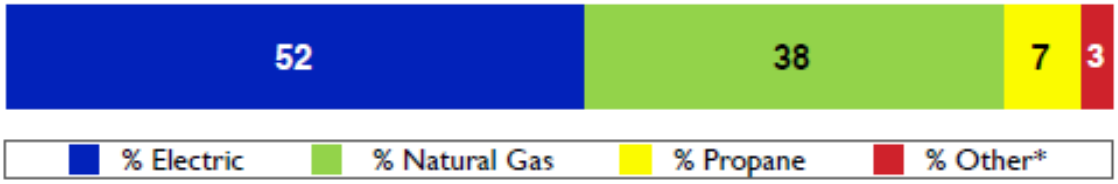
Model Inputs	Description	Key Sources
Energy Impacts	The annual reduction in consumption attributable to each specific measure. Savings were developed as a percentage of the energy end use that the measure affects.	AEG DEEM AEG BEST (HVAC only) AEO 2015 Illinois TRM Arkansas TRM Minnesota TRM Other secondary sources
Peak Demand Impacts	Savings during the peak demand periods are specified for each electric measure. These impacts relate to the energy savings and depend on the extent to which each measure is coincident with the system peak.	AEG DEEM AEG BEST (HVAC only) Illinois TRM
Costs	Equipment Measures: Includes the full cost of purchasing and installing the equipment on a per-household or per-square-foot basis for the residential and nonresidential sectors, respectively. Non-equipment measures: Existing buildings – full installed cost. New Construction - the costs may be either the full cost of the measure, or as appropriate, it may be the incremental cost of upgrading from a standard level to a higher efficiency level.	AEG DEEM AEO 2015 Illinois TRM Michigan Database RS Means Other secondary sources
Measure Lifetimes	Estimates derived from the technical data and secondary data sources that support the measure demand and energy savings analysis.	AEG DEEM AEO 2015 Arkansas TRM Other secondary sources
Applicability	Estimate of the percentage of dwellings in the residential sector or square feet in the nonresidential sector where the measure is applicable and where it is technically feasible to implement.	AEG DEEM Other secondary sources
On Market and Off Market Availability	Expressed as years for equipment measures to reflect when the equipment technology is available or no longer available in the market.	AEG appliance standards and building codes analysis

2015 Residential Customer Energy Survey Results[9]

Space and Water Heating

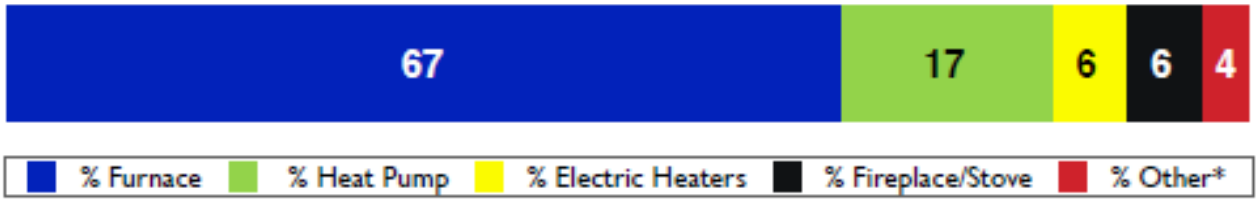
The majority of Empire customers (52%) heat their homes primarily with electricity, followed by 38% with natural gas and 7% with propane. Most Empire customers (67%) use a central warm air furnace as their home's primary heating system.

Figure 1 Primary Heating Fuel for Home



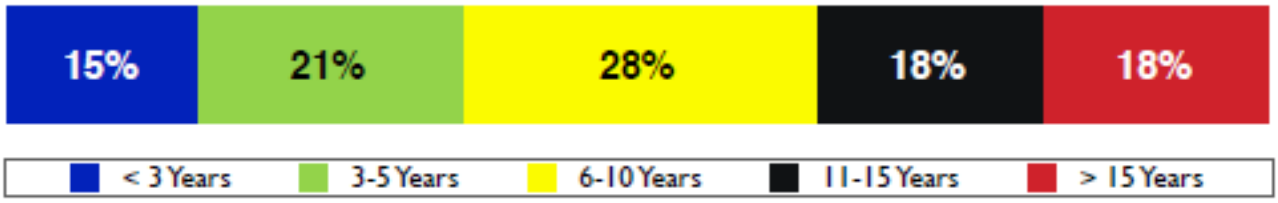
* Wood (60 respondents), pellet stove (4), geothermal (1), heat pump (1), unspecified (2).

Figure 2 Primary Heating System for Home



A plurality of respondents (28%) said their primary home heating system is between six and ten years old. The percentage of respondents with newer home heating systems (15%) is about the same as those with older systems (18%).

Figure 3 Age of Home Heating System

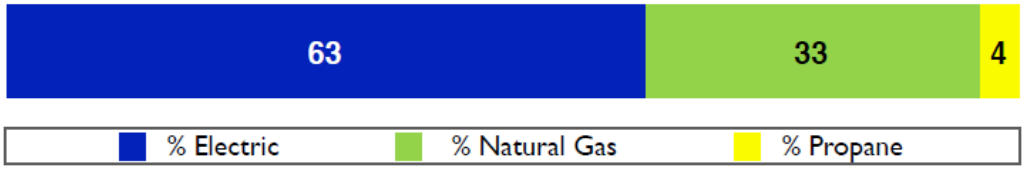


Electricity is the primary water heating fuel for most respondents (63%), followed by natural gas (33%) and propane (4%). Nearly 60% of respondents noted their hot water heater is three to ten years old (58%). Less than 10% have a primary water heater more than 15 years old. The most common size of hot water heater is 40 gallons followed by 30 gallons (38% and 29%, respectively). Approximately 95% of respondents have just one water heater in the home, while 5% have two water

[9] See the Empire District Electric Company's Residential Customer Energy Survey 2015.

heaters, and 1% have three or more. Standard tank is the type of hot water heating system used by 97% of respondents.

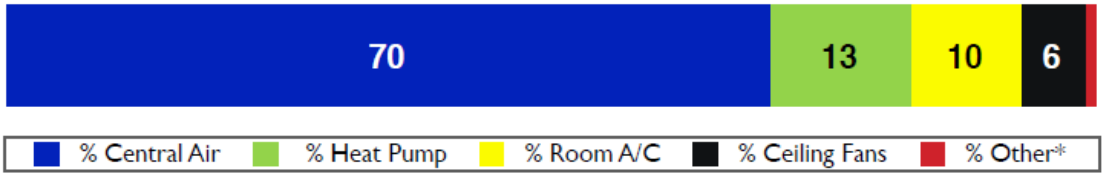
Figure 4 Primary Fuel for Water Heating



Cooling

The vast majority of customers (70%) rely on central air conditioning as the primary method of cooling their home. Slightly more than 50% of respondents said their home cooling system is either three-to-five years old (24%) or six-to-ten years old (29%). The percentage of respondents with newer home cooling systems (16%) is about the same as those with older systems (14%). A slim majority of homes (51%) are equipped with manually adjusted thermostats, while 44% have programmable thermostats (5% of respondents said their home has no thermostat).

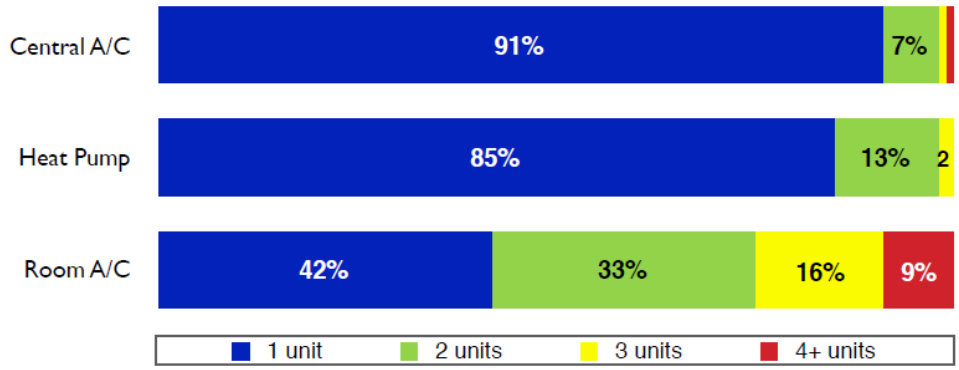
Figure 5 Primary Cooling System for Home



* Attic fan (4 respondents), fans (4), water cooler (1), unspecified (1), and do not cool home (7).

The vast majority of respondents who cooled their home using either a central air conditioner or a heat pump have only one unit. Those using room air conditioners as their primary cooling method are more likely to have two or more units (58%) as opposed to a single unit (42%).

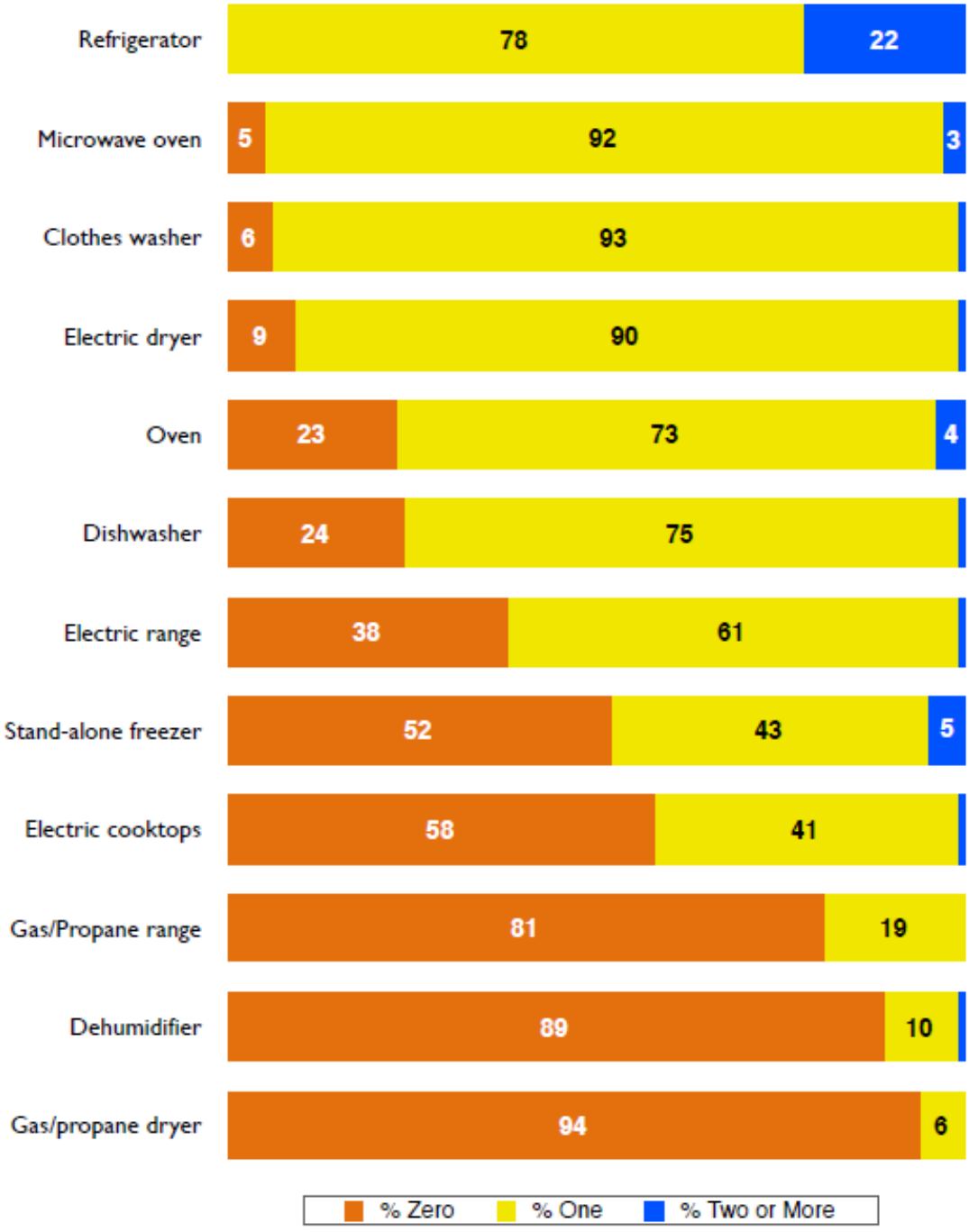
Figure 6 Number of Cooling Systems



Appliances

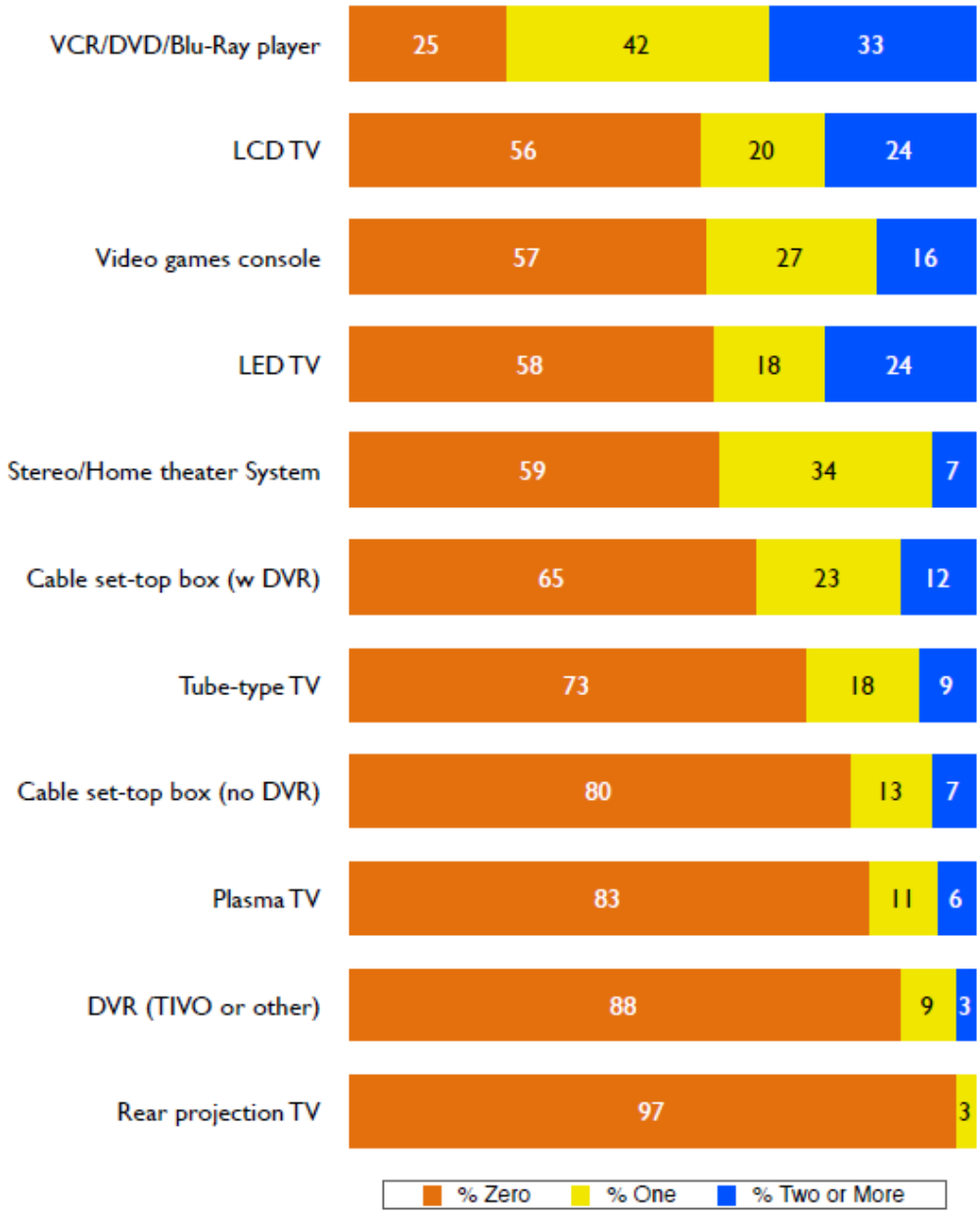
At least 90% of respondents has at least one refrigerator, microwave oven, clothes washer, or electric clothes dryer. Most respondents have refrigerators that are three-to-ten years old (60%) and about 20% are less than three years old. At least 75% of respondents have an oven or a dishwasher. Relatively few homes are equipped with a gas/propane dryer (6%), dehumidifier (11%), or gas/propane range (19%).

Figure 7 Number of Household Appliances



Seventy-five percent have at least one VCR/DVD/Blu-Ray player in the home, and more than 40% have at least one LCD television, LED television, stereo/home theater system, or video game console. Very few homes are equipped with a rear projection TV (3%). About 65% of respondents have at least one computer laptop (25% have two or more) and at least one printer/copier/scanner. Approximately 50% have a tablet computer (20% had two or more), about 40% have a desktop computer, and 34% have a computer monitor. Very few homes have a fax machine (3%).

Figure 8 Number of Entertainment Devices in the Home

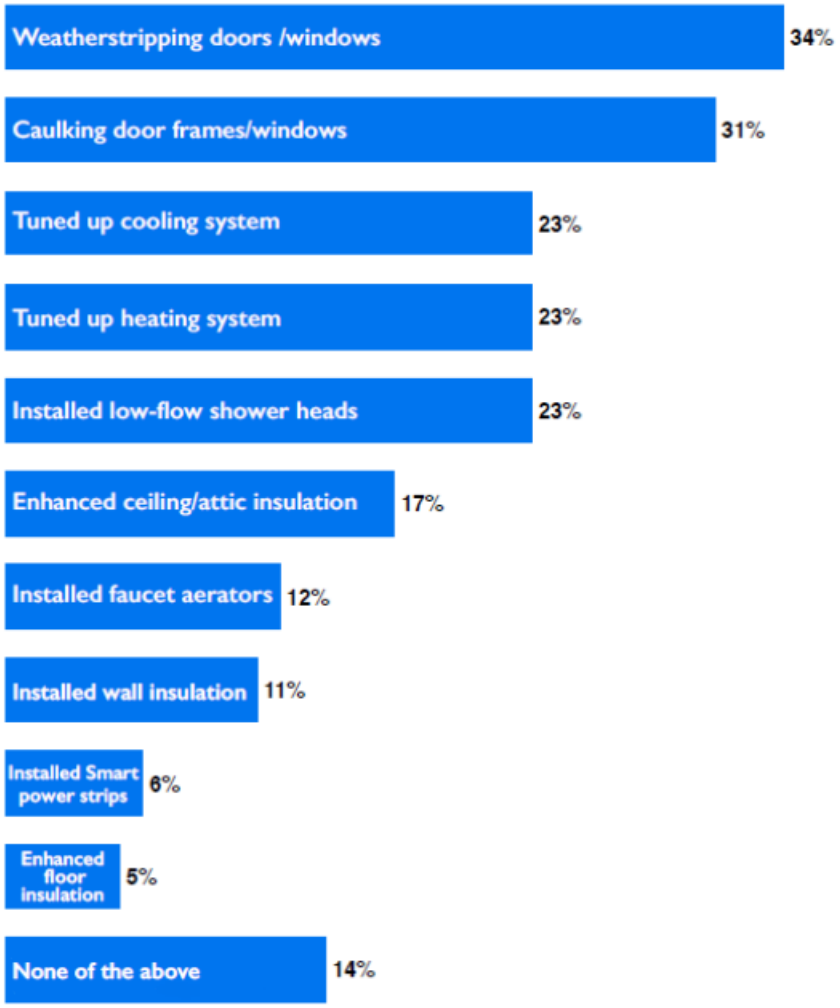


Home appliances/devices most likely to be highly energy efficient are televisions, clothes washers, clothes dryers, and refrigerators. By contrast, home appliances/devices least likely to be highly energy

efficient are room air conditioners, furnaces/boilers, and stand-alone freezer. A relatively large percentage of respondents (17% to 37%, depending on the appliance/device) are not sure if their appliances/devices are highly energy efficient or not.

Weatherstripping windows/doors (34%) and improving window/door caulking (31%) are the energy efficiency measures most likely to have been implemented over the past five years. Heating/cooling system tune-ups and installing low-flow shower heads are the next most likely measures to be undertaken (23% each). Less than 10% of respondents have enhanced their floor insulation or installed Smart power strips in the past five years.

Figure 9 Energy Efficient Measures Implemented in the Past 5 Years



SECTION 3 DEVELOPMENT OF POTENTIAL DEMAND-SIDE PROGRAMS

(3) The utility shall develop potential demand-side programs that are designed to deliver an appropriate selection of end-use measures to each market segment. The utility shall describe and document its potential demand-side program planning and design process which shall include at least the following activities and elements:

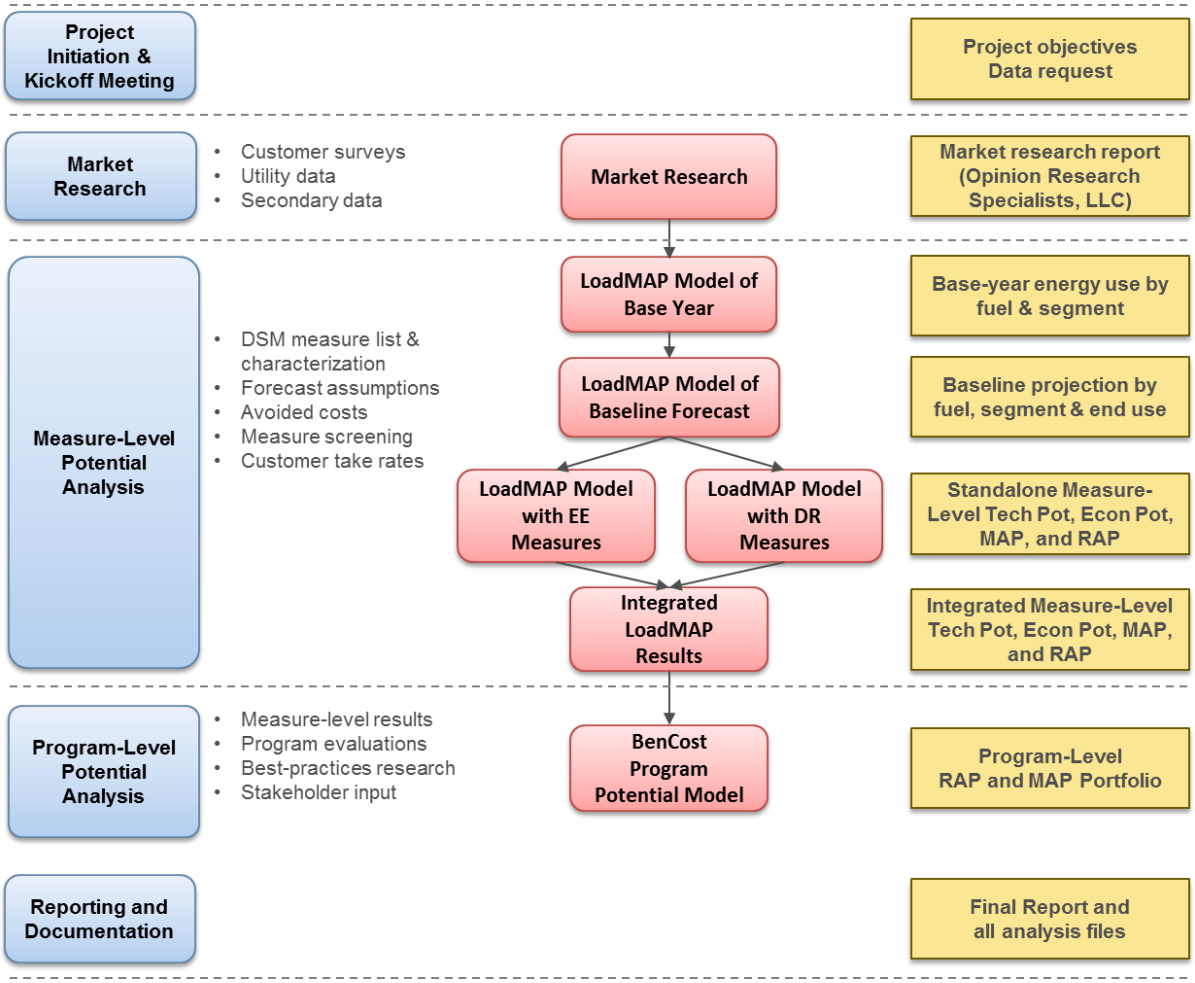
Empire engaged AEG to conduct a Demand-Side Management Potential Study in Empire's Missouri service territory. To perform the potential analysis, AEG used a bottom-up approach following the major steps listed below. The steps are described in more detail throughout the remainder of this chapter.[10]

1) Perform a market characterization to describe sector-level electricity use for the residential and nonresidential sectors for the base year, 2014.
2) Develop a baseline projection of energy consumption and peak demand by sector, segment, and end use for 2016 through 2035.
3) Define and characterize demand-side resources to be applied to all sectors, segments, and end uses.
4) Estimate measure-level technical, economic, and achievable potential in terms of energy and peak demand impacts from each demand-side resource 2016 through 2035.
5) Develop estimates of program-level potential based on the measure-level potential by assigning specific delivery mechanisms and program cost structures.

For the measure-level energy efficiency potential analysis, AEG used its Load Management Analysis and Planning tool (LoadMAP™) version 4.0 to develop both the baseline projection and the estimates of potential. AEG developed LoadMAP in 2007 and has enhanced it over time, using it for more than 50 studies in the past five years.

[10] See the Empire District Electric Company DSM Market Potential Study for the full report.

Figure 10 Potential Analysis Framework



Market Characterization

In order to estimate the savings potential from energy-efficient measures, it is necessary to understand how much energy is used today and what equipment is currently being used. The characterization begins with a segmentation of Empire's electricity footprint to quantify energy use by sector, segment, end-use application, and the current set of technologies used.

Table 9 Overview of Empire Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, Nonresidential
2	Segment	Residential: Single Family, Multifamily, Single Family Low Income, and Multifamily Low Income Nonresidential: Small and Large
3	Vintage	Existing and new construction
4	End use	Cooling, lighting, water heat, motors, etc. (as appropriate)
5	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, motors by application, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

With the segmentation scheme defined, AEG then performed a high-level market characterization of electricity sales in the base year, 2014, to allocate sales to each customer segment. AEG used Empire data and secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count, energy consumption, and peak demand matched the Empire system totals from 2014 billing data. This information provided control totals at a sector level for calibrating the LoadMAP model to known data for the base-year.

Total electricity use for Empire in 2014 was 3,872 GWh. As shown in Table 10, the residential sector accounts for approximately fifty-one percent (51%) of annual energy use, followed by nonresidential with 49%. In terms of summer peak demand, the total system peak in 2014 was 1,083 MW. The residential sector contributes the most to peak with 59%, due to the saturation of air conditioning equipment.

Table 10 Empire Sector Control Totals (2014)

Sector	Annual Electricity Use (GWh)	% of Annual Use	Summer Peak Demand (MW)	% of Summer Peak
Residential	1,958	51%	641	59%
Nonresidential	1,914	49%	442	41%
Total	**3,872**	**100%**	**1,083**	**59%**

Residential Sector

The total number of households and electricity sales for the service territory were obtained from Empire's customer database. In 2014, there were 141,838 households in the Empire service territory that used a total of 1,958 GWh with peak demand of 641 MW. AEG allocated these totals into four residential segments.

Table 11 Residential Sector Control Totals (2014)

Segment	Number of Customers	Electricity Sales (GWh)	% of Total Usage	Avg. Use/ Customer (kWh)	Peak Demand Summer (MW)
Single Family, Non Low Income	98,601	1,485	76%	15,056	487
Multi Family, Non Low Income	6,802	56	3%	8,187	16
Single Family, Low Income	30,688	378	19%	12,305	127
Multi Family, Low Income	5,747	40	2%	6,922	12
Total	**141,838**	**1,958**	**100%**	**13,802**	**641**

Figure 11 shows the distribution of annual electricity use and summer peak demand by end use for all residential customers. Three end uses — space heating, appliances and cooling — account for 61% of total electricity use. Appliances include refrigerators, freezers, stoves, clothes washers, clothes dryers, dishwashers, and microwaves. The remainder of the energy falls into the electronics, lighting, heating, water heating, and the miscellaneous category – which is comprised of furnace fans, pool pumps, and other "plug" loads (all other usage, such as hair dryers, power tools, coffee makers, etc.). As expected, air conditioning is the largest contributor to summer peak demand, followed by appliances. Lighting has low peak coincidence and makes a small contribution.

Figure 11 Residential Electricity Use and Summer Peak Demand by End Use (2014)

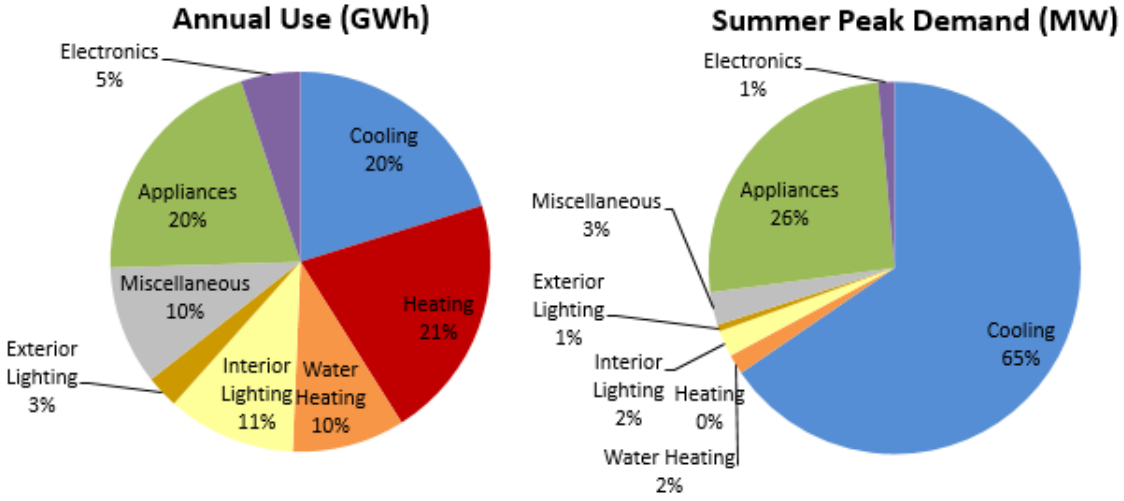
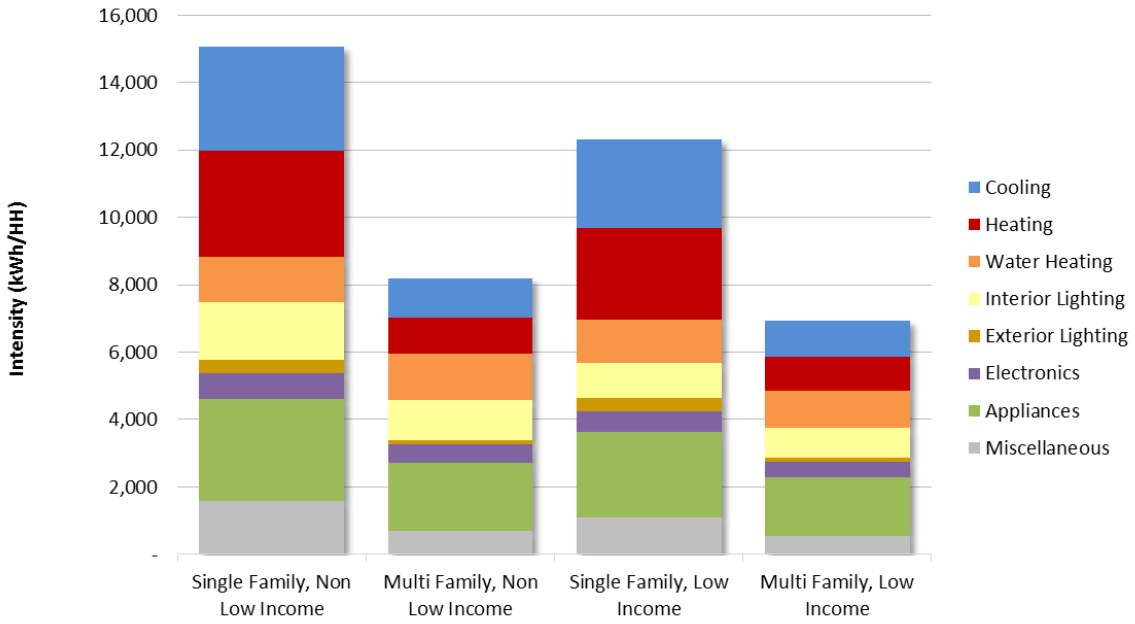


Figure 12 presents the electricity intensities (kWh per household) by end use. Single family homes have higher use across all end uses primarily due to larger home size.

Figure 12 Residential Intensity by End Use and Segment (Annual kWh/HH, 2014)



Nonresidential Sector

In 2014, nonresidential customers consumed 1,914 GWh in Empire's service territory. Empire billing data and secondary data were used to allocate this energy usage into two segments and to develop estimates of energy intensity (annual kWh/square foot). AEG analyzed Empire's nonresidential customer billing data and determined that there would be two segments, small and large nonresidential customers. The break point for differentiating the segments is 1,000 MWh annual use in 2014. Customers with usage equal to and above the threshold were characterized as large nonresidential, all other customers were considered small nonresidential.

The nonresidential sector excludes customers that opt-out of Empire's DSIM charge (as of September 2015). These opt-out customers have been removed since they have elected not to participate in energy efficiency programs and are therefore not applicable to the analysis. For the purpose of the analysis, the number of opt-out customers and the opt-out electricity load is held constant throughout the forecast.

Table 12 Nonresidential Sector Control Totals (2014)

Segment	Electricity Sales (GWh)	% of Total Usage	Avg. Use / Square Foot (kWh)	Summer Peak Demand (MW)
Small Nonresidential	1,157	60%	11.0	237
Large Nonresidential	757	40%	42.0	205
Total	**1,914**	**100%**	**15.6**	**442**

Figure 13 shows the distribution of annual electricity consumption by end use for the small and large nonresidential segments. The lighting and cooling end uses account for a significant portion of

electric usage in the small nonresidential segment. By contrast, large nonresidential usage is dominated by motors and process end uses. Figure 14 shows the nonresidential peak summer demand by end use for both the small and large nonresidential segments. Cooling dominates both segments.

Figure 13 Nonresidential Sector Electricity Consumption by End Use (2014)

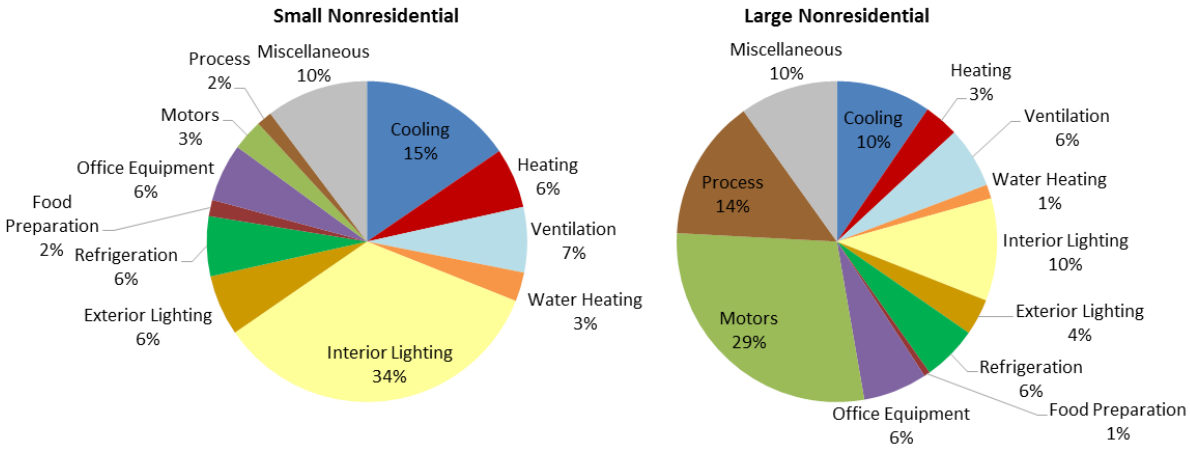
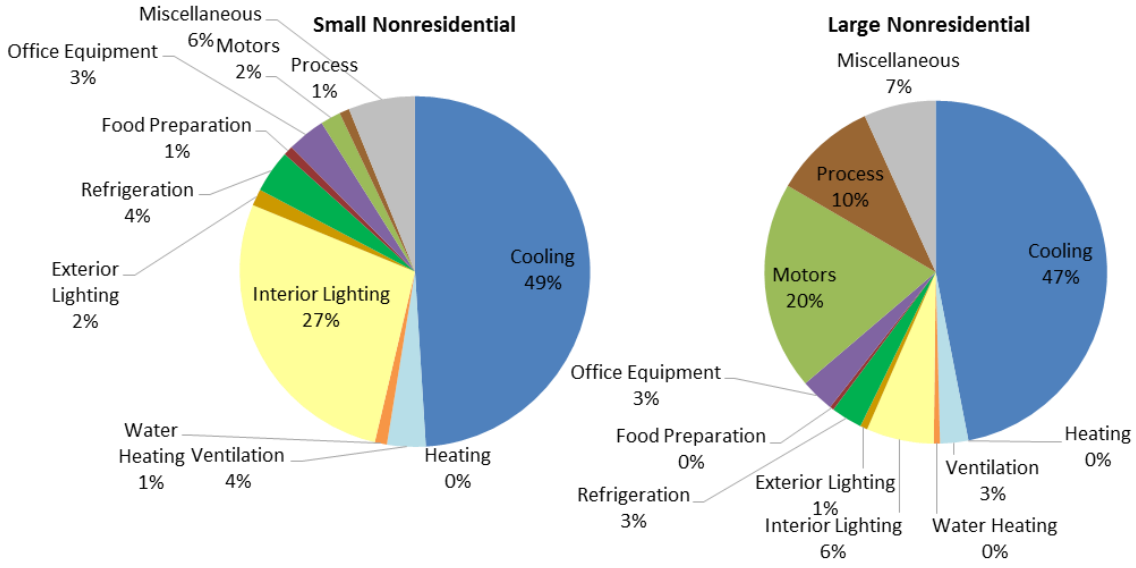


Figure 14 Nonresidential Sector Electricity Peak Summer Demand by End Use (2014)



Baseline End-Use Projection

Prior to developing estimates of energy-efficiency potential, AEG developed a baseline end-use projection to quantify what the consumption is likely to be in the future in the absence of energy-efficiency programs after 2015. Savings from past programs are embedded in the projection, but the baseline projection assumes that those past programs cease to exist in the future. Possible savings from future programs are captured by the potential estimates.

The baseline projection incorporates assumptions regarding:

- Customer population and economic growth
- Appliance/equipment standards and building codes already mandated
- Forecasts of future electricity prices and other drivers of consumption
- Trends in fuel shares and appliance saturations and assumptions about miscellaneous electricity growth
- Naturally occurring energy efficiency, which reflects the manufacturing of more efficient options in response to new appliance standards and purchases of high-efficiency appliances and equipment by early adopters outside of utility programs.

Because the baseline projection includes the effects of naturally occurring energy efficiency, it is referred to it as the "net" baseline projection in the remainder of this section.

Although it aligns closely, the baseline projection is not Empire's official load forecast. Rather it was developed to serve as the metric against which DSM potentials are measured. This section presents the baseline projections AEG developed for this study.

Below, baseline projections for each sector are presented, which include projections of annual use in GWh and summer peak demand in MW. A summary across all sectors is also presented.

Residential Sector Baseline Projection

Table 13 and Figure 15 present AEG's net baseline projection for electricity at the end-use level for the residential sector as a whole. Overall, residential usage remains relatively flat, increasing only slightly from 1,958 GWh in 2014 to ** ** in 2035, an increase of ** **. The unevenness of the projection is due to federal codes and standards coming into effect. Table 13 shows the estimate of naturally occurring energy efficiency, which has the greatest impact in the lighting end

uses due to early adoption of LED lamps. Most noticeable is that lighting use decreases throughout the time period as the lighting standards from EISA[11] come into effect.

Table 13 Residential Baseline Projection by End Use (Net GWh)

*****Highly Confidential in its entirety*****

Figure 15 Residential Baseline Projection by End Use (Net GWh)

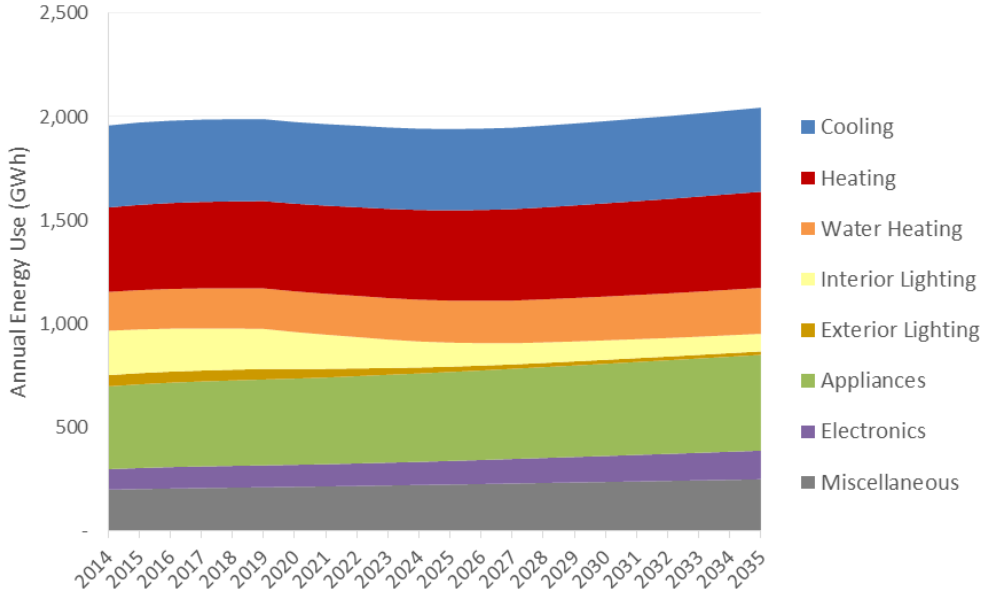


Table 14 shows the end-use projection at the technology level for select years. This projection is in general alignment with Empire's residential load forecast. Specific observations include:

[11] Energy Independence and Security Act. Passed in 2007, the law improved fuel economy, created standards for appliances, industrial motors, lighting, and more. The efficiency standards for lighting became effective in 2012 and have begun to transform the market. http://www2.epa.gov/laws-regulations/summary-energy-independence-and-security-act

1) Lighting use continues to decline in the early years of the projection, reflecting the first phase of the EISA lighting standard. Lighting energy use declines more dramatically, starting in 2020, as a result of the second phase of the EISA lighting standard.

2) Growth in electronics is substantial and reflects an increase in the saturation of electronics and the trend toward higher-powered computers. Growth in other miscellaneous use is also substantial. This end use has grown consistently in the past and future growth assumptions that are consistent with the Annual Energy Outlook are incorporated.

Table 14 Residential Baseline Projection by End Use and Technology (Net GWh)

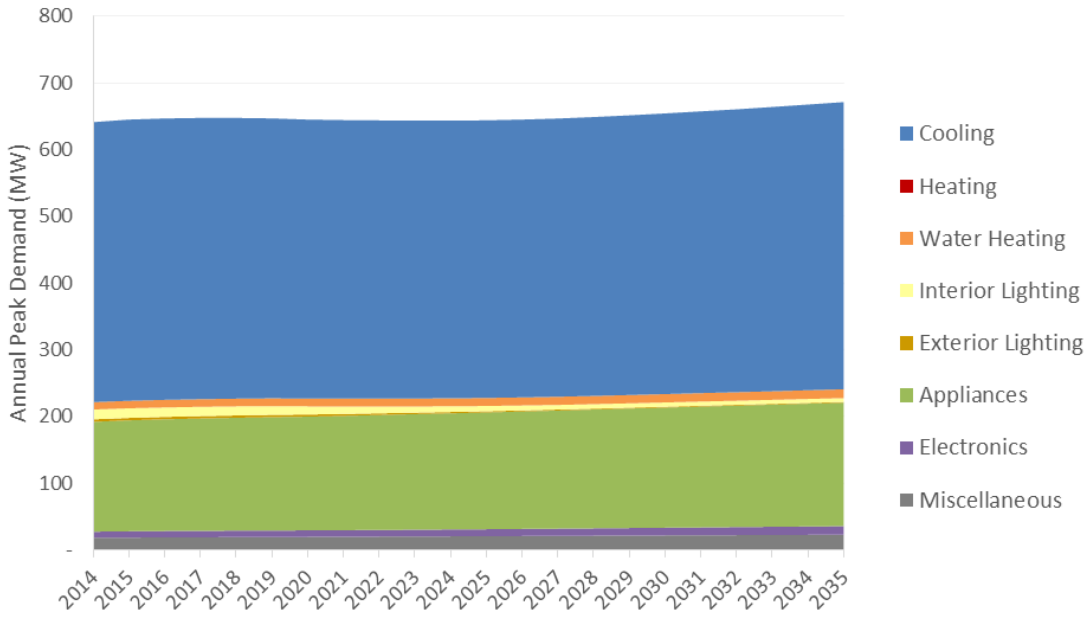
Highly Confidential in its entirety

Table 15 and Figure 16 present the residential baseline projection for summer peak demand at the end-use level. Overall, residential summer peak increases slightly from 641 MW in 2014 to ** ** in 2035. The summer peak associated with electronics and miscellaneous uses increases substantially, in correspondence with growth in annual energy use.

Table 15 Residential Summer Peak Baseline Projection by End Use (Net MW)

*****Highly Confidential in its entirety*****

Figure 16 Residential Summer Peak Baseline Projection by End Use (Net MW)



Nonresidential Sector Baseline Projection

Net annual electricity use in the nonresidential sector remains relatively flat over the forecast horizon, starting at 1,914 GWh in 2014, and increasing slightly to ** ** in 2035. Table 16 and Figure 17 present the baseline projection at the end-use level for the nonresidential sector as a whole. Usage in lighting declines throughout the projection, due largely to the phasing in of appliance standards such as the EISA lighting standards, as well as naturally occurring energy efficiency. Growth in miscellaneous use is substantial, this end use has grown consistently in the past and we incorporate future growth assumptions that are consistent with the Annual Energy Outlook.

Table 16 Nonresidential Baseline Projection by End Use (Net GWh)

*****Highly Confidential in its entirety*****

Figure 17 Nonresidential Baseline Projection by End Use (GWh)

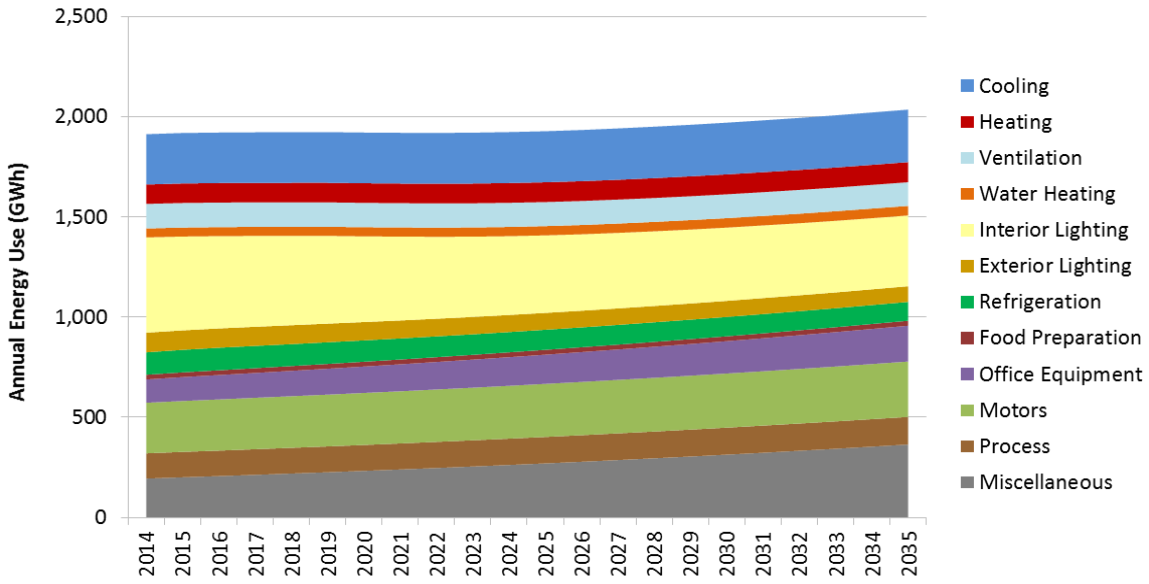


Table 17 presents the nonresidential sector annual projection by technology for select years. Screw-in lighting and refrigeration technologies decrease significantly over the timeline as a result of efficiency standards.

Table 17 Nonresidential Baseline Projection by End Use and Technology (Net GWh)

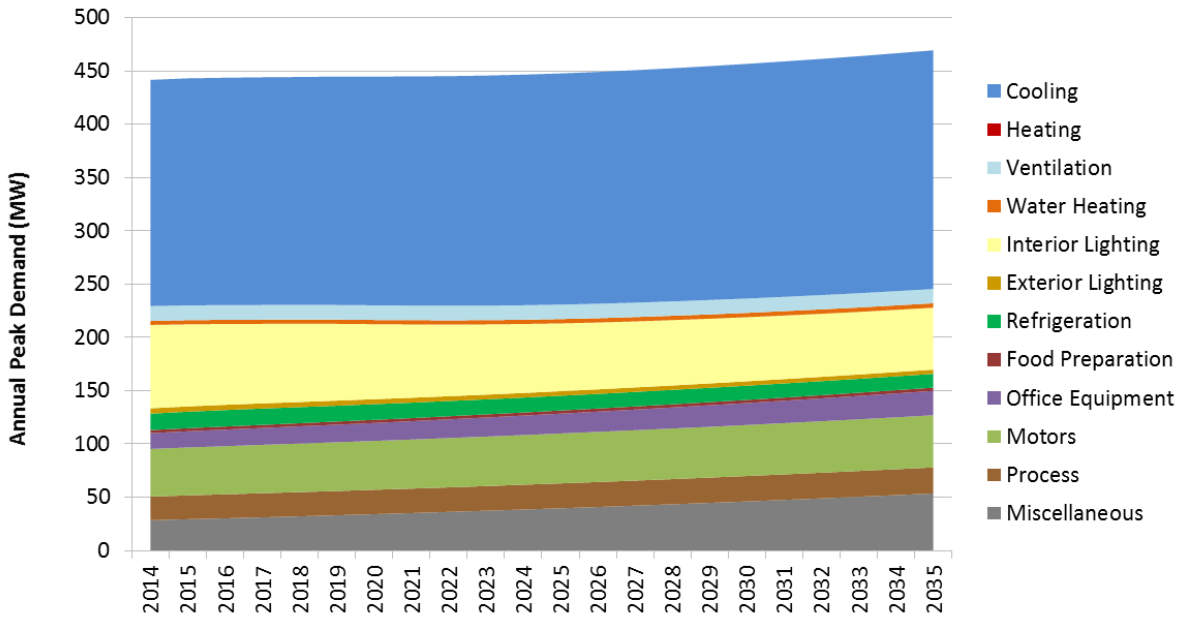
*****Highly Confidential in its entirety*****

Table 18 and Figure 18 present the net summer peak baseline projection at the end-use level for the nonresidential sector as a whole. Summer peak demand increases over the forecast horizon, starting at 442 MW in 2014 and increasing to **469 MW** in 2035. The peak increases primarily due to customer growth within the sector.

Table 18 Nonresidential Summer Peak Baseline Projection by End Use (Net MW)

*****Highly Confidential in its entirety*****

Figure 18 Nonresidential Summer Peak Baseline Projection by End Use (Net MW)



Summary of Baseline Projection across Sectors

Table 19 provides a summary of the baseline projection for net annual use by sector for the entire Empire service territory. Overall, the projection shows a small increase in electricity use, driven primarily by customer growth projections. The average annual growth rate across both sectors over the forecast horizon is ** .**

Table 19 Baseline Projection Summary (Net GWh)

*****Highly Confidential in its entirety*****

Table 20 provides a summary of the baseline projection for net summer peak demand. Overall, the projection increases primarily due to customer growth.

Table 20 Baseline Summer Peak Projection Summary (Net MW)

*****Highly Confidential in its entirety*****

Energy Efficiency Potential

In this study, the energy efficiency potential estimates represent net savings[12] developed into several levels of potential. At the measure-level, before delivery mechanisms and program costs are considered, there are four levels: technical potential, economic potential, maximum achievable potential, and realistic achievable potential. Technical and economic potential are both theoretical limits to efficiency savings and would not be realizable in actual programs. Achievable potential embodies a set of assumptions about the decisions consumers make regarding the efficiency of the equipment they purchase, the maintenance activities they undertake, the controls they use for energy-consuming equipment, and the elements of building construction. These levels are described in more detail below.

- **Technical Potential** is the theoretical upper limit of energy efficiency potential, assuming that customers adopt all feasible measures regardless of cost or customer preference. At the time of existing equipment failure, customers replace their equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option.
- **Economic Potential** represents the adoption of all ***cost-effective*** energy efficiency measures. Cost-effectiveness is measured by the total resource cost (TRC) test, which compares lifetime energy and capacity benefits to the costs of the delivering the measure. If the benefits outweigh the costs (the TRC ratio is equal to or greater than 1.0), a given measure is included in the economic potential. Customers are then assumed to purchase the most cost-effective option applicable to them at any decision juncture. Economic potential is still a hypothetical upper-boundary of savings potential as it represents only measures that are economic but does not yet consider customer acceptance and other factors.
- **Maximum Achievable Potential** (MAP) estimates customer adoption of economic measures when delivered through DSM programs under ideal market, implementation, and customer preference conditions and an appropriate regulatory framework. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with trade allies and delivery partners. Maximum Achievable Potential establishes a maximum target for the savings that an administrator can hope to achieve through its DSM programs and involves incentives that represent a substantial portion of the incremental cost combined with high administrative and marketing costs.

[12] Savings in "net" terms instead of "gross" terms mean that the baseline forecast does include naturally occurring efficiency. In other words, the baseline assumes that energy efficiency levels reflect that some customers are already purchasing the more efficient option.

- **Realistic Achievable Potential (RAP)** reflects expected program participation given barriers to customer acceptance, non-ideal implementation conditions, and limited program budgets.

Table 21 and Figure 19 summarize the energy efficiency savings in terms of annual energy use for all measures for four levels of potential relative to the Empire load forecast. Figure 20 displays the EE projections versus the baseline. Please note that only selected years of the projection are shown (2016-2019, 2025 and 2035).

- Technical potential reflects the adoption of all EE measures regardless of cost-effectiveness. First-year savings are 129 GWh, or ** **of the baseline projection. Cumulative savings in 2035 are 1,399 GWh, or ** ** of the baseline projection.

- Economic potential reflects savings when the most efficient cost-effective measures are taken by all customers. The first-year savings in 2016 are 82 GWh, or ** ** of the baseline projection. By 2035, cumulative savings reach 884 GWh, or ** ** of the baseline projection.

- Maximum achievable potential represents savings that are possible through utility programs under ideal implementation conditions. It shows 39 GWh savings in the first year, or ** ** of the baseline projection and by 2035 cumulative achievable savings reach 575 GWh, or ** ** of the baseline projection.

- Realistic achievable potential represents savings that are possible through utility programs. It shows 22 GWh savings in the first year, or ** ** of the baseline projection and by 2035 cumulative achievable savings reach 330 GWh, or ** ** of the baseline projection.

Table 21 Summary of Energy Efficiency Potential (Annual Energy, GWh)

	2016	** **	** **	** **	** **	** **
Empire Baseline Projection (GWh)	** **	** **	** **	** **	** **	** **
Cumulative Savings (GWh)						
Realistic Achievable Potential	22	41	61	81	172	330
Maximum Achievable Potential	39	73	108	143	304	575
Economic Potential	82	150	218	280	514	884
Technical Potential	129	231	340	439	866	1,399
Cumulative Savings as a % of Baseline						
Realistic Achievable Potential	** **	** **	** **	** **	** **	** **
Maximum Achievable Potential	** **	** **	** **	** **	** **	** **
Economic Potential	** **	** **	** **	** **	** **	** **
Technical Potential	** **	** **	** **	** **	** **	** **

Figure 19 Summary of Energy Efficiency Potential as % of Empire Baseline Projection (Annual Energy)

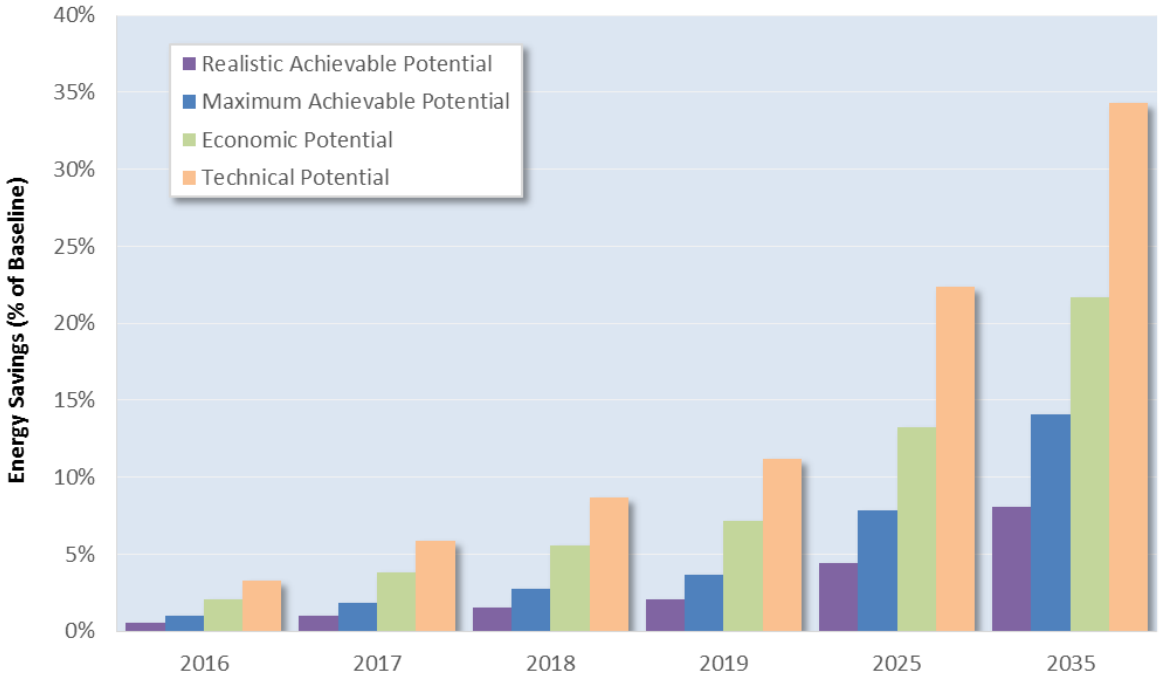


Figure 20 Empire Baseline Projection and Implied Forecasts with Energy Efficiency Potential Cases (Annual Energy, GWh)

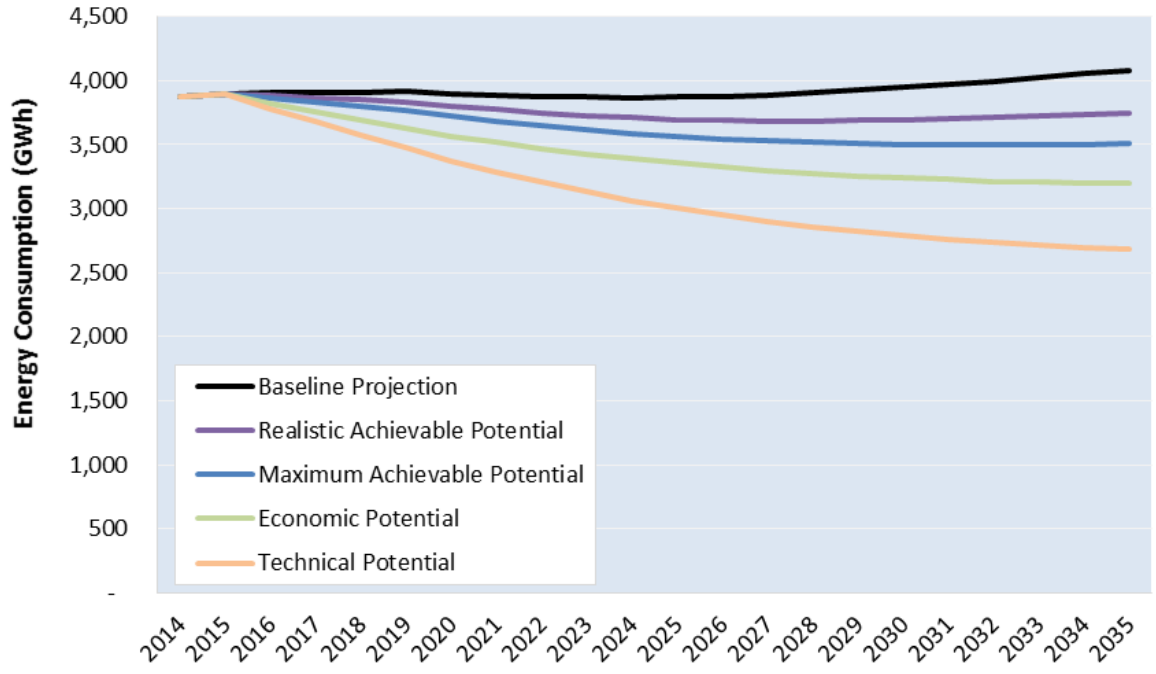
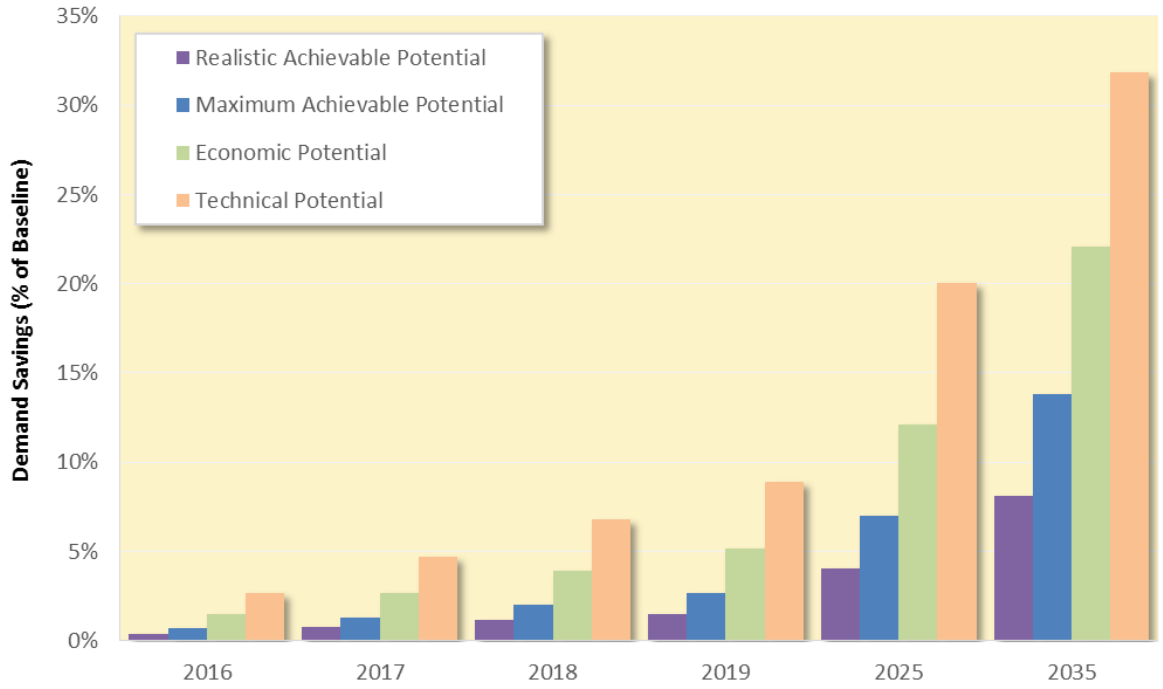


Table 22 summarizes the summer peak demand savings from all energy efficiency measures for four levels of potential relative to the baseline projection.

Table 22: Summary of Energy Efficiency Potential (Summer Peak, MW)

	2016	2017	2018	2019	2025	2035
Empire Baseline Projection (MW)	** **	** **	** **	** **	** **	** **
Cumulative Savings (MW)						
Realistic Achievable Potential	5	9	13	18	46	96
Maximum Achievable Potential	8	15	23	31	81	165
Economic Potential	17	31	45	59	138	261
Technical Potential	29	51	75	97	223	371
Cumulative Savings as a % of Baseline						
Realistic Achievable Potential	** **	** **	** **	** **	** **	** **
Maximum Achievable Potential	** **	** **	** **	** **	** **	** **
Economic Potential	** **	** **	** **	** **	** **	** **
Technical Potential	** **	** **	** **	** **	** **	** **

Figure 21 Summary of Peak Demand Savings



Residential Energy Efficiency Potential

Table 23 and

Figure 22 present estimates for measure-level energy efficiency potential for the residential sector in terms of annual energy savings. Realistic achievable potential in the first year in 2016 is 16 GWh, or ** ** of the baseline projection. By 2035, cumulative achievable savings are 176 GWh, or ** ** of the baseline projection.

Table 23 Residential Energy Efficiency Potential (Annual Energy, GWh)

	2016	2017	2018	2019	2025	2035
Empire Baseline Projection (GWh)	** **	** **	** **	** **	** **	** **
Cumulative Savings (GWh)						
Realistic Achievable Potential	16	28	41	53	92	176
Maximum Achievable Potential	27	48	68	88	148	281
Economic Potential	64	113	158	198	292	494
Technical Potential	93	157	216	268	454	742
Cumulative Savings as a % of Baseline						
Realistic Achievable Potential	** **	** **	** **	** **	** **	** **
Maximum Achievable Potential	** **	** **	** **	** **	** **	** **
Economic Potential	** **	** **	** **	** **	** **	** **
Technical Potential	** **	** **	** **	** **	** **	** **

Figure 22 Residential Energy Efficiency Savings as a % of Baseline (Annual Energy)

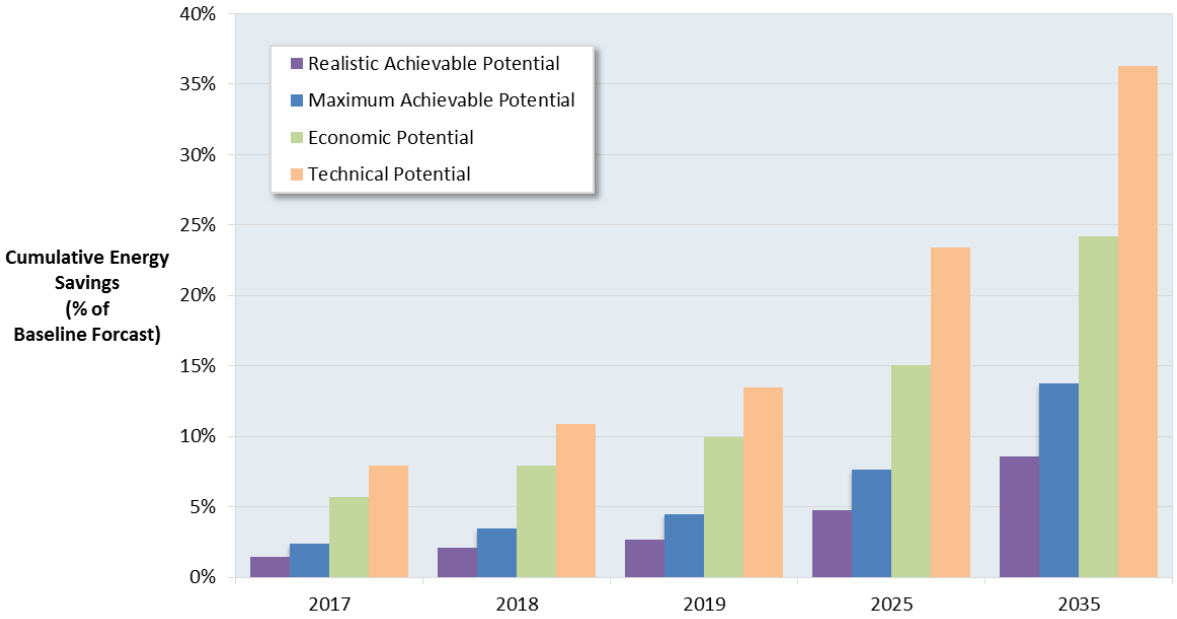


Table 24 and show residential energy efficiency potential in terms of summer peak savings. In the first year in 2016, realistic achievable summer peak savings are 3 MW. By 2035, cumulative realistic achievable summer peak savings are 57 MW.

Table 24 Residential Energy Efficiency Potential (Summer Peak Demand, MW)

	2016	2017	2018	2019	2025	2035
Empire Baseline Projection (MW)	** **	** **	** **	** **	** **	** **
Cumulative Savings (MW)						
Realistic Achievable Potential	3	6	8	11	26	57
Maximum Achievable Potential	5	9	13	17	41	90
Economic Potential	13	22	30	38	82	162
Technical Potential	22	38	53	68	146	249
Cumulative Savings as a % of Baseline						
Realistic Achievable Potential	** **	** **	** **	** **	** **	** **
Maximum Achievable Potential	** **	** **	** **	** **	** **	** **
Economic Potential	** **	** **	** **	** **	** **	** **
Technical Potential	** **	** **	** **	** **	** **	** **

Figure 23 and Figure 24 present projections of energy savings by end use as a percent of total annual savings and cumulative savings. Lighting savings account for a substantial portion of the savings throughout the projection horizon, but the share declines over time as the market is transformed. The same is true for exterior lighting. Water heater savings increase after 2021 as a result of heat pump water heaters becoming cost-effective at that time. Savings from cooling measures and appliances are steadily increasing throughout the forecast horizon.

Figure 23 Residential Realistic Achievable Savings Forecast (Annual Energy, % of Total)

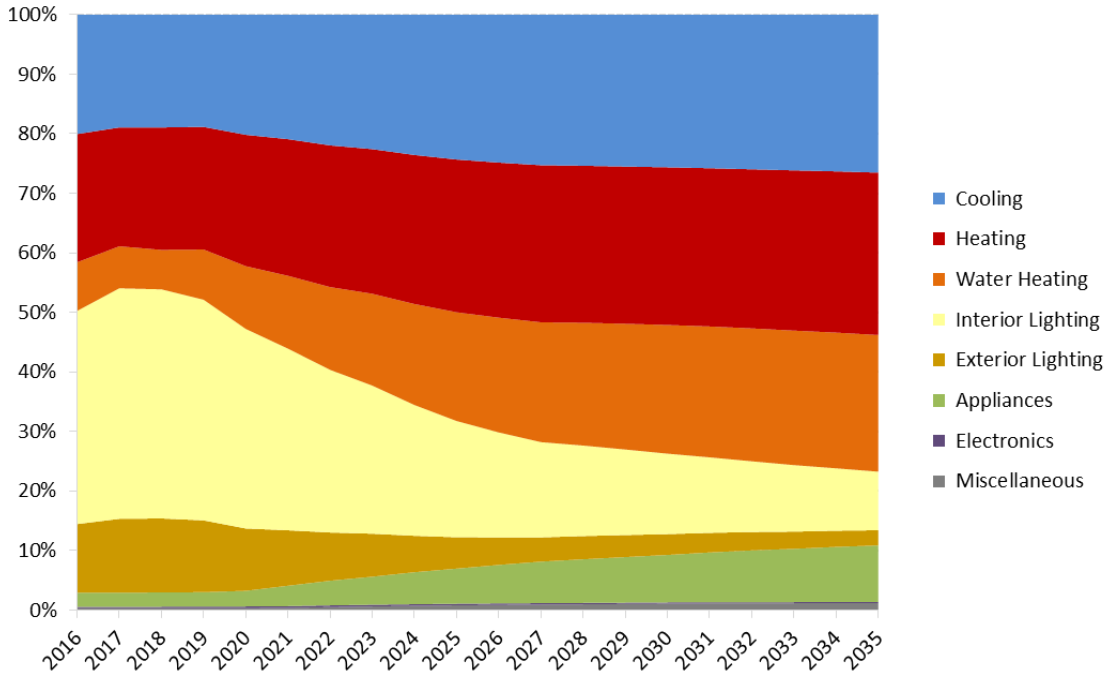
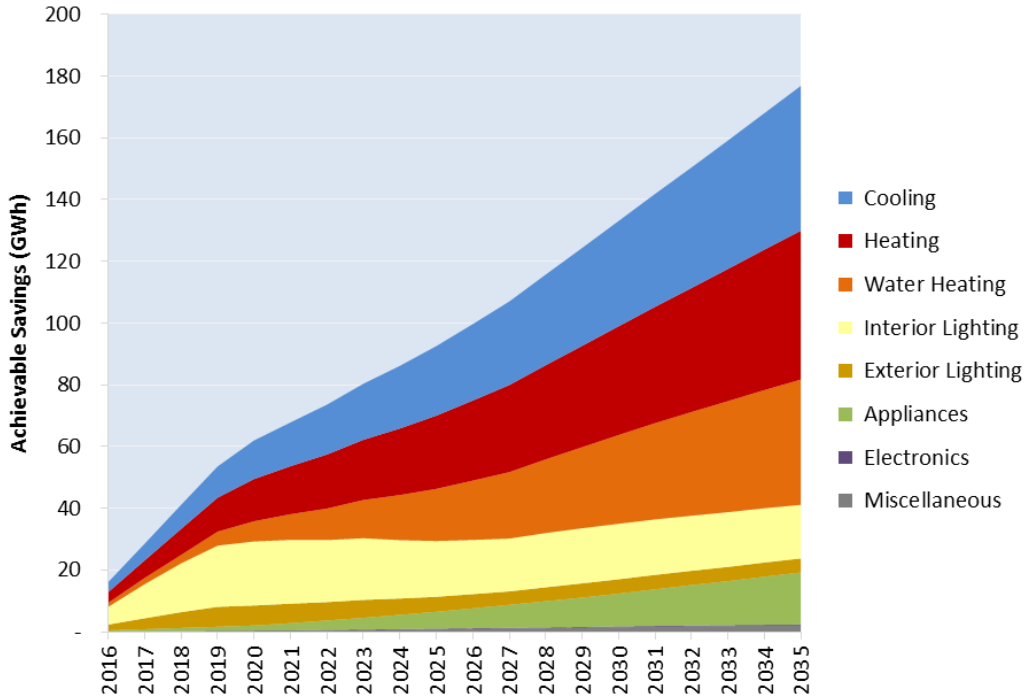


Figure 24 Residential Realistic Achievable Savings Forecast (Annual Energy, GWh)



Nonresidential Energy Efficiency Potential

Table 25 and Figure 25 present estimates for the four levels of energy efficiency potential for the nonresidential sector from the perspective of annual energy savings. In 2016, the first year of the projection, realistic achievable potential is 6 GWh, or ** ** of the Empire load forecast. By 2035, savings are 154 GWh, or ** ** of the forecast.

Table 25 Nonresidential Energy Efficiency Potential (Energy Savings)

	2016	2017	2018	2019	2025	2035
Empire Baseline Projection (GWh)	** **	** **	** **	** **	** **	** **
Cumulative Savings (GWh)						
Realistic Achievable Potential	6	13	20	27	80	154
Maximum Achievable Potential	12	25	40	55	156	293
Economic Potential	18	38	60	81	222	390
Technical Potential	36	74	124	171	411	658
Energy Savings as a % of Baseline						
Realistic Achievable Potential	** **	** **	** **	** **	** **	** **
Maximum Achievable Potential	** **	** **	** **	** **	** **	** **
Economic Potential	** **	** **	** **	** **	** **	** **
Technical Potential	** **	** **	** **	** **	** **	** **

Figure 25 Nonresidential Energy Efficiency Savings (% of Baseline)

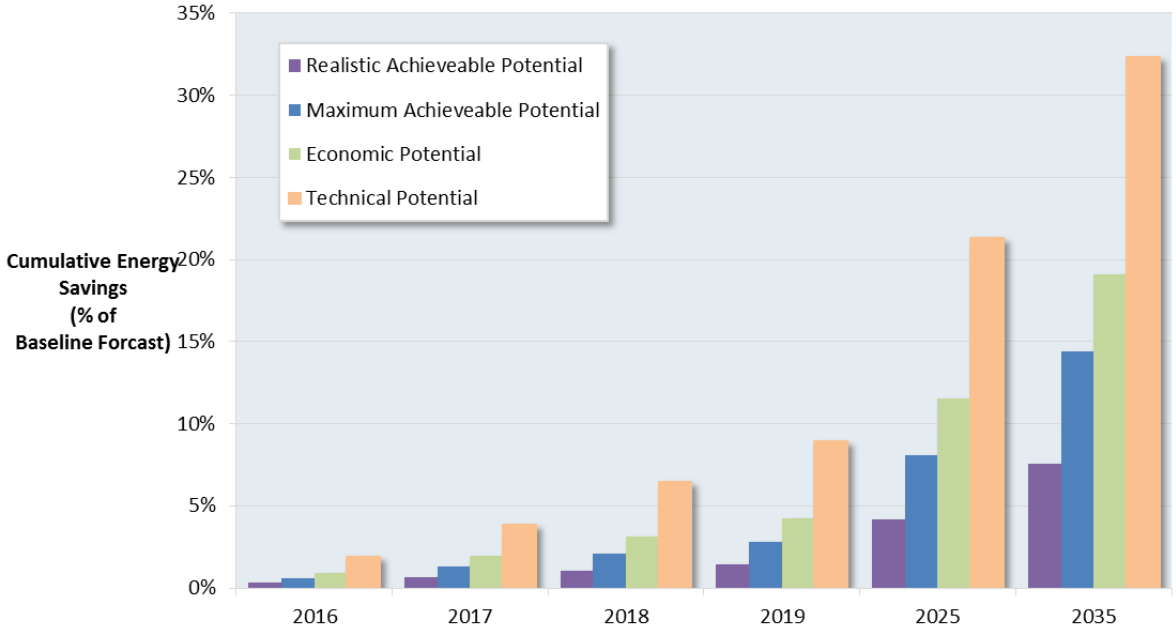


Table 26 presents savings estimates from the perspective of summer peak demand. In 2016, the first year of the projection, realistic achievable potential is 1.2 MW. By 2035, savings are 35.4 MW.

Table 26 Nonresidential Energy Efficiency Potential (Summer Peak Demand)

	2016	2017	2018	2019	2025	2035
Empire Baseline Projection (MW)	** **	** **	** **	** **	** **	** **
Cumulative Savings (MW)						
Realistic Achievable Potential	1.2	2.6	4.4	6.1	18.4	35.4
Maximum Achievable Potential	2.3	5.3	8.7	12.1	35.8	67.9
Economic Potential	3.5	7.9	12.9	17.9	50.2	89.9
Technical Potential	7.0	13.3	21.3	29.2	72.6	114.7
Cumulative Savings as a % of Baseline						
Realistic Achievable Potential	** **	** **	** **	** **	** **	** **
Maximum Achievable Potential	** **	** **	** **	** **	** **	** **
Economic Potential	** **	** **	** **	** **	** **	** **
Technical Potential	** **	** **	** **	** **	** **	** **

Figure 26 and Figure 27 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Lighting savings from interior and exterior applications account for a substantial portion of the savings throughout the forecast horizon. Variable frequency drives deployed on fans, pumps compressed air and other end uses are yield savings especially for large nonresidential customers. Cooling savings are also substantial throughout the forecast.

Figure 26 Nonresidential Achievable Savings Forecast (Annual Energy, % of Total)

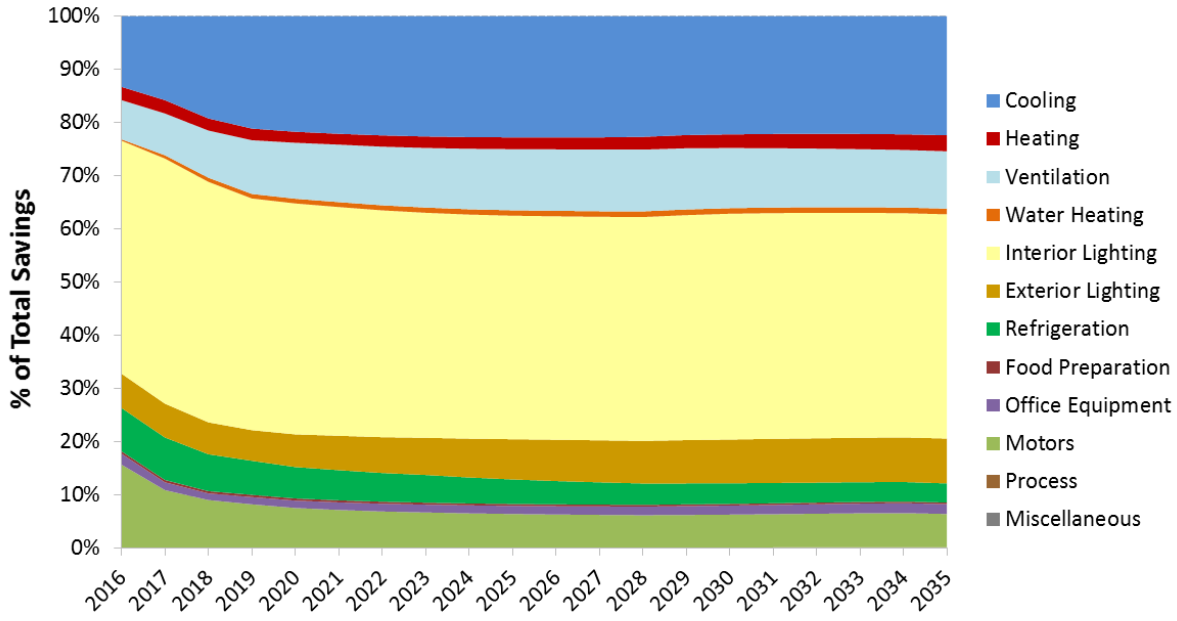
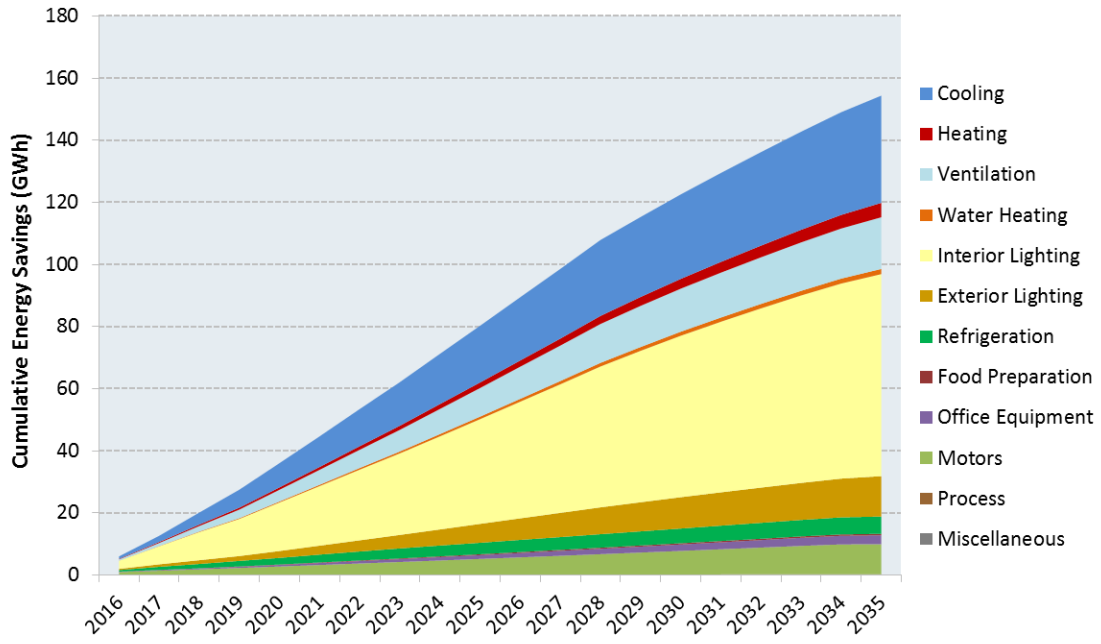


Figure 27 Nonresidential Achievable Savings Forecast (Annual Energy, GWh)



3.1 Previously Implemented Demand-Side Programs from Other Utilities

(A) Review demand-side programs that have been implemented by other utilities with similar characteristics and identify programs that would be applicable for the utility;

In order to further fulfill this requirement of the IRP rule, Empire analyzed the demand-side portfolios of KCP&L and Ameren Missouri. These utilities were chosen due to their proximity to Empire's service territory. However, Empire is smaller and more rural than other IOUs in Missouri.

In previous filings, Empire has also analyzed the energy efficiency portfolios of comparably-sized utilities in other states or regions. However, this did not prove to be a useful exercise. The rule section above specifies that the purpose of the exercise is to "identify programs that would be applicable for the utility." Comparably-sized investor-owned utilities in different states and regions encounter many differences in relevant, but difficult-to-analyze variables. These variables—which could include things like rate structures, energy efficiency rules, recovery mechanisms, regulatory environments, customer ideologies, and utility practices—would inevitably vary significantly from state to state or region to region. Empire has based its analysis of other Missouri investor-owned utilities on the assertion that, regardless of size,

the only utility that could possess enough "similar characteristics" to serve as a useful reference point would have to be a Missouri investor-owned utility.

Empire designed the proposed programs based upon the potential study results and potential program designs. The programs are designed to enhance Empire's current DSM portfolio and to expand the available program offerings to allow customers greater access to energy efficiency rebates and information while considering Empire's historical program performance and the demographics of Empire's customers. While many commonalities exist between Empire's proposed programs and KCP&L / Ameren Missouri's programs, there are some programs that were deemed not cost-effective or beneficial to Empire's service territory. For example, Residential Appliance Recycling measures are cost-effective but when bundled into a program were found to be non-cost-effective until 2022. Another example, Empire has not experienced significant participation in their ENERGY STAR New Homes program and have decided to remove the offering from the portfolio but enhance other programs for residential and nonresidential customers to benefit from energy savings technologies and measures.

Table 27 Demand-Side Program Review

Program	KCP&L[13]	Ameren MO	Empire IRP
Residential			
Lighting & Appliances	Instant incentives for CFLs and LEDs	– Online lighting and power strips incentives – Rebates for Energy Star appliances and heat pump water heater	X
Appliance Recycling	$50 refrigerator or freezer RAC/dehumidifier pick-up	$50 refrigerator or freezer RAC/dehumidifier pick-up	Future years
HVAC		Rebates available for space heating/ cooling, ECM motors, space heating/ cooling tune-up	X
Whole House	$50 Audit & Direct Install Kit Rebates for insulation/air sealing and HVAC equipment	$25 Audit & Direct Install kit Rebates for ceiling insulation, air sealing and ENERGY Star windows	X
Low Income	– Direct Install kits – Weatherization – Multi-Family common area	Weatherization	X
New Construction	n/a	Incentives for HVAC measures	No historic participation
Home Energy Report	Program with a low income component	n/a	X
Non-Residential Programs			
Business Prescriptive	Varying rebates for prescriptive measures	Varying rebates for prescriptive measures	X
Business Custom	Up to $250,000 per customer per year or 2x projected DSIM charge Incentive $0.10 per first year kWh saved, up to 50% of project cost	Incentive • Lighting $0.06/kWh • Non-Lighting $0.07/kWh	X
Small Business Direct Install	Free assessment and up to 70% lighting equipment and installation costs	n/a	No historic participation
Strategic Energy Management	$0.20 per first year kWh saved	n/a	Future years
Block Bidding	Customers purchase blocks of energy	n/a	Determined not be beneficial to Empire's territory
RCx	n/a	Financial assistance for studies, purchase and implementation of upgrades and re-commissioning efforts.	Future years
New Construction	n/a	Whole building performance; $/kWh incentives based on savings	No historic participation
Demand Response			
Programmable Thermostat	*Residential & Small Business* Free communicating thermostat and $25 per year	n/a	Future years
DR Incentive	Companies volunteer if they can reduce load by a minimum of 25 kW	n/a	Future years

[13] KCP&L Case No. EO-2015-0240, filed August 28, 2015.

3.2 Market Segment Identification

(B) Identify, describe, and document market segments that are numerous and diverse enough to provide relatively complete coverage of the major classes and decision-makers identified in subsection (1)(A) and that are specifically defined to reflect the primary market imperfections that are common to the members of the market segment;

Empire District Electric ("Empire" or "EDE") engaged Applied Energy Group ("AEG") to conduct a Demand-Side Management (DSM) Potential Study to assess the future potential for savings through its programs and to identify refinements that will enhance savings.

The first step in the analysis was to assess Empire's market. The market assessment defines the market segments (building types, end uses, and other dimensions) that are relevant in the Empire service territory. The segmentation scheme for this project is presented in Table 28.

Table 28 Overview of Empire Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, Nonresidential
2	Segment	Residential: Single Family, Multifamily, Single Family Low Income, and Multifamily Low Income Nonresidential: Small and Large
3	Vintage	Existing and new construction
4	End use	Cooling, lighting, water heat, motors, etc. (as appropriate)
5	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, motors by application, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

The residential market segments were determined from the 2015 Residential Customer Energy Survey that Empire commissioned in 2015.[14] The survey identified five home types which were condensed to two segments: single family (81% detached, 4% attached, 6% mobile/manufactured homes) and multi-family (4% with 2 to 4 units, 4% with 5 or more units).

[14] A total of 2,750 residential customers within Empire's Missouri, Arkansas, Kansas and Oklahoma service territory completed the six-page questionnaire. The survey included questions on general household characteristics, space and water heating equipment, cooling equipment, appliances, electronics, and energy efficiency actions.

AEG reviewed the survey data and determined that there was sufficient data to identify low income customers in single- and multi-family segments. Based on the US DOE WAP, the low income definition for Missouri is $48,500 for a family of four and $31,860 for a family of two. There is an average of 2.6 people per home based on the survey responses. Therefore, 'low income' was defined as an annual household income of less than $30,000 per year due to the ranges offered in the survey (the closest option was $30,000-$49,999). The definition of 'low income' customers was reviewed with stakeholders. There was concern that the percentage of customers was underestimated. Empire's median household income is approximately $38,000; coupled with the survey data and DOE WAP definition of low income customers in Missouri led AEG and Empire to keep the household income threshold at $30,000.

With the segmentation scheme defined, AEG then performed a high-level market characterization of electricity sales in the base year, 2014, to allocate sales to each customer segment. AEG used Empire data and secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count, energy consumption, and peak demand matched the Empire system totals from 2014 billing data. This information provided control totals at a sector level for calibrating the LoadMAP model to known data for the base-year.

The total number of households and electricity sales for the service territory were obtained from Empire's customer database. In 2014, there were 141,838 households in the Empire service territory that used a total of 1,958 GWh. AEG allocated these totals into four residential segments, identified from the Residential Customer Energy Survey that Empire commissioned in 2015 (shown in Table 29).

Table 29 Residential Control Totals (2014)

Segment	Number of Customers	Electricity Sales (GWh)	% of Total Usage	Avg. Use/ Customer (kWh)
Single Family	98,601	1,485	76%	15,056
Multi Family	6,802	56	3%	8,187
Low Income Single Family	30,688	378	19%	12,305
Low Income Multi Family	5,747	40	2%	6,922
Total	**141,838**	**1,958**	**100%**	**13,802**

AEG utilized commercial and industrial customer billing data and secondary sources to develop the commercial and industrial market segments, shown in Table 30. The nonresidential sector excludes customers that opt-out of Empire's DSM tariff (as of September 2015) and is segmented into small and

large nonresidential segments based upon a 1,000 MWh annual use threshold.[15] While some potential studies further divide the non-residential class into building types and industries, this is useful primarily for large utilities with many customers in each segment and with the resources and intention, at least at some point in the future, to develop segment-specific program offerings. For Empire, it was determined that the additional effort and resources to analyze the non-residential sector at a more granular level would not add significant value or accuracy to the study.

Table 30 Nonresidential Control Totals (2014)

Segment	Electricity Sales (GWh)	% of Total Usage	Avg. Use / Square Foot (kWh)
Small Nonresidential	1,157	60%	11.0
Large Nonresidential	757	40%	42.0
Total	**1,914**	**100%**	**15.6**

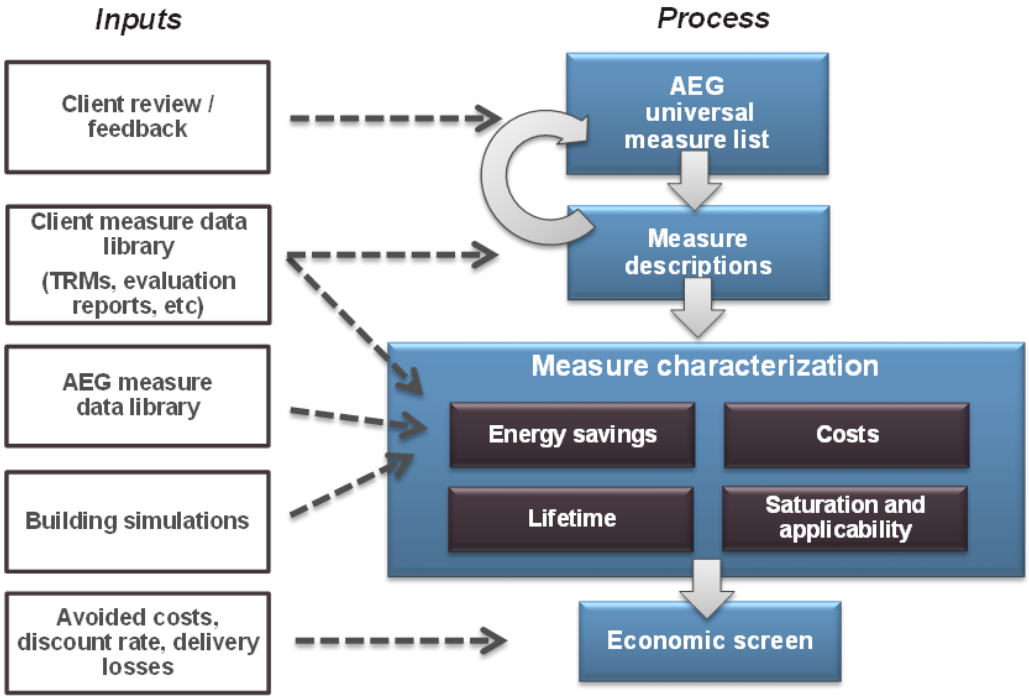
[15] Empire's commercial and industrial market does not have significant variability that would require segmentation by business type (e.g. there are a number of small retail facilities). For this reason, the potential study examined two nonresidential segments, small and large. Empire's decision to move forward with this methodology was discussed at a meeting with stakeholders on September 29, 2015.

3.3 Development of End Use Measures

(C) Identify a comprehensive list of end-use measures and demand-side programs considered by the utility and develop menus of end-use measures for each demand-side program. The demand-side programs shall be appropriate to the shared characteristics of each market segment. The end-use measures shall reflect technological changes in end-uses that may be reasonably anticipated to occur during the planning horizon;

AEG compiled a comprehensive list of energy efficiency and demand response measures for each customer sector, drawing upon Empire's current programs, AEG's measure database and measure lists developed from previous studies. The list of energy efficiency measures covers all major types of end-use equipment, as well as devices and actions to reduce energy consumption. Potential measures include the replacement of a unit that has failed or is at the end of its useful life with an efficient unit, retrofit or early replacement of equipment, improvements to the building envelope, the application of controls to optimize energy use, and other actions resulting in improved energy efficiency. If considered today, some of these measures would not pass the economic screens initially, but may pass in future years as a result of lower projected equipment costs or higher avoided costs. AEG developed a preliminary list of measures, which was distributed to Empire for review.

Figure 28 Approach for Energy-Efficiency Measure Assessment



Each measure was characterized with energy and demand savings, incremental cost, service life, and other performance factors, drawing upon data from well-vetted national and regional sources. Measure energy and demand impacts were calculated using generally accepted engineering algorithms based on a set of reasonable assumptions.

Only cost-effective measures are included in economic and achievable potential. Therefore, each individual measure is screened for cost-effectiveness. The analysis uses each measure's values for savings, costs, and lifetimes that were developed as part of the measure characterization process described above, along with Empire's avoided cost data, to determine economically feasible measures. LoadMAP utilized the TRC test for measure screening (i.e., a TRC benefit-cost ratio of at least 1.0).

The Total Resource Cost Test (TRC) is the primary method of assessing the cost-effectiveness of energy efficient measures and programs. The TRC test is a widely-accepted methodology that has been used across the United States for over twenty-five years. TRC measures the net costs and benefits of an energy efficiency program as a resource option based on the total costs of the program, including both the participant's and the utility's costs. This test represents the combination of the effects of a program on both participating and non-participating customers.

The LoadMAP model performs this screening dynamically, taking into account changing savings and cost data over time. Thus, some measures pass the economic screen for some — but not all — of the years in the projection. Table 31 and Table 32 present the measures screened in LoadMAP.

Table 31 Residential Measures

End Use	Efficient Technology	Baseline
HVAC	Central AC SEER 14.0	SEER 13.0
HVAC	Central AC SEER 15.0	SEER 13.0
HVAC	Central AC SEER 16.0	SEER 13.0
HVAC	Central AC SEER 18.0	SEER 13.0
HVAC	Room AC EER 11.2	EER 11.0
HVAC	Room AC EER 12.1	EER 11.0
HVAC	Room AC EER 13.0	EER 11.0
HVAC	Air-Source Heat Pump SEER 15.0 / HSPF 8.5	SEER 14.0 / HSPF 8.2
HVAC	Air-Source Heat Pump SEER 16.0 / HSPF 9.0	SEER 14.0 / HSPF 8.2
HVAC	Air-Source Heat Pump SEER 18.0 / HSPF 10.0	SEER 14.0 / HSPF 8.2
HVAC	Geothermal Heat Pump EER 16.1 / COP 3.5	EER 13.4 / COP 3.1
HVAC	Geothermal Heat Pump EER 23.0 / COP 4.3	EER 13.4 / COP 3.1
HVAC	Geothermal Heat Pump EER 30.0 / COP 5.0	EER 13.4 / COP 3.1
HVAC	ECM Fan Motor	Standard
HVAC	Ductless Mini Split Heat Pump	Standard
HVAC	Thermostat - Programmable/Interactive	Standard
HVAC	Central AC - Maintenance	n/a
HVAC	Central Heat Pump - Maintenance	n/a
Water Heating	ENERGY STAR Water Heater (<= 55 Gal)	EF 0.91
Water Heating	Heat Pump Water Heater (<= 55 Gal)	EF 0.91
Water Heating	Heat Pump Water Heater (> 55 Gal)	EF 0.885

End Use	Efficient Technology	Baseline
Water Heating	Drainwater Heat Recovery	Standard
Water Heating	Faucet Aerators	Standard
Water Heating	Low-Flow Showerheads	Standard
Water Heating	Tank Blanket/Insulation	Standard
Water Heating	Pipe Insulation	Standard
Water Heating	Desuperheater	Standard
Lighting	CFL General Service Screw-In	EISA Compliant
Lighting	LED General Service Screw-In	EISA Compliant
Lighting	T8 Linear Lighting	EISA Compliant
Lighting	LED Linear Lighting	EISA Compliant
Lighting	Halogen Exempted Screw-In	Incandescent
Lighting	CFL Exempted Screw-In	Incandescent
Lighting	LED Exempted Screw-In	Incandescent
Appliances	ENERGY STAR Refrigerator	Standard
Appliances	CEE 2 Refrigerator	Standard
Appliances	ENERGY STAR Freezer	Standard
Appliances	CEE Clothes Washer	Standard (2015/8)
Appliances	ENERGY STAR Clothes Washer	Standard (2015/8)
Appliances	ENERGY STAR Clothes Dryer	Standard
Appliances	ENERGY STAR Clothes Dryer	Standard
Appliances	Heat Pump Clothes Dryer	Standard
Appliances	ENERGY STAR Dishwasher	Standard
Appliances	Convection Stove	Standard
Appliances	Halogen Burner Stove	Standard
Appliances	ENERGY STAR Dehumidifier	Standard
Appliances	ENERGY STAR Air Purifier	Standard
Appliances	ENERGY STAR Ceiling Fan	Standard
Recycle	Room AC Recycling	n/a
Recycle	Refrigerator Recycling	n/a
Recycle	Freezer Recycling	n/a
Electronics	ENERGY STAR Personal Computers	Standard
Electronics	ENERGY STAR Monitor	Standard
Electronics	ENERGY STAR Laptops	Standard
Electronics	ENERGY STAR Printer/Fax/Copier	Standard
Electronics	ENERGY STAR TVs	Standard
Electronics	Smart Power Strips	
Shell	Insulation - Ceiling	Standard
Shell	Insulation - Ducting	Standard
Shell	Insulation - Foundation	Standard
Shell	Insulation - Floor	Standard
Shell	Air Sealing	Standard
Shell	Insulation - Radiant Barrier	Standard
Shell	Insulation - Wall Cavity	Standard
Shell	Insulation - Wall Sheathing	Standard
Shell	Ducting - Repair and Sealing	Standard
Shell	Windows - High Efficiency	Standard
Shell	Windows - Install Reflective Film	Standard
Shell	Doors - Storm and Thermal	Standard
Miscellaneous	ENERGY STAR Two-Speed Pool Pump	Standard
Miscellaneous	ENERGY STAR Variable Speed Pool Pump	Standard
Miscellaneous	Heat Pump Pool Heater	Standard
Other	ENERGY STAR Home Design	n/a
Other	Behavioral Programs	n/a
Renewable	Photovoltaic System	Electronics
Renewable	Wind	Heating

Table 32 Nonresidential Measures

End Use	Efficient Technology	Baseline
HVAC	Air-Cooled Chiller COP 3.91 (EER 13.3)	COP 3.06 (EER 10.4)
HVAC	Air-Cooled Chiller COP 4.40 (EER 15.0)	COP 3.06 (EER 10.4)
HVAC	Water-Cooled Chiller COP 7.82 (0.45 kW/TR)	COP 6.39 (0.56 kW/TR)
HVAC	Water-Cooled Chiller COP 9.02 (0.38 kW/TR)	COP 6.39 (0.56 kW/TR)
HVAC	Water-Cooled Chiller COP 9.77 (0.36 kW/TR)	COP 6.39 (0.56 kW/TR)
HVAC	RTU EER 11.5	EER 11.2
HVAC	RTU EER 12	EER 11.2
HVAC	RTU EER 13.9	EER 11.2
HVAC	Room AC EER 11.2	EER 11.0
HVAC	Room AC EER 11.5	EER 11.0
HVAC	Room AC EER 13.0	EER 11.0
HVAC	Air-Source Heat Pump EER 12 (COP 3.4)	EER 11.0 (COP 3.3)
HVAC	Geothermal Heat Pump EER 17.0 (COP 3.5)	EER 13.8 (COP 3.4)
HVAC	Geothermal Heat Pump EER 27.8 (COP 4.9)	EER 13.8 (COP 3.4)
HVAC	Chiller - VSD on Fans	Standard
HVAC	Chiller - Chilled Water Reset	Standard
HVAC	Chiller - Chilled Water Variable-Flow System	Standard
HVAC	Chiller - Heat Recovery	Standard
HVAC	HVAC - Economizer	Standard
HVAC	Space Heating - Heat Recovery Ventilator	Standard
HVAC	Thermostat - Programmable/Interactive	Standard
HVAC	Lodging - Guest Room Controls	Standard
HVAC	Destratification Fans (HVLS)	Standard
HVAC	RTU - Maintenance	n/a
HVAC	RTU - Advanced Controls	Standard
Ventilation	Ventilation Variable Air Volume	Constant Volume
Ventilation	Ventilation - ECM on VAV Boxes	Standard
Ventilation	Ventilation - Variable Speed Control	Standard
Ventilation	Ventilation - Demand Controlled	Standard
Water Heating	Heat Pump Water Heater	EF 0.97
Water Heating	Tankless Water Heater	EF 0.97
Water Heating	Drainwater Heat Recovery	Standard
Water Heating	Faucet Aerators/Low Flow Nozzles	Standard
Water Heating	Pipe Insulation	Standard
Lighting	CFL Screw-in	EISA Compliant
Lighting	LED Screw-in	EISA Compliant
Lighting	High-Bay HPS Fixtures	Metal Halide
Lighting	High-Bay T8 Fixtures	Metal Halide
Lighting	High-Bay T5 Fixtures	Metal Halide
Lighting	High-Bay LED Fixtures	Metal Halide
Lighting	HPS Lighting	Metal Halide Lighting
Lighting	LED Linear Lighting	T8 Linear Lighting
Lighting	Lighting Controls	Standard
Refrigeration	Walk-in Refrigerator/Freezer	Standard
Refrigeration	Reach-in Refrigerator/Freezer	Standard
Refrigeration	ENERGY STAR Icemaker	Standard
Refrigeration	ENERGY STAR Vending Machine	Standard
Refrigeration	Anti-Sweat Heater	Standard

End Use	Efficient Technology	Baseline
Refrigeration	Door Gasket Replacement	Standard
Refrigeration	Evaporator Fan Controls	Standard
Refrigeration	Floating Head Pressure	Standard
Refrigeration	Strip Curtain	Standard
Refrigeration	High Efficiency Compressor	Standard
Refrigeration	Variable Speed Compressor	Standard
Refrigeration	Grocery - Display Case - LED Lighting	Standard
Refrigeration	Grocery - Display Case Motion Sensors	Standard
Food Preparation	ENERGY STAR Oven	Standard
Food Preparation	ENERGY STAR Fryer	Standard
Food Preparation	ENERGY STAR Dishwasher	Standard
Food Preparation	ENERGY STAR Steamer	Standard
Food Preparation	ENERGY STAR Hot Food Container	Standard
Office Equipment	ENERGY STAR Desktop Computer	Standard
Office Equipment	ENERGY STAR Laptop	Standard
Office Equipment	ENERGY STAR Server	Standard
Office Equipment	ENERGY STAR Monitor	Standard
Office Equipment	ENERGY STAR Printer/Copier/Fax	Standard
Office Equipment	ENERGY STAR POS Terminal	Standard
Office Equipment	Office Equipment - Smart Power Strips	Standard
Office Equipment	Data Center - Air Flow Optimization and Commissioning	Standard
Office Equipment	Data Center - Server Virtualization	Standard
Shell	Insulation - Ceiling	Standard
Shell	Insulation - Ducting	Standard
Shell	Insulation - Foundation	Standard
Shell	Insulation - Radiant Barrier	Standard
Shell	Insulation - Wall Cavity	Standard
Shell	HVAC - Duct Repair and Sealing	Standard
Shell	Windows - High Efficiency	Standard
Shell	Cool Roofs	Standard
Motors	Compressed Air	Standard
Motors	Pumping System	Standard
Motors	Fan System	Standard
Motors	Motors - Variable Frequency Drive	Standard
Motors	Motors - Efficient Rewind	Standard
Miscellaneous	Two-Speed Pool Pump	Standard
Miscellaneous	Variable Speed Pool Pump	Standard
Miscellaneous	Heat Pump Pool Heater	Standard
Motors	Compressed Air	Standard
Other	Strategic Energy Management	n/a
Other	Commissioning	n/a
Other	Retrocommissioning	n/a
Other	Advanced New Construction Designs	n/a
All	Photovoltaic System	n/a
All	Wind System	n/a

3.4 Advanced, Metering, and Distribution Assessment

(D) Assess how advancements in metering and distribution technologies that may be reasonably anticipated to occur during the planning horizon affect the ability to implement or deliver potential demand-side programs;

Advancements in metering and distribution technologies, such as two-way communicating meters and programmable thermostats, allow utilities to communicate real-time with the customer and provide customers with a better understanding of their energy consumption. These advanced technologies, and those that can reasonably be anticipated to surface during the planning horizon are costly, and if utilized would have an impact on customer rates and could impact the cost effectiveness of the demand-side program. These technologies are not currently prevalent throughout Empire's territory but could improve demand-side programs, particularly customer behavior programs. The demand response programs were modeled to start in 2022 to give Empire time to roll out the AMI meters to participating customers.

3.5 End-Use Measures Marketing Plan

(E) Design a marketing plan and delivery process to present the menu of end-use measures to the members of each market segment and to persuade decision-makers to implement as many of these measures as may be appropriate to their situation. When appropriate, consider multiple approaches such as rebates, financing, and direct installations for the same menu of end-use measures;

The marketing plan and delivery process will be designed to inform each market segment of the DSM programs. The plans will include a combination of strategies and approaches to reach all market segments and decision-makers (as described in 1.1(A)).

Preliminary program-specific marketing (included in the program descriptions in 1.2(B)). The program-specific marketing tactics will be discussed and finalized during implementation. The marketing plan will include, but not be limited to,

- The Smart Energy Solutions portal of Empire District's website
- Direct customer outreach (via Empire and/or an implementation contractor)
- Bill inserts, on-bill messaging and email blasts

- Newspaper, radio and billboard advertisements
- Community newsletters and events
- Trade publication advertisements
- Partnerships with local businesses/contractors developed through education and training seminars as well as presentations/presence at Chamber of Commerce meetings, trade association events and business organization events.

The Missouri Weatherization Agencies have primary responsibility for promoting Low-Income Weatherization Program. Empire will supplement statewide marketing efforts, promoting the program through community events and organizations, including churches and nonprofit organizations within the service territory.

3.6 State-Wide Marketing and Outreach Program Evaluation

(F) Evaluate, describe, and document the feasibility, cost-reduction potential and potential benefits of statewide marketing and outreach programs, joint programs with natural gas utilities, upstream market transformation programs, and other activities. In the event that statewide marketing and outreach programs are preferred, the utilities shall develop joint programs in consultation with the stakeholder group;

Empire will cooperatively market programs jointly run with outside organizations, such as non-profit organizations and other Missouri electric and natural gas utilities. Empire is currently cooperatively marketing the Low-Income Weatherization, Low-Income New Homes, Building Operating Certificate and whole-home programs with partnering organizations. Empire will assess the benefits and economies to be had from cooperating with neighboring municipalities, rural electric cooperatives and investor owned utilities.

3.7 Cost Effectiveness

(G) Estimate the characteristics needed for the twenty (20)-year planning horizon to assess the cost effectiveness of each potential demand-side program, including:

1. An assessment of the demand and energy reduction impacts of each stand-alone end-use measure contained in each potential demand-side program;

Measures that were found to be cost-effective at some point during the 20-year period analyzed for the DSM Potential Study were vetted for inclusion in the DSM program design. The measures shown in the following two tables are included in the proposed DSM programs.

Table 33 Residential Measures, Potential DSM Program Design

Measure Name	Measure Life	Coincidence Factor	Gross kWh Savings per Unit	Gross Non-Coincident kW Savings Per Unit	Incremental Cost per Unit
Standard CFL	5	8%	23.7	0.03	$1.70
LED	10	8%	26.0	0.03	$8.00
Specialty LED	7	8%	22.4	0.03	$5.00
ENERGY STAR Dehumidifier	12	37%	161.1	0.10	$60
ENERGY STAR Air Purifier	9	100%	267.0	0.03	$70
ENERGY STAR Refrigerator	12	100%	44.3	0.01	$40
CEE Tier 2 Refrigerator	12	100%	110.5	0.02	$140
ENERGY STAR Freezer	11	95%	46.8	0.01	$35
Refrigerator Recycling	8	0%	820.6	0.09	$120
Freezer Recycling	8	0%	731.0	0.08	$120
Room Air Conditioner Recycling	4	30%	294.4	0.79	$49
Air Sealing	15	68%	435.7	0.20	$224
Attic Insulation R-38	25	68%	1,303.6	0.22	$510
Wall Insulation R-11	25	68%	2,000.8	0.38	$1,295
Foundation Insulation R-13	25	68%	1,267.0	0.13	$435
Floor Insulation R-30	25	68%	1,832.3	0.26	$629
Duct Installation & Sealing	20	68%	590.4	0.16	$411
ENERGY STAR Windows	25	100%	739.5	0.72	$882
Radiant Barrier Insulation	25	100%	269.7	0.38	$610
Smart Power Strip 5-Plug	4	80%	56.5	0.01	$16
Faucet Aerator	9	2%	73.2	1.36	$8
Low Flow Showerhead	10	3%	108.6	0.29	$12
Hot Water Pipe Insulation	15	100%	81.5	0.01	$15
Water Heater Wrap	5	100%	143.0	0.02	$10
CAC SEER 15, EER 12.5	18	68%	384.2	0.37	$553
CAC SEER 16, EER 13	18	68%	540.3	0.48	$829
CAC SEER 17, EER 13	18	68%	678.0	0.48	$1,106
ASHP SEER 15, HSPF 8.5	18	72%	432.9	0.17	$411
ASHP SEER 16, HSPF 9	18	72%	975.4	0.28	$914
ASHP SEER 18, HSPF 10	18	72%	1,892.5	0.28	$1,828
Programmable Thermostat	10	72%	224.7	0.26	$30
Furnace Blower Motor	18	68%	928.6	0.27	$125
Heat Pump Water Heater ≤55 gallons	13	12%	1,586.4	0.63	$1,000
Heat Pump Water Heater >55 gallons	13	12%	216.0	0.09	$150

Measure Name	Measure Life	Coincidence Factor	Gross kWh Savings per Unit	Gross Non-Coincident kW Savings Per Unit	Incremental Cost per Unit
Behavioral Reports	2	72%	40.0	0.01	$0
Low Income Weatherization	15	100%	2,052.0	0.73	$0
Photovoltaic 10 kW	20	100%	14,892	3.40	$23,000
Photovoltaic 5 kW	20	100%	7,446	1.70	$11,500
Inclining Block Rate	20	100%	-	0.09	$0
Space Heating DLC	10	100%	-	1.20	$0
Water Heating DLC	10	100%	-	1.00	$0
CAC DLC	10	100%	-	1.01	$0

Table 34 Nonresidential Measures, Potential DSM Program Design

Measure Name	Measure Life	Coincidence Factor	Gross kWh Savings per Unit	Gross Non-Coincident kW Savings Per Unit	Incremental Cost per Unit
Room Air Conditioner (12 EER)	9	91%	127.7	0.10	$80
CAC <65 kBtu (SEER 14)	15	91%	417.0	0.36	$825
CAC 65<135 kBtu (EER 11.7)	15	91%	579.2	0.46	$1,500
CAC 135<240 kBtu (EER 11.7)	15	91%	1,651.3	1.31	$2,800
CAC 240<760 kBtu (EER 10.5)	15	91%	1,807.2	1.43	$3,125
CAC ≥760 kBtu (EER 9.9)	15	91%	2,055.1	1.62	$7,150
Heat Pump <65 kBtu (SEER 14, HSPF 8.5)	15	91%	1,193.5	0.36	$685
Heat Pump 65<135 kBtu (EER 11.3, COP 3.4)	15	91%	698.3	0.29	$1,650
Heat Pump 135<240 kBtu (EER 10.9, COP 3.2)	15	91%	788.3	0.62	$3,000
Heat Pump ≥240 kBtu (EER 10.3, COP 3.2)	15	91%	3,102.8	2.45	$3,500
Packaged Terminal Air Conditioner	15	91%	359.7	0.28	$84
Packaged Terminal Heat Pump	15	91%	436.2	0.30	$84
Guest Room Energy Management	15	91%	256.5	0.12	$260
Variable Speed Drive - Chilled Water Pump	15	100%	5,893.1	1.04	$1,330
Variable Speed Drive - Hot Water Pump	15	100%	6,079.5	-	$1,330
Demand Controlled Ventilation	10	100%	2,450.0	-	$1,500
ENERGY STAR Steamer	12	40%	13,920.1	6.71	$2,490
ENERGY STAR Dishwasher	10	36%	7,471.0	1.14	$1,000
ENERGY STAR Hot Food Holding Cabinets	12	36%	9,308.0	1.70	$1,200
ENERGY STAR Ice Maker (2016)	10	94%	646.2	0.13	$296
ENERGY STAR Ice Maker (2018)	10	94%	390.5	0.08	$178
ENERGY STAR Electric Convention Oven	12	40%	2,248.5	1.03	$1,000
ENERGY STAR Electric Fryer	12	40%	951.7	0.16	$210
Vending Machine	5	0%	342.5	0.04	$80
Evaporator Fan Control	16	100%	481.0	0.06	$291
Strip Curtain for Walk-In Cooler/Freezer	6	100%	1,198.0	0.20	$286
Night Covers for Open Refrigerated Display Cases	5	0%	2,470.0	-	$420
Door Heater Controls	12	0%	843.5	-	$300
Refrigeration Economizer	15	0%	5,150.0	4.21	$2,558
Kitchen Demand Ventilation Controls	15	100%	4,486.0	0.76	$1,000
Directional LED Bulb (<15W)	8	63%	191.3	0.05	$40
Directional LED Bulb (≥15W)	8	63%	307.2	0.08	$50
High Bay Fluorescent Fixture (HP T8 >4 lamps)	15	63%	1,443.3	0.36	$225
High Bay Fluorescent Fixture (HP T8 ≤4 lamps)	15	63%	863.7	0.22	$200
High Bay Fluorescent Fixture w/ HE Electronic Ballast (T5 >4 lamps)	15	63%	933.2	0.23	$100
High Bay Fluorescent Fixture w/ HE Electronic Ballast (T5 ≤4 lamps)	15	63%	539.1	0.14	$100
LED High & Low-Bay Fixture	8	63%	781.4	0.20	$200
LED Exit Sign	16	100%	78.8	0.01	$30
LED Flood Light (<15W)	10	0%	210.8	0.04	$35

Measure Name	Measure Life	Coincidence Factor	Gross kWh Savings per Unit	Gross Non-Coincident kW Savings Per Unit	Incremental Cost per Unit
LED Flood Light (≥15W)	10	0%	236.3	0.05	$45
LED Recessed Fixture (1x4)	8	63%	155.3	0.04	$36
LED Recessed Fixture (2x2)	8	63%	93.3	0.02	$23
LED Recessed Fixture (2x4)	8	63%	199.4	0.05	$56
Lighting Optimization - Remove 4ft Lamp from T8 System	11	63%	162.3	0.04	$12
Lighting Optimization - Remove 8ft Lamp from T8 System	11	63%	336.2	0.08	$16
Omnidirectional LED Bulb (<10W)	6	63%	112.5	0.03	$29
Omnidirectional LED Bulb (≥10W)	6	63%	173.3	0.04	$39
LED Parking Garage/Canopy (<30W)	10	0%	518.2	0.11	$125
LED Parking Garage/Canopy (30-75W)	10	0%	762.4	0.16	$250
LED Parking Garage/Canopy (≥75W)	10	0%	873.7	0.18	$375
LED Wall Mounted Area Lights (<30W)	10	0%	518.2	0.11	$125
LED Wall Mounted Area Lights (30-75W)	10	0%	762.4	0.16	$250
LED Wall Mounted Area Lights (≥75W)	10	0%	873.7	0.18	$375
LED Refrigerator Case Light	10	90%	249.2	0.06	$133
Photocell Occupancy Sensor	8	63%	922.1	0.23	$66
Wall-Mount Occupancy Sensor	8	63%	608.6	0.15	$42
C&I Custom Rebate	15	91%	15,000	1.71	$2,500
Small C&I Strategic Energy Management	3	91%	7,636	1.71	$1,527
Large C&I Strategic Energy Management	3	91%	172,152	38.55	$34,430
Small C&I Retrocommissioning	3	91%	4,581	1.03	$687
Large C&I Retrocommissioning	3	91%	103,291	23.13	$15,494
Photovoltaic 20 kW	20	100%	29,115	6.65	$74,664
Photovoltaic 30 kW	20	100%	45,673	10.43	$117,126
Curtailment Agreements	3	100%	-	99.69	$0
Curtailment Agreements - Non Firm	3	100%	-	106.52	$0

2. An assessment of how the interactions between end-use measures, when bundled with other end-use measures in the potential demand-side program, would affect the stand-alone end-use measure impact estimates;

End-use measures were screened for cost-effectiveness on a stand-alone and bundled basis. Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income programs, the DSM programs were designed to be cost-effective. Measures were bundled based on end-use and delivery mechanism.

3. An estimate of the incremental and cumulative number of program participants and end-use measure installations due to the potential demand-side program;

An estimate of the realistic achievable potential (RAP) Program Design incremental and cumulative end-use measure installations and participants is shown in the tables below.

Table 35 Incremental Residential End-Use Measure Installations

Efficient Measure	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
LED	5,500	11,000	11,000	10,700	10,400	10,200	8,500	8,300	8,100	7,800	7,800	7,800	7,800	7,800	7,800	7,800	7,800	7,800	7,800
Specialty LED	700	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,500	1,600	1,600	1,600	1,600	1,600
Refrigerator Recycling	-	-	-	-	-	400	500	500	600	700	700	800	900	1,000	1,100	1,100	1,100	1,100	1,100
Freezer Recycling	-	-	-	-	-	200	240	270	310	340	380	420	460	500	540	580	580	580	580
Room Air Conditioner Recycling	-	-	-	-	-	17	23	30	40	60	70	90	100	120	140	160	160	160	160
Audit	150	400	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
LED	600	1,600	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Faucet Aerator	95	250	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320
Low Flow Showerhead	65	180	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
Hot Water Pipe Insulation	55	150	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
Water Heater Wrap	55	150	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190	190
Air Sealing	60	160	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Attic Insulation R-38	60	160	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Wall Insulation R-11	-	-	-	-	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Foundation Insulation R-13	20	50	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Floor Insulation R-30	20	50	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Duct Installation & Sealing	25	60	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
ENERGY STAR Windows	15	40	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
CAC SEER 15, EER 12.5	35	74	78	82	86	90	110	120	130	130	130	140	130	130	130	130	130	110	110
CAC SEER 16, EER 13	22	46	48	50	53	56	60	70	70	80	80	80	80	80	80	80	80	70	70
CAC SEER 17, EER 13	4	8	8	8	8	8	10	10	20	20	20	20	20	20	20	20	20	10	10
ASHP SEER 15, HSPF 8.5	100	210	221	240	260	270	290	300	310	320	310	310	300	300	280	280	280	280	280
ASHP SEER 16, HSPF 9	15	32	40	50	50	50	60	60	60	60	60	60	60	60	60	60	60	60	60
ASHP SEER 18, HSPF 10	10	21	20	30	30	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Programmable Thermostat	50	180	260	350	430	390	430	450	470	490	480	490	470	470	460	460	460	430	430
Furnace Blower Motor	10	34	50	66	82	100	102	104	106	108	110	112	114	116	118	120	120	120	120
Heat Pump Water Heater ≤55 gallons	15	30	40	70	100	160	170	170	180	190	190	200	200	200	200	200	200	200	200
Heat Pump Water Heater >55 gallons	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
ENERGY STAR Dehumidifier	110	240	270	290	320	330	350	350	350	340	330	330	330	330	340	340	340	340	340
ENERGY STAR Air Purifier	100	220	240	250	250	250	250	250	250	250	250	250	310	310	310	310	310	300	300
ENERGY STAR Refrigerator	-	-	-	-	-	-	-	200	200	220	220	220	220	220	230	250	250	250	250
ENERGY STAR Freezer	-	-	-	-	-	100	100	100	100	200	360	790	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Behavioral Reports	15,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Audit	20	40	40	40	40	40	40	40	60	60	60	60	60	60	60	60	60	60	60
LED	80	160	160	160	160	160	160	160	240	240	240	240	240	240	240	240	240	240	240
Faucet Aerator	15	30	30	30	30	30	30	30	40	40	40	40	40	40	40	40	40	40	40
Low Flow Showerhead	10	20	20	20	20	20	20	20	30	30	30	30	30	30	30	30	30	30	30
Hot Water Pipe Insulation	10	20	20	20	20	20	20	20	30	30	30	30	30	30	30	30	30	30	30
Water Heater Wrap	10	20	20	20	20	20	20	20	30	30	30	30	30	30	30	30	30	30	30
Air Sealing	15	30	30	30	30	30	30	30	40	40	40	40	40	40	40	40	40	40	40
Attic Insulation R-38	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Foundation Insulation R-13	-	-	-	-	-	-	-	-	10	10	10	10	10	10	10	10	10	10	10
Floor Insulation R-30	-	-	-	-	-	-	-	-	10	10	10	10	10	10	10	10	10	10	10
Duct Installation & Sealing	5	20	10	20	20	20	20	20	30	30	30	30	30	30	30	30	30	30	30
ENERGY STAR Windows	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
CAC SEER 15, EER 12.5	-	-	-	-	-	-	10	10	20	20	20	20	20	20	20	20	20	20	20
CAC SEER 16, EER 13	-	-	-	-	-	-	-	-	-	-	20	20	20	20	20	20	20	20	20
ASHP SEER 15, HSPF 8.5	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Programmable Thermostat	10	20	20	20	20	20	20	20	30	30	50	50	50	50	50	50	50	50	50
Heat Pump Water Heater ≤55 gallons	5	10	10	10	20	40	40	40	40	40	40	40	50	50	50	50	50	50	50
ENERGY STAR Dehumidifier	5	10	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
ENERGY STAR Air Purifier	5	10	10	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
ENERGY STAR Refrigerator	10	20	20	20	20	20	20	20	30	30	30	30	30	30	30	30	30	30	30
Behavioral Reports	-	-	-	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Low Income Weatherization	150	300	300	300	300	300	300	300	350	350	350	350	350	350	350	350	350	350	350
Space Heating DLC	-	-	-	-	-	350	440	450	450	10	10	10	10	10	10	10	10	10	10
Water Heating DLC	-	-	-	-	-	180	340	340	340	340	20	20	20	20	20	20	20	20	20
CAC DLC	-	-	-	-	-	-	-	-	-	650	490	490	500	500	10	10	10	10	10

Table 36 Incremental Non-Residential End-Use Measure Installations

Efficient Measure	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Room Air Conditioner (12 EER)	2	8	9	9	9	9	9	10	10	10	10	10	10	10	10	10	10	10	10
Packaged Terminal Air Conditioner	29	59	61	69	71	71	71	71	71	71	71	71	72	73	74	75	75	76	76
Guest Room Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	2	9	16	22	29	36	42
Variable Speed Drive - Chilled Water Pump	5	9	13	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
Variable Speed Drive - Hot Water Pump	5	9	13	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48
Demand Controlled Ventilation	-	-	-	-	-	-	50	70	80	100	100	100	100	100	100	100	100	100	100
ENERGY STAR Steamer	40	90	90	90	90	90	90	90	90	90	90	90	90	90	90	110	110	110	110
ENERGY STAR Dishwasher	40	90	90	100	100	110	110	110	120	120	120	120	120	120	120	110	110	110	110
ENERGY STAR Hot Food Holding Cabinets	35	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	60	50
ENERGY STAR Ice Maker (2018)	1	2	10	40	80	80	80	80	80	80	80	80	80	80	80	80	80	70	60
ENERGY STAR Electric Convention Oven	80	160	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	190	190
ENERGY STAR Electric Fryer	20	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Vending Machine	-	-	-	-	-	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Evaporator Fan Control	30	90	110	80	100	110	130	140	160	180	190	210	230	250	260	280	270	260	250
Strip Curtain for Walk-In Cooler/Freezer	15	50	50	60	50	60	60	70	80	90	100	110	120	120	130	140	140	140	140
Night Covers for Open Refrigerated Displa	2	6	8	10	12	13	15	17	18	20	22	23	25	26	28	29	30	16	17
Door Heater Controls	40	80	80	120	150	190	220	250	290	320	350	380	410	440	470	500	480	460	440
Refrigeration Economizer	40	100	110	120	130	130	150	160	180	200	210	230	240	260	270	290	280	270	260
Directional LED Bulb (<15W)	400	800	600	500	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Directional LED Bulb (≥15W)	400	800	600	500	400	400	400	400	400	400	400	400	400	400	400	400	380	360	340
High Bay Fluorescent Fixture (HP T8 >4 lam	25	50	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
High Bay Fluorescent Fixture (HP T8 ≤4 lam	25	50	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
High Bay Fluorescent Fixture w/ HE Electro	31	64	67	69	68	52	9	9	9	9	9	8	8	8	8	8	8	8	8
High Bay Fluorescent Fixture w/ HE Electro	31	64	67	69	68	52	9	9	9	9	9	8	8	8	8	8	8	8	8
LED High & Low-Bay Fixture	60	130	130	140	140	100	20	20	20	20	20	20	20	20	20	20	20	20	20
LED Exit Sign	25	120	180	240	310	380	440	510	520	520	520	520	520	520	520	520	520	520	520
LED Recessed Fixture (1x4)	60	130	140	150	730	750	770	780	800	810	810	800	800	800	800	810	810	820	830
LED Recessed Fixture (2x2)	60	290	440	590	760	930	1,080	1,250	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270
LED Recessed Fixture (2x4)	60	290	440	590	760	930	1,080	1,250	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270
Lighting Optimization - Remove 4ft Lamp fr	50	240	360	480	620	760	880	1,020	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040
Lighting Optimization - Remove 8ft Lamp fr	50	240	360	480	620	760	880	1,020	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040	1,040
LED Wall Mounted Area Lights (<30W)	30	60	80	100	100	110	120	130	130	130	130	130	130	130	130	130	130	130	130
LED Refrigerator Case Light	30	60	80	100	120	140	160	160	160	160	160	160	150	150	150	150	150	140	140
Photocell Occupancy Sensor	2	5	6	7	9	10	10	10	10	10	20	20	20	20	20	20	20	20	20
Wall-Mount Occupancy Sensor	15	30	70	90	130	140	140	140	140	140	140	140	140	140	140	140	140	140	140
C&I Custom Rebate	20	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Small C&I Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	12	12	12	12
Small C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	8	8	8	8	8	8
Large C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	2	2	2	2
Curtailment Agreements	-	-	-	-	-	-	-	-	-	-	-	-	10	10	10	10	10	10	10

Table 37 Cumulative Residential End-Use Measure Installations

Efficient Measure	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
LED	5,500	16,500	27,500	38,200	48,600	58,800	67,300	75,600	83,700	91,500	99,300	107,100	114,900	122,700	130,500	138,300	146,100	153,900	161,700
Specialty LED	700	2,100	3,500	4,900	6,300	7,700	9,100	10,500	11,900	13,300	14,700	16,100	17,500	19,000	20,600	22,200	23,800	25,400	27,000
Refrigerator Recycling	-	-	-	-	-	400	900	1,400	2,000	2,700	3,400	4,200	5,100	6,100	7,200	8,300	9,400	10,500	11,600
Freezer Recycling	-	-	-	-	-	200	440	710	1,020	1,360	1,740	2,160	2,620	3,120	3,660	4,240	4,820	5,400	5,980
Room Air Conditioner Recycling	-	-	-	-	-	17	40	70	110	170	240	330	430	550	690	850	1,010	1,170	1,330
Audit	150	550	1,050	1,550	2,050	2,550	3,050	3,550	4,050	4,550	5,050	5,550	6,050	6,550	7,050	7,550	8,050	8,550	9,050
LED	600	2,200	4,200	6,200	8,200	10,200	12,200	14,200	16,200	18,200	20,200	22,200	24,200	26,200	28,200	30,200	32,200	34,200	36,200
Faucet Aerator	95	345	665	985	1,305	1,625	1,945	2,265	2,585	2,905	3,225	3,545	3,865	4,185	4,505	4,825	5,145	5,465	5,785
Low Flow Showerhead	65	245	465	685	905	1,125	1,345	1,565	1,785	2,005	2,225	2,445	2,665	2,885	3,105	3,325	3,545	3,765	3,985
Hot Water Pipe Insulation	55	205	395	585	775	965	1,155	1,345	1,535	1,725	1,915	2,105	2,295	2,485	2,675	2,865	3,055	3,245	3,435
Water Heater Wrap	55	205	395	585	775	965	1,155	1,345	1,535	1,725	1,915	2,105	2,295	2,485	2,675	2,865	3,055	3,245	3,435
Air Sealing	60	220	420	620	820	1,020	1,220	1,420	1,620	1,820	2,020	2,220	2,420	2,620	2,820	3,020	3,220	3,420	3,620
Attic Insulation R-38	60	220	420	620	820	1,020	1,220	1,420	1,620	1,820	2,020	2,220	2,420	2,620	2,820	3,020	3,220	3,420	3,620
Wall Insulation R-11	-	-	-	-	40	80	120	160	200	240	280	320	360	400	440	480	520	560	600
Foundation Insulation R-13	20	70	130	190	250	310	370	430	490	550	610	670	730	790	850	910	970	1,030	1,090
Floor Insulation R-30	20	70	130	190	250	310	370	430	490	550	610	670	730	790	850	910	970	1,030	1,090
Duct Installation & Sealing	25	85	165	245	325	405	485	565	645	725	805	885	965	1,045	1,125	1,205	1,285	1,365	1,445
ENERGY STAR Windows	15	55	105	155	205	255	305	355	405	455	505	555	605	655	705	755	805	855	905
CAC SEER 15, EER 12.5	35	109	187	269	355	445	555	675	805	935	1,065	1,205	1,335	1,465	1,595	1,725	1,855	1,965	2,075
CAC SEER 16, EER 13	22	68	116	166	219	275	335	405	475	555	635	715	795	875	955	1,035	1,115	1,185	1,255
CAC SEER 17, EER 13	4	12	20	28	36	44	54	64	84	104	124	144	164	184	204	224	244	254	264
ASHP SEER 15, HSPF 8.5	100	310	531	771	1,031	1,301	1,591	1,891	2,201	2,521	2,831	3,141	3,441	3,741	4,021	4,301	4,581	4,861	5,141
ASHP SEER 16, HSPF 9	15	47	87	137	187	237	297	357	417	477	537	597	657	717	777	837	897	957	1,017
ASHP SEER 18, HSPF 10	10	31	51	81	111	151	191	231	271	311	351	391	431	471	511	551	591	631	671
Programmable Thermostat	50	230	490	840	1,270	1,660	2,090	2,540	3,010	3,500	3,980	4,470	4,940	5,410	5,870	6,330	6,790	7,220	7,650
Furnace Blower Motor	10	44	94	160	242	342	444	548	654	762	872	984	1,098	1,214	1,332	1,452	1,572	1,692	1,812
Heat Pump Water Heater ≤55 gallons	15	45	85	155	255	415	585	755	935	1,125	1,315	1,515	1,715	1,915	2,115	2,315	2,515	2,715	2,915
Heat Pump Water Heater >55 gallons	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	155	165	175	185
ENERGY STAR Dehumidifier	110	350	620	910	1,230	1,560	1,910	2,260	2,610	2,950	3,280	3,610	3,940	4,270	4,610	4,950	5,290	5,630	5,970
ENERGY STAR Air Purifier	100	320	560	810	1,060	1,310	1,560	1,810	2,060	2,310	2,560	2,810	3,120	3,430	3,740	4,050	4,360	4,660	4,960
ENERGY STAR Refrigerator	-	-	-	-	-	-	-	200	400	620	840	1,060	1,280	1,500	1,730	1,980	2,230	2,480	2,730
ENERGY STAR Freezer	-	-	-	-	-	100	200	300	400	600	960	1,750	2,750	3,750	4,750	5,750	6,750	7,750	8,750
Behavioral Reports	15,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Audit	20	60	100	140	180	220	260	300	360	420	480	540	600	660	720	780	840	900	960
LED	80	240	400	560	720	880	1,040	1,200	1,440	1,680	1,920	2,160	2,400	2,640	2,880	3,120	3,360	3,600	3,840
Faucet Aerator	15	45	75	105	135	165	195	225	265	305	345	385	425	465	505	545	585	625	665
Low Flow Showerhead	10	30	50	70	90	110	130	150	180	210	240	270	300	330	360	390	420	450	480
Hot Water Pipe Insulation	10	30	50	70	90	110	130	150	180	210	240	270	300	330	360	390	420	450	480
Water Heater Wrap	10	30	50	70	90	110	130	150	180	210	240	270	300	330	360	390	420	450	480
Air Sealing	15	45	75	105	135	165	195	225	265	305	345	385	425	465	505	545	585	625	665
Attic Insulation R-38	10	30	50	70	90	110	130	150	170	190	210	230	250	270	290	310	330	350	370
Foundation Insulation R-13	-	-	-	-	-	-	-	-	10	20	30	40	50	60	70	80	90	100	110
Floor Insulation R-30	-	-	-	-	-	-	-	-	10	20	30	40	50	60	70	80	90	100	110
Duct Installation & Sealing	5	25	35	55	75	95	115	135	165	195	225	255	285	315	345	375	405	435	465
ENERGY STAR Windows	5	15	25	35	45	55	65	75	85	95	105	115	125	135	145	155	165	175	185
CAC SEER 15, EER 12.5	-	-	-	-	-	-	10	20	40	60	80	100	120	140	160	180	200	220	240
CAC SEER 16, EER 13	-	-	-	-	-	-	-	-	-	-	20	40	60	80	100	120	140	160	180
ASHP SEER 15, HSPF 8.5	10	30	50	70	90	110	130	150	170	190	210	230	250	270	290	310	330	350	370
Programmable Thermostat	10	30	50	70	90	110	130	150	180	210	260	310	360	410	460	510	560	610	660
Heat Pump Water Heater ≤55 gallons	5	15	25	35	55	95	135	175	215	255	295	335	385	435	485	535	585	635	685
ENERGY STAR Dehumidifier	5	15	25	45	65	85	105	125	145	165	185	205	225	245	265	285	305	325	345
ENERGY STAR Air Purifier	5	15	25	35	55	75	95	115	135	155	175	195	215	235	255	275	295	315	335
ENERGY STAR Refrigerator	10	30	50	70	90	110	130	150	180	210	240	270	300	330	360	390	420	450	480
Behavioral Reports	-	-	-	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Low Income Weatherization	150	450	750	1,050	1,350	1,650	1,950	2,250	2,600	2,950	3,300	3,650	4,000	4,350	4,700	5,050	5,400	5,750	6,100
Space Heating DLC	-	-	-	-	-	350	790	1,240	1,690	1,700	1,710	1,720	1,730	1,740	1,750	1,760	1,770	1,780	1,790
Water Heating DLC	-	-	-	-	-	180	520	860	1,200	1,540	1,560	1,580	1,600	1,620	1,640	1,660	1,680	1,700	1,720
CAC DLC	-	-	-	-	-	-	-	-	-	650	1,140	1,630	2,130	2,630	2,640	2,650	2,660	2,670	2,680

Table 38 Cumulative Non-Residential End-Use Measure Installations

Efficient Measure	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Room Air Conditioner (12 EER)	2	10	19	28	37	46	55	65	75	85	95	105	115	125	135	145	155	165	175
Packaged Terminal Air Conditioner	29	88	149	218	289	360	431	502	573	644	715	786	858	931	1,005	1,080	1,155	1,231	1,307
Guest Room Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	2	11	27	49	78	114	156
Variable Speed Drive - Chilled Water Pump	5	14	27	45	65	87	111	137	165	195	227	261	297	335	375	417	461	507	555
Variable Speed Drive - Hot Water Pump	5	14	27	45	65	87	111	137	165	195	227	261	297	335	375	417	461	507	555
Demand Controlled Ventilation	-	-	-	-	-	-	50	120	200	300	400	500	600	700	800	900	1,000	1,100	1,200
ENERGY STAR Steamer	40	130	220	310	400	490	580	670	760	850	940	1,030	1,120	1,210	1,300	1,410	1,520	1,630	1,740
ENERGY STAR Dishwasher	40	130	220	320	420	530	640	750	870	990	1,110	1,230	1,350	1,470	1,590	1,700	1,810	1,920	2,030
ENERGY STAR Hot Food Holding Cabinets	35	105	175	245	315	385	455	525	595	665	735	805	875	945	1,015	1,085	1,155	1,215	1,265
ENERGY STAR Ice Maker (2018)	1	3	13	53	133	213	293	373	453	533	613	693	773	853	933	1,013	1,093	1,163	1,223
ENERGY STAR Electric Convention Oven	80	240	410	580	750	920	1,090	1,260	1,430	1,600	1,770	1,940	2,110	2,280	2,450	2,620	2,790	2,980	3,170
ENERGY STAR Electric Fryer	20	60	100	140	180	220	260	300	340	380	420	460	500	540	580	620	660	700	740
Vending Machine	-	-	-	-	-	50	100	150	200	250	300	350	400	450	500	550	600	650	700
Evaporator Fan Control	30	120	230	310	410	520	650	790	950	1,130	1,320	1,530	1,760	2,010	2,270	2,550	2,820	3,080	3,330
Strip Curtain for Walk-In Cooler/Freezer	15	65	115	175	225	285	345	415	495	585	685	795	915	1,035	1,165	1,305	1,445	1,585	1,725
Night Covers for Open Refrigerated Displa	2	8	16	26	38	51	66	83	101	121	143	166	191	217	245	274	304	320	337
Door Heater Controls	40	120	200	320	470	660	880	1,130	1,420	1,740	2,090	2,470	2,880	3,320	3,790	4,290	4,770	5,230	5,670
Refrigeration Economizer	40	140	250	370	500	630	780	940	1,120	1,320	1,530	1,760	2,000	2,260	2,530	2,820	3,100	3,370	3,630
Directional LED Bulb (<15W)	400	1,200	1,800	2,300	2,700	3,100	3,500	3,900	4,300	4,700	5,100	5,500	5,900	6,300	6,700	7,100	7,500	7,900	8,300
Directional LED Bulb (≥15W)	400	1,200	1,800	2,300	2,700	3,100	3,500	3,900	4,300	4,700	5,100	5,500	5,900	6,300	6,700	7,100	7,480	7,840	8,180
High Bay Fluorescent Fixture (HP T8 >4 lam	25	75	135	195	255	315	375	435	495	555	615	675	735	795	855	915	975	1,035	1,095
High Bay Fluorescent Fixture (HP T8 ≤4 lam	25	75	135	195	255	315	375	435	495	555	615	675	735	795	855	915	975	1,035	1,095
High Bay Fluorescent Fixture w/ HE Electro	31	95	162	231	299	351	360	369	378	387	396	404	412	420	428	436	444	452	460
High Bay Fluorescent Fixture w/ HE Electro	31	95	162	231	299	351	360	369	378	387	396	404	412	420	428	436	444	452	460
LED High & Low-Bay Fixture	60	190	320	460	600	700	720	740	760	780	800	820	840	860	880	900	920	940	960
LED Exit Sign	25	145	325	565	875	1,255	1,695	2,205	2,725	3,245	3,765	4,285	4,805	5,325	5,845	6,365	6,885	7,405	7,925
LED Recessed Fixture (1x4)	60	190	330	480	1,210	1,960	2,730	3,510	4,310	5,120	5,930	6,730	7,530	8,330	9,130	9,940	10,750	11,570	12,400
LED Recessed Fixture (2x2)	60	350	790	1,380	2,140	3,070	4,150	5,400	6,670	7,940	9,210	10,480	11,750	13,020	14,290	15,560	16,830	18,100	19,370
LED Recessed Fixture (2x4)	60	350	790	1,380	2,140	3,070	4,150	5,400	6,670	7,940	9,210	10,480	11,750	13,020	14,290	15,560	16,830	18,100	19,370
Lighting Optimization - Remove 4ft Lamp fr	50	290	650	1,130	1,750	2,510	3,390	4,410	5,450	6,490	7,530	8,570	9,610	10,650	11,690	12,730	13,770	14,810	15,850
Lighting Optimization - Remove 8ft Lamp fr	50	290	650	1,130	1,750	2,510	3,390	4,410	5,450	6,490	7,530	8,570	9,610	10,650	11,690	12,730	13,770	14,810	15,850
LED Wall Mounted Area Lights (<30W)	30	90	170	270	370	480	600	730	860	990	1,120	1,250	1,380	1,510	1,640	1,770	1,900	2,030	2,160
LED Refrigerator Case Light	30	90	170	270	390	530	690	850	1,010	1,170	1,330	1,490	1,640	1,790	1,940	2,090	2,240	2,380	2,520
Photocell Occupancy Sensor	2	7	13	20	29	39	49	59	69	79	99	119	139	159	179	199	219	239	259
Wall-Mount Occupancy Sensor	15	45	115	205	335	475	615	755	895	1,035	1,175	1,315	1,455	1,595	1,735	1,875	2,015	2,155	2,295
C&I Custom Rebate	20	65	115	165	215	265	315	365	415	465	515	565	615	665	715	765	815	865	915
Small C&I Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	24	36	48	60
Small C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	8	16	24	32	40	48
Large C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	6	8	10	12
Curtailment Agreements	-	-	-	-	-	-	-	-	-	-	-	-	10	20	30	40	50	60	70

Table 39 Incremental Participation by Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**17,303**	**35,076**	**35,518**	**45,757**	**46,073**	**47,461**	**47,773**	**48,119**	**48,459**	**48,943**	**48,693**	**49,322**	**49,741**	**49,938**	**49,636**	**49,730**	**49,725**	**49,639**	**49,633**
Total Residential	**16,859**	**34,092**	**34,502**	**34,663**	**34,836**	**35,594**	**35,585**	**35,841**	**36,019**	**36,281**	**36,463**	**37,085**	**37,467**	**37,646**	**37,815**	**37,897**	**37,897**	**37,817**	**37,817**
Residential Lighting	1,033	2,067	2,067	2,017	1,967	1,933	1,650	1,617	1,583	1,533	1,533	1,533	1,533	1,550	1,567	1,567	1,567	1,567	1,567
Residential Appliance Recycling	-	-	-	-	-	617	763	800	950	1,100	1,150	1,310	1,460	1,620	1,780	1,840	1,840	1,840	1,840
Whole House Efficiency	826	2,025	2,435	2,646	2,869	3,044	3,172	3,424	3,486	3,648	3,780	4,242	4,474	4,476	4,468	4,490	4,490	4,410	4,410
Residential Behavioral	15,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Total Residential Low Income	**250**	**510**	**500**	**10,520**	**10,540**	**10,560**	**10,570**	**10,570**	**10,710**	**10,710**	**10,750**	**10,750**	**10,760**	**10,760**	**10,760**	**10,760**	**10,760**	**10,760**	**10,760**
Low Income Whole House Efficiency	100	210	200	220	240	260	270	270	360	360	400	400	410	410	410	410	410	410	410
Low Income Behavioral	-	-	-	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Low Income Weatherization	150	300	300	300	300	300	300	300	350	350	350	350	350	350	350	350	350	350	350
Total Business	**194**	**474**	**516**	**574**	**697**	**777**	**838**	**918**	**940**	**952**	**960**	**967**	**974**	**992**	**1,011**	**1,023**	**1,018**	**1,012**	**1,006**
C&I Prescriptive Rebate	174	429	466	524	647	727	788	868	890	902	910	917	924	932	939	951	946	940	934
C&I Custom Rebate	20	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	12	12	12	12
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	10	10	10	10	10	10
Demand Response	**-**	**-**	**-**	**-**	**-**	**530**	**780**	**790**	**790**	**1,000**	**520**	**520**	**540**	**540**	**50**	**50**	**50**	**50**	**50**
Demand Load Control	-	-	-	-	-	530	780	790	790	1,000	520	520	530	530	40	40	40	40	40
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	10	10	10	10	10	10	10

Table 40 Cumulative Participation by Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**17,303**	**35,951**	**40,453**	**45,116**	**49,952**	**55,546**	**61,131**	**66,972**	**72,991**	**79,272**	**85,735**	**92,820**	**100,287**	**107,933**	**115,748**	**123,645**	**131,542**	**139,359**	**147,176**
Total Residential	**16,859**	**35,951**	**40,453**	**45,116**	**49,952**	**55,546**	**61,131**	**66,972**	**72,991**	**79,272**	**85,735**	**92,820**	**100,287**	**107,933**	**115,748**	**123,645**	**131,542**	**139,359**	**147,176**
Residential Lighting	1,033	3,100	5,167	7,184	9,151	11,084	12,734	14,351	15,934	17,467	19,000	20,533	22,066	23,616	25,183	26,750	28,317	29,884	31,451
Residential Appliance Recycling	-	-	-	-	-	617	1,380	2,180	3,130	4,230	5,380	6,690	8,150	9,770	11,550	13,390	15,230	17,070	18,910
Whole House Efficiency	826	2,851	5,286	7,932	10,801	13,845	17,017	20,441	23,927	27,575	31,355	35,597	40,071	44,547	49,015	53,505	57,995	62,405	66,815
Residential Behavioral	15,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Total Residential Low Income	**250**																		
Low Income Whole House Efficiency	100	310	510	730	970	1,230	1,500	1,770	2,130	2,490	2,890	3,290	3,700	4,110	4,520	4,930	5,340	5,750	6,160
Low Income Behavioral	-	-	-	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Low Income Weatherization	150	450	750	1,050	1,350	1,650	1,950	2,250	2,600	2,950	3,300	3,650	4,000	4,350	4,700	5,050	5,400	5,750	6,100
Total Business	**194**																		
C&I Prescriptive Rebate	174	603	1,069	1,593	2,240	2,967	3,755	4,623	5,513	6,415	7,325	8,242	9,166	10,098	11,037	11,988	12,934	13,874	14,808
C&I Custom Rebate	20	65	115	165	215	265	315	365	415	465	515	565	615	665	715	765	815	865	915
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	24	36	48	60
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	10	20	30	40	50	60
Demand Response	**-**																		
Demand Load Control	-	-	-	-	-	530	1,310	2,100	2,890	3,890	4,410	4,930	5,460	5,990	6,030	6,070	6,110	6,150	6,190
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	10	20	30	40	50	60	70

4. For each year of the planning horizon, an estimate of the incremental and cumulative demand reduction and energy savings due to the potential demand-side program; and

An estimate of the realistic achievable potential incremental and cumulative demand reductions and energy savings due to the DSM Programs is shown in the tables below.

Table 41 Incremental Net Demand Reductions by Program (kW)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**506**	**1,105**	**1,174**	**1,282**	**1,344**	**2,002**	**2,299**	**2,343**	**2,418**	**2,568**	**2,102**	**2,123**	**3,139**	**3,202**	**2,737**	**2,777**	**2,778**	**2,762**	**2,759**
Total Residential	**190**	**428**	**479**	**509**	**544**	**585**	**611**	**625**	**645**	**664**	**665**	**684**	**688**	**699**	**706**	**711**	**711**	**694**	**694**
Residential Lighting	12	23	23	23	22	22	19	18	18	17	17	17	17	18	18	18	18	18	18
Residential Appliance Recycling	-	-	-	-	-	35	44	46	55	65	68	78	87	98	108	112	112	112	112
Whole House Efficiency	92	232	283	313	349	355	375	387	399	409	407	415	411	411	408	408	408	391	391
Residential Behavioral	86	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173
Total Residential Low Income	**122**	**245**	**244**	**303**	**304**	**306**	**308**	**308**	**355**	**355**	**365**	**365**	**366**	**366**	**366**	**366**	**366**	**366**	**366**
Low Income Whole House Efficiency	12	25	24	26	27	28	31	31	41	41	51	51	51	51	51	51	51	51	51
Low Income Behavioral	-	-	-	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58
Low Income Weatherization	110	220	220	220	220	220	220	220	257	257	257	257	257	257	257	257	257	257	257
Total Business	**194**	**431**	**451**	**470**	**496**	**511**	**513**	**530**	**538**	**542**	**546**	**549**	**552**	**604**	**627**	**662**	**663**	**664**	**661**
C&I Prescriptive Rebate	173	386	400	419	445	461	462	479	488	491	495	498	501	504	507	543	543	545	541
C&I Custom Rebate	20	46	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	19	19	19	19
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	50	50	50	50	50	50
Demand Response	**-**	**-**	**-**	**-**	**-**	**600**	**868**	**880**	**880**	**1,008**	**526**	**526**	**1,533**	**1,533**	**1,039**	**1,039**	**1,039**	**1,039**	**1,039**
Demand Load Control	-	-	-	-	-	600	868	880	880	1,008	526	526	537	537	42	42	42	42	42
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	997	997	997	997	997	997	997

Table 42 Cumulative Net Demand Reductions by Program (kW)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**506**	**1,611**	**2,698**	**3,808**	**4,978**	**6,749**	**8,814**	**10,918**	**13,064**	**15,312**	**17,054**	**18,754**	**21,321**	**23,757**	**25,691**	**25,891**	**25,573**	**25,164**	**24,679**
Total Residential	**190**	**619**	**1,011**	**1,347**	**1,718**	**2,130**	**2,566**	**3,015**	**3,485**	**3,968**	**4,422**	**4,853**	**5,269**	**5,638**	**5,989**	**6,340**	**6,659**	**6,939**	**7,172**
Residential Lighting	12	35	59	82	104	126	145	163	181	198	204	198	192	186	182	178	177	176	176
Residential Appliance Recycling	-	-	-	-	-	35	79	126	181	244	309	384	467	524	582	641	691	731	767
Whole House Efficiency	92	324	607	920	1,268	1,623	1,996	2,381	2,778	3,180	3,563	3,925	4,264	4,582	4,880	5,175	5,446	5,687	5,884
Residential Behavioral	86	259	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346
Total Residential Low Income	**122**	**367**	**611**	**914**	**1,218**	**1,466**	**1,716**	**1,967**	**2,263**	**2,560**	**2,864**	**3,166**	**3,468**	**3,770**	**4,071**	**4,260**	**4,336**	**4,412**	**4,483**
Low Income Whole House Efficiency	12	37	62	87	114	142	172	202	243	283	330	376	421	466	511	553	594	633	667
Low Income Behavioral	-	-	-	58	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
Low Income Weatherization	110	330	550	770	989	1,209	1,429	1,649	1,905	2,162	2,418	2,675	2,931	3,188	3,444	3,591	3,628	3,664	3,701
Total Business	**194**	**625**	**1,076**	**1,546**	**2,042**	**2,554**	**3,064**	**3,588**	**4,087**	**4,548**	**5,006**	**5,446**	**5,762**	**5,994**	**6,236**	**6,455**	**6,567**	**6,639**	**6,689**
C&I Prescriptive Rebate	173	559	959	1,379	1,824	2,285	2,745	3,218	3,667	4,077	4,484	4,874	5,139	5,270	5,393	5,513	5,602	5,674	5,723
C&I Custom Rebate	20	66	117	167	218	269	319	370	421	471	522	573	623	674	725	755	760	760	760
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	37	56	56	56
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	50	99	149	149	149	149
Demand Response	**-**	**-**	**-**	**-**	**-**	**600**	**1,468**	**2,348**	**3,228**	**4,236**	**4,762**	**5,289**	**6,822**	**8,356**	**9,395**	**8,837**	**8,011**	**7,173**	**6,335**
Demand Load Control	-	-	-	-	-	600	1,468	2,348	3,228	4,236	4,762	5,289	5,825	6,362	6,404	5,846	5,020	4,182	3,344
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	997	1,994	2,991	2,991	2,991	2,991	2,991

Table 43 Incremental Net Energy Savings by Program (MWh)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**3,002**	**6,543**	**6,921**	**7,671**	**8,078**	**8,717**	**9,000**	**9,243**	**9,695**	**9,939**	**10,049**	**10,270**	**10,470**	**10,893**	**11,122**	**11,386**	**11,353**	**11,235**	**11,142**
Total Residential	**1,123**	**2,429**	**2,640**	**2,759**	**2,929**	**3,353**	**3,449**	**3,486**	**3,590**	**3,687**	**3,705**	**3,818**	**3,899**	**3,974**	**4,040**	**4,063**	**4,063**	**4,034**	**4,034**
Residential Lighting	116	232	232	226	220	217	184	181	177	171	171	171	171	173	174	174	174	174	174
Residential Appliance Recycling	-	-	-	-	-	295	365	378	449	516	535	606	677	749	821	840	840	840	840
Whole House Efficiency	407	997	1,208	1,333	1,508	1,642	1,700	1,727	1,764	1,799	1,800	1,841	1,851	1,853	1,845	1,848	1,848	1,820	1,820
Residential Behavioral	600	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Total Residential Low Income	**355**	**716**	**711**	**1,118**	**1,136**	**1,167**	**1,171**	**1,171**	**1,326**	**1,326**	**1,341**	**1,341**	**1,356**	**1,356**	**1,356**	**1,356**	**1,356**	**1,356**	**1,356**
Low Income Whole House Efficiency	47	101	95	102	120	151	155	155	207	207	222	222	238	238	238	238	238	238	238
Low Income Behavioral	-	-	-	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400
Low Income Weatherization	308	616	616	616	616	616	616	616	718	718	718	718	718	718	718	718	718	718	718
Total Business	**1,524**	**3,397**	**3,571**	**3,794**	**4,014**	**4,187**	**4,366**	**4,572**	**4,766**	**4,910**	**4,994**	**5,103**	**5,182**	**5,530**	**5,700**	**5,942**	**5,909**	**5,820**	**5,727**
C&I Prescriptive Rebate	1,413	3,147	3,294	3,517	3,736	3,910	4,089	4,295	4,488	4,633	4,717	4,826	4,904	5,009	5,088	5,330	5,297	5,207	5,114
C&I Custom Rebate	111	250	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278	278
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	92	92	92	92	92
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	243	243	243	243	243	243
Demand Response	**-**	**-**	**-**	**-**	**-**	**10**	**14**	**14**	**14**	**16**	**8**	**8**	**33**	**33**	**25**	**25**	**25**	**25**	**25**
Demand Load Control	-	-	-	-	-	10	14	14	14	16	8	8	9	9	1	1	1	1	1
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	24	24	24	24	24	24	24

Table 44 Cumulative Net Energy Savings by Program (MWh)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**3,002**	**9,544**	**15,865**	**22,337**	**29,215**	**36,322**	**43,683**	**51,253**	**59,062**	**66,818**	**74,311**	**81,545**	**88,055**	**93,696**	**99,376**	**104,381**	**108,012**	**111,034**	**113,463**
Total Residential	**1,123**	**3,552**	**5,591**	**7,151**	**8,879**	**11,027**	**13,260**	**15,526**	**17,895**	**20,333**	**22,611**	**24,820**	**27,064**	**29,032**	**30,955**	**32,851**	**34,594**	**36,173**	**37,522**
Residential Lighting	116	348	580	806	1,026	1,243	1,427	1,607	1,784	1,955	2,010	1,950	1,889	1,835	1,789	1,747	1,737	1,731	1,728
Residential Appliance Recycling	-	-	-	-	-	295	660	1,038	1,487	2,001	2,532	3,134	3,805	4,252	4,701	5,155	5,537	5,852	6,148
Whole House Efficiency	407	1,404	2,612	3,945	5,453	7,089	8,773	10,480	12,224	13,977	15,669	17,336	18,970	20,544	22,065	23,549	24,920	26,191	27,246
Residential Behavioral	600	1,800	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Total Residential Low Income	**355**	**1,072**	**1,782**	**2,900**	**4,036**	**4,801**	**5,570**	**6,339**	**7,262**	**8,183**	**9,114**	**10,039**	**10,980**	**11,908**	**12,829**	**13,433**	**13,722**	**13,996**	**14,228**
Low Income Whole House Efficiency	47	148	243	345	465	616	769	922	1,127	1,330	1,542	1,750	1,972	2,182	2,384	2,578	2,765	2,936	3,066
Low Income Behavioral	-	-	-	400	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
Low Income Weatherization	308	923	1,539	2,155	2,770	3,386	4,001	4,617	5,335	6,053	6,772	7,490	8,208	8,926	9,644	10,055	10,157	10,260	10,363
Total Business	**1,524**	**4,921**	**8,492**	**12,286**	**16,300**	**20,484**	**24,830**	**29,351**	**33,853**	**38,234**	**42,510**	**46,601**	**49,895**	**52,607**	**55,417**	**57,932**	**59,543**	**60,726**	**61,587**
C&I Prescriptive Rebate	1,413	4,560	7,854	11,370	15,107	19,013	23,081	27,326	31,550	35,654	39,652	43,465	46,482	48,673	50,871	52,885	54,376	55,559	56,420
C&I Custom Rebate	111	361	638	916	1,193	1,471	1,748	2,026	2,303	2,581	2,858	3,136	3,413	3,691	3,968	4,135	4,163	4,163	4,163
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	92	183	275	275	275
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	243	486	730	730	730	730
Demand Response	**-**	**-**	**-**	**-**	**-**	**10**	**23**	**38**	**52**	**68**	**76**	**85**	**117**	**150**	**174**	**165**	**152**	**139**	**125**
Demand Load Control	-	-	-	-	-	10	23	38	52	68	76	85	93	102	102	94	80	67	54
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	24	48	72	72	72	72	72

5. For each year of the planning horizon, an estimate of the costs, including:

A. The incremental cost of each stand-alone end-use measure;

The incremental cost of each end-use measure is shown in the table below.

Table 45 Measure Incremental Costs

Program	Efficient Measure	
Residential Lighting	LED	$8
Residential Lighting	Specialty LED	$5
Residential Appliance Recycling	Refrigerator Recycling	$120
Residential Appliance Recycling	Freezer Recycling	$120
Residential Appliance Recycling	Room Air Conditioner Recycling	$49
Whole House Efficiency	Audit	$0
Whole House Efficiency	LED	$8
Whole House Efficiency	Faucet Aerator	$8
Whole House Efficiency	Low Flow Showerhead	$12
Whole House Efficiency	Hot Water Pipe Insulation	$15
Whole House Efficiency	Water Heater Wrap	$10
Whole House Efficiency	Air Sealing	$224
Whole House Efficiency	Attic Insulation R-38	$510
Whole House Efficiency	Wall Insulation R-11	$1,295
Whole House Efficiency	Foundation Insulation R-13	$435
Whole House Efficiency	Floor Insulation R-30	$629
Whole House Efficiency	Duct Installation & Sealing	$411
Whole House Efficiency	ENERGY STAR Windows	$882
Whole House Efficiency	CAC SEER 15, EER 12.5	$553
Whole House Efficiency	CAC SEER 16, EER 13	$829
Whole House Efficiency	CAC SEER 17, EER 13	$1,106
Whole House Efficiency	ASHP SEER 15, HSPF 8.5	$411
Whole House Efficiency	ASHP SEER 16, HSPF 9	$914
Whole House Efficiency	ASHP SEER 18, HSPF 10	$1,828
Whole House Efficiency	Programmable Thermostat	$30
Whole House Efficiency	Furnace Blower Motor	$125
Whole House Efficiency	Heat Pump Water Heater ≤55 gallons	$1,000
Whole House Efficiency	Heat Pump Water Heater >55 gallons	$150
Whole House Efficiency	ENERGY STAR Dehumidifier	$60
Whole House Efficiency	ENERGY STAR Air Purifier	$70
Whole House Efficiency	ENERGY STAR Refrigerator	$40
Whole House Efficiency	ENERGY STAR Freezer	$35
Residential Behavioral	Behavioral Reports	$0
Low Income Whole House Efficiency	Audit	$0
Low Income Whole House Efficiency	LED	$8
Low Income Whole House Efficiency	Faucet Aerator	$8
Low Income Whole House Efficiency	Low Flow Showerhead	$12
Low Income Whole House Efficiency	Hot Water Pipe Insulation	$15
Low Income Whole House Efficiency	Water Heater Wrap	$10
Low Income Whole House Efficiency	Air Sealing	$224
Low Income Whole House Efficiency	Attic Insulation R-38	$510

Program	Efficient Measure	
Low Income Whole House Efficiency	Wall Insulation R-11	$1,295
Low Income Whole House Efficiency	Foundation Insulation R-13	$435
Low Income Whole House Efficiency	Floor Insulation R-30	$629
Low Income Whole House Efficiency	Duct Installation & Sealing	$411
Low Income Whole House Efficiency	ENERGY STAR Windows	$882
Low Income Whole House Efficiency	CAC SEER 15, EER 12.5	$553
Low Income Whole House Efficiency	CAC SEER 16, EER 13	$829
Low Income Whole House Efficiency	CAC SEER 17, EER 13	$1,106
Low Income Whole House Efficiency	ASHP SEER 15, HSPF 8.5	$411
Low Income Whole House Efficiency	ASHP SEER 16, HSPF 9	$914
Low Income Whole House Efficiency	ASHP SEER 18, HSPF 10	$1,828
Low Income Whole House Efficiency	Programmable Thermostat	$30
Low Income Whole House Efficiency	Furnace Blower Motor	$125
Low Income Whole House Efficiency	Heat Pump Water Heater ≤55 gallons	$1,000
Low Income Whole House Efficiency	Heat Pump Water Heater >55 gallons	$150
Low Income Whole House Efficiency	ENERGY STAR Dehumidifier	$60
Low Income Whole House Efficiency	ENERGY STAR Air Purifier	$70
Low Income Whole House Efficiency	ENERGY STAR Refrigerator	$40
Low Income Whole House Efficiency	ENERGY STAR Freezer	$35
Low Income Behavioral	Behavioral Reports	$0
Low Income Weatherization	Low Income Weatherization	$0
C&I Prescriptive Rebate	Room Air Conditioner (12 EER)	$80
C&I Prescriptive Rebate	Packaged Terminal Air Conditioner	$84
C&I Prescriptive Rebate	Packaged Terminal Heat Pump	$84
C&I Prescriptive Rebate	Guest Room Energy Management	$260
C&I Prescriptive Rebate	Variable Speed Drive - Chilled Water Pump	$1,330
C&I Prescriptive Rebate	Variable Speed Drive - Hot Water Pump	$1,330
C&I Prescriptive Rebate	Demand Controlled Ventilation	$1,500
C&I Prescriptive Rebate	ENERGY STAR Steamer	$2,490
C&I Prescriptive Rebate	ENERGY STAR Dishwasher	$1,000
C&I Prescriptive Rebate	ENERGY STAR Hot Food Holding Cabinets	$1,200
C&I Prescriptive Rebate	ENERGY STAR Ice Maker (2018)	$178
C&I Prescriptive Rebate	ENERGY STAR Electric Convention Oven	$1,000
C&I Prescriptive Rebate	ENERGY STAR Electric Fryer	$210
C&I Prescriptive Rebate	Vending Machine	$80
C&I Prescriptive Rebate	Evaporator Fan Control	$291
C&I Prescriptive Rebate	Strip Curtain for Walk-In Cooler/Freezer	$286
C&I Prescriptive Rebate	Night Covers for Open Refrigerated Display Cases	$420
C&I Prescriptive Rebate	Door Heater Controls	$300
C&I Prescriptive Rebate	Refrigeration Economizer	$2,558
C&I Prescriptive Rebate	Directional LED Bulb (<15W)	$40
C&I Prescriptive Rebate	Directional LED Bulb (≥15W)	$50
C&I Prescriptive Rebate	High Bay Fluorescent Fixture (HP T8 >4 lamps)	$225
C&I Prescriptive Rebate	High Bay Fluorescent Fixture (HP T8 ≤4 lamps)	$200
C&I Prescriptive Rebate	High Bay Fluorescent Fixture w/ HE Electronic Ballast (T5 >4 lamps)	$100
C&I Prescriptive Rebate	High Bay Fluorescent Fixture w/ HE Electronic Ballast (T5 ≤4 lamps)	$100
C&I Prescriptive Rebate	LED High & Low-Bay Fixture	$200
C&I Prescriptive Rebate	LED Exit Sign	$30
C&I Prescriptive Rebate	LED Flood Light (<15W)	$35
C&I Prescriptive Rebate	LED Flood Light (≥15W)	$45

Program	Efficient Measure	
C&I Prescriptive Rebate	LED Recessed Fixture (1x4)	$36
C&I Prescriptive Rebate	LED Recessed Fixture (2x2)	$23
C&I Prescriptive Rebate	LED Recessed Fixture (2x4)	$56
C&I Prescriptive Rebate	Lighting Optimization - Remove 4ft Lamp from T8 System	$12
C&I Prescriptive Rebate	Lighting Optimization - Remove 8ft Lamp from T8 System	$16
C&I Prescriptive Rebate	Omnidirectional LED Bulb (<10W)	$29
C&I Prescriptive Rebate	Omnidirectional LED Bulb (≥10W)	$39
C&I Prescriptive Rebate	LED Parking Garage/Canopy (<30W)	$125
C&I Prescriptive Rebate	LED Parking Garage/Canopy (30-75W)	$250
C&I Prescriptive Rebate	LED Parking Garage/Canopy (≥75W)	$375
C&I Prescriptive Rebate	LED Wall Mounted Area Lights (<30W)	$125
C&I Prescriptive Rebate	LED Wall Mounted Area Lights (30-75W)	$250
C&I Prescriptive Rebate	LED Wall Mounted Area Lights (≥75W)	$375
C&I Prescriptive Rebate	LED Refrigerator Case Light	$133
C&I Prescriptive Rebate	Photocell Occupancy Sensor	$66
C&I Prescriptive Rebate	Wall-Mount Occupancy Sensor	$42
C&I Custom Rebate	C&I Custom Rebate	$2,500
Strategic Energy Management	Small C&I Strategic Energy Management	$1,527
Strategic Energy Management	Large C&I Strategic Energy Management	$34,430
C&I Retrocommissioning	Small C&I Retrocommissioning	$687
C&I Retrocommissioning	Large C&I Retrocommissioning	$15,494
Renewables	Photovoltaic 10 kW	$23,000
Renewables	Photovoltaic 5 kW	$11,500
Renewables	Photovoltaic 20 kW	$74,664
Renewables	Photovoltaic 30 kW	$117,126

B. The cost of incentives paid by the utility to customers or utility financing to encourage participation in the potential demand-side program. The utility shall consider multiple levels of incentives paid by the utility for each end-use measure within a potential demand-side program, with corresponding adjustments to the maximum achievable potential and the realistic achievable potential of that potential demand-side program;

The RAP Program Design cost of incentives or financing to encourage participation in the DSM Programs is shown in the table below. The incentives varied depending on the scenario analyzed, for example the realistic achievable potential scenario versus the maximum achievable potential scenario.

Table 46 Measure Incentives

Program	Efficient Measure	
Residential Lighting	LED	$4.00
Residential Lighting	Specialty LED	$2.50
Residential Appliance Recycling	Refrigerator Recycling	$50
Residential Appliance Recycling	Freezer Recycling	$50
Whole House Efficiency	Air Sealing	$0.80 per sq. ft., up to $300
Whole House Efficiency	Attic Insulation R-38	$0.30 per sq. ft., up to $500
Whole House Efficiency	Wall Insulation R-11	$0.30 per sq. ft., up to $150

Program	Efficient Measure	
Whole House Efficiency	Foundation Insulation R-13	$0.30 per sq. ft., up to $150
Whole House Efficiency	Floor Insulation R-30	$0.30 per sq. ft., up to $150
Whole House Efficiency	Duct Installation & Sealing	$0.10 per sq. ft., up to $150
Whole House Efficiency	ENERGY STAR Windows	$75 per window., up to $750
Whole House Efficiency	CAC SEER 15, EER 12.5	$250
Whole House Efficiency	CAC SEER 16, EER 13	$350
Whole House Efficiency	CAC SEER 17, EER 13	$450
Whole House Efficiency	ASHP SEER 15, HSPF 8.5	$250
Whole House Efficiency	ASHP SEER 16, HSPF 9	$350
Whole House Efficiency	ASHP SEER 18, HSPF 10	$450
Whole House Efficiency	Programmable Thermostat	$15
Whole House Efficiency	Furnace Blower Motor	$50
Whole House Efficiency	Heat Pump Water Heater ≤55 gallons	$400
Whole House Efficiency	Heat Pump Water Heater >55 gallons	$75
Whole House Efficiency	ENERGY STAR Dehumidifier	$30
Whole House Efficiency	ENERGY STAR Air Purifier	$30
Whole House Efficiency	ENERGY STAR Refrigerator	$30
Whole House Efficiency	ENERGY STAR Freezer	$20
Low Income Whole House Efficiency	Air Sealing	$1.50 per sq. ft., up to $600
Low Income Whole House Efficiency	Attic Insulation R-38	$0.60 per sq. ft., up to $800
Low Income Whole House Efficiency	Wall Insulation R-11	$0.50 per sq. ft., up to $300
Low Income Whole House Efficiency	Foundation Insulation R-13	$0.50 per sq. ft., up to $300
Low Income Whole House Efficiency	Floor Insulation R-30	$0.50 per sq. ft., up to $300
Low Income Whole House Efficiency	Duct Installation & Sealing	$0.20 per sq. ft., up to $300
Low Income Whole House Efficiency	ENERGY STAR Windows	$150 per window, up to $1,500
Low Income Whole House Efficiency	CAC SEER 15, EER 12.5	$500
Low Income Whole House Efficiency	CAC SEER 16, EER 13	$700
Low Income Whole House Efficiency	CAC SEER 17, EER 13	$900
Low Income Whole House Efficiency	ASHP SEER 15, HSPF 8.5	$500
Low Income Whole House Efficiency	ASHP SEER 16, HSPF 9	$700
Low Income Whole House Efficiency	ASHP SEER 18, HSPF 10	$900
Low Income Whole House Efficiency	Programmable Thermostat	$30
Low Income Whole House Efficiency	Furnace Blower Motor	$100
Low Income Whole House Efficiency	Heat Pump Water Heater ≤55 gallons	$800
Low Income Whole House Efficiency	Heat Pump Water Heater >55 gallons	$150
Low Income Whole House Efficiency	ENERGY STAR Dehumidifier	$60
Low Income Whole House Efficiency	ENERGY STAR Air Purifier	$60
Low Income Whole House Efficiency	ENERGY STAR Refrigerator	$60
Low Income Whole House Efficiency	ENERGY STAR Freezer	$40
C&I Prescriptive Rebate	Room Air Conditioner (12 EER)	$40
C&I Prescriptive Rebate	Packaged Terminal Air Conditioner	$40
C&I Prescriptive Rebate	Packaged Terminal Heat Pump	$40
C&I Prescriptive Rebate	Guest Room Energy Management	$125
C&I Prescriptive Rebate	Variable Speed Drive - Chilled Water Pump	$500
C&I Prescriptive Rebate	Variable Speed Drive - Hot Water Pump	$500
C&I Prescriptive Rebate	Demand Controlled Ventilation	$600
C&I Prescriptive Rebate	ENERGY STAR Steamer	$750
C&I Prescriptive Rebate	ENERGY STAR Dishwasher	$400
C&I Prescriptive Rebate	ENERGY STAR Hot Food Holding Cabinets	$500
C&I Prescriptive Rebate	ENERGY STAR Ice Maker (2018)	$60

Program	Efficient Measure	
C&I Prescriptive Rebate	ENERGY STAR Electric Convention Oven	$400
C&I Prescriptive Rebate	ENERGY STAR Electric Fryer	$100
C&I Prescriptive Rebate	Vending Machine	$40
C&I Prescriptive Rebate	Evaporator Fan Control	$125
C&I Prescriptive Rebate	Strip Curtain for Walk-In Cooler/Freezer	$125
C&I Prescriptive Rebate	Night Covers for Open Refrigerated Display Cases	$175
C&I Prescriptive Rebate	Door Heater Controls	$125
C&I Prescriptive Rebate	Refrigeration Economizer	$800
C&I Prescriptive Rebate	Directional LED Bulb (<15W)	$15
C&I Prescriptive Rebate	Directional LED Bulb (≥15W)	$15
C&I Prescriptive Rebate	High Bay Fluorescent Fixture (HP T8 >4 lamps)	$75
C&I Prescriptive Rebate	High Bay Fluorescent Fixture (HP T8 ≤4 lamps)	$75
C&I Prescriptive Rebate	High Bay Fluorescent Fixture w/ HE Electronic Ballast (T5 >4 lamps)	$30
C&I Prescriptive Rebate	High Bay Fluorescent Fixture w/ HE Electronic Ballast (T5 ≤4 lamps)	$30
C&I Prescriptive Rebate	LED High & Low-Bay Fixture	$100
C&I Prescriptive Rebate	LED Exit Sign	$15
C&I Prescriptive Rebate	LED Flood Light (<15W)	$15
C&I Prescriptive Rebate	LED Flood Light (≥15W)	$15
C&I Prescriptive Rebate	LED Recessed Fixture (1x4)	$15
C&I Prescriptive Rebate	LED Recessed Fixture (2x2)	$15
C&I Prescriptive Rebate	LED Recessed Fixture (2x4)	$15
C&I Prescriptive Rebate	Lighting Optimization - Remove 4ft Lamp from T8 System	$6
C&I Prescriptive Rebate	Lighting Optimization - Remove 8ft Lamp from T8 System	$8
C&I Prescriptive Rebate	Omnidirectional LED Bulb (<10W)	$15
C&I Prescriptive Rebate	Omnidirectional LED Bulb (≥10W)	$15
C&I Prescriptive Rebate	LED Parking Garage/Canopy (<30W)	$60
C&I Prescriptive Rebate	LED Parking Garage/Canopy (30-75W)	$80
C&I Prescriptive Rebate	LED Parking Garage/Canopy (≥75W)	$100
C&I Prescriptive Rebate	LED Wall Mounted Area Lights (<30W)	$60
C&I Prescriptive Rebate	LED Wall Mounted Area Lights (30-75W)	$80
C&I Prescriptive Rebate	LED Wall Mounted Area Lights (≥75W)	$100
C&I Prescriptive Rebate	LED Refrigerator Case Light	$50
C&I Prescriptive Rebate	Photocell Occupancy Sensor	$25
C&I Prescriptive Rebate	Wall-Mount Occupancy Sensor	$20
C&I Custom Rebate	C&I Custom Rebate	$0.10
Strategic Energy Management	Small C&I Strategic Energy Management	$0.10
Strategic Energy Management	Large C&I Strategic Energy Management	$0.10
C&I Retrocommissioning	Small C&I Retrocommissioning	$0.15
C&I Retrocommissioning	Large C&I Retrocommissioning	$0.15
Renewables	Photovoltaic 10 kW	$5,000
Renewables	Photovoltaic 5 kW	$2,500
Renewables	Photovoltaic 20 kW	$10,000
Renewables	Photovoltaic 30 kW	$15,000

C. The cost of incentives to customers to participate in the potential demand-side program paid by the entities other than the utility;

The RAP Program Design cost of incentives to customers to participate in the DSM Programs is shown in the table below.

Table 47 Total Incentives per Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$365,335**	**$820,495**	**$894,350**	**$956,195**	**$1,024,975**	**$1,153,275**	**$1,245,075**	**$1,298,675**	**$1,377,930**	**$1,444,430**	**$1,454,230**	**$1,502,045**	**$1,537,999**	**$1,607,174**	**$1,612,151**	**$1,652,466**	**$1,643,466**	**$1,620,181**	**$1,605,606**
Total Residential	**$141,555**	**$323,480**	**$371,200**	**$399,500**	**$426,250**	**$491,100**	**$512,400**	**$528,000**	**$548,100**	**$566,100**	**$568,450**	**$590,800**	**$598,600**	**$605,950**	**$608,750**	**$611,450**	**$611,450**	**$597,700**	**$597,700**
Residential Lighting	$23,750	$47,500	$47,500	$46,300	$45,100	$44,300	$37,500	$36,700	$35,900	$34,700	$34,700	$34,700	$34,700	$34,950	$35,200	$35,200	$35,200	$35,200	$35,200
Residential Appliance Recycling	$0	$0	$0	$0	$0	$30,000	$37,000	$38,500	$45,500	$52,000	$54,000	$61,000	$68,000	$75,000	$82,000	$84,000	$84,000	$84,000	$84,000
Whole House Efficiency	$117,805	$275,980	$323,700	$353,200	$381,150	$416,800	$437,900	$452,800	$466,700	$479,400	$479,750	$495,100	$495,900	$496,000	$491,550	$492,250	$492,250	$478,500	$478,500
Residential Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Residential Low Income	**$30,970**	**$64,940**	**$61,940**	**$65,540**	**$74,140**	**$90,140**	**$95,140**	**$95,140**	**$116,040**	**$116,040**	**$130,640**	**$130,640**	**$138,640**	**$138,640**	**$138,640**	**$138,640**	**$138,640**	**$138,640**	**$138,640**
Low Income Whole House Efficiency	$30,970	$64,940	$61,940	$65,540	$74,140	$90,140	$95,140	$95,140	$116,040	$116,040	$130,640	$130,640	$138,640	$138,640	$138,640	$138,640	$138,640	$138,640	$138,640
Low Income Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Low Income Weatherization																			
Total Business	**$192,810**	**$432,075**	**$461,210**	**$491,155**	**$524,585**	**$545,535**	**$598,535**	**$636,035**	**$674,290**	**$712,290**	**$729,140**	**$754,605**	**$772,245**	**$834,070**	**$860,748**	**$898,363**	**$889,363**	**$879,828**	**$865,253**
C&I Prescriptive Rebate	$177,810	$398,325	$423,710	$453,655	$487,085	$508,035	$561,035	$598,535	$636,790	$674,790	$691,640	$717,105	$734,745	$760,085	$777,600	$815,215	$806,215	$796,680	$782,105
C&I Custom Rebate	$15,000	$33,750	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$9,163	$9,163	$9,163	$9,163	$9,163
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$36,485	$36,485	$36,485	$36,485	$36,485	$36,485
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$26,500**	**$39,000**	**$39,500**	**$39,500**	**$50,000**	**$26,000**	**$26,000**	**$28,514**	**$28,514**	**$4,014**	**$4,014**	**$4,014**	**$4,014**	**$4,014**
Demand Load Control	$0	$0	$0	$0	$0	$26,500	$39,000	$39,500	$39,500	$50,000	$26,000	$26,000	$26,500	$26,500	$2,000	$2,000	$2,000	$2,000	$2,000
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,014	$2,014	$2,014	$2,014	$2,014	$2,014	$2,014

D. The cost to the customer and to the utility of technology to implement a potential demand-side program;

The RAP Program Design cost to the customer and utility to implement the DSM Programs is shown in the tables below.

Table 48 Total Utility Administrative Costs per Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$343,430**	**$798,415**	**$897,195**	**$984,746**	**$1,064,980**	**$1,354,577**	**$1,490,853**	**$1,562,179**	**$1,630,650**	**$1,740,457**	**$1,654,728**	**$1,741,979**	**$1,859,417**	**$1,938,080**	**$1,856,597**	**$1,881,116**	**$1,877,357**	**$1,858,845**	**$1,853,237**
Total Residential	**$215,514**	**$505,254**	**$586,485**	**$620,580**	**$655,303**	**$776,192**	**$815,681**	**$853,494**	**$886,779**	**$929,923**	**$951,179**	**$1,029,404**	**$1,075,727**	**$1,098,880**	**$1,119,072**	**$1,130,152**	**$1,130,152**	**$1,115,907**	**$1,115,907**
Residential Lighting	$13,382	$26,763	$26,763	$26,110	$25,456	$25,020	$21,316	$20,880	$20,444	$19,790	$19,790	$19,790	$19,790	$19,989	$20,189	$20,189	$20,189	$20,189	$20,189
Residential Appliance Recycling	$0	$0	$0	$0	$0	$87,837	$108,613	$113,850	$135,176	$156,450	$163,526	$186,226	$207,550	$230,250	$252,950	$261,400	$261,400	$261,400	$261,400
Whole House Efficiency	$163,576	$401,379	$482,610	$517,358	$552,735	$586,223	$608,640	$641,652	$654,047	$676,571	$690,751	$746,276	$771,275	$771,529	$768,821	$771,451	$771,451	$757,206	$757,206
Residential Behavioral	$38,556	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112
Total Residential Low Income	**$22,804**	**$47,529**	**$45,606**	**$75,916**	**$80,572**	**$87,541**	**$90,088**	**$90,088**	**$108,760**	**$108,760**	**$117,260**	**$117,260**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**
Low Income Whole House Efficiency	$22,804	$47,529	$45,606	$48,700	$53,356	$60,325	$62,872	$62,872	$81,544	$81,544	$90,044	$90,044	$93,529	$93,529	$93,529	$93,529	$93,529	$93,529	$93,529
Low Income Behavioral	$0	$0	$0	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216
Low Income Weatherization																			
Total Business	**$105,112**	**$245,632**	**$265,104**	**$288,250**	**$329,105**	**$355,591**	**$386,112**	**$417,069**	**$433,583**	**$447,233**	**$453,915**	**$462,941**	**$469,665**	**$525,175**	**$548,229**	**$561,668**	**$557,909**	**$553,642**	**$548,034**
C&I Prescriptive Rebate	$94,492	$221,737	$238,554	$261,700	$302,555	$329,041	$359,562	$390,519	$407,033	$420,683	$427,365	$436,391	$443,115	$452,362	$459,180	$472,619	$468,860	$464,593	$458,985
C&I Custom Rebate	$10,620	$23,895	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$16,236	$16,236	$16,236	$16,236	$16,236
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$46,263	$46,263	$46,263	$46,263	$46,263	$46,263
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$135,253**	**$198,972**	**$201,528**	**$201,528**	**$254,541**	**$132,374**	**$132,374**	**$193,280**	**$193,280**	**$68,551**	**$68,551**	**$68,551**	**$68,551**	**$68,551**
Demand Load Control	$0	$0	$0	$0	$0	$135,253	$198,972	$201,528	$201,528	$254,541	$132,374	$132,374	$134,920	$134,920	$10,191	$10,191	$10,191	$10,191	$10,191
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$58,360	$58,360	$58,360	$58,360	$58,360	$58,360	$58,360

Table 49 Total Customer Incremental Costs per Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$649,944**	**$1,410,002**	**$1,484,217**	**$1,541,888**	**$1,625,834**	**$1,713,476**	**$1,760,219**	**$1,761,407**	**$1,789,134**	**$1,790,821**	**$1,755,923**	**$1,743,828**	**$1,707,856**	**$1,698,285**	**$1,662,842**	**$1,642,144**	**$1,569,666**	**$1,483,750**	**$1,413,822**
Total Residential	**$267,805**	**$586,427**	**$648,198**	**$688,237**	**$746,057**	**$823,706**	**$828,774**	**$817,251**	**$814,806**	**$807,174**	**$778,372**	**$773,505**	**$749,483**	**$726,857**	**$700,456**	**$675,893**	**$649,958**	**$608,803**	**$585,442**
Residential Lighting	$30,821	$59,276	$57,001	$53,443	$50,074	$47,308	$38,584	$36,322	$34,176	$31,781	$30,561	$29,389	$28,261	$27,396	$26,556	$25,537	$24,557	$23,615	$22,709
Residential Appliance Recycling	$0	$0	$0	$0	$0	$32,511	$38,573	$38,784	$44,126	$48,692	$48,840	$53,199	$56,999	$60,576	$63,794	$63,140	$60,717	$58,388	$56,147
Whole House Efficiency	$236,985	$527,151	$591,197	$634,793	$695,983	$743,887	$751,618	$742,146	$736,503	$726,701	$698,971	$690,917	$664,224	$638,886	$610,106	$587,216	$564,683	$526,801	$506,587
Residential Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Residential Low Income	**$25,879**	**$53,727**	**$47,861**	**$50,099**	**$57,110**	**$71,200**	**$72,795**	**$70,002**	**$84,758**	**$81,506**	**$89,881**	**$86,432**	**$89,306**	**$85,879**	**$82,584**	**$79,415**	**$76,368**	**$73,438**	**$70,620**
Low Income Whole House Efficiency	$25,879	$53,727	$47,861	$50,099	$57,110	$71,200	$72,795	$70,002	$84,758	$81,506	$89,881	$86,432	$89,306	$85,879	$82,584	$79,415	$76,368	$73,438	$70,620
Low Income Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Low Income Weatherization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Business	**$356,260**	**$769,848**	**$788,158**	**$803,552**	**$822,667**	**$818,570**	**$858,649**	**$874,154**	**$889,571**	**$902,141**	**$887,669**	**$883,891**	**$869,066**	**$885,548**	**$879,802**	**$886,837**	**$843,340**	**$801,510**	**$757,760**
C&I Prescriptive Rebate	$319,260	$689,792	$702,620	$721,297	$743,568	$742,506	$785,504	$803,816	$821,931	$837,097	$825,121	$823,742	$811,226	$807,989	$794,622	$804,925	$764,572	$725,764	$684,920
C&I Custom Rebate	$37,000	$80,056	$85,537	$82,255	$79,099	$76,064	$73,145	$70,339	$67,640	$65,044	$62,548	$60,148	$57,840	$55,621	$53,487	$51,434	$49,461	$47,563	$45,738
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,596	$10,190	$9,799	$9,423	$9,061
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$21,939	$21,097	$20,287	$19,509	$18,760	$18,040
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Demand Load Control	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

E. The utility's cost to administer the potential demand-side program; and

The RAP Program Design utility's cost to administer the DSM Programs is shown in the tables below.

Table 50 Total Utility Administrative Costs per Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$343,430**	**$798,415**	**$897,195**	**$984,746**	**$1,064,980**	**$1,354,577**	**$1,490,853**	**$1,562,179**	**$1,630,650**	**$1,740,457**	**$1,654,728**	**$1,741,979**	**$1,859,417**	**$1,938,080**	**$1,856,597**	**$1,881,116**	**$1,877,357**	**$1,858,845**	**$1,853,237**
Total Residential	**$215,514**	**$505,254**	**$586,485**	**$620,580**	**$655,303**	**$776,192**	**$815,681**	**$853,494**	**$886,779**	**$929,923**	**$951,179**	**$1,029,404**	**$1,075,727**	**$1,098,880**	**$1,119,072**	**$1,130,152**	**$1,130,152**	**$1,115,907**	**$1,115,907**
Residential Lighting	$13,382	$26,763	$26,763	$26,110	$25,456	$25,020	$21,316	$20,880	$20,444	$19,790	$19,790	$19,790	$19,790	$19,989	$20,189	$20,189	$20,189	$20,189	$20,189
Residential Appliance Recycling	$0	$0	$0	$0	$0	$87,837	$108,613	$113,850	$135,176	$156,450	$163,526	$186,226	$207,550	$230,250	$252,950	$261,400	$261,400	$261,400	$261,400
Whole House Efficiency	$163,576	$401,379	$482,610	$517,358	$552,735	$586,223	$608,640	$641,652	$654,047	$676,571	$690,751	$746,276	$771,275	$771,529	$768,821	$771,451	$771,451	$757,206	$757,206
Residential Behavioral	$38,556	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112
Total Residential Low Income	**$22,804**	**$47,529**	**$45,606**	**$75,916**	**$80,572**	**$87,541**	**$90,088**	**$90,088**	**$108,760**	**$108,760**	**$117,260**	**$117,260**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**
Low Income Whole House Efficiency	$22,804	$47,529	$45,606	$48,700	$53,356	$60,325	$62,872	$62,872	$81,544	$81,544	$90,044	$90,044	$93,529	$93,529	$93,529	$93,529	$93,529	$93,529	$93,529
Low Income Behavioral	$0	$0	$0	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216
Low Income Weatherization																			
Total Business	**$105,112**	**$245,632**	**$265,104**	**$288,250**	**$329,105**	**$355,591**	**$386,112**	**$417,069**	**$433,583**	**$447,233**	**$453,915**	**$462,941**	**$469,665**	**$525,175**	**$548,229**	**$561,668**	**$557,909**	**$553,642**	**$548,034**
C&I Prescriptive Rebate	$94,492	$221,737	$238,554	$261,700	$302,555	$329,041	$359,562	$390,519	$407,033	$420,683	$427,365	$436,391	$443,115	$452,362	$459,180	$472,619	$468,860	$464,593	$458,985
C&I Custom Rebate	$10,620	$23,895	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$16,236	$16,236	$16,236	$16,236	$16,236
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$46,263	$46,263	$46,263	$46,263	$46,263	$46,263
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$135,253**	**$198,972**	**$201,528**	**$201,528**	**$254,541**	**$132,374**	**$132,374**	**$193,280**	**$193,280**	**$68,551**	**$68,551**	**$68,551**	**$68,551**	**$68,551**
Demand Load Control	$0	$0	$0	$0	$0	$135,253	$198,972	$201,528	$201,528	$254,541	$132,374	$132,374	$134,920	$134,920	$10,191	$10,191	$10,191	$10,191	$10,191
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$58,360	$58,360	$58,360	$58,360	$58,360	$58,360	$58,360

F. Other costs identified by the utility;

AEG did not identify other costs for the DSM Programs.

3.8 Participants and Impacts

(H) A tabulation of the incremental and cumulative number of participants, load impacts, utility costs, and program participant costs in each year of the planning horizon for each potential demand-side program; and

The realistic achievable potential incremental and cumulative participants, load impacts, utility costs, and program participant costs for each DSM Program can be found in the tables below.

Table 51 Incremental Participation by Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**17,303**	**35,076**	**35,518**	**45,757**	**46,073**	**47,461**	**47,773**	**48,119**	**48,459**	**48,943**	**48,693**	**49,322**	**49,741**	**49,938**	**49,636**	**49,730**	**49,725**	**49,639**	**49,633**
Total Residential	**16,859**	**34,092**	**34,502**	**34,663**	**34,836**	**35,594**	**35,585**	**35,841**	**36,019**	**36,281**	**36,463**	**37,085**	**37,467**	**37,646**	**37,815**	**37,897**	**37,897**	**37,817**	**37,817**
Residential Lighting	1,033	2,067	2,067	2,017	1,967	1,933	1,650	1,617	1,583	1,533	1,533	1,533	1,533	1,550	1,567	1,567	1,567	1,567	1,567
Residential Appliance Recycling	-	-	-	-	-	617	763	800	950	1,100	1,150	1,310	1,460	1,620	1,780	1,840	1,840	1,840	1,840
Whole House Efficiency	826	2,025	2,435	2,646	2,869	3,044	3,172	3,424	3,486	3,648	3,780	4,242	4,474	4,476	4,468	4,490	4,490	4,410	4,410
Residential Behavioral	15,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Total Residential Low Income	**250**	**510**	**500**	**10,520**	**10,540**	**10,560**	**10,570**	**10,570**	**10,710**	**10,710**	**10,750**	**10,750**	**10,760**	**10,760**	**10,760**	**10,760**	**10,760**	**10,760**	**10,760**
Low Income Whole House Efficiency	100	210	200	220	240	260	270	270	360	360	400	400	410	410	410	410	410	410	410
Low Income Behavioral	-	-	-	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Low Income Weatherization	150	300	300	300	300	300	300	300	350	350	350	350	350	350	350	350	350	350	350
Total Business	**194**	**474**	**516**	**574**	**697**	**777**	**838**	**918**	**940**	**952**	**960**	**967**	**974**	**992**	**1,011**	**1,023**	**1,018**	**1,012**	**1,006**
C&I Prescriptive Rebate	174	429	466	524	647	727	788	868	890	902	910	917	924	932	939	951	946	940	934
C&I Custom Rebate	20	45	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	12	12	12	12
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	10	10	10	10	10	10
Demand Response	**-**	**-**	**-**	**-**	**-**	**530**	**780**	**790**	**790**	**1,000**	**520**	**520**	**540**	**540**	**50**	**50**	**50**	**50**	**50**
Demand Load Control	-	-	-	-	-	530	780	790	790	1,000	520	520	530	530	40	40	40	40	40
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	10	10	10	10	10	10	10

Table 52 Cumulative Participation by Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**17,303**	**35,951**	**40,453**	**45,116**	**49,952**	**55,546**	**61,131**	**66,972**	**72,991**	**79,272**	**85,735**	**92,820**	**100,287**	**107,933**	**115,748**	**123,645**	**131,542**	**139,359**	**147,176**
Total Residential	**16,859**	**35,951**	**40,453**	**45,116**	**49,952**	**55,546**	**61,131**	**66,972**	**72,991**	**79,272**	**85,735**	**92,820**	**100,287**	**107,933**	**115,748**	**123,645**	**131,542**	**139,359**	**147,176**
Residential Lighting	1,033	3,100	5,167	7,184	9,151	11,084	12,734	14,351	15,934	17,467	19,000	20,533	22,066	23,616	25,183	26,750	28,317	29,884	31,451
Residential Appliance Recycling	-	-	-	-	-	617	1,380	2,180	3,130	4,230	5,380	6,690	8,150	9,770	11,550	13,390	15,230	17,070	18,910
Whole House Efficiency	826	2,851	5,286	7,932	10,801	13,845	17,017	20,441	23,927	27,575	31,355	35,597	40,071	44,547	49,015	53,505	57,995	62,405	66,815
Residential Behavioral	15,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Total Residential Low Income	**250**																		
Low Income Whole House Efficiency	100	310	510	730	970	1,230	1,500	1,770	2,130	2,490	2,890	3,290	3,700	4,110	4,520	4,930	5,340	5,750	6,160
Low Income Behavioral	-	-	-	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Low Income Weatherization	150	450	750	1,050	1,350	1,650	1,950	2,250	2,600	2,950	3,300	3,650	4,000	4,350	4,700	5,050	5,400	5,750	6,100
Total Business	**194**																		
C&I Prescriptive Rebate	174	603	1,069	1,593	2,240	2,967	3,755	4,623	5,513	6,415	7,325	8,242	9,166	10,098	11,037	11,988	12,934	13,874	14,808
C&I Custom Rebate	20	65	115	165	215	265	315	365	415	465	515	565	615	665	715	765	815	865	915
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	24	36	48	60
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	10	20	30	40	50	60
Demand Response	**-**																		
Demand Load Control	-	-	-	-	-	530	1,310	2,100	2,890	3,890	4,410	4,930	5,460	5,990	6,030	6,070	6,110	6,150	6,190
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	10	20	30	40	50	60	70

Table 53 Incremental Net Demand Reductions by Program (kW)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**506**	**1,105**	**1,174**	**1,282**	**1,344**	**2,002**	**2,299**	**2,343**	**2,418**	**2,568**	**2,102**	**2,123**	**3,139**	**3,202**	**2,737**	**2,777**	**2,778**	**2,762**	**2,759**
Total Residential	**190**	**428**	**479**	**509**	**544**	**585**	**611**	**625**	**645**	**664**	**665**	**684**	**688**	**699**	**706**	**711**	**711**	**694**	**694**
Residential Lighting	12	23	23	23	22	22	19	18	18	17	17	17	17	18	18	18	18	18	18
Residential Appliance Recycling	-	-	-	-	-	35	44	46	55	65	68	78	87	98	108	112	112	112	112
Whole House Efficiency	92	232	283	313	349	355	375	387	399	409	407	415	411	411	408	408	408	391	391
Residential Behavioral	86	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173	173
Total Residential Low Income	**122**	**245**	**244**	**303**	**304**	**306**	**308**	**308**	**355**	**355**	**365**	**365**	**366**	**366**	**366**	**366**	**366**	**366**	**366**
Low Income Whole House Efficiency	12	25	24	26	27	28	31	31	41	41	51	51	51	51	51	51	51	51	51
Low Income Behavioral	-	-	-	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58
Low Income Weatherization	110	220	220	220	220	220	220	220	257	257	257	257	257	257	257	257	257	257	257
Total Business	**194**	**431**	**451**	**470**	**496**	**511**	**513**	**530**	**538**	**542**	**546**	**549**	**552**	**604**	**627**	**662**	**663**	**664**	**661**
C&I Prescriptive Rebate	173	386	400	419	445	461	462	479	488	491	495	498	501	504	507	543	543	545	541
C&I Custom Rebate	20	46	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51	51
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	19	19	19	19
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	50	50	50	50	50	50
Demand Response	**-**	**-**	**-**	**-**	**-**	**600**	**868**	**880**	**880**	**1,008**	**526**	**526**	**1,533**	**1,533**	**1,039**	**1,039**	**1,039**	**1,039**	**1,039**
Demand Load Control	-	-	-	-	-	600	868	880	880	1,008	526	526	537	537	42	42	42	42	42
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	997	997	997	997	997	997	997

Table 54 Cumulative Net Demand Reductions by Program (kW)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**506**	**1,611**	**2,698**	**3,808**	**4,978**	**6,749**	**8,814**	**10,918**	**13,064**	**15,312**	**17,054**	**18,754**	**21,321**	**23,757**	**25,691**	**25,891**	**25,573**	**25,164**	**24,679**
Total Residential	**190**	**619**	**1,011**	**1,347**	**1,718**	**2,130**	**2,566**	**3,015**	**3,485**	**3,968**	**4,422**	**4,853**	**5,269**	**5,638**	**5,989**	**6,340**	**6,659**	**6,939**	**7,172**
Residential Lighting	12	35	59	82	104	126	145	163	181	198	204	198	192	186	182	178	177	176	176
Residential Appliance Recycling	-	-	-	-	-	35	79	126	181	244	309	384	467	524	582	641	691	731	767
Whole House Efficiency	92	324	607	920	1,268	1,623	1,996	2,381	2,778	3,180	3,563	3,925	4,264	4,582	4,880	5,175	5,446	5,687	5,884
Residential Behavioral	86	259	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346	346
Total Residential Low Income	**122**	**367**	**611**	**914**	**1,218**	**1,466**	**1,716**	**1,967**	**2,263**	**2,560**	**2,864**	**3,166**	**3,468**	**3,770**	**4,071**	**4,260**	**4,336**	**4,412**	**4,483**
Low Income Whole House Efficiency	12	37	62	87	114	142	172	202	243	283	330	376	421	466	511	553	594	633	667
Low Income Behavioral	-	-	-	58	115	115	115	115	115	115	115	115	115	115	115	115	115	115	115
Low Income Weatherization	110	330	550	770	989	1,209	1,429	1,649	1,905	2,162	2,418	2,675	2,931	3,188	3,444	3,591	3,628	3,664	3,701
Total Business	**194**	**625**	**1,076**	**1,546**	**2,042**	**2,554**	**3,064**	**3,588**	**4,087**	**4,548**	**5,006**	**5,446**	**5,762**	**5,994**	**6,236**	**6,455**	**6,567**	**6,639**	**6,689**
C&I Prescriptive Rebate	173	559	959	1,379	1,824	2,285	2,745	3,218	3,667	4,077	4,484	4,874	5,139	5,270	5,393	5,513	5,602	5,674	5,723
C&I Custom Rebate	20	66	117	167	218	269	319	370	421	471	522	573	623	674	725	755	760	760	760
Strategic Energy Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	37	56	56	56
C&I Retrocommissioning	-	-	-	-	-	-	-	-	-	-	-	-	-	50	99	149	149	149	149
Demand Response	**-**	**-**	**-**	**-**	**-**	**600**	**1,468**	**2,348**	**3,228**	**4,236**	**4,762**	**5,289**	**6,822**	**8,356**	**9,395**	**8,837**	**8,011**	**7,173**	**6,335**
Demand Load Control	-	-	-	-	-	600	1,468	2,348	3,228	4,236	4,762	5,289	5,825	6,362	6,404	5,846	5,020	4,182	3,344
Curtailment Agreement	-	-	-	-	-	-	-	-	-	-	-	-	997	1,994	2,991	2,991	2,991	2,991	2,991

Table 55 Total Incentives per Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$365,335**	**$820,495**	**$894,350**	**$956,195**	**$1,024,975**	**$1,153,275**	**$1,245,075**	**$1,298,675**	**$1,377,930**	**$1,444,430**	**$1,454,230**	**$1,502,045**	**$1,537,999**	**$1,607,174**	**$1,612,151**	**$1,652,466**	**$1,643,466**	**$1,620,181**	**$1,605,606**
Total Residential	**$141,555**	**$323,480**	**$371,200**	**$399,500**	**$426,250**	**$491,100**	**$512,400**	**$528,000**	**$548,100**	**$566,100**	**$568,450**	**$590,800**	**$598,600**	**$605,950**	**$608,750**	**$611,450**	**$611,450**	**$597,700**	**$597,700**
Residential Lighting	$23,750	$47,500	$47,500	$46,300	$45,100	$44,300	$37,500	$36,700	$35,900	$34,700	$34,700	$34,700	$34,700	$34,950	$35,200	$35,200	$35,200	$35,200	$35,200
Residential Appliance Recycling	$0	$0	$0	$0	$0	$30,000	$37,000	$38,500	$45,500	$52,000	$54,000	$61,000	$68,000	$75,000	$82,000	$84,000	$84,000	$84,000	$84,000
Whole House Efficiency	$117,805	$275,980	$323,700	$353,200	$381,150	$416,800	$437,900	$452,800	$466,700	$479,400	$479,750	$495,100	$495,900	$496,000	$491,550	$492,250	$492,250	$478,500	$478,500
Residential Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Residential Low Income	**$30,970**	**$64,940**	**$61,940**	**$65,540**	**$74,140**	**$90,140**	**$95,140**	**$95,140**	**$116,040**	**$116,040**	**$130,640**	**$130,640**	**$138,640**	**$138,640**	**$138,640**	**$138,640**	**$138,640**	**$138,640**	**$138,640**
Low Income Whole House Efficiency	$30,970	$64,940	$61,940	$65,540	$74,140	$90,140	$95,140	$95,140	$116,040	$116,040	$130,640	$130,640	$138,640	$138,640	$138,640	$138,640	$138,640	$138,640	$138,640
Low Income Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Low Income Weatherization																			
Total Business	**$192,810**	**$432,075**	**$461,210**	**$491,155**	**$524,585**	**$545,535**	**$598,535**	**$636,035**	**$674,290**	**$712,290**	**$729,140**	**$754,605**	**$772,245**	**$834,070**	**$860,748**	**$898,363**	**$889,363**	**$879,828**	**$865,253**
C&I Prescriptive Rebate	$177,810	$398,325	$423,710	$453,655	$487,085	$508,035	$561,035	$598,535	$636,790	$674,790	$691,640	$717,105	$734,745	$760,085	$777,600	$815,215	$806,215	$796,680	$782,105
C&I Custom Rebate	$15,000	$33,750	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500	$37,500
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$9,163	$9,163	$9,163	$9,163	$9,163
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$36,485	$36,485	$36,485	$36,485	$36,485	$36,485
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$26,500**	**$39,000**	**$39,500**	**$39,500**	**$50,000**	**$26,000**	**$26,000**	**$28,514**	**$28,514**	**$4,014**	**$4,014**	**$4,014**	**$4,014**	**$4,014**
Demand Load Control	$0	$0	$0	$0	$0	$26,500	$39,000	$39,500	$39,500	$50,000	$26,000	$26,000	$26,500	$26,500	$2,000	$2,000	$2,000	$2,000	$2,000
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,014	$2,014	$2,014	$2,014	$2,014	$2,014	$2,014

Table 56 Total Utility Administrative Costs per Program

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$343,430**	**$798,415**	**$897,195**	**$984,746**	**$1,064,980**	**$1,354,577**	**$1,490,853**	**$1,562,179**	**$1,630,650**	**$1,740,457**	**$1,654,728**	**$1,741,979**	**$1,859,417**	**$1,938,080**	**$1,856,597**	**$1,881,116**	**$1,877,357**	**$1,858,845**	**$1,853,237**
Total Residential	**$215,514**	**$505,254**	**$586,485**	**$620,580**	**$655,303**	**$776,192**	**$815,681**	**$853,494**	**$886,779**	**$929,923**	**$951,179**	**$1,029,404**	**$1,075,727**	**$1,098,880**	**$1,119,072**	**$1,130,152**	**$1,130,152**	**$1,115,907**	**$1,115,907**
Residential Lighting	$13,382	$26,763	$26,763	$26,110	$25,456	$25,020	$21,316	$20,880	$20,444	$19,790	$19,790	$19,790	$19,790	$19,989	$20,189	$20,189	$20,189	$20,189	$20,189
Residential Appliance Recycling	$0	$0	$0	$0	$0	$87,837	$108,613	$113,850	$135,176	$156,450	$163,526	$186,226	$207,550	$230,250	$252,950	$261,400	$261,400	$261,400	$261,400
Whole House Efficiency	$163,576	$401,379	$482,610	$517,358	$552,735	$586,223	$608,640	$641,652	$654,047	$676,571	$690,751	$746,276	$771,275	$771,529	$768,821	$771,451	$771,451	$757,206	$757,206
Residential Behavioral	$38,556	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112	$77,112
Total Residential Low Income	**$22,804**	**$47,529**	**$45,606**	**$75,916**	**$80,572**	**$87,541**	**$90,088**	**$90,088**	**$108,760**	**$108,760**	**$117,260**	**$117,260**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**	**$120,745**
Low Income Whole House Efficiency	$22,804	$47,529	$45,606	$48,700	$53,356	$60,325	$62,872	$62,872	$81,544	$81,544	$90,044	$90,044	$93,529	$93,529	$93,529	$93,529	$93,529	$93,529	$93,529
Low Income Behavioral	$0	$0	$0	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216	$27,216
Low Income Weatherization																			
Total Business	**$105,112**	**$245,632**	**$265,104**	**$288,250**	**$329,105**	**$355,591**	**$386,112**	**$417,069**	**$433,583**	**$447,233**	**$453,915**	**$462,941**	**$469,665**	**$525,175**	**$548,229**	**$561,668**	**$557,909**	**$553,642**	**$548,034**
C&I Prescriptive Rebate	$94,492	$221,737	$238,554	$261,700	$302,555	$329,041	$359,562	$390,519	$407,033	$420,683	$427,365	$436,391	$443,115	$452,362	$459,180	$472,619	$468,860	$464,593	$458,985
C&I Custom Rebate	$10,620	$23,895	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550	$26,550
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$16,236	$16,236	$16,236	$16,236	$16,236
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$46,263	$46,263	$46,263	$46,263	$46,263	$46,263
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$135,253**	**$198,972**	**$201,528**	**$201,528**	**$254,541**	**$132,374**	**$132,374**	**$193,280**	**$193,280**	**$68,551**	**$68,551**	**$68,551**	**$68,551**	**$68,551**
Demand Load Control	$0	$0	$0	$0	$0	$135,253	$198,972	$201,528	$201,528	$254,541	$132,374	$132,374	$134,920	$134,920	$10,191	$10,191	$10,191	$10,191	$10,191
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$58,360	$58,360	$58,360	$58,360	$58,360	$58,360	$58,360

Table 57 Customer Incremental Costs (NPV)

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$649,944**	**$1,410,002**	**$1,484,217**	**$1,541,888**	**$1,625,834**	**$1,713,476**	**$1,760,219**	**$1,761,407**	**$1,789,134**	**$1,790,821**	**$1,755,923**	**$1,743,828**	**$1,707,856**	**$1,698,285**	**$1,662,842**	**$1,642,144**	**$1,569,666**	**$1,483,750**	**$1,413,822**
Total Residential	**$267,805**	**$586,427**	**$648,198**	**$688,237**	**$746,057**	**$823,706**	**$828,774**	**$817,251**	**$814,806**	**$807,174**	**$778,372**	**$773,505**	**$749,483**	**$726,857**	**$700,456**	**$675,893**	**$649,958**	**$608,803**	**$585,442**
Residential Lighting	$30,821	$59,276	$57,001	$53,443	$50,074	$47,308	$38,584	$36,322	$34,176	$31,781	$30,561	$29,389	$28,261	$27,396	$26,556	$25,537	$24,557	$23,615	$22,709
Residential Appliance Recycling	$0	$0	$0	$0	$0	$32,511	$38,573	$38,784	$44,126	$48,692	$48,840	$53,199	$56,999	$60,576	$63,794	$63,140	$60,717	$58,388	$56,147
Whole House Efficiency	$236,985	$527,151	$591,197	$634,793	$695,983	$743,887	$751,618	$742,146	$736,503	$726,701	$698,971	$690,917	$664,224	$638,886	$610,106	$587,216	$564,683	$526,801	$506,587
Residential Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Residential Low Income	**$25,879**	**$53,727**	**$47,861**	**$50,099**	**$57,110**	**$71,200**	**$72,795**	**$70,002**	**$84,758**	**$81,506**	**$89,881**	**$86,432**	**$89,306**	**$85,879**	**$82,584**	**$79,415**	**$76,368**	**$73,438**	**$70,620**
Low Income Whole House Efficiency	$25,879	$53,727	$47,861	$50,099	$57,110	$71,200	$72,795	$70,002	$84,758	$81,506	$89,881	$86,432	$89,306	$85,879	$82,584	$79,415	$76,368	$73,438	$70,620
Low Income Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Low Income Weatherization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Business	**$356,260**	**$769,848**	**$788,158**	**$803,552**	**$822,667**	**$818,570**	**$858,649**	**$874,154**	**$889,571**	**$902,141**	**$887,669**	**$883,891**	**$869,066**	**$885,548**	**$879,802**	**$886,837**	**$843,340**	**$801,510**	**$757,760**
C&I Prescriptive Rebate	$319,260	$689,792	$702,620	$721,297	$743,568	$742,506	$785,504	$803,816	$821,931	$837,097	$825,121	$823,742	$811,226	$807,989	$794,622	$804,925	$764,572	$725,764	$684,920
C&I Custom Rebate	$37,000	$80,056	$85,537	$82,255	$79,099	$76,064	$73,145	$70,339	$67,640	$65,044	$62,548	$60,148	$57,840	$55,621	$53,487	$51,434	$49,461	$47,563	$45,738
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,596	$10,190	$9,799	$9,423	$9,061
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$21,939	$21,097	$20,287	$19,509	$18,760	$18,040
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Demand Load Control	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

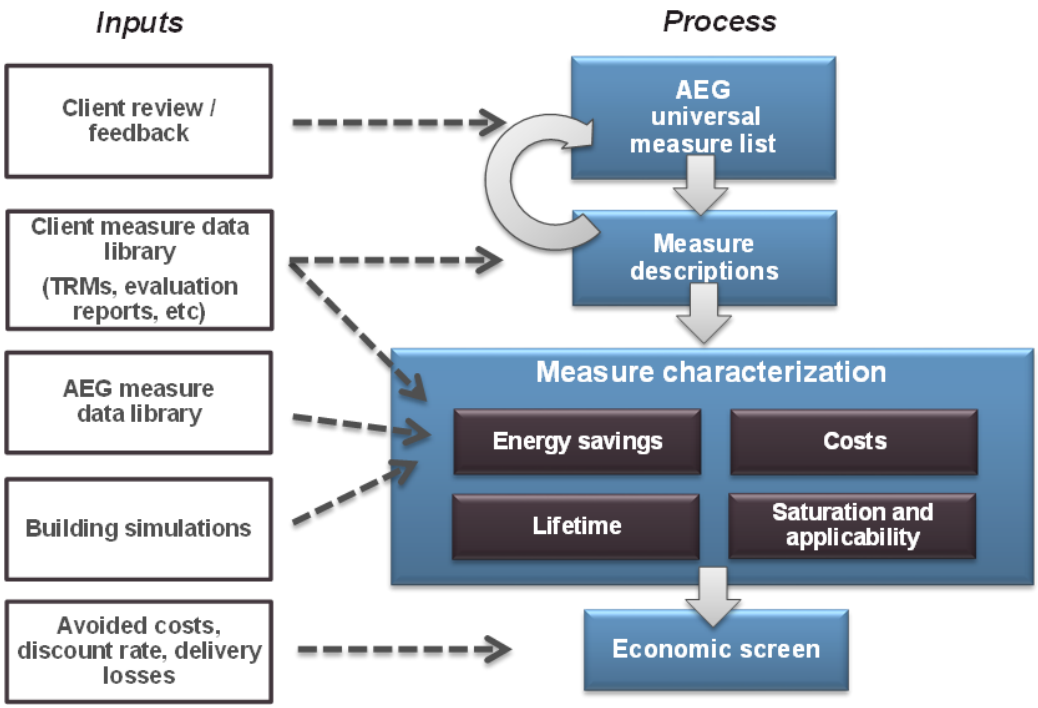
3.9 Sources and Quality of Information

(I) The utility shall describe and document how it performed the assessments and developed the estimates pursuant to subsection (3)(G) and shall provide documentation of its sources and quality of information.

The measure lifetime, gross energy and demand savings per unit and incremental cost per unit are detailed in Section 3.7.

As required by 4 CSR 240-22.050, Empire must achieve all cost-effective demand-side savings. AEG utilized measure and participation data from the comprehensive DSM Potential Study to inform and develop the DSM Program Design. Figure 29 outlines the framework for energy-efficiency measure analysis.

Figure 29 Approach for Energy-Efficiency Measure Assessment



A comprehensive list of EE/DR measures was developed and screened for cost-effectiveness (i.e. a TRC benefit-cost ratio of at least 1.0). Each measure was characterized with energy and demand savings, incremental cost, service life, and other performance factors, drawing upon data from well-vetted national and regional sources. Energy efficient measure energy and demand impacts were calculated using generally accepted engineering algorithms based on a set of reasonable assumptions.

The LoadMAP model performs the cost-effectiveness screening dynamically, taking into account changing savings and cost data over time. Thus, some measures pass the economic screen for some — but not all — of the years in the projection.

Measures that were cost-effective within LoadMAP were included in the economic and achievable potential. The DSM Potential Study measure-level maximum achievable potential (MAP) and realistic achievable potential (RAP) results were exported into the DSM Program Design. The measures were vetted for inclusion in a DSM program and measures were bundled into programs and re-screened for cost-effectiveness. Except for the low-income weatherization and low-income new homes programs, the programs were designed to be cost-effective. Measures were bundled based on the end-use, sector and implementation.

The Total Resource Cost Test (TRC) is the primary method of assessing the cost-effectiveness of energy efficient measures and programs. The TRC test is a widely-accepted methodology that has been used across the United States for over twenty-five years. TRC measures the net costs and benefits of an energy efficiency program as a resource option based on the total costs of the program, including both the participant's and the utility's costs. This test represents the combination of the effects of a program on both participating and non-participating customers.

Several sources of data were used to characterize the energy efficiency measures. We used recent studies performed for the Midwest, AEG data (e.g., DEEM database), and national and well-vetted regional data sources:

- AEG's Database of Energy Efficiency Measures.
- Consortium for Energy Efficiency. Program Resources.[16]
- ENERGY STAR. Energy Efficiency Product Specifications.[17]
- U.S. Department of Energy. Current Rulemakings and Notices.[18]
- Illinois Statewide Technical Reference Manual for Energy Efficiency. Version 4.0 Effective June 1, 2015.
- Arkansas Public Service Commission. Arkansas Technical Reference Manual. Version 4.0 (August 29, 2014).

[16] Consortium for Energy Efficiency. Program Resources. https://www.cee1.org/
[17] Energy Star. Product Specifications and Partner Commitments Search. http://www.energystar.gov/products/spec/
[18] U.S. Department of Energy. Current Rulemakings and Notices. http://energy.gov/eere/buildings/current-rulemakings-and-notices

- State of Minnesota. Technical Reference Manual for Energy Conservation Improvement Programs. Version 1.3. Effective January 1, 2016 – December 31, 2016.
- Michigan Public Service Commission (2015). Michigan Energy Measures Database. Prepared by Morgan Marketing Partners.
- Ameren Missouri 2014 Integrated Resource Plan. Appendix A – Technical Resource Manual.
- Public Utilities Commission of Ohio (2010). State of Ohio Energy Efficiency Technical Reference Manual. Prepared by Vermont Energy Investment Corporation.
- ComEd. ComEd Programs NTG Approach for EPY8.[19]

All measure calculations and sources are identified in the program design workbooks.

[19] http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/ComEd_EPY8_NTG_Summary_2015-01-13.pdf

SECTION 4 DEMAND-SIDE RATE DEVELOPMENT

(4) The utility shall develop potential demand-side rates designed for each market segment to reduce the net consumption of electricity or modify the timing of its use. The utility shall describe and document its demand-side rate planning and design process and shall include at least the following activities and elements:

4.1 Demand-Side Rate Review

(A) Review demand-side rates that have been implemented by other utilities and identify whether similar demand-side rates would be applicable for the utility taking into account factors such as similarity in electric prices and customer makeup;

AEG reviewed demand-side rates that have been implemented and/or piloted by other utilities. The electric utilities in Missouri have not piloted a demand-side rate within the last few years.

(B) Identify demand-side rates applicable to the major classes and decision-makers identified in subsection (1)(A). When appropriate, consider multiple demand-side rate designs for the same major classes;

There are four common types of demand-side rates:

- **Time-of-Use**. Customers pay a higher price during the designated peak period and lower prices during off-peak periods. The designated peak and off-peak periods are typically defined by the season, day and time of day. Requires interval meter.
- **Critical Peak Price**. Customers pay higher peak period prices during the few days a year when wholesale prices are the highest and pay a discounted off-peak price for the remainder of the year. Requires interval meter.
- **Peak Time Rebate**. Customers are paid for load reductions during a peak period. There is no rate discount during non-event hours. Requires smart meter and method for estimating customer's baseline usage.

- **Real Time Pricing**. Customers pay for energy at a rate that is linked to the hourly market price for electricity. Depending on their size, participants are typically made aware of the hourly prices on either a day-ahead or hour-ahead basis. Typically, only the largest customers —above one megawatt of load — face hour-ahead prices. Requires interval meter.

These demand-side rate options have similar demand savings impacts but the implementation costs can vary significantly. AEG focused on the demand-side rate option with the lowest implementation cost, Critical Peak Pricing (CPP). As shown later in the filing, CPP was not found to be cost-effective at any time during the 20-year timeframe. Therefore, the remaining three demand-side rate options were not analyzed.

AEG also considered a residential Inclining Block Rate (IBR). IBR is considered a conservation rate that applies a differing rates based on customer usage. The rate increases as the amount of electricity consumed increases. Typically, the rate is separated into two blocks or tiers by a kWh threshold, the first block below the threshold is charged one rate and the second block above the threshold is charged another higher rate. Unlike other DR and rate based options, this option has low to zero operation, maintenance and incentive costs. However, introducing this rate option requires a significant amount of rate making and regulatory changes that cannot be captured within the modeling.

Table 58 Demand-Side Rate Options

Option	Eligible Customer Classes	Mechanism	Reliability[20]	Current Empire offering?
Critical Peak Pricing	All segments	Higher rate for a particular block of hours that occurs every day	Non-firm	No
Inclining Block Rate	Residential	Applies a rate(s) to a customer's bill if they exceed certain thresholds.	Non-firm	No

(C) Assess how technological advancements that may be reasonably anticipated to occur during the planning horizon, including advanced metering and distribution systems, affect the ability to implement demand-side rates;

Demand side rates are most effective with the use of two-way communicating meters and programmable thermostats, allowing Empire to communicate with customers real-time. Two-way communicating meters, or smart meters, and programmable thermostats are not currently prevalent throughout Empire's territory making pilot programs more costly. The demand response programs were modeled to start in 2022 to give Empire time to roll out the AMI meters to participating customers.

[20] Reliability refers to the customer's commitment to the specific program, it is not related to the technology that calls the events.

(D) Estimate the input data and other characteristics needed for the twenty (20)-year planning horizon to assess the cost effectiveness of each potential demand-side rate, including:

1. An assessment of the demand and energy reduction impacts of each potential demand-side rate;

The demand-side rate impacts are shown in the table below.

Table 59 Demand-Side Rate, Potential kW Savings

Customer Class	Option	Data Element	Unit	Reduction
Residential	CAC DLC	Peak Reduction (kW)	kW	1.009
Residential	Space Heating DLC	Peak Reduction (kW)	kW	1.200
Residential	Water Heating DLC	Peak Reduction (kW)	kW	1.000
Residential	Critical Peak Pricing	Per Customer Impact w/ Tech (%)	%	24.9%
Residential	Critical Peak Pricing	Per Customer Impact w/o Tech (%)	%	14.8%
Residential	Inclining Block Rate	Per Customer Impact w/ Tech (%)	%	0.0%
Residential	Inclining Block Rate	Per Customer Impact w/o Tech (%)	%	2.0%
Nonresidential	CAC DLC	Peak Reduction (kW)	kW	1.176
Nonresidential	Space Heating DLC	Peak Reduction (kW)	kW	1.176
Nonresidential	Curtailment Agreements	Per Customer Impact w/ Tech (%)	%	20%
Nonresidential	Curtailment Agreements	Per Customer Impact w/o Tech (%)	%	20%
Nonresidential Non-Metered	Critical Peak Pricing	Per Customer Impact w/ Tech (%)	%	14.9%
Nonresidential Non-Metered	Critical Peak Pricing	Per Customer Impact w/o Tech (%)	%	0.7%
Nonresidential Metered	Curtailment Agreements - Non Firm	Per Customer Impact w/ Tech (%)	%	20%
Nonresidential Metered	Curtailment Agreements - Non Firm	Per Customer Impact w/o Tech (%)	%	20%
Small Nonresidential Metered	Critical Peak Pricing	Per Customer Impact w/ Tech (%)	%	13.9%
Small Nonresidential Metered	Critical Peak Pricing	Per Customer Impact w/o Tech (%)	%	8.7%
Large Nonresidential Metered	Critical Peak Pricing	Per Customer Impact w/ Tech (%)	%	19%
Large Nonresidential Metered	Critical Peak Pricing	Per Customer Impact w/o Tech (%)	%	10%

2. An assessment of how the interactions between multiple potential demand-side rates, if offered simultaneously, would affect the impact estimates;

The demand-side rates were screened for cost-effectiveness as stand-alone pilot programs. Programs that that were determined to be cost-effective by customer class were bundled together to assess overall impacts. To avoid double counting of load reduction impacts, program-eligibility criteria were defined to

ensure that customers do not participate in mutually exclusive programs at the same time. For example, residential customers cannot participate in both a Critical Peak Pricing option and Inclining Block Rates.

3. An assessment of how the interactions between potential demand-side rates and potential demand-side programs would affect the impact estimates of the potential demand-side programs and potential demand-side rates;

The interactions between potential demand-side rates and potential demand-side programs were assessed. To avoid double counting of load reduction impacts, program-eligibility criteria were defined to ensure that customers do not participate in mutually exclusive programs at the same time.

4. For each year of the planning horizon, an estimate of the incremental and cumulative demand reduction and energy savings due to the potential demand-side rate; and

The realistic and maximum achievable potential incremental demand savings due to the potential demand-side rate pilot programs can be found in the following tables. There were no energy savings associated with the programs.

Table 60 Realistic Achievable Potential Incremental Net Coincident Demand Savings (MW)

Demand Side Rates	Customer Class	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Critical Peak Pricing	Residential	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Non-Residential Non-Metered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Small Non-Residential Metered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Large Non-Residential Metered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inclining Block Rate	Residential	0.21	0.62	1.24	1.86	2.06	2.06	2.07	2.07	2.08	2.09	2.09	2.10	2.11	2.12	2.13	2.14	2.15	2.16	2.17	2.18

Table 61 Maximum Achievable Potential Incremental Net Coincident Demand Savings (MW)

Demand Side Rates	Customer Class	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Critical Peak Pricing	Residential	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Non-Residential Non-Metered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Small Non-Residential Metered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Large Non-Residential Metered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inclining Block Rate	Residential	0.28	0.83	1.65	2.48	2.75	2.75	2.76	2.77	2.77	2.78	2.79	2.80	2.82	2.83	2.84	2.85	2.86	2.88	2.89	2.90

5. For each year of the planning horizon, an estimate of the costs of each potential demand-side rate, including:

A. The cost of incentives to customers to participate in the potential demand-side rate paid by the utility. The utility shall consider multiple levels of incentives to achieve customer participation in each potential demand-side rate, with corresponding adjustments to the maximum achievable potential and the realistic achievable potentials of that potential demand-side rate;

The Critical Peak Pricing was found not to be cost-effective for any customer class. While the Inclining Block Rate was cost-effective, significant rate-making needs to take place to put the rate into effect. Additionally, the savings associated with Inclining Block Rates is subjective; an average savings value was utilized for the analysis but zero savings could be seen with the implementation of such a rate. Empire's current capacity balance and forecast do not necessitate or support taking potentially-costly measures to promote additional conservation at peak times.

B. The cost to the customer and to the utility of technology to implement the potential demand-side rate;

AEG did not identify any costs to the customer for participating in a demand-side rate program.

C. The utility's cost to administer the potential demand-side rate; and

The Critical Peak Pricing was found not to be cost-effective for any customer class. While the Inclining Block Rate was cost-effective, significant rate-making needs to take place to put the rate into effect. Additionally, the savings associated with Inclining Block Rates is subjective; an average savings value was utilized for the analysis but zero savings could be seen with the implementation of such a rate. Empire's current capacity balance and forecast do not necessitate or support taking potentially-costly measures to promote additional conservation at peak times.

D. Other costs identified by the utility;

AEG did not identify any other costs for the demand-side rates.

(E) A tabulation of the incremental and cumulative number of participants, load impacts, utility costs, and program participant costs in each year of the planning horizon for each potential demand-side program;

The Critical Peak Pricing was found not to be cost-effective for any customer class. While the Inclining Block Rate was cost-effective, significant rate-making needs to take place to put the rate into effect. Additionally, the savings associated with Inclining Block Rates is subjective; an average savings value was utilized for the analysis but zero savings could be seen with the implementation of such a rate. Empire's current capacity balance and load forecast do not necessitate or support taking potentially-costly measures to promote additional conservation at peak times.

(F) Evaluate how each demand-side rate would be considered by the utility's Regional Transmission Organization (RTO) in resource adequacy determinations, eligibility to participate as a demand response resource in RTO markets for energy, capacity, and ancillary services; and

Empire's analysis did not include consideration of RTO treatment at this time. Empire's RTO does not currently have a market for demand-side resources. In the absence of a market and market rules, there is no firm basis for estimating the value of these resources at the RTO level. Empire will consider this type of treatment in the future as a market is developed.

(G) The utility shall describe and document how it performed the assessments and developed the estimates pursuant to subsection (4)(D) and shall document its sources and quality of information.

The Critical Peak Pricing was found not to be cost-effective for any customer class. While the Inclining Block Rate was cost-effective, significant rate-making needs to take place to put the rate into effect. Additionally, the savings associated with Inclining Block Rates is subjective; an average savings value was utilized for the analysis but zero savings could be seen with the implementation of such a rate. Empire's current capacity balance and forecast do not necessitate or support taking potentially-costly measures to promote additional conservation.[21]

[21] See the Empire District Electric Company DSM Market Potential Study for the full report.

SECTION 5 DEMAND-SIDE PROGRAM COST EFFECTIVENESS

(5) The utility shall describe and document its evaluation of the cost effectiveness of each potential demand-side program developed pursuant to section (3) and each potential demand-side rate developed pursuant to section (4). All costs and benefits shall be expressed in nominal dollars.

(A) In each year of the planning horizon, the benefits of each potential demand-side program and each potential demand-side rate shall be calculated as the cumulative demand reduction multiplied by the avoided demand cost plus the cumulative energy savings multiplied by the avoided energy cost. These calculations shall be performed both with and without the avoided probable environmental costs. The utility shall describe and document the methods, data, and assumptions it used to develop the avoided costs.

1. The utility avoided demand cost shall include the capacity cost of generation, transmission, and distribution facilities, adjusted to reflect reliability reserve margins and capacity losses on the transmission and distribution systems, or the corresponding market-based equivalents of those costs. The utility shall describe and document how it developed its avoided demand cost, and the capacity cost chosen shall be consistent throughout the triennial compliance filing.

Empire developed its avoided demand costs utilizing the same basic methodology as the previous IRP (2013 IRP). The 2013 IRP avoided demand costs were developed with input from its IRP Stakeholder Advisory Group. The Avoided Demand Cost is comprised of values for generation, transmission, and distribution. Empire began with $10/kW as the avoided generation cost, and increased that to $20/kW by 2018 and then trended this to the levelized carrying cost of an installed simple-cycle combustion turbine by 2028, which is approximately the first year of capacity needs based on the base case assumptions of this IRP. In 2029 and beyond, Empire continued to use the levelized carrying cost of a simple-cycle combustion turbine escalated at the rate of inflation. For the transmission cost component of the avoided demand cost, Empire used the levelized carrying cost of the estimated transmission cost to interconnect a simple-cycle combustion turbine. Using the same approach as the previous IRP, Empire determined that the avoided distribution costs for demand-side screening purposes for its system would be close to zero. The graph below illustrates the projections for price ($/kW) over the 20-year planning horizon as

assumptions for avoided demand costs. The subsequent chart details the assumptions for generation, transmission, and distribution that comprised the avoided demand cost ($/kW).

Figure 30 Forecasted Electricity Market Price ($/kW) Over the 20-Year Planning Horizon

****Highly Confidential in its entirety****

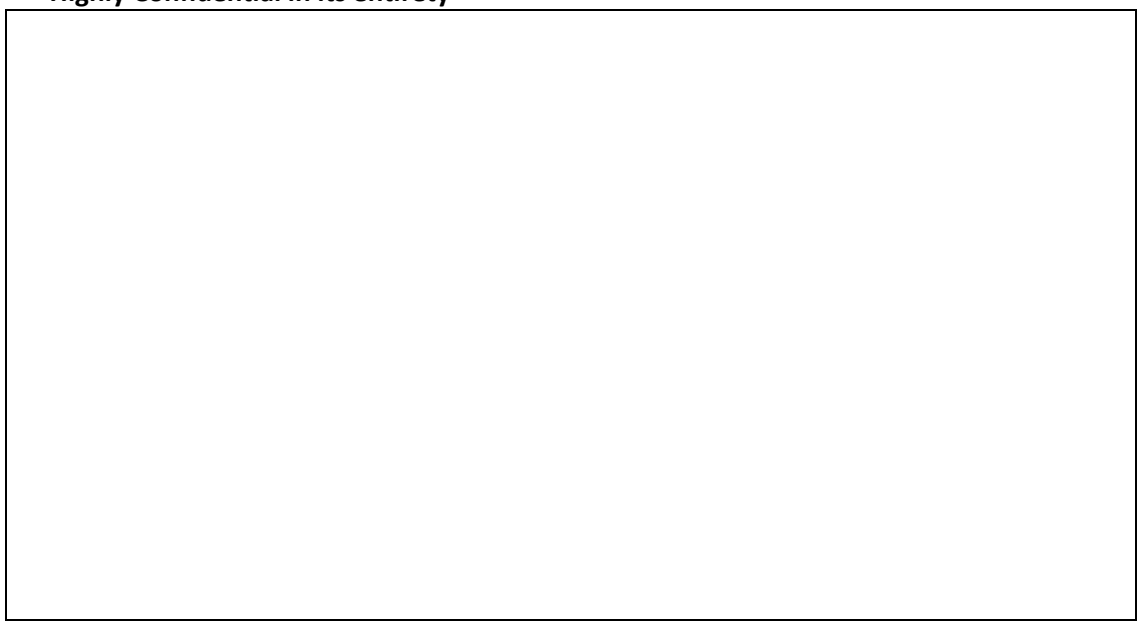


Table 62 Forecasted Electricity Market Price ($/kW)

*****Highly Confidential in its entirety*****

2. The utility avoided energy cost shall include the fuel costs, emission allowance costs, and other variable operation and maintenance costs of generation facilities, adjusted to reflect energy losses on the transmission and distribution systems, or the corresponding market-based equivalents of those costs. The utility shall describe and document how it developed its avoided energy cost, and the energy costs shall be consistent throughout the triennial compliance filing.

Empire engaged ABB to develop its avoided energy costs. Since Empire is a member of the Southwest Power Pool (SPP) and part of the SPP integrated marketplace (SPP IM), Empire utilized market prices as the avoided energy cost. ABB created a forward view of the SPP-KSMO regional electricity market using the Spring 2015 Power Reference Case database. The database uses publicly available information through 2024 and is further extrapolated to 2035 using general trends for prices, demand growth and resource expansion. The forward view is a proprietary perspective of the future based on public or

commercial information and experience in working in electricity markets. This fundamental approach relies on first identifying the basic components of electricity price: supply, transmission and demand, and, using best available sources, project the components over time and geography. Supply is disaggregated into types of generation, and further disaggregated into fuels (or drivers), operations of the resources (capacity, heat rates, planned outages, and forced outages), the amount of additions (and retirements) over time and other factors such as emissions from power generation. Demand is the demand for electricity by zone (187 zones in North America). Monthly peak and energy demand is forecast over a ten year period. Then, reference hourly demand of electricity is applied to forecasts to produce forecasts of hourly demand by region. Figure 31 illustrates Empire's assumptions for the average avoided energy costs ($/MWh) for each of the five avoided probable environmental cost scenarios (no future carbon, low, mid, high and weighted average of the four).

Figure 31 – Average Forecasted Energy Costs ($/MWh) for the Five Avoided Probable Environmental Cost Scenarios

*****Highly Confidential in its entirety*****

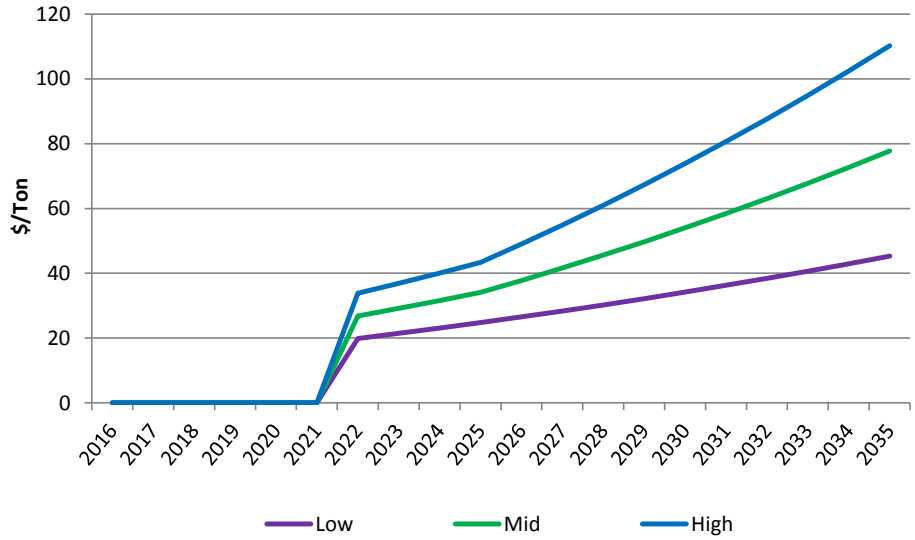
3. The avoided probable environmental costs include the effects of the probable environmental costs calculated pursuant to 4 CSR 240-22.040(2)(B) on the utility avoided demand cost and the utility avoided energy cost. The utility shall describe and document how it developed its avoided probable environmental cost.

Empire engaged ABB for consultation in developing its avoided probable environmental costs as outlined below.

1. No avoided environmental cost scenario: Assumes there will not be a CO2 tax during the 20-year planning horizon.
2. Low avoided environmental cost scenario: Assumes there will be a Low CO2 tax beginning in 2022 based on Synapse 2014 Low Case Report.
3. Mid (Base) avoided environmental cost scenario: Assumes there will be a CO2 tax beginning in 2022 based on EPA Building Blocks.
4. High avoided environmental cost scenario: Assumes there will be a High CO2 tax beginning in 2022 based on Synapse 2014 High Case Report.
5. Weighted avoided environmental cost scenario: Assumes a weighted average of the four environmental cost scenarios with a 50-percent probability placed on the Mid avoided probable environmental cost scenario, a 10-percent probability placed on the No CO2 avoided probable environmental cost scenario, 25-percent probability placed on the Low avoided probable environmental cost scenario and a 15-percent probability placed on the High avoided probable environmental cost scenario.

Projections of price for CO2 ($/ton) for the Low, Mid, and High avoided probable environmental cost scenarios is illustrated in Figure 32.

Figure 32 Projections of Price for CO2 ($/ton) for the Low, Mid, and High Avoided Probable Environmental Cost Scenarios



Empire used these assumptions for CO_2 prices combined with the previously-described assumptions for avoided energy costs to create the following graphs, which illustrate Empire's assumptions for avoided energy costs for each of the avoided probable environmental cost scenarios. Figure 33 illustrates Empire's assumptions for the avoided energy costs ($/MWh) for the No CO2 avoided probable environmental cost scenario.

Figure 33 Empire's Assumptions for Avoided Energy Costs for the No CO_2 Avoided Probable Environmental Cost Scenario

*****Highly Confidential in its entirety*****

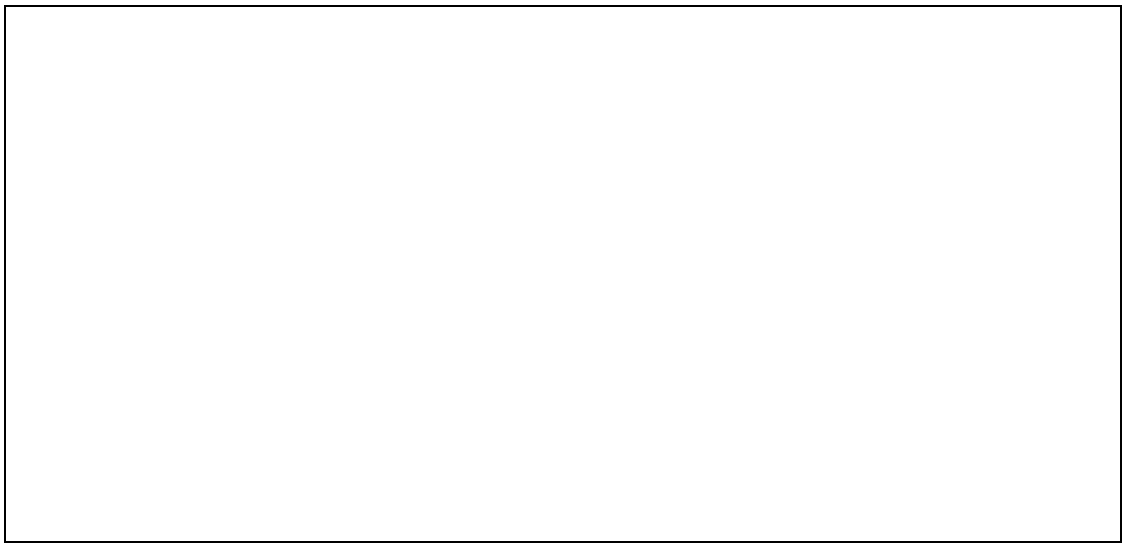


Figure 34 illustrates Empire's assumptions for the avoided energy costs ($/MWh) for the Low avoided probable environmental cost scenario.

Figure 34 Empire's Assumptions for the Avoided Energy Costs ($/MWh) for the Low Avoided Probable Environmental Cost Scenario

*****Highly Confidential in its entirety*****

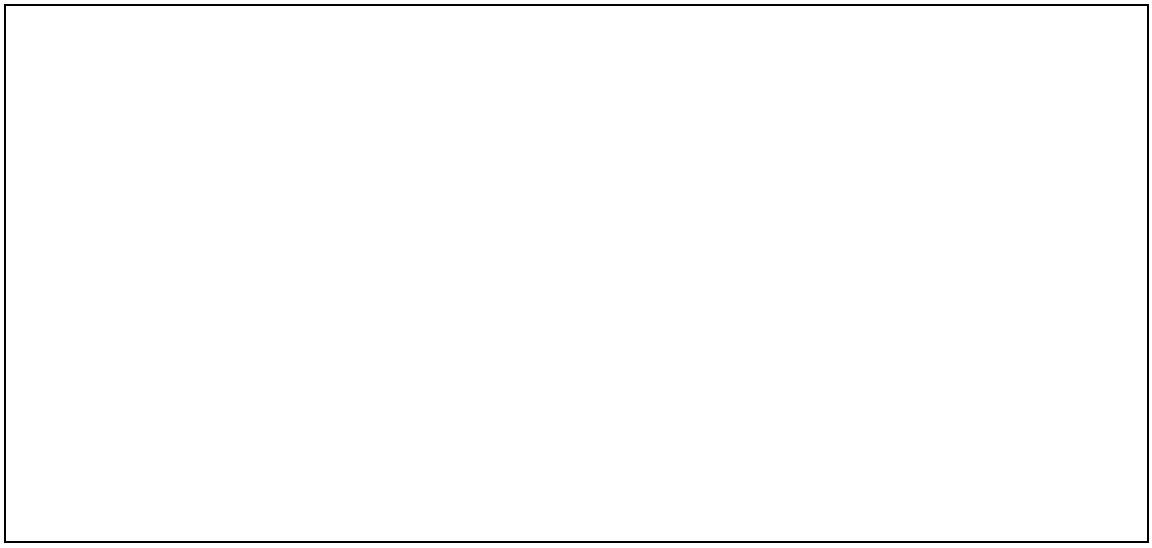


Figure 35 illustrates Empire's assumptions for the avoided energy costs ($/MWh) for the Mid avoided probable environmental cost scenario.

Figure 35 Empire's Assumptions for the Avoided Energy Costs ($/MWh) for the Mid Avoided Probable Environmental Cost Scenario

*****Highly Confidential in its entirety*****

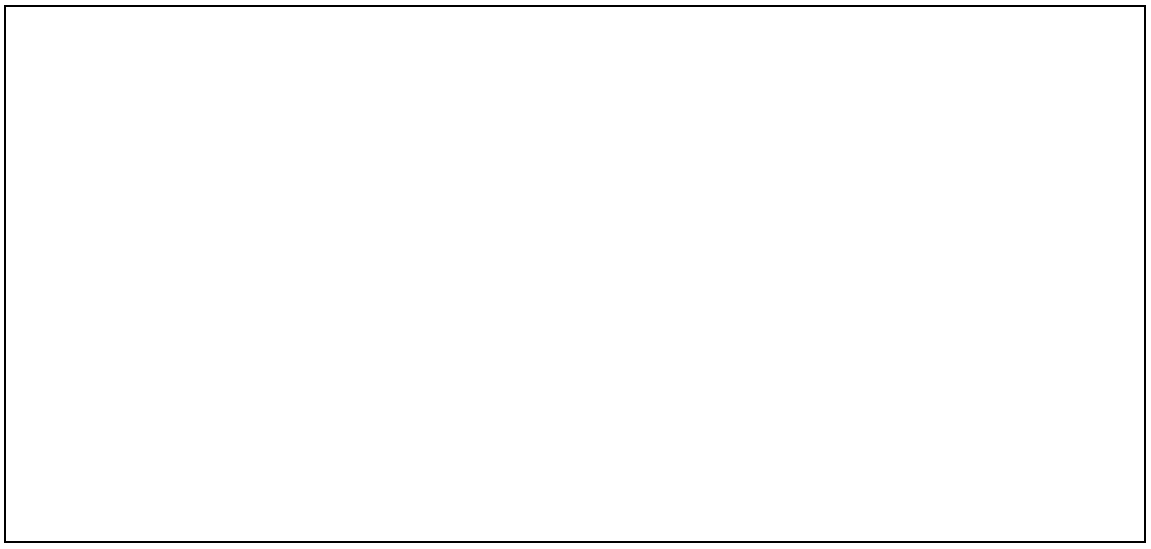
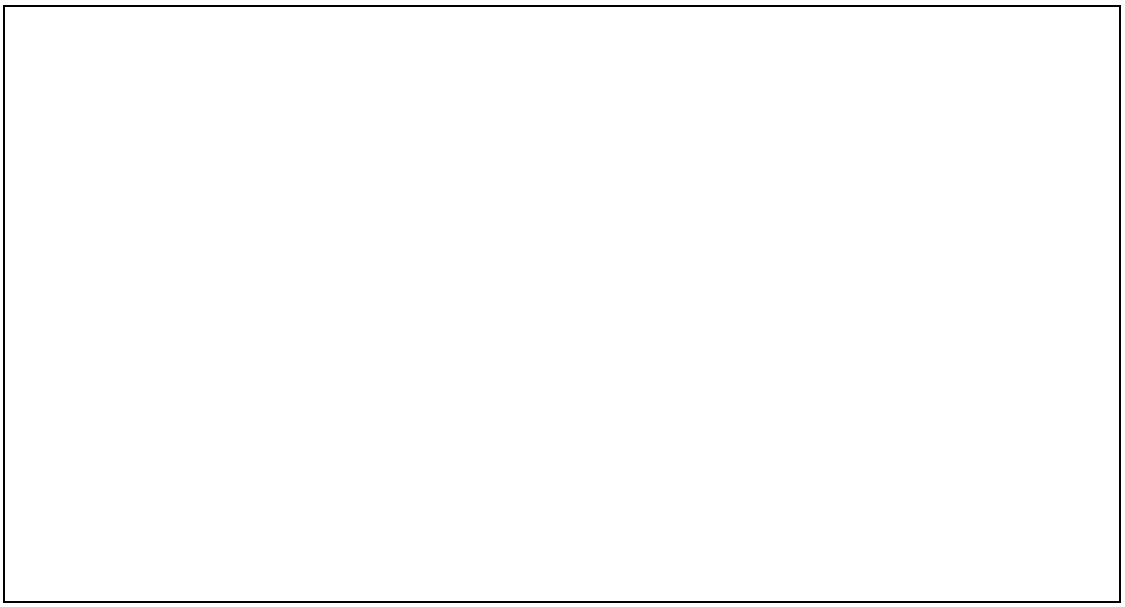


Figure 36 illustrates Empire's assumptions for the avoided energy costs ($/MWh) for the High avoided probable environmental cost scenario.

Figure 36 Empire's Assumptions for the Avoided Energy Costs ($/MWh) for the High Avoided Probable Environmental Cost Scenario

*****Highly Confidential in its entirety*****



(B) The total resource cost test shall be used to evaluate the cost effectiveness of the potential demand-side programs and potential demand-side rates. In each year of the planning horizon—

1. The costs of each potential demand-side program shall be calculated as the sum of all incremental costs of end-use measures that are implemented due to the program (including both utility and participant contributions) plus utility costs to administer, deliver, and evaluate each potential demand-side program;

The demand-side program total resource cost test costs are shown in the table below.

Table 63 Total Resource Cost Test Program Costs

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$993,374**	**$2,177,781**	**$2,313,880**	**$2,417,570**	**$2,536,525**	**$2,827,362**	**$2,939,125**	**$2,949,315**	**$2,981,529**	**$3,014,675**	**$2,874,847**	**$2,876,552**	**$2,870,551**	**$2,863,666**	**$2,736,390**	**$2,688,132**	**$2,573,508**	**$2,439,555**	**$2,330,178**
Total Residential	**$483,319**	**$1,072,294**	**$1,190,538**	**$1,240,085**	**$1,306,423**	**$1,461,979**	**$1,473,782**	**$1,466,262**	**$1,463,253**	**$1,461,077**	**$1,421,558**	**$1,442,876**	**$1,422,136**	**$1,387,621**	**$1,347,542**	**$1,304,310**	**$1,254,261**	**$1,182,594**	**$1,137,216**
Residential Lighting	$44,203	$85,012	$81,750	$76,661	$71,842	$67,882	$55,440	$52,199	$49,126	$45,697	$43,943	$42,257	$40,636	$39,416	$38,230	$36,763	$35,352	$33,996	$32,691
Residential Appliance Recycling	$0	$0	$0	$0	$0	$104,741	$124,460	$125,357	$142,972	$158,705	$159,416	$174,293	$186,780	$199,027	$210,059	$208,491	$200,491	$192,798	$185,400
Whole House Efficiency	$400,561	$913,129	$1,037,481	$1,094,852	$1,168,641	$1,225,946	$1,232,906	$1,230,069	$1,214,768	$1,202,452	$1,166,056	$1,176,184	$1,146,503	$1,102,811	$1,054,664	$1,016,178	$977,186	$916,150	$880,997
Residential Behavioral	$38,556	$74,153	$71,308	$68,572	$65,940	$63,410	$60,977	$58,637	$56,387	$54,224	$52,143	$50,142	$48,218	$46,368	$44,589	$42,878	$41,233	$39,650	$38,129
Total Residential Low Income	**$48,683**	**$99,432**	**$90,035**	**$117,607**	**$126,009**	**$143,186**	**$144,033**	**$138,506**	**$164,288**	**$157,984**	**$169,172**	**$162,681**	**$164,808**	**$158,484**	**$152,403**	**$146,555**	**$140,932**	**$135,524**	**$130,324**
Low Income Whole House Efficiency	$48,683	$99,432	$90,035	$93,406	$102,736	$120,806	$122,512	$117,811	$144,386	$138,846	$150,769	$144,983	$147,790	$142,119	$136,666	$131,422	$126,379	$121,530	$116,866
Low Income Behavioral	$0	$0	$0	$24,202	$23,273	$22,380	$21,521	$20,696	$19,901	$19,138	$18,403	$17,697	$17,018	$16,365	$15,737	$15,133	$14,553	$13,994	$13,457
Low Income Weatherization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Business	**$461,372**	**$1,006,054**	**$1,033,307**	**$1,059,877**	**$1,104,093**	**$1,110,977**	**$1,163,971**	**$1,191,301**	**$1,206,623**	**$1,216,626**	**$1,194,605**	**$1,184,919**	**$1,162,748**	**$1,201,340**	**$1,196,807**	**$1,199,150**	**$1,141,660**	**$1,086,188**	**$1,028,742**
C&I Prescriptive Rebate	$413,752	$903,020	$923,218	$954,013	$1,002,290	$1,013,081	$1,069,831	$1,100,773	$1,119,569	$1,132,913	$1,114,104	$1,107,506	$1,088,306	$1,079,997	$1,060,136	$1,067,723	$1,015,276	$964,654	$911,872
C&I Custom Rebate	$47,620	$103,034	$110,089	$105,865	$101,803	$97,896	$94,140	$90,528	$87,054	$83,714	$80,501	$77,412	$74,442	$71,586	$68,839	$66,197	$63,657	$61,215	$58,866
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$19,985	$19,218	$18,480	$17,771	$17,089
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$49,757	$47,848	$46,012	$44,246	$42,548	$40,916
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$111,220**	**$157,339**	**$153,245**	**$147,365**	**$178,988**	**$89,511**	**$86,076**	**$120,858**	**$116,221**	**$39,639**	**$38,118**	**$36,655**	**$35,248**	**$33,896**
Demand Load Control	$0	$0	$0	$0	$0	$111,220	$157,339	$153,245	$147,365	$178,988	$89,511	$86,076	$84,366	$81,128	$5,893	$5,667	$5,449	$5,240	$5,039
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$36,493	$35,092	$33,746	$32,451	$31,206	$30,008	$28,857

2. The costs of each potential demand-side rate shall be calculated as the sum of all incremental costs that are due to the rate (including both utility and participant contributions) plus utility costs to administer, deliver, and evaluate each potential demand-side rate; and

The demand-side rate pilot programs were not cost-effective. Therefore, the program costs are not analyzed.

3. For purposes of this test, the costs of potential demand-side programs and potential demand-side rates shall not include lost revenues or utility incentive payments to customers.

The total resource cost test did not include lost revenues or utility payments to customers.

(C) The utility cost test shall also be performed for purposes of comparison. In each year of the planning horizon—

1. The costs of each potential demand-side program and potential demand-side rate shall be calculated as the sum of all utility incentive payments plus utility costs to administer, deliver, and evaluate each potential demand-side program or potential demand-side rate;

The demand-side program utility cost test costs are shown in the table below.

Table 64 Utility Cost Test Costs

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$708,765**	**$1,556,790**	**$1,656,695**	**$1,725,975**	**$1,787,173**	**$2,062,239**	**$2,163,461**	**$2,175,442**	**$2,199,990**	**$2,239,549**	**$2,102,272**	**$2,109,432**	**$2,124,406**	**$2,131,786**	**$2,005,748**	**$1,964,836**	**$1,882,620**	**$1,788,890**	**$1,710,268**
Total Residential	**$357,069**	**$796,934**	**$885,600**	**$907,103**	**$924,863**	**$1,042,110**	**$1,050,193**	**$1,050,512**	**$1,049,239**	**$1,051,974**	**$1,027,570**	**$1,053,540**	**$1,046,958**	**$1,025,126**	**$999,085**	**$968,412**	**$931,252**	**$881,124**	**$847,314**
Residential Lighting	$37,132	$71,413	$68,673	$64,390	$60,334	$57,003	$46,509	$43,785	$41,201	$38,316	$36,846	$35,432	$34,073	$33,035	$32,028	$30,799	$29,617	$28,481	$27,388
Residential Appliance Recycling	$0	$0	$0	$0	$0	$96,899	$115,145	$115,850	$132,117	$146,578	$147,091	$160,759	$172,302	$183,549	$193,679	$192,058	$184,689	$177,602	$170,787
Whole House Efficiency	$281,381	$651,368	$745,619	$774,141	$798,588	$824,799	$827,561	$832,240	$819,534	$812,856	$791,491	$807,207	$792,365	$762,174	$728,789	$702,676	$675,714	$635,391	$611,010
Residential Behavioral	$38,556	$74,153	$71,308	$68,572	$65,940	$63,410	$60,977	$58,637	$56,387	$54,224	$52,143	$50,142	$48,218	$46,368	$44,589	$42,878	$41,233	$39,650	$38,129
Total Residential Low Income	**$53,774**	**$108,153**	**$99,451**	**$125,789**	**$132,298**	**$146,109**	**$146,471**	**$140,851**	**$164,382**	**$158,075**	**$167,630**	**$161,197**	**$162,194**	**$155,970**	**$149,985**	**$144,230**	**$138,696**	**$133,374**	**$128,256**
Low Income Whole House Efficiency	$53,774	$108,153	$99,451	$101,588	$109,025	$123,729	$124,949	$120,155	$144,481	$138,937	$149,226	$143,500	$145,175	$139,605	$134,248	$129,097	$124,143	$119,380	$114,799
Low Income Behavioral	$0	$0	$0	$24,202	$23,273	$22,380	$21,521	$20,696	$19,901	$19,138	$18,403	$17,697	$17,018	$16,365	$15,737	$15,133	$14,553	$13,994	$13,457
Low Income Weatherization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Business	**$297,922**	**$651,702**	**$671,644**	**$693,083**	**$730,012**	**$741,007**	**$778,619**	**$800,798**	**$810,120**	**$815,353**	**$799,980**	**$791,711**	**$776,567**	**$817,324**	**$814,718**	**$811,845**	**$773,871**	**$737,079**	**$698,817**
C&I Prescriptive Rebate	$272,302	$596,269	$612,415	$636,127	$675,241	$688,338	$727,971	$752,093	$763,284	$770,315	$756,669	$750,062	$736,517	$729,053	$715,148	$716,096	$681,796	$648,537	$613,673
C&I Custom Rebate	$25,620	$55,433	$59,229	$56,956	$54,771	$52,669	$50,648	$48,705	$46,836	$45,039	$43,310	$41,649	$40,051	$38,514	$37,036	$35,615	$34,248	$32,934	$31,670
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,686	$14,123	$13,581	$13,060	$12,559
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$49,757	$47,848	$46,012	$44,246	$42,548	$40,916
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$133,012**	**$188,179**	**$183,282**	**$176,249**	**$214,147**	**$107,092**	**$102,983**	**$138,688**	**$133,366**	**$41,959**	**$40,349**	**$38,801**	**$37,312**	**$35,881**
Demand Load Control	$0	$0	$0	$0	$0	$133,012	$188,179	$183,282	$176,249	$214,147	$107,092	$102,983	$100,936	$97,063	$7,049	$6,779	$6,519	$6,269	$6,028
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$37,752	$36,303	$34,910	$33,571	$32,282	$31,044	$29,853

2. For purposes of this test, the costs of potential demand-side programs and potential demand-side rates shall not include lost revenues; and

The utility cost test did not include lost revenues.

3. The costs shall include, but separately identify, the costs of any rate of return or incentive included in the utility's recovery of demand-side program costs.

The demand-side programs did not include any costs of the rate of return.

(D) The present value of program benefits minus the present value of program costs over the planning horizon must be positive or the ratio of annualized benefits to annualized costs must be greater than one (1) for a potential demand-side program or potential demand-side rate to pass the utility cost test or the total resource cost test. The utility may relax this criterion for programs that are judged to have potential benefits that are not captured by the estimated load impacts or avoided costs, including programs required to comply with legal mandates.

The demand-side program total resource cost test and utility cost test benefit-cost ratios are shown in the tables below. All programs, except the Low Income programs, have a total resource cost test benefit-cost ratio greater than one (1).

(E) The utility shall provide results of the total resource cost test and the utility cost test for each potential demand-side program evaluated pursuant to subsection (5)(B) and for each potential demand–side rate evaluated pursuant to subsection (5)(C) of this rule, including a tabulation of the benefits (avoided costs), demand-side resource costs, and net benefits or costs.

The demand-side program total resource cost test and utility cost test benefit-cost ratios are shown in the tables below. All programs, except the Low Income programs, have a total resource cost test benefit-cost ratio greater than one (1).

Table 65 Total Resource Cost Test Program Costs

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$993,374**	**$2,177,781**	**$2,313,880**	**$2,417,570**	**$2,536,525**	**$2,827,362**	**$2,939,125**	**$2,949,315**	**$2,981,529**	**$3,014,675**	**$2,874,847**	**$2,876,552**	**$2,870,551**	**$2,863,666**	**$2,736,390**	**$2,688,132**	**$2,573,508**	**$2,439,555**	**$2,330,178**
Total Residential	**$483,319**	**$1,072,294**	**$1,190,538**	**$1,240,085**	**$1,306,423**	**$1,461,979**	**$1,473,782**	**$1,466,262**	**$1,463,253**	**$1,461,077**	**$1,421,558**	**$1,442,876**	**$1,422,136**	**$1,387,621**	**$1,347,542**	**$1,304,310**	**$1,254,261**	**$1,182,594**	**$1,137,216**
Residential Lighting	$44,203	$85,012	$81,750	$76,661	$71,842	$67,882	$55,440	$52,199	$49,126	$45,697	$43,943	$42,257	$40,636	$39,416	$38,230	$36,763	$35,352	$33,996	$32,691
Residential Appliance Recycling	$0	$0	$0	$0	$0	$104,741	$124,460	$125,357	$142,972	$158,705	$159,416	$174,293	$186,780	$199,027	$210,059	$208,491	$200,491	$192,798	$185,400
Whole House Efficiency	$400,561	$913,129	$1,037,481	$1,094,852	$1,168,641	$1,225,946	$1,232,906	$1,230,069	$1,214,768	$1,202,452	$1,166,056	$1,176,184	$1,146,503	$1,102,811	$1,054,664	$1,016,178	$977,186	$916,150	$880,997
Residential Behavioral	$38,556	$74,153	$71,308	$68,572	$65,940	$63,410	$60,977	$58,637	$56,387	$54,224	$52,143	$50,142	$48,218	$46,368	$44,589	$42,878	$41,233	$39,650	$38,129
Total Residential Low Income	**$48,683**	**$99,432**	**$90,035**	**$117,607**	**$126,009**	**$143,186**	**$144,033**	**$138,506**	**$164,288**	**$157,984**	**$169,172**	**$162,681**	**$164,808**	**$158,484**	**$152,403**	**$146,555**	**$140,932**	**$135,524**	**$130,324**
Low Income Whole House Efficiency	$48,683	$99,432	$90,035	$93,406	$102,736	$120,806	$122,512	$117,811	$144,386	$138,846	$150,769	$144,983	$147,790	$142,119	$136,666	$131,422	$126,379	$121,530	$116,866
Low Income Behavioral	$0	$0	$0	$24,202	$23,273	$22,380	$21,521	$20,696	$19,901	$19,138	$18,403	$17,697	$17,018	$16,365	$15,737	$15,133	$14,553	$13,994	$13,457
Low Income Weatherization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Business	**$461,372**	**$1,006,054**	**$1,033,307**	**$1,059,877**	**$1,104,093**	**$1,110,977**	**$1,163,971**	**$1,191,301**	**$1,206,623**	**$1,216,626**	**$1,194,605**	**$1,184,919**	**$1,162,748**	**$1,201,340**	**$1,196,807**	**$1,199,150**	**$1,141,660**	**$1,086,188**	**$1,028,742**
C&I Prescriptive Rebate	$413,752	$903,020	$923,218	$954,013	$1,002,290	$1,013,081	$1,069,831	$1,100,773	$1,119,569	$1,132,913	$1,114,104	$1,107,506	$1,088,306	$1,079,997	$1,060,136	$1,067,723	$1,015,276	$964,654	$911,872
C&I Custom Rebate	$47,620	$103,034	$110,089	$105,865	$101,803	$97,896	$94,140	$90,528	$87,054	$83,714	$80,501	$77,412	$74,442	$71,586	$68,839	$66,197	$63,657	$61,215	$58,866
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$19,985	$19,218	$18,480	$17,771	$17,089
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$49,757	$47,848	$46,012	$44,246	$42,548	$40,916
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$111,220**	**$157,339**	**$153,245**	**$147,365**	**$178,988**	**$89,511**	**$86,076**	**$120,858**	**$116,221**	**$39,639**	**$38,118**	**$36,655**	**$35,248**	**$33,896**
Demand Load Control	$0	$0	$0	$0	$0	$111,220	$157,339	$153,245	$147,365	$178,988	$89,511	$86,076	$84,366	$81,128	$5,893	$5,667	$5,449	$5,240	$5,039
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$36,493	$35,092	$33,746	$32,451	$31,206	$30,008	$28,857

Table 66 Total Resource Cost Test Program Benefits

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$1,994,597**	**$4,658,757**	**$5,251,543**	**$5,726,268**	**$6,275,234**	**$7,209,107**	**$7,656,453**	**$7,908,283**	**$8,397,834**	**$8,715,700**	**$8,530,976**	**$8,729,571**	**$9,076,671**	**$9,279,686**	**$9,089,589**	**$9,337,570**	**$9,316,135**	**$9,209,995**	**$9,113,922**
Total Residential	**$602,994**	**$1,499,224**	**$1,824,561**	**$1,992,626**	**$2,273,644**	**$2,597,634**	**$2,698,466**	**$2,753,068**	**$2,847,202**	**$2,929,713**	**$2,947,780**	**$3,030,541**	**$3,069,115**	**$3,113,077**	**$3,143,470**	**$3,156,404**	**$3,155,279**	**$3,108,560**	**$3,099,156**
Residential Lighting	$61,021	$129,294	$135,650	$137,051	$137,662	$138,824	$118,894	$117,248	$115,827	$113,031	$113,917	$114,686	$115,380	$117,153	$118,919	$119,488	$119,993	$120,325	$120,423
Residential Appliance Recycling	$0	$0	$0	$0	$0	$151,742	$189,038	$197,433	$236,117	$273,537	$285,361	$325,940	$365,909	$407,186	$449,100	$462,274	$464,815	$466,743	$467,655
Whole House Efficiency	$497,840	$1,267,625	$1,574,868	$1,734,848	$1,996,858	$2,152,266	$2,235,513	$2,282,064	$2,336,687	$2,382,451	$2,385,317	$2,425,581	$2,423,258	$2,423,700	$2,409,872	$2,408,194	$2,402,115	$2,351,086	$2,339,733
Residential Behavioral	$44,134	$102,305	$114,043	$120,727	$139,124	$154,801	$155,021	$156,323	$158,571	$160,695	$163,185	$164,334	$164,568	$165,037	$165,578	$166,449	$168,355	$170,406	$171,344
Total Residential Low Income	**$382,765**	**$804,063**	**$823,359**	**$894,461**	**$933,426**	**$980,541**	**$994,806**	**$1,001,548**	**$1,214,155**	**$1,219,700**	**$1,248,330**	**$1,250,196**	**$1,263,280**	**$1,262,816**	**$1,261,934**	**$1,260,300**	**$1,258,402**	**$1,255,333**	**$1,250,356**
Low Income Whole House Efficiency	$57,252	$126,057	$121,578	$133,328	$149,176	$176,590	$184,511	$185,430	$264,189	$265,024	$289,847	$290,063	$303,123	$302,941	$302,635	$302,105	$301,413	$300,408	$299,012
Low Income Behavioral	$0	$0	$0	$40,242	$46,375	$51,600	$51,674	$52,108	$52,857	$53,565	$54,395	$54,778	$54,856	$55,012	$55,193	$55,483	$56,118	$56,802	$57,115
Low Income Weatherization	$325,512	$678,006	$701,781	$720,891	$737,876	$752,351	$758,621	$764,010	$897,109	$901,112	$904,088	$905,355	$905,301	$904,863	$904,107	$902,712	$900,870	$898,123	$894,229
Total Business	**$1,008,838**	**$2,355,470**	**$2,603,623**	**$2,839,182**	**$3,068,164**	**$3,248,413**	**$3,395,239**	**$3,567,782**	**$3,744,793**	**$3,886,541**	**$3,980,915**	**$4,097,973**	**$4,183,961**	**$4,351,310**	**$4,455,292**	**$4,695,133**	**$4,679,819**	**$4,626,536**	**$4,547,881**
C&I Prescriptive Rebate	$906,868	$2,116,976	$2,329,748	$2,558,179	$2,780,669	$2,955,257	$3,099,844	$3,270,291	$3,445,174	$3,585,258	$3,678,168	$3,794,240	$3,879,588	$3,993,257	$4,076,537	$4,315,786	$4,299,827	$4,246,471	$4,168,357
C&I Custom Rebate	$101,970	$238,494	$273,875	$281,002	$287,495	$293,156	$295,395	$297,491	$299,619	$301,283	$302,748	$303,733	$304,372	$304,854	$305,203	$305,297	$305,209	$304,761	$303,863
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20,126	$20,262	$20,463	$20,605	$20,703
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$53,200	$53,426	$53,788	$54,321	$54,698	$54,958
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$382,520**	**$567,943**	**$585,885**	**$591,684**	**$679,745**	**$353,951**	**$350,861**	**$560,315**	**$552,483**	**$228,894**	**$225,733**	**$222,635**	**$219,566**	**$216,529**
Demand Load Control	$0	$0	$0	$0	$0	$382,520	$567,943	$585,885	$591,684	$679,745	$353,951	$350,861	$352,579	$347,643	$26,891	$26,515	$26,143	$25,777	$25,414
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$207,736	$204,840	$202,002	$199,218	$196,492	$193,789	$191,115

Table 67 Total Resource Cost Test Benefit-Cost Ratio

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**2.01**	**2.14**	**2.27**	**2.37**	**2.47**	**2.55**	**2.61**	**2.68**	**2.82**	**2.89**	**2.97**	**3.03**	**3.16**	**3.24**	**3.32**	**3.47**	**3.62**	**3.78**	**3.91**
Total Residential	**1.25**	**1.40**	**1.53**	**1.61**	**1.74**	**1.78**	**1.83**	**1.88**	**1.95**	**2.01**	**2.07**	**2.10**	**2.16**	**2.24**	**2.33**	**2.42**	**2.52**	**2.63**	**2.73**
Residential Lighting	1.38	1.52	1.66	1.79	1.92	2.05	2.14	2.25	2.36	2.47	2.59	2.71	2.84	2.97	3.11	3.25	3.39	3.54	3.68
Residential Appliance Recycling	n/a	n/a	n/a	n/a	n/a	1.45	1.52	1.57	1.65	1.72	1.79	1.87	1.96	2.05	2.14	2.22	2.32	2.42	2.52
Whole House Efficiency	1.24	1.39	1.52	1.58	1.71	1.76	1.81	1.86	1.92	1.98	2.05	2.06	2.11	2.20	2.28	2.37	2.46	2.57	2.66
Residential Behavioral	1.14	1.38	1.60	1.76	2.11	2.44	2.54	2.67	2.81	2.96	3.13	3.28	3.41	3.56	3.71	3.88	4.08	4.30	4.49
Total Residential Low Income	**7.86**	**8.09**	**9.14**	**7.61**	**7.41**	**6.85**	**6.91**	**7.23**	**7.39**	**7.72**	**7.38**	**7.68**	**7.67**	**7.97**	**8.28**	**8.60**	**8.93**	**9.26**	**9.59**
Low Income Whole House Efficiency	1.18	1.27	1.35	1.43	1.45	1.46	1.51	1.57	1.83	1.91	1.92	2.00	2.05	2.13	2.21	2.30	2.38	2.47	2.56
Low Income Behavioral	n/a	n/a	n/a	1.66	1.99	2.31	2.40	2.52	2.66	2.80	2.96	3.10	3.22	3.36	3.51	3.67	3.86	4.06	4.24
Low Income Weatherization	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Business	**2.19**	**2.34**	**2.52**	**2.68**	**2.78**	**2.92**	**2.92**	**2.99**	**3.10**	**3.19**	**3.33**	**3.46**	**3.60**	**3.62**	**3.72**	**3.92**	**4.10**	**4.26**	**4.42**
C&I Prescriptive Rebate	2.19	2.34	2.52	2.68	2.77	2.92	2.90	2.97	3.08	3.16	3.30	3.43	3.56	3.70	3.85	4.04	4.24	4.40	4.57
C&I Custom Rebate	2.14	2.31	2.49	2.65	2.82	2.99	3.14	3.29	3.44	3.60	3.76	3.92	4.09	4.26	4.43	4.61	4.79	4.98	5.16
Strategic Energy Management	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.01	1.05	1.11	1.16	1.21
C&I Retrocommissioning	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.07	1.12	1.17	1.23	1.29	1.34
Demand Response	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**3.44**	**3.61**	**3.82**	**4.02**	**3.80**	**3.95**	**4.08**	**4.64**	**4.75**	**5.77**	**5.92**	**6.07**	**6.23**	**6.39**
Demand Load Control	n/a	n/a	n/a	n/a	n/a	3.44	3.61	3.82	4.02	3.80	3.95	4.08	4.18	4.29	4.56	4.68	4.80	4.92	5.04
Curtailment Agreement	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.69	5.84	5.99	6.14	6.30	6.46	6.62

Table 68 Utility Cost Test Program Costs

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**$708,765**	**$1,556,790**	**$1,656,695**	**$1,725,975**	**$1,787,173**	**$2,062,239**	**$2,163,461**	**$2,175,442**	**$2,199,990**	**$2,239,549**	**$2,102,272**	**$2,109,432**	**$2,124,406**	**$2,131,786**	**$2,005,748**	**$1,964,836**	**$1,882,620**	**$1,788,890**	**$1,710,268**
Total Residential	**$357,069**	**$796,934**	**$885,600**	**$907,103**	**$924,863**	**$1,042,110**	**$1,050,193**	**$1,050,512**	**$1,049,239**	**$1,051,974**	**$1,027,570**	**$1,053,540**	**$1,046,958**	**$1,025,126**	**$999,085**	**$968,412**	**$931,252**	**$881,124**	**$847,314**
Residential Lighting	$37,132	$71,413	$68,673	$64,390	$60,334	$57,003	$46,509	$43,785	$41,201	$38,316	$36,846	$35,432	$34,073	$33,035	$32,028	$30,799	$29,617	$28,481	$27,388
Residential Appliance Recycling	$0	$0	$0	$0	$0	$96,899	$115,145	$115,850	$132,117	$146,578	$147,091	$160,759	$172,302	$183,549	$193,679	$192,058	$184,689	$177,602	$170,787
Whole House Efficiency	$281,381	$651,368	$745,619	$774,141	$798,588	$824,799	$827,561	$832,240	$819,534	$812,856	$791,491	$807,207	$792,365	$762,174	$728,789	$702,676	$675,714	$635,391	$611,010
Residential Behavioral	$38,556	$74,153	$71,308	$68,572	$65,940	$63,410	$60,977	$58,637	$56,387	$54,224	$52,143	$50,142	$48,218	$46,368	$44,589	$42,878	$41,233	$39,650	$38,129
Total Residential Low Income	**$53,774**	**$108,153**	**$99,451**	**$125,789**	**$132,298**	**$146,109**	**$146,471**	**$140,851**	**$164,382**	**$158,075**	**$167,630**	**$161,197**	**$162,194**	**$155,970**	**$149,985**	**$144,230**	**$138,696**	**$133,374**	**$128,256**
Low Income Whole House Efficiency	$53,774	$108,153	$99,451	$101,588	$109,025	$123,729	$124,949	$120,155	$144,481	$138,937	$149,226	$143,500	$145,175	$139,605	$134,248	$129,097	$124,143	$119,380	$114,799
Low Income Behavioral	$0	$0	$0	$24,202	$23,273	$22,380	$21,521	$20,696	$19,901	$19,138	$18,403	$17,697	$17,018	$16,365	$15,737	$15,133	$14,553	$13,994	$13,457
Low Income Weatherization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Business	**$297,922**	**$651,702**	**$671,644**	**$693,083**	**$730,012**	**$741,007**	**$778,619**	**$800,798**	**$810,120**	**$815,353**	**$799,980**	**$791,711**	**$776,567**	**$817,324**	**$814,718**	**$811,845**	**$773,871**	**$737,079**	**$698,817**
C&I Prescriptive Rebate	$272,302	$596,269	$612,415	$636,127	$675,241	$688,338	$727,971	$752,093	$763,284	$770,315	$756,669	$750,062	$736,517	$729,053	$715,148	$716,096	$681,796	$648,537	$613,673
C&I Custom Rebate	$25,620	$55,433	$59,229	$56,956	$54,771	$52,669	$50,648	$48,705	$46,836	$45,039	$43,310	$41,649	$40,051	$38,514	$37,036	$35,615	$34,248	$32,934	$31,670
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$14,686	$14,123	$13,581	$13,060	$12,559
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$49,757	$47,848	$46,012	$44,246	$42,548	$40,916
Demand Response	**$0**	**$0**	**$0**	**$0**	**$0**	**$133,012**	**$188,179**	**$183,282**	**$176,249**	**$214,147**	**$107,092**	**$102,983**	**$138,688**	**$133,366**	**$41,959**	**$40,349**	**$38,801**	**$37,312**	**$35,881**
Demand Load Control	$0	$0	$0	$0	$0	$133,012	$188,179	$183,282	$176,249	$214,147	$107,092	$102,983	$100,936	$97,063	$7,049	$6,779	$6,519	$6,269	$6,028
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$37,752	$36,303	$34,910	$33,571	$32,282	$31,044	$29,853

Table 69 Utility Cost Test Program Benefits

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	$1,994,597	$4,658,757	$5,251,543	$5,726,268	$6,275,234	$7,209,107	$7,656,453	$7,908,283	$8,397,834	$8,715,700	$8,530,976	$8,729,571	$9,076,671	$9,279,686	$9,089,589	$9,337,570	$9,316,135	$9,209,995	$9,113,922
Total Residential	$602,994	$1,499,224	$1,824,561	$1,992,626	$2,273,644	$2,597,634	$2,698,466	$2,753,068	$2,847,202	$2,929,713	$2,947,780	$3,030,541	$3,069,115	$3,113,077	$3,143,470	$3,156,404	$3,155,279	$3,108,560	$3,099,156
Residential Lighting	$61,021	$129,294	$135,650	$137,051	$137,662	$138,824	$118,894	$117,248	$115,827	$113,031	$113,917	$114,686	$115,380	$117,153	$118,919	$119,488	$119,993	$120,325	$120,423
Residential Appliance Recycling	$0	$0	$0	$0	$0	$151,742	$189,038	$197,433	$236,117	$273,537	$285,361	$325,940	$365,909	$407,186	$449,100	$462,274	$464,815	$466,743	$467,655
Whole House Efficiency	$497,840	$1,267,625	$1,574,868	$1,734,848	$1,996,858	$2,152,266	$2,235,513	$2,282,064	$2,336,687	$2,382,451	$2,385,317	$2,425,581	$2,423,258	$2,423,700	$2,409,872	$2,408,194	$2,402,115	$2,351,086	$2,339,733
Residential Behavioral	$44,134	$102,305	$114,043	$120,727	$139,124	$154,801	$155,021	$156,323	$158,571	$160,695	$163,185	$164,334	$164,568	$165,037	$165,578	$166,449	$168,355	$170,406	$171,344
Total Residential Low Income	$382,765	$804,063	$823,359	$894,461	$933,426	$980,541	$994,806	$1,001,548	$1,214,155	$1,219,700	$1,248,330	$1,250,196	$1,263,280	$1,262,816	$1,261,934	$1,260,300	$1,258,402	$1,255,333	$1,250,356
Low Income Whole House Efficiency	$57,252	$126,057	$121,578	$133,328	$149,176	$176,590	$184,511	$185,430	$264,189	$265,024	$289,847	$290,063	$303,123	$302,941	$302,635	$302,105	$301,413	$300,408	$299,012
Low Income Behavioral	$0	$0	$0	$40,242	$46,375	$51,600	$51,674	$52,108	$52,857	$53,565	$54,395	$54,778	$54,856	$55,012	$55,193	$55,483	$56,118	$56,802	$57,115
Low Income Weatherization	$325,512	$678,006	$701,781	$720,891	$737,876	$752,351	$758,621	$764,010	$897,109	$901,112	$904,088	$905,355	$905,301	$904,863	$904,107	$902,712	$900,870	$898,123	$894,229
Total Business	$1,008,838	$2,355,470	$2,603,623	$2,839,182	$3,068,164	$3,248,413	$3,395,239	$3,567,782	$3,744,793	$3,886,541	$3,980,915	$4,097,973	$4,183,961	$4,351,310	$4,455,292	$4,695,133	$4,679,819	$4,626,536	$4,547,881
C&I Prescriptive Rebate	$906,868	$2,116,976	$2,329,748	$2,558,179	$2,780,669	$2,955,257	$3,099,844	$3,270,291	$3,445,174	$3,585,258	$3,678,168	$3,794,240	$3,879,588	$3,993,257	$4,076,537	$4,315,786	$4,299,827	$4,246,471	$4,168,357
C&I Custom Rebate	$101,970	$238,494	$273,875	$281,002	$287,495	$293,156	$295,395	$297,491	$299,619	$301,283	$302,748	$303,733	$304,372	$304,854	$305,203	$305,297	$305,209	$304,761	$303,863
Strategic Energy Management	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$20,126	$20,262	$20,463	$20,605	$20,703
C&I Retrocommissioning	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$53,200	$53,426	$53,788	$54,321	$54,698	$54,958
Demand Response	$0	$0	$0	$0	$0	$382,520	$567,943	$585,885	$591,684	$679,745	$353,951	$350,861	$560,315	$552,483	$228,894	$225,733	$222,635	$219,566	$216,529
Demand Load Control	$0	$0	$0	$0	$0	$382,520	$567,943	$585,885	$591,684	$679,745	$353,951	$350,861	$352,579	$347,643	$26,891	$26,515	$26,143	$25,777	$25,414
Curtailment Agreement	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$207,736	$204,840	$202,002	$199,218	$196,492	$193,789	$191,115

Table 70 Utility Cost Test Benefit-Cost Ratio

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**2.81**	**2.99**	**3.17**	**3.32**	**3.51**	**3.50**	**3.54**	**3.64**	**3.82**	**3.89**	**4.06**	**4.14**	**4.27**	**4.35**	**4.53**	**4.75**	**4.95**	**5.15**	**5.33**
Total Residential	**1.69**	**1.88**	**2.06**	**2.20**	**2.46**	**2.49**	**2.57**	**2.62**	**2.71**	**2.78**	**2.87**	**2.88**	**2.93**	**3.04**	**3.15**	**3.26**	**3.39**	**3.53**	**3.66**
Residential Lighting	1.64	1.81	1.98	2.13	2.28	2.44	2.56	2.68	2.81	2.95	3.09	3.24	3.39	3.55	3.71	3.88	4.05	4.22	4.40
Residential Appliance Recycling	n/a	n/a	n/a	n/a	n/a	1.57	1.64	1.70	1.79	1.87	1.94	2.03	2.12	2.22	2.32	2.41	2.52	2.63	2.74
Whole House Efficiency	1.77	1.95	2.11	2.24	2.50	2.61	2.70	2.74	2.85	2.93	3.01	3.00	3.06	3.18	3.31	3.43	3.55	3.70	3.83
Residential Behavioral	1.14	1.38	1.60	1.76	2.11	2.44	2.54	2.67	2.81	2.96	3.13	3.28	3.41	3.56	3.71	3.88	4.08	4.30	4.49
Total Residential Low Income	**7.12**	**7.43**	**8.28**	**7.11**	**7.06**	**6.71**	**6.79**	**7.11**	**7.39**	**7.72**	**7.45**	**7.76**	**7.79**	**8.10**	**8.41**	**8.74**	**9.07**	**9.41**	**9.75**
Low Income Whole House Efficiency	1.06	1.17	1.22	1.31	1.37	1.43	1.48	1.54	1.83	1.91	1.94	2.02	2.09	2.17	2.25	2.34	2.43	2.52	2.60
Low Income Behavioral	n/a	n/a	n/a	1.66	1.99	2.31	2.40	2.52	2.66	2.80	2.96	3.10	3.22	3.36	3.51	3.67	3.86	4.06	4.24
Low Income Weatherization	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Business	**3.39**	**3.61**	**3.88**	**4.10**	**4.20**	**4.38**	**4.36**	**4.46**	**4.62**	**4.77**	**4.98**	**5.18**	**5.39**	**5.32**	**5.47**	**5.78**	**6.05**	**6.28**	**6.51**
C&I Prescriptive Rebate	3.33	3.55	3.80	4.02	4.12	4.29	4.26	4.35	4.51	4.65	4.86	5.06	5.27	5.48	5.70	6.03	6.31	6.55	6.79
C&I Custom Rebate	3.98	4.30	4.62	4.93	5.25	5.57	5.83	6.11	6.40	6.69	6.99	7.29	7.60	7.92	8.24	8.57	8.91	9.25	9.59
Strategic Energy Management	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.37	1.43	1.51	1.58	1.65
C&I Retrocommissioning	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.07	1.12	1.17	1.23	1.29	1.34
Demand Response	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**2.88**	**3.02**	**3.20**	**3.36**	**3.17**	**3.31**	**3.41**	**4.04**	**4.14**	**5.46**	**5.59**	**5.74**	**5.88**	**6.03**
Demand Load Control	n/a	n/a	n/a	n/a	n/a	2.88	3.02	3.20	3.36	3.17	3.31	3.41	3.49	3.58	3.81	3.91	4.01	4.11	4.22
Curtailment Agreement	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.50	5.64	5.79	5.93	6.09	6.24	6.40

(F) If the utility calculates values for other tests to assist in the design of demand-side programs or demand-side rates, the utility shall describe and document the tests and provide the results of those tests.

Three other benefit-cost tests were utilized to analyze cost-effectiveness from different perspectives:

- **Participant Cost Test** quantifies the benefits and costs to the customer due to program participation.
- **Ratepayer Impact Measure (RIM) Cost Test** measures what happens to a customer's rates due to changes in utility revenues and operating costs.
- **Societal Cost Test** measures the effects of a program on society as a whole.

Table 71 Participant Cost Test Benefit-Cost Ratio

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**7.21**	**7.23**	**7.27**	**7.32**	**7.27**	**7.41**	**7.39**	**7.48**	**7.68**	**7.79**	**7.91**	**8.05**	**8.26**	**8.40**	**8.58**	**8.80**	**9.02**	**9.29**	**9.50**
Total Residential	**5.12**	**5.31**	**5.43**	**5.34**	**5.33**	**5.66**	**5.75**	**5.82**	**5.96**	**6.12**	**6.27**	**6.44**	**6.70**	**6.95**	**7.24**	**7.43**	**7.60**	**7.91**	**8.09**
Residential Lighting	7.01	7.11	7.24	7.38	7.55	7.72	7.92	8.10	8.29	8.48	8.68	8.87	9.08	9.30	9.52	9.74	9.96	10.19	10.43
Residential Appliance Recycling	n/a	n/a	n/a	n/a	n/a	15.79	16.21	16.42	16.85	17.29	17.52	17.96	18.42	18.87	19.33	19.65	20.12	20.61	21.10
Whole House Efficiency	4.19	4.51	4.76	4.71	4.76	4.71	4.73	4.78	4.83	4.90	5.01	5.08	5.21	5.33	5.47	5.60	5.72	5.95	6.08
Residential Behavioral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Residential Low Income	**25.73**	**24.57**	**26.74**	**27.40**	**24.24**	**19.96**	**19.37**	**19.83**	**19.44**	**19.90**	**18.14**	**18.57**	**17.97**	**18.40**	**18.83**	**19.28**	**19.74**	**20.21**	**20.69**
Low Income Whole House Efficiency	4.97	4.97	5.13	5.16	5.01	4.75	4.71	4.80	5.35	5.46	5.23	5.33	5.35	5.46	5.57	5.69	5.80	5.92	6.05
Low Income Behavioral	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Low Income Weatherization	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Business	**7.44**	**7.49**	**7.59**	**7.75**	**7.84**	**8.04**	**7.91**	**7.99**	**8.09**	**8.13**	**8.29**	**8.41**	**8.57**	**8.58**	**8.67**	**8.89**	**9.14**	**9.33**	**9.54**
C&I Prescriptive Rebate	7.64	7.68	7.79	7.95	8.02	8.21	8.04	8.11	8.19	8.22	8.37	8.49	8.65	8.78	8.94	9.16	9.42	9.62	9.84
C&I Custom Rebate	5.72	5.83	5.94	6.07	6.21	6.36	6.51	6.66	6.82	6.98	7.14	7.31	7.48	7.66	7.84	8.03	8.22	8.41	8.61
Strategic Energy Management	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.50	2.55	2.60	2.65	2.70
C&I Retrocommissioning	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3.60	3.66	3.73	3.80	3.87	3.94
Demand Response	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
Demand Load Control	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Curtailment Agreement	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 72 Ratepayer Impact Cost Test Benefit-Cost Ratio

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**0.49**	**0.52**	**0.55**	**0.57**	**0.60**	**0.64**	**0.66**	**0.68**	**0.69**	**0.71**	**0.70**	**0.71**	**0.74**	**0.75**	**0.75**	**0.76**	**0.78**	**0.79**	**0.80**
Total Residential	**0.40**	**0.44**	**0.47**	**0.49**	**0.52**	**0.53**	**0.54**	**0.55**	**0.57**	**0.58**	**0.59**	**0.60**	**0.60**	**0.61**	**0.63**	**0.64**	**0.65**	**0.66**	**0.67**
Residential Lighting	0.34	0.37	0.40	0.43	0.45	0.47	0.48	0.49	0.51	0.52	0.53	0.55	0.56	0.58	0.59	0.60	0.62	0.63	0.64
Residential Appliance Recycling	n/a	n/a	n/a	n/a	n/a	0.42	0.43	0.44	0.46	0.47	0.48	0.50	0.51	0.52	0.54	0.55	0.57	0.58	0.59
Whole House Efficiency	0.44	0.47	0.49	0.51	0.54	0.55	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69
Residential Behavioral	0.22	0.27	0.31	0.34	0.40	0.45	0.46	0.47	0.49	0.50	0.52	0.53	0.54	0.56	0.57	0.58	0.60	0.62	0.63
Total Residential Low Income	**0.56**	**0.59**	**0.63**	**0.62**	**0.65**	**0.66**	**0.67**	**0.69**	**0.71**	**0.72**	**0.73**	**0.75**	**0.76**	**0.77**	**0.78**	**0.79**	**0.80**	**0.82**	**0.83**
Low Income Whole House Efficiency	0.39	0.41	0.43	0.45	0.46	0.46	0.48	0.49	0.52	0.54	0.55	0.57	0.57	0.59	0.60	0.61	0.62	0.63	0.64
Low Income Behavioral	n/a	n/a	n/a	0.33	0.39	0.44	0.45	0.47	0.48	0.50	0.51	0.53	0.54	0.55	0.56	0.58	0.59	0.61	0.63
Low Income Weatherization	0.61	0.64	0.68	0.71	0.74	0.76	0.78	0.80	0.81	0.83	0.84	0.86	0.87	0.88	0.89	0.90	0.92	0.93	0.94
Total Business	**0.53**	**0.57**	**0.60**	**0.63**	**0.65**	**0.68**	**0.69**	**0.70**	**0.72**	**0.73**	**0.75**	**0.77**	**0.78**	**0.79**	**0.81**	**0.83**	**0.85**	**0.86**	**0.88**
C&I Prescriptive Rebate	0.52	0.56	0.59	0.62	0.65	0.67	0.68	0.69	0.71	0.73	0.74	0.76	0.78	0.79	0.81	0.83	0.85	0.86	0.88
C&I Custom Rebate	0.60	0.63	0.67	0.70	0.73	0.76	0.78	0.79	0.81	0.83	0.85	0.87	0.89	0.90	0.92	0.94	0.95	0.97	0.98
Strategic Energy Management	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.56	0.58	0.60	0.62	0.64
C&I Retrocommissioning	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.50	0.51	0.53	0.55	0.57	0.59
Demand Response	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**2.66**	**2.79**	**2.95**	**3.09**	**2.94**	**3.06**	**3.15**	**3.66**	**3.75**	**4.75**	**4.86**	**4.97**	**5.08**	**5.19**
Demand Load Control	n/a	n/a	n/a	n/a	n/a	2.66	2.79	2.95	3.09	2.94	3.06	3.15	3.22	3.29	3.49	3.57	3.65	3.74	3.82
Curtailment Agreement	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4.78	4.89	5.00	5.11	5.22	5.33	5.45

Table 73 Societal Cost Test Benefit-Cost Ratio

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Total Portfolio	**2.01**	**2.14**	**2.27**	**2.37**	**2.47**	**2.55**	**2.61**	**2.68**	**2.82**	**2.89**	**2.97**	**3.03**	**3.16**	**3.24**	**3.32**	**3.47**	**3.62**	**3.78**	**3.91**
Total Residential	**1.25**	**1.40**	**1.53**	**1.61**	**1.74**	**1.78**	**1.83**	**1.88**	**1.95**	**2.01**	**2.07**	**2.10**	**2.16**	**2.24**	**2.33**	**2.42**	**2.52**	**2.63**	**2.73**
Residential Lighting	1.38	1.52	1.66	1.79	1.92	2.05	2.14	2.25	2.36	2.47	2.59	2.71	2.84	2.97	3.11	3.25	3.39	3.54	3.68
Residential Appliance Recycling	n/a	n/a	n/a	n/a	n/a	1.45	1.52	1.57	1.65	1.72	1.79	1.87	1.96	2.05	2.14	2.22	2.32	2.42	2.52
Whole House Efficiency	1.24	1.39	1.52	1.58	1.71	1.76	1.81	1.86	1.92	1.98	2.05	2.06	2.11	2.20	2.28	2.37	2.46	2.57	2.66
Residential Behavioral	1.14	1.38	1.60	1.76	2.11	2.44	2.54	2.67	2.81	2.96	3.13	3.28	3.41	3.56	3.71	3.88	4.08	4.30	4.49
Total Residential Low Income	**7.86**	**8.09**	**9.14**	**7.61**	**7.41**	**6.85**	**6.91**	**7.23**	**7.39**	**7.72**	**7.38**	**7.68**	**7.67**	**7.97**	**8.28**	**8.60**	**8.93**	**9.26**	**9.59**
Low Income Whole House Efficiency	1.18	1.27	1.35	1.43	1.45	1.46	1.51	1.57	1.83	1.91	1.92	2.00	2.05	2.13	2.21	2.30	2.38	2.47	2.56
Low Income Behavioral	n/a	n/a	n/a	1.66	1.99	2.31	2.40	2.52	2.66	2.80	2.96	3.10	3.22	3.36	3.51	3.67	3.86	4.06	4.24
Low Income Weatherization	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total Business	**2.19**	**2.34**	**2.52**	**2.68**	**2.78**	**2.92**	**2.92**	**2.99**	**3.10**	**3.19**	**3.33**	**3.46**	**3.60**	**3.62**	**3.72**	**3.92**	**4.10**	**4.26**	**4.42**
C&I Prescriptive Rebate	2.19	2.34	2.52	2.68	2.77	2.92	2.90	2.97	3.08	3.16	3.30	3.43	3.56	3.70	3.85	4.04	4.24	4.40	4.57
C&I Custom Rebate	2.14	2.31	2.49	2.65	2.82	2.99	3.14	3.29	3.44	3.60	3.76	3.92	4.09	4.26	4.43	4.61	4.79	4.98	5.16
Strategic Energy Management	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.01	1.05	1.11	1.16	1.21
C&I Retrocommissioning	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.07	1.12	1.17	1.23	1.29	1.34
Demand Response	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**3.44**	**3.61**	**3.82**	**4.02**	**3.80**	**3.95**	**4.08**	**4.64**	**4.75**	**5.77**	**5.92**	**6.07**	**6.23**	**6.39**
Demand Load Control	n/a	n/a	n/a	n/a	n/a	3.44	3.61	3.82	4.02	3.80	3.95	4.08	4.18	4.29	4.56	4.68	4.80	4.92	5.04
Curtailment Agreement	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.69	5.84	5.99	6.14	6.30	6.46	6.62

(G) The utility shall describe and document how it performed the cost effectiveness assessments pursuant to section (5) and shall describe and document its methods and its sources and quality of information.

Empire engaged AEG to conduct a Demand-Side Management Potential Study and assist with demand-side program design in Empire's Missouri service territory. As part of the potential study, a comprehensive list of EE/DR measures was developed and screened for cost-effectiveness (i.e. a TRC benefit-cost ratio of at least 1.0). Each measure was characterized with energy and demand savings, incremental cost, service life, and other performance factors, drawing upon data from well-vetted national and regional sources. Energy efficient measure energy and demand impacts were calculated using generally accepted engineering algorithms based on a set of reasonable assumptions. Because of the diversity in equipment and energy consumption patterns across multiple building types and end-uses, there exists a variability in these savings estimates as they relate to program design and target markets, particularly at the planning stage of these programs.

The Total Resource Cost Test (TRC) is the primary method of assessing the cost-effectiveness of energy efficient measures and programs. The TRC test is a widely-accepted methodology that has been used across the United States for over twenty-five years. TRC measures the net costs and benefits of an energy efficiency program as a resource option based on the total costs of the program, including both the participant's and the utility's costs. This test represents the combination of the effects of a program on both participating and non-participating customers.

Four other benefit-cost tests were utilized to analyze cost-effectiveness from different perspectives:

- **Participant Cost Test** quantifies the benefits and costs to the customer due to program participation.
- **Ratepayer Impact Measure Cost Test** measures what happens to a customer's rates due to changes in utility revenues and operating costs.
- **Utility Cost Test** measures the net costs of a program as a resource option based on the costs incurred by the program administrator, excluding any net costs incurred by the participant.
- **Societal Cost Test** measures the effects of a program on society as a whole.

The cost-effectiveness analysis was performed using Empire-specific data. The input data gathered for the model included:

Table 74 Cost-Effectiveness Model Inputs

General Inputs	Specific-Project Inputs
Retail Rate ($/kWh)	Utility Project Costs (Administrative & Incentives)
Commodity Cost ($/kWh)	Direct Participant Project Costs ($/Participant)
Demand Cost ($/kW-Year)	Measure Life (Years)
Environmental Damage Cost ($/kWh)	kWh/Participant Saved (Net and Gross)
Discount Rate (%)	kW/Participant Saved (Net and Gross)
Inflation Rate (%)	Number of Participants
Line Losses (%)	

Empire provided commodity costs for five scenarios:

- No CO_2 assumes no carbon cost
- Low CO_2
- Mid CO_2
- High CO_2
- Weighted CO_2 is a weighted average of the four commodity cost scenarios, assuming 10% No CO_2, 25% Low CO_2, 50% Mid CO_2 and 15% High CO_2.

The weighted CO2 commodity cost was utilized to determine the cost-effectiveness of each EE/DR measure.

Measures that were cost-effective within LoadMAP are included in the economic and achievable potential. The DSM Potential Study maximum achievable potential (MAP) and realistic achievable potential (RAP) was exported into the DSM Program Design. The measures were vetted for inclusion in a DSM program and measures were bundled into programs and re-screened for cost-effectiveness.

AEG utilized its BenCost model[22] to perform the benefit-cost screening and develop the DSM Program Design. AEG considered several energy efficiency portfolios based on the cost-effective measures.

- **RAP- Portfolio**. Alternative demand-side portfolio designed to represent one-half of the RAP Program Design portfolio participation.
- **RAP Program Design Portfolio**. The Realistic Achievable Potential (RAP) candidates from the DSM Potential Study that Empire proposes passing to the integration phase. This portfolio reflects expected program participation given barriers to customer acceptance and non-ideal implementation conditions. These measures are delivered under less than ideal market conditions.
- **RAP+ Portfolio**. Alternative demand-side portfolio designed to represent the midpoint between the RAP Program Design and MAP Program Design portfolios.

[22] The model is consistent with the California Standard Practice Manual.

- **MAP Program Design Portfolio**. The Maximum Achievable Potential (MAP) candidates from the DSM Potential Study that Empire proposes passing into the integration phase. This portfolio reflects expected program participation given ideal market implementation and few barriers to customer adoption. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with dealers and delivery partners. Under this scenario, incentives represent a substantial portion of the incremental cost combined with high administrative and marketing costs.

- **Aggressive Capacity Portfolio**. Alternative demand-side portfolio designed to utilize demand-side resources to meet additional future capacity.

The energy efficiency portfolios described above were screened using the weighted CO2 avoided cost. The RAP Program Design Portfolio was also screened utilizing the remaining four avoided costs.

Except for the low-income programs, the programs were designed to be cost-effective. Measures were bundled based on the end-use, sector and implementation.

The measure lifetime, gross energy and demand savings per unit and incremental cost per unit are detailed in Section 3.7. Source documentation is shown in the following tables.

Table 75 End-Use Measure Documentation

Measure Name	Sources
CFL, LED, Specialty LED	Illinois/Energy Star
ENERGY STAR Dehumidifier	Illinois/Energy Star/DOE
ENERGY STAR Air Purifier	Illinois
ENERGY STAR / CEE Tier 2 Refrigerator	Illinois/Energy Star/DOE/CEE
ENERGY STAR Freezer	Illinois/Energy Star/DOE
Refrigerator / Freezer Recycling	Illinois
Room Air Conditioner Recycling	Illinois/Michigan
Air Sealing	Illinois/Michigan
Insulation (Attic, Wall, Floor)	Illinois/NREL
Foundation Insulation R-13	Illinois/Michigan
Duct Installation & Sealing	Illinois
ENERGY STAR Windows	Arkansas/Michigan
Radiant Barrier Insulation	Arkansas/Michigan
Smart Power Strip 5-Plug	Illinois
Faucet Aerator	Illinois
Low Flow Showerhead	Illinois
Hot Water Pipe Insulation	Illinois/Ohio
Water Heater Wrap	Illinois/Ohio
Central Air Conditioner/Heat Pump	Illinois/Michigan/CEE/DOE
Programmable Thermostat	Illinois
Furnace Blower Motor	Ameren MO/Illinois
Heat Pump Water Heater	Illinois/Energy Star/DOE
Chillers	Illinois
Room Air Conditioner (12 EER)	Illinois
Air Conditioner / Heat Pump	Illinois/Michigan/CEE
PTAC/PTHP	Illinois

Guest Room Energy Management	Illinois
Variable Speed Drive	Illinois
Demand Controlled Ventilation	Illinois
ENERGY STAR Steamer	Illinois
ENERGY STAR Dishwasher	Illinois
ENERGY STAR Hot Food Holding Cabinets	Illinois
ENERGY STAR Ice Maker	Illinois
ENERGY STAR Electric Convention Oven	Illinois
ENERGY STAR Electric Fryer	ENERGY STAR
Vending Machine	Illinois
Evaporator Fan Control	Illinois
Strip Curtain for Walk-In Cooler/Freezer	ENERGY STAR/Illinois
Night Covers for Open Refrigerated Display Cases	Illinois
Door Heater Controls	Illinois
Refrigeration Economizer	Illinois
Kitchen Demand Ventilation Controls	Illinois
Nonresidential Lighting	Illinois/Minnesota
Photovoltaic	NREL, Deutsche Bank

Several sources of data were used to characterize the energy efficiency measures. We used recent studies performed for the Midwest, AEG data (e.g., DEEM database), and national and well-vetted regional data sources:

- AEG's Database of Energy Efficiency Measures.
- Consortium for Energy Efficiency. Program Resources.[23]
- ENERGY STAR. Energy Efficiency Product Specifications.[24]
- U.S. Department of Energy. Current Rulemakings and Notices.[25]
- Illinois Statewide Technical Reference Manual for Energy Efficiency. Version 4.0 Effective June 1, 2015.
- Arkansas Public Service Commission. Arkansas Technical Reference Manual. Version 4.0 (August 29, 2014).
- State of Minnesota. Technical Reference Manual for Energy Conservation Improvement Programs. Version 1.3. Effective January 1, 2016 – December 31, 2016.
- Michigan Public Service Commission (2015). Michigan Energy Measures Database. Prepared by Morgan Marketing Partners.
- Ameren Missouri 2014 Integrated Resource Plan. Appendix A – Technical Resource Manual.

[23] Consortium for Energy Efficiency. Program Resources. https://www.cee1.org/
[24] Energy Star. Product Specifications and Partner Commitments Search. http://www.energystar.gov/products/spec/
[25] U.S. Department of Energy. Current Rulemakings and Notices. http://energy.gov/eere/buildings/current-rulemakings-and-notices

- Public Utilities Commission of Ohio (2010). State of Ohio Energy Efficiency Technical Reference Manual. Prepared by Vermont Energy Investment Corporation.
- ComEd. ComEd Programs NTG Approach for EPY8.[26]

[26] http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/ComEd_EPY8_NTG_Summary_2015-01-13.pdf

SECTION 6 TOTAL RESOURCE COST TEST

(6) Potential demand-side programs and potential demand-side rates that pass the total resource cost test including probable environmental costs shall be considered as demand-side candidate resource options and must be included in at least one (1) alternative resource plan developed pursuant to 4 CSR 240-22.060(3).

Potential demand-side programs and demand-side rate pilot programs that passed the total resource cost test (achieved a TRC benefit-cost ratio of at least 1.0) were considered as a demand-side candidate resource options and were included in at least one of the nine alternative resource plans.

(A) The utility may bundle demand-side candidate resource options into portfolios, as long as the requirements pursuant to section (1) are met and as long as multiple demand-side candidate resource options and portfolios advance for consideration in the integrated resource analysis in 4 CSR 240-22.060. The utility shall describe and document how its demand-side candidate resource options and portfolios satisfy these requirements.

Measures that were cost-effective within LoadMAP are included in the economic and achievable potential. The DSM Potential Study maximum achievable potential (MAP) and realistic achievable potential (RAP) was exported into the DSM Program Design. The measures were vetted for inclusion in a DSM program and measures were bundled into programs and re-screened for cost-effectiveness.

AEG utilized its BenCost model[27] to perform the benefit-cost screening and develop the DSM Program Design. AEG considered several energy efficiency portfolios based on the cost-effective measures.

- **RAP- Portfolio**. Alternative demand-side portfolio designed to represent one-half of the RAP Program Design portfolio participation.
- **RAP Program Design Portfolio**. The Realistic Achievable Potential (RAP) candidates from the DSM Potential Study that Empire proposes passing to the integration phase. This portfolio reflects expected program participation given barriers to customer acceptance and non-ideal implementation conditions. These measures are delivered under less than ideal market conditions.
- **RAP+ Portfolio**. Alternative demand-side portfolio designed to represent the midpoint between the RAP Program Design and MAP Program Design portfolios.

[27] The model is consistent with the California Standard Practice Manual.

- **MAP Program Design Portfolio**. The Maximum Achievable Potential (MAP) candidates from the DSM Potential Study that Empire proposes passing into the integration phase. This portfolio reflects expected program participation given ideal market implementation and few barriers to customer adoption. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with dealers and delivery partners. Under this scenario, incentives represent a substantial portion of the incremental cost combined with high administrative and marketing costs.
- **Aggressive Capacity Portfolio**. Alternative demand-side portfolio designed to utilize demand-side resources to meet additional future capacity.

The RAP Program Design Portfolio was also screened utilizing the remaining four avoided costs.

- No CO_2 assumes no carbon cost
- Low CO_2
- Mid CO_2
- High CO_2

(B) For each demand-side candidate resource option or portfolio, the utility shall describe and document the time-differentiated load impact estimates over the planning horizon at the level of detail required by the supply system simulation model that is used in the integrated resource analysis, including a tabulation of the estimated annual change in energy usage and in diversified demand for each year in the planning horizon due to the implementation of the candidate demand-side resource option or portfolio.

The time-differentiated load impacts for each demand-side candidate resource option is provided in the program design workbooks. The time-differentiated load impact by program scenario is shown in Table 78 below.

(C) The utility shall describe and document its assessment of the potential uncertainty associated with the load impact estimates of the demand-side candidate resource options or portfolios. The utility shall estimate—

The demand-side program cost-effectiveness evaluation included an analysis of nine program scenarios to account for potential uncertainty.

1. The impact of the uncertainty concerning the customer participation levels by estimating and comparing the maximum achievable potential and realistic achievable potential of each demand-side candidate resource option or portfolio; and

The demand-side program cost-effectiveness evaluation included an analysis of nine program scenarios with varying participation levels and incentives to account for potential uncertainty.

2. The impact of uncertainty concerning the cost effectiveness by identifying uncertain factors affecting which end-use resources are cost effective. The utility shall identify how the menu of cost-effective end-use measures changes with these uncertain factors and shall estimate how these changes affect the load impact estimates associated with the demand-side candidate resource options.

The demand-side program cost-effectiveness evaluation included an analysis of nine program scenarios with varying participation levels and incentives to account for potential uncertainty.

- **RAP- Portfolio**. Alternative demand-side portfolio designed to represent one-half of the RAP Program Design portfolio participation.
- **RAP Program Design Portfolio**. The Realistic Achievable Potential (RAP) candidates from the DSM Potential Study that Empire proposes passing to the integration phase. This portfolio reflects expected program participation given barriers to customer acceptance and non-ideal implementation conditions. These measures are delivered under less than ideal market conditions.
- **RAP+ Portfolio**. Alternative demand-side portfolio designed to represent the midpoint between the RAP Program Design and MAP Program Design portfolios.
- **MAP Program Design Portfolio**. The Maximum Achievable Potential (MAP) candidates from the DSM Potential Study that Empire proposes passing into the integration phase. This portfolio reflects expected program participation given ideal market implementation and few barriers to customer adoption. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with dealers and delivery partners. Under this scenario, incentives represent a substantial portion of the incremental cost combined with high administrative and marketing costs.
- **Aggressive Capacity Portfolio**. Alternative demand-side portfolio designed to utilize demand-side resources to meet additional future capacity.

The RAP Program Design Portfolio was also screened utilizing the remaining four avoided costs.

- No CO_2 assumes no carbon cost
- Low CO_2
- Mid CO_2
- High CO_2

Table 76 Comparison of Incremental Participation by Scenario

Incremental Participation	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
RAP- Program Design	8,659	17,539	17,760	22,878	23,037	23,723	23,875	24,044	24,230	24,472	24,347	24,662	24,871	24,969	24,818	24,864	24,862	24,819	24,816
RAP Program Design	17,303	35,076	35,518	45,757	46,073	47,461	47,773	48,119	48,459	48,943	48,693	49,322	49,741	49,938	49,636	49,730	49,725	49,639	49,633
RAP+ Program Design	20,453	46,468	46,893	62,058	66,051	65,758	66,064	66,431	67,338	66,376	66,405	66,835	67,188	65,969	65,833	65,991	66,045	66,108	66,206
MAP Program Design	23,578	57,837	58,244	81,784	83,399	84,031	84,333	84,742	86,215	83,808	84,115	84,346	84,631	81,998	82,016	82,250	82,362	82,576	82,777
Aggressive Capacity Program Design	17,303	35,076	35,518	45,757	46,073	47,461	66,064	66,431	67,338	66,376	66,405	84,346	84,631	81,998	82,016	82,250	82,362	82,576	82,777
No CO2 Program Design	17,269	35,107	35,640	45,919	46,235	47,513	47,868	48,112	48,401	49,083	48,843	49,472	49,891	50,078	49,764	49,858	49,853	49,767	49,761
Low CO2 Program Design	17,299	35,168	35,710	45,957	46,850	47,848	48,150	48,289	48,609	49,093	48,843	49,472	49,891	50,078	49,764	49,858	49,853	49,767	49,761
Mid CO2 Program Design	17,303	35,176	35,718	46,542	47,050	47,865	48,173	48,319	48,609	49,093	48,843	49,482	49,901	50,100	49,786	49,880	49,875	49,789	49,783
High CO2 Program Design	17,303	35,176	35,818	46,742	47,059	47,865	48,173	48,319	48,609	49,103	48,853	49,494	49,913	50,100	49,786	49,880	49,875	49,789	49,783

Table 77 Comparison of Net MWh Savings by Scenario

Net MWh	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
RAP- Program Design	1,514	3,279	3,465	3,837	4,040	4,355	4,495	4,616	4,841	4,962	5,021	5,132	5,219	5,431	5,548	5,681	5,664	5,605	5,559
RAP Program Design	3,002	6,543	6,921	7,671	8,078	8,707	8,986	9,229	9,681	9,922	10,040	10,262	10,437	10,861	11,097	11,361	11,328	11,210	11,117
RAP+ Program Design	3,685	8,445	9,327	10,809	11,161	11,856	12,300	12,653	13,107	13,336	13,509	13,709	13,900	14,447	14,733	14,978	15,019	14,966	14,912
MAP Program Design	4,345	10,339	11,719	13,932	14,231	14,993	15,602	16,066	16,522	16,737	16,967	17,143	17,349	18,020	18,265	18,575	18,688	18,708	18,683
Aggressive Capacity Program Design	3,002	6,543	6,921	7,671	8,078	8,707	12,300	12,653	13,107	13,336	13,509	17,143	17,349	18,020	18,265	18,575	18,688	18,708	18,683
No CO2 Program Design	2,955	6,654	7,224	8,020	8,427	9,033	9,315	9,524	9,857	10,076	10,348	10,570	10,745	10,925	11,070	11,334	11,301	11,183	11,090
Low CO2 Program Design	2,999	6,742	7,326	8,082	8,762	9,185	9,401	9,635	9,988	10,230	10,348	10,570	10,745	10,925	11,070	11,334	11,301	11,183	11,090
Mid CO2 Program Design	3,002	6,748	7,332	8,325	8,770	9,187	9,404	9,639	9,988	10,230	10,348	10,813	10,988	11,260	11,405	11,669	11,636	11,518	11,425
High CO2 Program Design	3,002	6,748	7,336	8,413	8,771	9,187	9,404	9,639	9,988	10,474	10,591	10,905	11,080	11,260	11,405	11,669	11,636	11,518	11,425

Table 78 Comparison of Net Coincidence MW Savings by Scenario

Net MW	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
RAP- Program Design	0.26	0.55	0.59	0.64	0.67	1.00	1.15	1.17	1.21	1.28	1.05	1.06	1.57	1.60	1.37	1.39	1.39	1.38	1.38
RAP Program Design	0.51	1.10	1.17	1.28	1.34	2.00	2.30	2.34	2.42	2.57	2.10	2.12	3.14	3.20	2.74	2.78	2.78	2.76	2.76
RAP+ Program Design	0.62	1.39	1.47	1.64	6.14	4.63	4.81	4.86	5.30	4.41	4.19	4.22	4.75	3.37	3.16	3.19	3.20	3.19	3.19
MAP Program Design	0.73	1.67	1.77	6.14	7.81	7.25	7.33	7.38	8.18	6.25	6.28	6.31	6.35	3.53	3.57	3.61	3.63	3.62	3.63
Aggressive Capacity Program Design	0.51	1.10	1.17	1.28	1.34	2.00	4.81	4.86	5.30	4.41	4.19	6.31	6.35	3.53	3.57	3.61	3.63	3.62	3.63
No CO2 Program Design	0.50	1.17	1.31	1.42	1.48	2.14	2.45	2.49	2.53	2.68	2.21	2.23	3.25	3.26	2.78	2.82	2.82	2.80	2.80
Low CO2 Program Design	0.50	1.18	1.32	1.43	1.52	2.15	2.44	2.49	2.53	2.68	2.21	2.23	3.25	3.26	2.78	2.82	2.82	2.80	2.80
Mid CO2 Program Design	0.51	1.18	1.32	1.45	1.52	2.15	2.45	2.49	2.53	2.68	2.21	2.28	3.30	3.33	2.85	2.89	2.89	2.87	2.87
High CO2 Program Design	0.51	1.18	1.32	1.47	1.52	2.15	2.45	2.49	2.53	2.73	2.26	2.30	3.32	3.33	2.85	2.89	2.89	2.87	2.87

Table 79 Comparison of Incentives by Scenario

Total Incentives	2017 Q3/4	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
RAP- Program Design	$185,850	$411,380	$447,870	$478,180	$512,715	$576,765	$622,695	$649,475	$689,015	$722,265	$727,165	$751,130	$769,087	$803,669	$806,076	$826,341	$821,816	$810,091	$802,891
RAP Program Design	$365,335	$820,495	$894,350	$956,195	$1,024,975	$1,153,275	$1,245,075	$1,298,675	$1,377,930	$1,444,430	$1,454,230	$1,502,045	$1,537,999	$1,607,174	$1,612,151	$1,652,466	$1,643,466	$1,620,181	$1,605,606
RAP+ Program Design	$532,779	$1,275,280	$1,489,235	$1,669,785	$2,063,865	$2,097,308	$2,237,173	$2,329,423	$2,489,778	$2,454,425	$2,484,675	$2,528,700	$2,572,683	$2,554,088	$2,571,588	$2,614,905	$2,608,530	$2,599,435	$2,587,640
MAP Program Design	$722,035	$1,816,345	$2,202,885	$2,882,845	$3,197,045	$3,322,680	$3,526,580	$3,680,070	$3,960,460	$3,751,438	$3,820,988	$3,861,278	$3,916,128	$3,748,484	$3,785,334	$3,842,578	$3,840,628	$3,849,838	$3,841,908
Aggressive Capacity Program Design	$365,335	$820,495	$894,350	$956,195	$1,024,975	$1,153,275	$2,237,173	$2,329,423	$2,489,778	$2,454,425	$2,484,675	$3,861,278	$3,916,128	$3,748,484	$3,785,334	$3,842,578	$3,840,628	$3,849,838	$3,841,908
No CO2 Program Design	$352,660	$794,695	$865,000	$939,095	$1,007,875	$1,129,675	$1,213,075	$1,250,675	$1,323,930	$1,384,430	$1,454,230	$1,502,045	$1,537,999	$1,570,689	$1,566,504	$1,606,819	$1,597,819	$1,574,534	$1,559,959
Low CO2 Program Design	$363,535	$816,895	$890,750	$956,195	$1,064,475	$1,183,275	$1,251,075	$1,298,675	$1,377,930	$1,444,430	$1,454,230	$1,502,045	$1,537,999	$1,570,689	$1,566,504	$1,606,819	$1,597,819	$1,574,534	$1,559,959
Mid CO2 Program Design	$365,335	$820,495	$894,350	$987,795	$1,070,475	$1,183,275	$1,251,075	$1,298,675	$1,377,930	$1,444,430	$1,454,230	$1,538,530	$1,574,484	$1,616,336	$1,612,151	$1,652,466	$1,643,466	$1,620,181	$1,605,606
High CO2 Program Design	$365,335	$820,495	$896,350	$999,795	$1,070,475	$1,183,275	$1,251,075	$1,298,675	$1,377,930	$1,480,915	$1,490,715	$1,547,693	$1,583,646	$1,616,336	$1,612,151	$1,652,466	$1,643,466	$1,620,181	$1,605,606

Table 80 Comparison of Total Utility Administrative Costs by Scenario

Administration Costs	2017 Q3/4	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
RAP- Program Design	$34,700	$80,064	$90,806	$98,527	$106,420	$118,159	$125,991	$132,209	$138,331	$143,767	$145,592	$152,618	$158,985	$163,666	$164,350	$166,828	$166,327	$163,803	$163,025
RAP Program Design	$68,436	$159,807	$181,420	$197,027	$212,738	$236,280	$251,931	$264,379	$276,645	$287,515	$291,168	$305,211	$317,951	$327,312	$328,699	$333,630	$332,634	$327,606	$326,031
RAP+ Program Design	$96,317	$230,958	$268,501	$302,960	$343,786	$361,236	$381,977	$398,387	$416,553	$424,871	$431,745	$441,291	$451,153	$456,552	$459,747	$465,757	$464,029	$462,568	$461,931
MAP Program Design	$125,783	$309,240	$365,194	$443,548	$473,479	$502,303	$530,683	$553,748	$578,794	$585,371	$596,241	$601,109	$608,371	$610,723	$614,445	$623,263	$620,606	$623,160	$623,538
Aggressive Capacity Program Design	$68,436	$159,807	$181,420	$197,027	$212,738	$236,280	$381,977	$398,387	$416,553	$424,871	$431,745	$601,109	$608,371	$610,723	$614,445	$623,263	$620,606	$623,160	$623,538
No CO2 Program Design	$65,391	$153,612	$174,380	$193,037	$208,748	$229,340	$246,931	$255,839	$267,485	$281,315	$291,168	$305,211	$317,951	$322,059	$321,833	$326,764	$325,768	$320,740	$319,165
Low CO2 Program Design	$68,016	$158,967	$180,580	$197,027	$220,291	$242,854	$255,987	$264,192	$276,645	$287,515	$291,168	$305,211	$317,951	$322,059	$321,833	$326,764	$325,768	$320,740	$319,165
Mid CO2 Program Design	$68,436	$159,807	$181,420	$203,637	$224,491	$242,960	$256,131	$264,379	$276,645	$287,515	$291,168	$310,464	$323,204	$328,925	$328,699	$333,630	$332,634	$327,606	$326,031
High CO2 Program Design	$68,436	$159,807	$183,320	$209,637	$224,547	$242,960	$256,131	$264,379	$276,645	$292,769	$296,422	$312,077	$324,817	$328,925	$328,699	$333,630	$332,634	$327,606	$326,031

SECTION 7 DEVELOPMENT OF EVALUATION PLANS

(7) For each demand-side candidate resource option identified in section (6), the utility shall describe and document the general principles it will use to develop evaluation plans pursuant to 4 CSR 240-22.070(8). The utility shall verify that the evaluation costs in subsections (5)(B) and (5)(C) are appropriate and commensurate with these evaluation plans and principles.

Empire has designated approximately 5% of its portfolio budget for Evaluation, Measurement and Verification ("EM&V") activities. To cost-effectively evaluate Empire's DSM programs, the evaluation contractor will evaluate each program every two years, starting with the beginning of the second program year. This plan provides a high level, multi-year evaluation approach for Empire's energy efficiency program portfolio.

Project Initiation Meetings

The evaluation contractor will meet with Empire staff (and their contractors, if desired) annually in person or via teleconference to discuss evaluation objectives, a common set of expectations about what the evaluation will provide, and an agreement on the methods to be used to evaluate each program. The meeting will also provide an opportunity to review the data requirements for meeting the study objectives, establish the schedule of deliverables, set up a communications protocol, and develop a good working relationship.

Evaluation Plans

Program evaluation supports the need for public accountability, oversight, validation of program performance and cost-effective program improvements. An evaluation plan provides a roadmap for program evaluation activities, identifying evaluation objectives, the evaluation approach, data collection, sampling plans, and work schedule.

The evaluation contractor will develop detailed evaluation plans for each program. The plans will support a comprehensive approach, designed to be revised and extended into future years. The evaluation plan will include study strategies and techniques, study objectives, key researchable issues, data collection and analysis approaches, sampling strategies, timelines, and deliverables by the programs to be evaluated that year.

Program Design and Delivery Review

A program design and delivery review will be completed as part of the Year 1 process evaluation. This will include staff interviews and a review of the tracking system.

The evaluation contractor will conduct in-depth interviews with Empire design and delivery staff. The interviews with program managers and staff will discuss the roles and responsibilities of staff and trade allies; program goals, successes, and challenges in meeting these goals; the effectiveness of the programs' operations relative to the defined program goals and objectives; reasons for variance in program performance by customer class or territory; and areas in need of improvement in program design and implementation. The evaluation contractor will complete an interim memo summarizing the results of the program design and delivery review.

Quality program tracking systems are integral for effective program planning, implementation and evaluation. The evaluation contractor will evaluate Empire's tracking system including initial data validation (application processing, measure and savings capture and validation, audit trail, and system location), security, and data granularity (types of data being captured, QA/QC processes, data thresholds and back-up data capture, refresh rate and automated validations).

Evaluation Management and Reporting

The evaluation contractor will meet with Empire in person or via teleconference to summarize tasks completed for the month, problems encountered and solutions implemented, schedule and budget issues and updates, and tasks planned in the next month. The evaluation contractor will have ad-hoc meetings with Empire staff as needed to resolve issues as they arise and maintain ongoing communication.

It is imperative that the evaluation provide and discuss preliminary findings at the end of each data collection and analysis activity. This type of regular reporting ensures that the findings from each activity can be used to modify the programs as needed to improve their performance. The evaluation contractor will provide Empire with interim evaluation memorandum reports that will summarize preliminary evaluation findings and potential recommendations stemming from those findings.

The evaluation contractor will compile and synthesize the results of all evaluation activities each year into an annual comprehensive evaluation report that will identify key findings and recommendations at the cross-cutting and sector level (residential and commercial) as well as program level. The annual evaluation reports will be finalized by the end of each calendar year.

Process Evaluation Approach

Process evaluations will be conducted for each program at the end of the first year. The purpose is to assess the effectiveness of program processes, evaluate the achievements of program objectives, and make recommendations for program improvements. A good process evaluation will:

1. Assist program implementers and managers with managing programs to achieve cost effective savings while maintaining high levels of customer satisfaction.
2. Determine awareness levels to refine marketing strategies and reduce barriers to participation.
3. Provide recommendations for changing the program's structure, management, administration, design, delivery, operations or targets.
4. Determine if best practices should be incorporated.
5. Gather information from a variety of sources to address the issues stated above.

The process evaluations will provide recommendations to Empire, program implementers, and other program stakeholders on program design, delivery, and administration. The evaluation contractor will develop individual program plans that identify project objectives, data resources and collection, key researchable issues, budget and timeline. Once the evaluation plans have been reviewed by Empire, the evaluation contractor will design the sample plan and data collection instruments, and collect and analyze the data. The evaluation contractor will synthesize the findings and present recommendations to Empire in draft and final evaluation reports.

Data Collection and Sampling Plan

The data collection plan will define the specific data collection requirements, along with the source of the information and the use to which that the data will be put, the timing of the data collection, in relation to the rest of the plan, to assure that it meets the overall needs of the study, and the scheduling method and plan or coordinating contacts.

The sampling plan will describe the sample design, interview methodology and stratification of each program. Interviews of the major personnel categories will include Empire staff, program managers, third party implementers, participating and non-participating customers, and participating and non-participating trade allies, in addition to others.

The sample size of each group will be calculated at a 90% confidence interval with an error margin of +/- 10%. The number of completed interviews will provide a sufficient sample to meet the confidence interval requirements. The interview methodology will range depending on the market actor being interviewed, from on-site interviews, in-depth interviews or computer-assisted telephone interviews.

Program Design and Delivery Staff Interviews

Interviews with program staff will be conducted in-person and will focus on the program history and design, identifying areas for program improvement and the overall effectiveness of the program. The third party implementer interviews will be conducted at the locations where program files are maintained. Particular attention will be paid to the contractor's perception of how the programs operate, what program data are tracked and captured, how the data are managed and maintained, and how program subcontractor(s) are managed, if applicable.

Questions will be based on both portfolio- and program-level activities and achievements. Answers to these questions will help identify process improvements that can make the program more efficient and consequently more cost-effective and will be summarized in a chapter of the process evaluation report.

Customer Data Collection

Surveys of participating customers will be conducted via telephone. Participating customers will be asked about their experiences with the program, including the effectiveness and satisfaction with the program, the contractor/trade allies, the equipment itself, and marketing outreach. Participants will also answer a series of questions regarding program awareness, attitudes of energy efficiency and energy conservation, overall satisfaction, and barriers to participation, spillover and areas of improvement. The findings from the customer surveys will be summarized in a chapter of the process evaluation and the data tables from these surveys will be provided in separate appendices.

Trade Ally Data Collection

Trade allies will be asked about clarity of program rules, usefulness of support materials, marketing and coordination efforts and application processes. These responses will be instrumental in developing recommendations for improvement that will improve program effectiveness and customer satisfaction and remove barriers to participation. Trade ally interviews will also attempt to gather information that could be used to assess market effects or other program-related impacts such as free-ridership and spillover.

Non-Participating Customer and Trade Ally Data Collection

Where appropriate, interviews with non-participating customers and trade allies will be conducted to better understand the market, free ridership, spillover and how the program can increase participation and

effects in the market. These interviews will also provide insights into removing barriers to participation and improved marketing methods and messages.

Document Review

In addition to stakeholder interviews, the evaluation contractor will collect program materials, including process flowcharts, and marketing and outreach materials such as point of purchase (POP) materials, print and radio advertising copy and any cooperative marketing materials developed. The evaluation contractor will also request information on actual activities, such as completed marketing campaigns. Marketing schedules and quantitative data, such as enrollments per month, will be overlaid to determine the impacts of these campaigns.

Impact Evaluation Approach

Impact evaluations estimate gross and net demand, energy savings and the cost effectiveness of installed systems. They are used to verify measure installations, identify key energy assumptions and provide the research necessary to calculate defensible and accurate savings attributable to the program. Impact evaluations are typically conducted one year after the program is implemented because program results may not be accessible or apparent before then.

The evaluation contractor will adhere to the state evaluation protocols to obtain unbiased and reliable estimates of program-level net energy and demand savings over the life of the expected net impact. Measurement and Verification ("M&V") may be conducted at a higher level of rigor or with greater precision than the protocols (depending on resources or program goals), where more inputs measured or metered, but M&V may not use a lower level of rigor than is specified in the evaluation protocol.

Program level impact evaluations will be conducted to verify measure installations and identify key energy assumptions for equipment life, incremental equipment cost, program budget information, number of participants, free ridership and spillover. The evaluation will also provide the necessary research to calculate defensible and accurate savings attributable to the program.

The primary data collection methodologies for the impact evaluation will include:

- Strategies to measure and verify energy efficiency installation and determine energy impacts for each program, as appropriate, in kilowatt-hour or kilowatt reductions
    - Sample for field verification activities
    - Field verification activities and observations
    - Adjusted measure savings values based on field activities and data reviews

- Program-specific realization rates
- Energy savings based on four annual time periods (on-peak and off-peak)
- Billing analyses
- Applications and supporting documentation provided to Empire from customers, as appropriate
- Conclusions and recommendations for more accurately estimating energy savings for each program

Secondary data sources will be used for assumptions that do not require primary data collection.

The evaluation contractor will use inputs specific to Empire, including avoided costs and discounts rates to conduct cost-effectiveness analysis and program screening. The program evaluator will evaluate cost-effectiveness using the standard California tests including Total Resource Cost, Societal Cost Test, Participant Test, Utility Test and Rate Impact Measure Test. These tests consider the overall costs and benefits from various perspectives. All results will be provided with estimates of present value benefits, cost, net benefits and benefit-cost ratios. The analysis will include both a retrospective look at the program to date and a prospective analysis of the future of the program.

All work will be designed to meet the appropriate International Performance Measurement and Verification Protocol ("IPMVP") and the State of Missouri EM&V protocols.

SECTION 8 DEMAND-SIDE RESOURCES AND LOAD-BUILDING PROGRAMS

(8) Demand-side resources and load-building programs shall be separately designed and administered, and all costs shall be separately classified to permit a clear distinction between demand-side resource costs and the costs of load-building programs. The costs of demand-side resource development that also serve other functions shall be allocated between the functions served.

Empire did not include any load-building programs in the IRP.