VOLUME 5

DEMAND-SIDE RESOURCE ANALYSIS

THE EMPIRE DISTRICT
ELECTRIC COMPANY D/B/A LIBERTY ("LIBERTY-EMPIRE")

20 CSR 4240-22.050

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****Denotes Confidential****

TABLE OF CONTENTS

TABLE OF FIGURES

NP

TABLE OF TABLES

TABLE OF APPENDICES

TABLE OF RULE REQUIREMENTS

20 CSR 4240-22.050 DEMAND-SIDE RESOURCE ANALYSIS

DEMAND-SIDE RESOURCE ANALYSIS

Commission Rule 20 CSR 4240-22.050, Demand-Side Resource Analysis, provides in part as follows:

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–

1. Appropriate market segments within each major class;

Liberty-Empire 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 Liberty-Empire's service territory. The market assessment defined the market segments (building types, end uses, and other dimensions) that are relevant in the Liberty-Empire service territory. The segmentation scheme for this project is presented in Table 5-1.

Table 5-1 – Overview of Liberty-Empire Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, Commercial, Industrial
2	Segment	Residential: Single Family, Multifamily, Single Family Low-Income, and Multifamily Low-Income Commercial: Office, retail, education, grocery, healthcare, lodging, restaurant, warehouse, and miscellaneous Industrial: Key industrial segments and other/misc.
3	Vintage	Existing and new construction
4	End use	Cooling, Space Heating, Lighting, Water Heating, Motors, etc. (as appropriate by sector)
5	Appliances/end uses and technologies	Technologies such as lamp type, HVAC equipment, appliance type, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

With the segmentation scheme defined, we then performed a high-level market characterization of electricity sales in the base period. We used detailed Liberty-Empire billing and customer data with minimal augmentation from secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count and energy consumption matched the statements of revenue provided by Liberty-Empire. In C&I, opt-out customers were removed from the analysis to reflect their decision not to participate in energy efficiency programs delivered by Liberty-Empire. 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 Liberty-Empire's customer database. In 2019, there were 132,072 households in the Liberty-Empire service territory. These households used a total of 1,708 GWh with winter peak demand of 588 MW. Characterization of the residential electric market is shown in Figure 5-1 and Table 5-2.

Figure 5-1 – Residential Electricity Use by Segment (2019)

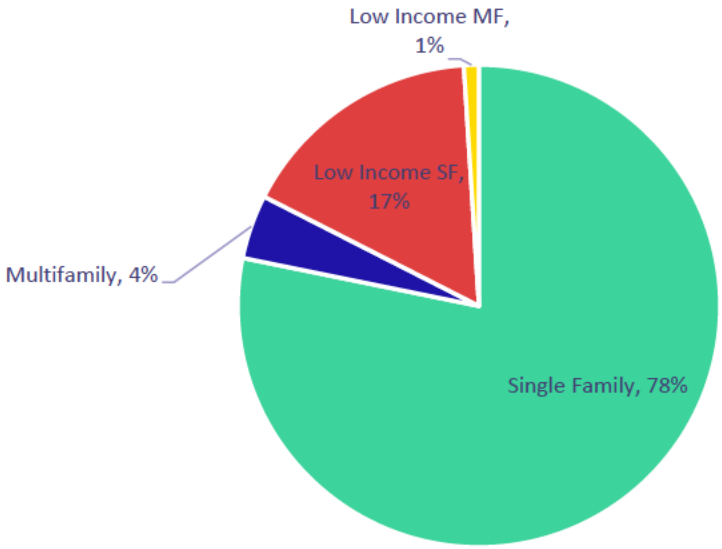

Table 5-2 – Residential Market Characterization (2019)

Segment	Households	Electric Use (GWh)	Annual Use/ Customer (kWh/HH)
Single Family	95,207	1,336	14,030
Multi Family	9,623	73	7,629
Low-Income Single Family	24,585	282	11,466
Low-Income Multi Family	2,657	17	6,450
Total	**132,072**	**1,708**	**12,934**

AEG utilized commercial and industrial customer billing data and secondary sources to develop the commercial, shown in Figure 5-2 and Table 5-3, and industrial market segments, shown in Figure 5-3 and Table 5-4. The commercial and industrial sectors exclude customers that opt-out of Liberty-Empire's DSM tariff (as of January 2019). 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 purposes of the analysis, number of opt-out customers and the removed opt-out electricity load was assumed to be constant throughout the forecast, and that usage amount was removed annually. Additionally, specific municipalities that are projected to discontinue service from Liberty-Empire were removed.

Figure 5-2 – Commercial Electricity Use by Segment (2019)

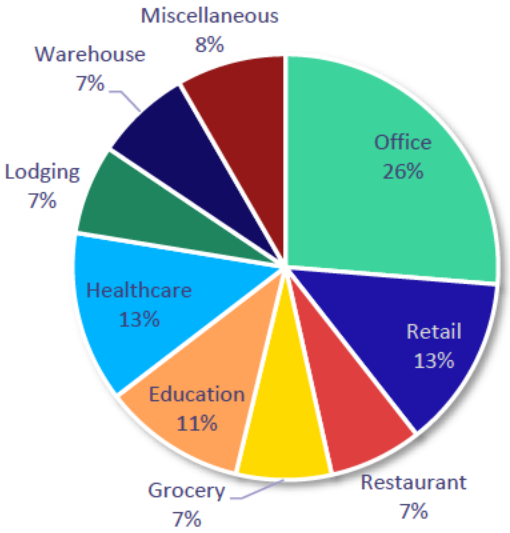

Table 5-3 – Commercial Market Characterization (2019)

Segment	Electricity Sales (GWh)	Intensity (Annual kWh/SqFt)	Floor Space (Million SqFt)
Office	370	16.9	21.84
Retail	185	19.8	9.31
Restaurant	100	22.8	4.37
Grocery	102	45.0	2.27
Education	153	9.4	16.32
Healthcare	183	25.2	7.25
Lodging	96	15.3	6.27
Warehouse	102	4.6	22.43
Miscellaneous	117	9.9	11.89
Total	**1,407**	**13.8**	**101.93**

Figure 5-3 – Industrial Electricity Use by Segment (2019)

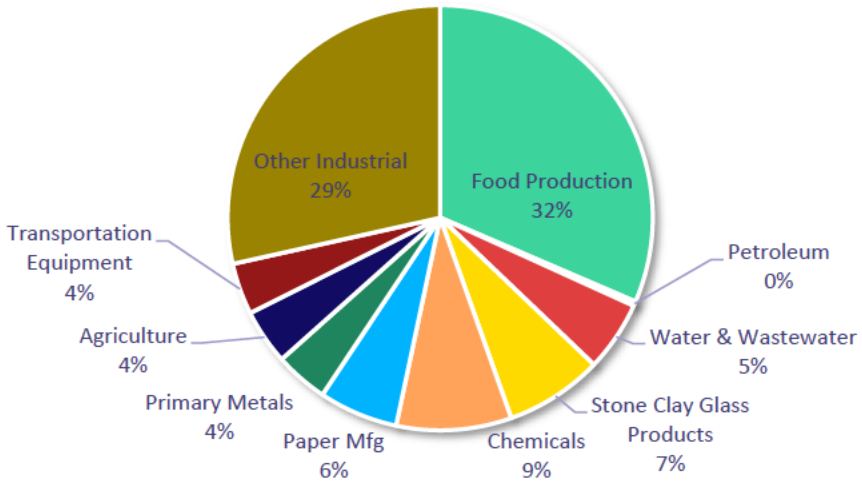

Table 5-4 – Industrial Market Characterization (2019)

Segment	Electricity Sales (GWh)	Intensity (Annual kWh/Employee)	Employees
Food Production	117	14,756	7,934
Petroleum	80	214,245	371
Water & Wastewater	95	207,396	458
Stone Clay Glass Products	28	27,768	997
Chemicals	33	31,528	1,034
Paper Manufacturing	22	25,783	869
Primary Metals	15	2,508	6,017
Agriculture	16	12,097	1,291
Transportation Equipment	15	4,671	3,119
Other Industrial	106	23,514	4,509
Total	**526**	**19,762**	**26,599**

2. All significant decision makers – including 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

Liberty-Empire's energy efficiency personnel regularly interface and communicate with a variety of trade allies, Community Action Program ("CAP") agencies, implementation contractors, consulting, evaluation, marketers, regulatory stakeholders, and customers from all classes. Decision makers are involved in all matters related to Liberty-Empire's active portfolios of residential, commercial and industrial energy efficiency programs in Arkansas and Missouri. The table below represents an exhaustive list of entities with which Liberty-Empire interacts regarding demand-side issues. Representatives from these entities are potential decision makers as defined by the IRP Regulatory Stakeholder Group.

Table 5-5 – List of Liberty-Empire Demand-Side 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 Stakeholders	Missouri Public Service Commission Staff
	Missouri Office of the Public Counsel
	Missouri Department of Economic Development-Division of Energy
	Missouri-based Environmental Advocates
	Missouri-based Customer Advocates
	Arkansas Public Service Commission Staff
	The Arkansas Energy Office
	Arkansas Community Action Agency Association
	The office of the Arkansas Attorney General

Category	Group
	Arkansas-based Environmental Advocates
	Kansas Public Service Commission Staff
	Oklahoma Public Service Commission Staff
	Municipal Governments advocating for Liberty-Empire Retail Customers
	Municipal Governments advocating for Liberty-Empire Wholesale Customers
	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

3. 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.;

Liberty-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.
- Non-Residential 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;

Liberty-Empire engaged AEG to conduct a Demand-Side Management Potential Study and DSM IRP Bundle analysis. AEG developed four DSM scenarios to assess the optimal demand-side savings for potential further consideration. Bundles were designed for the 20-year time period from 2022 to 2041. The recommended near-term demand-side management programs for 2022-2024 include:

- Residential Prescriptive
- Residential Lighting
- Appliance Recycling (beginning in 2030)
- Residential Whole House Efficiency
- Commercial Prescriptive

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

- Commercial Custom
- Small Business Direct Install (SBDI)
- Midstream Food Service
- Strategic Energy Management (SEM)
- Retrocommissioning

These bundles are detailed in Technical Volume 5 Appendix Document 5B.

Demand Response and Demand Side Rates

Demand response and demand side rate resources that were identified as cost effective were included in the modeling and are described below. Liberty-Empire anticipates following up with additional scoping studies and/or pilots to further study implementation designs, such as the Residential Time of Use pilot that is anticipated to begin in 2022.

- **Residential Direct Load Control ("DLC") of Smart Thermostats** – This option refers to the utility directly adjusting household temperatures through smart thermostats to reduce load during peak events.
- **Residential Time of Use ("TOU")** – This rate provides a higher price during the designated peak period and lower prices during off-peak periods.
- **Residential Critical Peak Pricing ("CPP")** – This rate provides a higher rate for a particular block of hours that occurs on a critical peak event day.
- **Commercial TOU** – This rate provides a higher price during the designated peak period and lower prices during off-peak periods.
- **Commercial CPP** – This rate provides a higher rate for a particular block of hours that occurs on a critical peak event day.
- **Commercial Real Time Pricing ("RTP")** – This rate is a varied rate that is linked to the hourly market price for electricity. Typically targeted at large C&I customers.
- **Industrial TOU** – This rate provides a higher price during the designated peak period and lower prices during off-peak periods.

- **Industrial CPP** – This rate provides a higher rate for a particular block of hours that occurs on a critical peak event day.
- **Industrial RTP** – This rate is a varied rate that is linked to the hourly market price for electricity. Typically targeted at large C&I customers.

1.3 Demand-Side Rates

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

The three most common types of demand-side rates are as follows:

- **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 an interval meter.
- **Critical Peak Price**. Customers pay higher peak period prices during a critical peak event day and pay a discounted off-peak price for the remainder of the year. A critical peak event day occurs multiple times a year and is typically called a day in advance when wholesale prices are forecasted to be highest. Requires an interval meter.
- **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 an interval meter.

AEG assessed these three most common demand side rate options for the Liberty-Empire service territory for a multitude of different customer segments.

Table 5-6 presents the eligible customer classes for the demand-side rates analyzed, briefly indicates the load control mechanism, and lists the associated reliability. These options are not currently offered by Liberty-Empire.

Table 5-6 – Demand-Side Rate Options

Program Option	Eligibility	Mechanism	Reliability[2]
Time of use (TOU) Rates	All segments	Higher rate for the peak block of hours that occurs every day. Requires either on/off peak meters or AMI technology.	Non-firm
Critical Peak Pricing (CPP)	All segments	Much higher rate for the peak block of hours that occurs only on critical event days. Requires AMI technology.	Non-firm
Real-time Pricing (RTP)	Commercial, Industrial	Dynamic rate that fluctuates throughout the day based on hourly energy market prices. Requires AMI technology.	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

AEG assessed multiple design and implementation options for both demand-side programs and demand-side rates. AEG crafted a measure and program list for screening, then optimized the programs once draft inputs were developed. AEG finalized these inputs once options were rescreened.

AEG developed four DSM scenarios to assess the optimal demand-side savings for potential further consideration. Bundles were designed for the 20-year time period from 2022 to 2041. The recommended near-term demand-side management programs for 2022-2024 include:

- Residential Prescriptive
- Residential Lighting
- Appliance Recycling (beginning in 2030)
- Residential Whole House Efficiency
- Commercial Prescriptive
- Commercial Custom
- Small Business Direct Install (SBDI)
- Midstream Food Service
- Strategic Energy Management (SEM)
- Retrocommissioning

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

These bundles are detailed in Technical Volume 5 Appendix Document 5B.

Demand Response and Demand Side Rates

Demand response and demand side rate resources that were identified as cost effective were included in the modeling and are described below. Liberty-Empire anticipates following up with additional scoping studies and/or pilots to further study implementation designs, such as the Residential Time of Use pilot that is anticipated to begin in 2022.

- Residential Direct Load Control ("DLC") of Smart Thermostats – This option refers to the utility directly adjusting household temperatures through smart thermostats to reduce load during peak events.
- Residential Time of Use ("TOU") – This rate provides a higher price during the designated peak period and lower prices during off-peak periods.
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- Commercial TOU – This rate provides a higher price during the designated peak period and lower prices during off-peak periods.
- Commercial CPP – This rate provides a higher rate for a particular block of hours that occurs on a critical peak event day.
- Commercial Real Time Pricing ("RTP") – This rate is a varied rate that is linked to the hourly market price for electricity. Typically targeted at large C&I customers.
- Industrial TOU – This rate provides a higher price during the designated peak period and lower prices during off-peak periods.
- Industrial CPP – This rate provides a higher rate for a particular block of hours that occurs on a critical peak event day.
- Industrial RTP – This rate is a varied rate that is linked to the hourly market price for electricity. Typically targeted at large C&I customers.

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

AEG assessed several different "improved" or "emerging" technologies that are either available in the market but restricted by current market barriers (e.g., due to high cost or low supply), or are not currently available, but come on-market at various times throughout the planning period. The intent for including these technologies was to capture the effects of advancements in

technology and potential reduction in technology costs. The assumptions for these technologies were based on currently available secondary research. Table 5-7 below contains the measures that AEG classified as emerging technology options.

Table 5-7 – Improved or Emerging Technologies

Sector	End Use	Technology	Measure Label
Residential	Cooling	Central AC	SEER 24.0 Ductless, Var.Ref.Flow
Residential	Cooling	Room AC	Dual Invertor CEER 14.7
Residential	Cooling / Heating	Air-Source Heat Pump	SEER 24.0
Residential	Cooling / Heating	Geothermal Heat Pump	EER 42.0 / COP 5.2
Residential	Water Heating	Water Heater (<= 55 Gal)	CEE Advanced Tier (UEF 3.75)
Residential	Water Heating	Water Heater (> 55 Gal)	CEE Tier 2 (UEF 3.1)
Residential	Water Heating	Water Heater (> 55 Gal)	CEE Advanced Tier (UEF 3.75)
Residential	Interior Lighting	General Service Screw-In	LED 2025 (122 lm/W)
Residential	Interior Lighting	General Service Screw-In	LED 2030 (136 lm/W)
Residential	Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Residential	Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Residential	Interior Lighting	Exempted Screw-In	LED 2025 (112 lm/W)
Residential	Interior Lighting	Exempted Screw-In	LED 2030 (125 lm/W)
Residential	Exterior Lighting	Screw-in	LED 2025 (132 lm/W)
Residential	Exterior Lighting	Screw-in	LED 2030 (150 lm/W)
Residential	Appliances	Refrigerator	CEE Tier 3
Residential	Appliances	Freezer	ENERGY STAR – Tier 2
Residential	Appliances	Clothes Dryer	Heat Pump Dryer (CEF 8.0)
Residential	Appliances	Clothes Dryer	Heat Pump Dryer (CEF 10.1)
Residential	Cooling / Heating	Ducting	Ducting - Repair and Sealing - Aerosol
Residential	Cooling / Heating	All	Building Shell - Liquid-Applied Weather-Resistive Barrier
Residential	Cooling / Heating	All	Building Shell - Whole-Home Aerosol Sealing
Residential	Cooling / Heating	All	Building Shell - High Reflectivity Roofs
Residential	Cooling / Heating	All	Space Heating - Heat Recovery Ventilator
Residential	Heating	All	Connected Thermostat - ENERGY STAR (1.0)
Residential	Cooling / Heating	All	Connected Thermostat - Line-Voltage
Residential	All	All	Home Energy Management System (HEMS)
Residential	Water Heating	All	Water Heater - Drain Water Heat Recovery
Residential	Water Heating	All	Water Heater - Desuperheater

Sector	End Use	Technology	Measure Label
Residential	Water Heating	All	Water Heater - Thermostatic Shower Restriction Valve
Residential	Appliances	Stove/Oven	Stove - Smart Burners
Residential	All	All	ENERGY STAR Home Design
Residential	All	All	Advanced New Construction Design - Zero Net Energy
Residential	Cooling / Heating	All	Combination Heat Pump Water Heater/Space Heating
Commercial	Cooling	Air-Cooled Chiller	COP 7.18 (EER 24.5)
Commercial	Cooling	Air-Cooled Chiller	COP 7.88 (EER 26.7)
Commercial	Cooling	Water-Cooled Chiller	COP 13.03 (0.27 kW/ton)
Commercial	Cooling	Water-Cooled Chiller	COP 14.07 (0.25 kW/ton)
Commercial	Cooling	RTU	IEER 21.5 – EIA High Efficiency VRF
Commercial	Cooling	PTAC	EER 13
Commercial	Cooling / Heating	PTHP	EER 13 / COP 3.6
Commercial	Cooling/Heating	Geothermal Heat Pump	EER 25.0 (COP 4.5)
Commercial	Water Heating	Water Heater	Heat Pump (UEF 3.75)
Commercial	Interior Lighting	General Service Lighting	LED 2025 (122 lm/W)
Commercial	Interior Lighting	General Service Lighting	LED 2030 (136 lm/W)
Commercial	Interior Lighting	Exempted Lighting	LED 2025 (112 lm/W)
Commercial	Interior Lighting	Exempted Lighting	LED 2030 (125 lm/W)
Commercial	Interior Lighting	High-Bay Lighting	LED 2025 (152 lm/W)
Commercial	Interior Lighting	High-Bay Lighting	LED 2030 (167 lm/W)
Commercial	Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Commercial	Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Commercial	Exterior Lighting	General Service Lighting	LED 2025 (132 lm/W)
Commercial	Exterior Lighting	General Service Lighting	LED 2030 (150 lm/W)
Commercial	Exterior Lighting	Area Lighting	LED 2025 (138 lm/W)
Commercial	Exterior Lighting	Area Lighting	LED 2030 (152 lm/W)
Commercial	Exterior Lighting	Area Lighting	LED 2025 (138 lm/W) w/ controls
Commercial	Exterior Lighting	Area Lighting	LED 2030 (152 lm/W) w/ controls
Commercial	Exterior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Commercial	Exterior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Commercial	Exterior Lighting	Linear Lighting	LED 2025 (126 lm/W system) w/ controls
Commercial	Exterior Lighting	Linear Lighting	LED 2030 (140 lm/W system) w/ controls
Commercial	Cooling / Heating	All	Building Shell - Cool Roofs
Commercial	Ventilation	Ventilation	Ventilation - Permanent Magnet Synchronous Fan Motor
Commercial	Cooling / Heating	All	HVAC - Adsorbent Air Cleaning
Commercial	Cooling / Heating	All	Thermostat - Connected

Sector	End Use	Technology	Measure Label
Commercial	Water Heating	Water Heater	Commercial Laundry - Ozone Treatment
Commercial	Water Heating	Water Heater	Commercial Laundry - Alternative Dry-Cleaning Methods
Commercial	Interior Lighting	Linear/High-Bay Lighting	Interior Lighting - Networked Lighting Controls
Commercial	Interior Lighting	All	Interior Lighting - LEC Exit Lighting
Commercial	Interior Lighting	All	Interior Lighting - Photoluminescent Exit Lighting
Commercial	Refrigeration	Walk-in Refrigerator/Freezer	Refrigeration - Automatic High-Speed Doors
Commercial	Refrigeration	Reach-in Refrigerator/Freezer	Refrigeration - Low-Heat/No-Heat Doors
Commercial	Refrigeration	All	Refrigeration - Replace Single-Compressor with Subcooled Multiplex
Commercial	Refrigeration	All	Refrigeration - High Efficiency Evaporator Fan Motors
Commercial	Refrigeration	All	Refrigeration - Permanent Magnet Synchronous Fan Motor
Commercial	Refrigeration	All	Refrigeration - Floating Head Pressure
Commercial	Refrigeration	All	Refrigeration - Suction Line Insulation
Commercial	Office Equipment	All	Office Equipment - Advanced Power Strips
Commercial	Office Equipment	Server	Data Center - Cutting Edge Measures
Commercial	Refrigeration	Miscellaneous	Ultra-Low Temperature Freezer - ENERGY STAR (1.1)
Commercial	All	All	Advanced New Construction Designs
Commercial	Miscellaneous	Miscellaneous	High Efficiency Transformer
Industrial	Cooling	Air-Cooled Chiller	COP 7.18 (EER 24.5)
Industrial	Cooling	Air-Cooled Chiller	COP 7.88 (EER 26.7)
Industrial	Cooling	Water-Cooled Chiller	COP 13.03 (0.27 kW/ton)
Industrial	Cooling	Water-Cooled Chiller	COP 14.07 (0.25 kW/ton)
Industrial	Cooling	RTU	IEER 21.5 - EIA High Efficiency VRF
Industrial	Cooling / Heating	Air-Source Heat Pump	IEER 20.3 (COP 3.7)
Industrial	Cooling / Heating	Geothermal Heat Pump	EER 25.0 (COP 4.5)
Industrial	Interior Lighting	General Service Lighting	LED 2025 (122 lm/W)
Industrial	Interior Lighting	General Service Lighting	LED 2030 (136 lm/W)
Industrial	Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Industrial	Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Industrial	Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system) w/ controls

Sector	End Use	Technology	Measure Label
Industrial	Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system) w/ controls
Industrial	Interior Lighting	High-Bay Lighting	LED 2025 (152 lm/W)
Industrial	Interior Lighting	High-Bay Lighting	LED 2030 (167 lm/W)
Industrial	Interior Lighting	High-Bay Lighting	LED 2025 (152 lm/W) w/ controls
Industrial	Interior Lighting	High-Bay Lighting	LED 2030 (167 lm/W) w/ controls
Industrial	Exterior Lighting	General Service Lighting	LED 2025 (132 lm/W)
Industrial	Exterior Lighting	General Service Lighting	LED 2030 (150 lm/W)
Industrial	Exterior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Industrial	Exterior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Industrial	Exterior Lighting	Linear Lighting	LED 2025 (126 lm/W system) w/ controls
Industrial	Exterior Lighting	Linear Lighting	LED 2030 (140 lm/W system) w/ controls
Industrial	Exterior Lighting	Area Lighting	LED 2025 (138 lm/W)
Industrial	Exterior Lighting	Area Lighting	LED 2030 (152 lm/W)
Industrial	Exterior Lighting	Area Lighting	LED 2025 (138 lm/W) w/ controls
Industrial	Exterior Lighting	Area Lighting	LED 2030 (152 lm/W) w/ controls
Industrial	Cooling / Heating	All	Thermostat - Connected
Industrial	Interior Lighting	Linear/High-Bay Lighting	Interior Lighting - Luminaire Level Lighting Controls
Industrial	Interior Lighting	Linear/High-Bay Lighting	Interior Lighting - Networked Lighting Controls
Industrial	Interior Lighting	All	Interior Lighting - LEC Exit Lighting
Industrial	Interior Lighting	All	Interior Lighting - Photoluminescent Exit Lighting
Industrial	Refrigeration	All	Refrigeration - Floating Head Pressure
Industrial	Miscellaneous	Miscellaneous	Circulating Engine Block Heater
Industrial	Motors	All	Motors - Energy Efficient Hydraulic Oils
Industrial	Miscellaneous	Miscellaneous	Agriculture - Swine Heat Pads
Industrial	Process	Other	Municipal Water Treatment - UV-C LED Disinfection
Industrial	Process	Other	Municipal Water Treatment - Pulsed Air Mixing

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.

Liberty-Empire obtained a variance from 20 CSR 4240-20.094(3)(A), parts 2 and 3. In the filing requesting the variance, the Company requested relief from the obligation to collect primary data in support of the 2022 market potential study. This is the same variance request which was granted in the 2019 IRP. Following the request for variance, the Company had discussions with interested stakeholders. The parties agreed that primary data would be beneficial, but collecting such data and incorporating the data into the 2022 IRP analysis would not likely be feasible. This is because such collection could jeopardize submission by the 2022 IRP filing deadline. Therefore, the parties agreed that the demand-side resource analysis variance requests should be approved for the 2022 IRP, but on the condition that Liberty-Empire agree to begin conducting residential and commercial surveys to collect the primary data needed for future market potential studies as soon as practical. As agreed, the Company did conduct the residential and commercial surveys, but the data was not fully analyzed and available in time to incorporate into the 2022 IRP.

For the DSM Potential Study, AEG used its Load Management Analysis and Planning tool (LoadMAPTM) version 5.0 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.[3]

Below is a discussion of the data sources for the study. In general, data was adapted to local conditions. For example, local sources are utilized for measure data and local weather data is used for building simulations.

Data Specific to Liberty-Empire Service Territory

Our highest priority data sources for this study were those that were specific to Liberty-Empire, including the primary market research.

- Liberty-Empire 2019 customer billing data
- Load forecasts: most recent load and peak forecasts, economic growth forecast by sector, and retail electricity price history and forecasts.
- Economic information: avoided cost forecasts, discount rate, and line loss factor.
- Residential saturation survey: 2015 Residential Customer Energy Survey completed by Opinion Research Specialists, LLC.
- Secondary saturation information from EIA's Annual Energy Outlook. Other primary market research from regional studies were used to benchmark values.
- Liberty-Empire current and historical DSM program data
- Measure characterizations from local technical reference manuals such as IL TRM and ARK TRM

AEG Data

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

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

- **AEG Energy Market Profiles**. For more than 10 years, AEG staff has maintained profiles of end-use consumption for the residential, commercial, and industrial sectors. These profiles include market size, fuel shares, unit consumption estimates, and annual energy use by fuel (electricity and natural gas), 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)**. AEG's BEST is a derivative of the DOE 2.2 building simulation model, used to estimate base-year UECs and EUIs, as well as measure savings for the HVAC-related measures.
- **AEG's Database of Energy Efficiency Measures (DEEM).** AEG maintains an extensive database of measure data for our studies. Our database draws upon reliable sources including the California Database for Energy Efficient Resources (DEER), the EIA Technology Forecast Updates – Residential and Commercial Building Technologies – Reference Case, RS Means cost data, and Grainger Catalog Cost data.
- **Recent studies.** AEG has conducted numerous studies of EE potential in the last five years. We checked our input assumptions and analysis results against the results from these other studies, as well as the results from the prior Liberty-Empire EE potential study completed in 2019. In addition, we used the information about impacts of building codes and appliance standards from recent reports for the Edison Electric Institute.[4]

Other Secondary Data and Reports

Finally, a variety of secondary data sources and reports were used for this study. The main sources are identified below.

[4] AEG staff has prepared three white papers on the topic of factors that affect U.S. electricity consumption, including appliance standards and building codes. Links to all three white papers are provided:
http://www.edisonfoundation.net/IEE/Documents/IEE_RohmundApplianceStandardsEfficiencyCodes1209.pdf
http://www.edisonfoundation.net/iee/Documents/IEE_CodesandStandardsAssessment_2010-2025_UPDATE.pdf.
http://www.edisonfoundation.net/iee/Documents/IEE_FactorsAffectingUSElecConsumption_Final.pdf

- **Annual Energy Outlook**. The Annual Energy Outlook (AEO), conducted each year by the U.S. Energy Information Administration (EIA), presents yearly projections and analysis of energy topics. For this study, we used data from the 2020 AEO and 2021 AEO where available.
- **American Community Survey**. The US Census American Community Survey is an ongoing survey that provides data every year on household characteristics. Data for Liberty-Empire were available for this study at http://www.census.gov/acs/www/
- **Local Weather Data**. Weather from NOAA's National Climatic Data Center for Joplin, MO was used where applicable.
- **EPRI End-Use Models (REEPS and COMMEND).** These models provide the energy-use elasticities we apply to electricity prices, household income, home size and heating and cooling.
- **Database for Energy Efficient Resources (DEER).** The California Energy Commission and California Public Utilities Commission (CPUC) sponsor this database, which is designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) for the state of California. We used the DEER database to cross check the measure savings we developed using BEST and DEEM.
- **Other relevant resources:** These include reports from the Consortium for Energy Efficiency, the US Environmental Protection Agency, and the American Council for an Energy-Efficient Economy.
- Table 5-8 through Table 5-10 below note how the data above was applied to the market profiles, measure characteristics, and baseline projection and potential estimates.

Table 5-8 – Data Applied for the Market Profiles

Model Inputs	Description	Key Sources
Market size	Base-year residential dwellings and nonresidential floor space	Liberty-Empire billing data Liberty-Empire RASS survey US Census ACS data AEO 2020
Annual intensity	Residential: Annual use per household Commercial: Annual use per square foot Industrial: Annual use per employee	Liberty-Empire billing data and RASS survey AEG's Energy Market Profiles

Model Inputs	Description	Key Sources
		AEO 2020 Recent AEG Studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology Percentage of commercial floor space with equipment/technology	Liberty-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	Liberty-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 2020 DEER NWPCC workbooks, RTF Recent AEG Studies
Peak factors	Share of technology energy use that occurs during the peak hour	Liberty-Empire system peak data EnergyShape database

Table 5-9 – 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	Itron's Liberty-Empire Forecast Drivers
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	Shipments data from AEO and ENERGY STAR AEO 2020 regional forecast assumptions[5] Appliance/efficiency standards analysis Liberty-Empire status and evaluation reports
Electricity prices	Forecast of average energy and capacity avoided costs and retail prices	Itron's Liberty-Empire Forecast Drivers
Utilization model parameters	Price elasticities, elasticities for other variables (income, weather)	Itron's Liberty-Empire Forecast Drivers

Table 5-10 – 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 2020 Missouri TRM Illinois TRM Arkansas 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) Missouri 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: 1. Existing buildings – full installed cost. 2. 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 2017 Missouri TRM Illinois TRM Michigan Database RS Means Other secondary sources

[5] We developed baseline purchase decisions using the Energy Information Agency's *Annual Energy Outlook* report (2017), 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 distributions/allocations of efficiency levels to manufacturer shipment data for recent years and then held values constant for the study period.

Model Inputs	Description	Key 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 2020 Missouri 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

SECTION 3 DEVELOPMENT OF POTENTIAL DEMAND-SIDE PROGRAMS

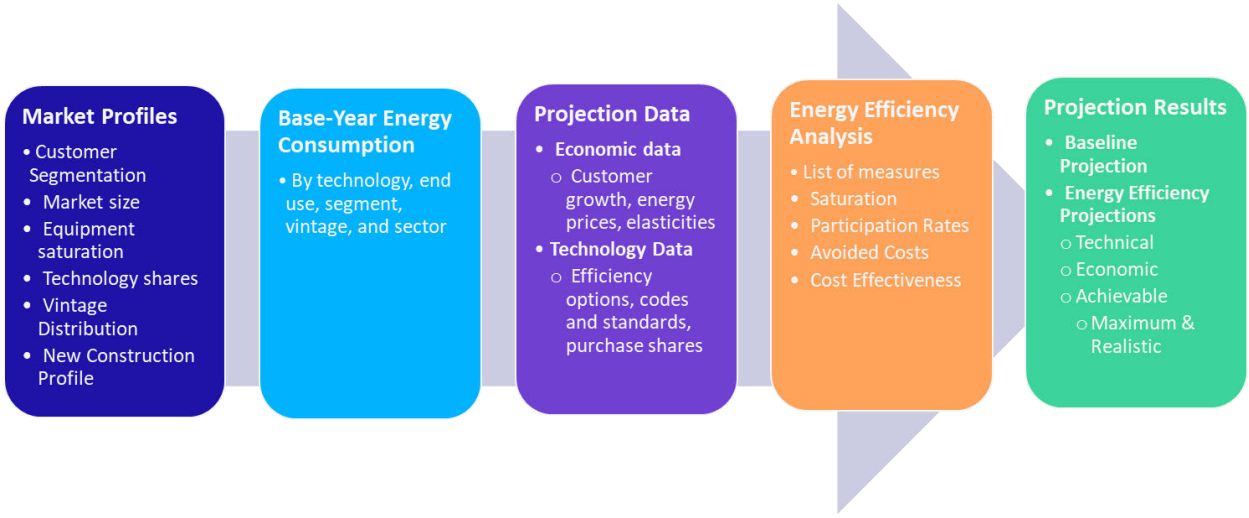
(3) The utility shall develop potential demand-side programs that are designed to deliver an appropriate selection of end-use measures to each market segment. The utility shall describe and document its potential demand-side program planning and design process which shall include at least the following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

Liberty-Empire engaged AEG to conduct a DSM Market Potential Study ("study") to assess the future potential for savings through its programs and to identify refinements that will enhance savings. The study is part of a larger effort to support Liberty-Empire's Demand-Side Resource Analysis under 20 CSR 4240-22.050 for the 2022 IRP filing. AEG worked closely with the other IRP contractors to ensure consistency across different aspects of load forecasting, supply resources, and final IRP resource modeling. Key objectives for the study include:

1) Provide credible and transparent estimation of the technical, economic, and achievable energy efficiency potential by year over the next 20 years within Liberty-Empire's Missouri service territory.
2) Evaluate energy efficiency measures, as well as demand response options and behavior change programs.
3) Develop several DSM bundles based upon cost-effective measures and equipment.
4) Support Liberty-Empire's Demand-Side Resource Analysis under 20 CSR 4240-22.050 for the 2022 IRP filing.
5) Develop a final report including summary data tables and graphs reporting incremental and cumulative potential by year from 2022 through 2042.

For the measure-level energy efficiency potential analysis, AEG used its Load Management Analysis and Planning tool (LoadMAP™) version 5.0 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. The analysis framework of the study is illustrated below in Figure 5-4.

Figure 5-4 – 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 Liberty-Empire's electricity footprint to quantify energy use by sector, segment, end-use application, and the current set of technologies used. AEG began with the previous potential study's base year and the original characterization assumptions as a starting point for this study. Using data provided by Liberty-Empire and Itron, as well as secondary sources like AEO, AEG updated specific assumptions to calibrate the base year of the study to the current conditions in the Liberty-Empire territory. This step was done to ensure that the updated base year of 2019 and the baseline projection beyond aligned specifically with the load forecast that is being used in Liberty-Empire's IRP. The final segmentation scheme is presented in Table 5-1.

With the segmentation scheme defined, AEG performed a high-level market characterization of electricity sales in the base year, 2019. AEG used detailed Liberty-Empire billing and customer data with minimal augmentation from secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count and energy consumption aligns with Liberty-Empire system totals provided by Itron, detailed in Technical Volume 3. This data provided control totals at a sector level for calibrating the LoadMAP™ model to known data

for the base-year. For the purposes of this analysis, impacts from solar PV were removed from the analysis in order to model the full unadjusted market energy consumption.

Total electricity consumption for all sectors for Liberty-Empire in 2019 was 3,641 GWh. As shown in Table 5-11, the residential sector accounted for more than one-third (46.9%) of annual energy use. The commercial and industrial sectors accounted for 38.6% and 14.4% of annual energy use, respectively.

Table 5-11 – Liberty-Empire Sector Control Totals (2019)

Sector	Annual Electricity Use (GWh)	% of Annual Use	Winter Peak Demand (MW)	% of Winter Peak
Residential	1,708	47%	588	60%
Commercial	1,407	39%	321	33%
Industrial	526	14%	76	8%
Total	3,641	100%	986	100%

Residential Sector

The total number of households and electricity sales for the service territory were obtained from Liberty-Empire's customer database. In 2019, there were 132,072 households in the Liberty-Empire service territory that consumed a total of 1,708 GWh, with a peak demand of 588 MW. These totals were allocated into four residential segments. Additionally, impacts from the solar PV installations were removed from our baseline projection in order to model the full unadjusted market unit consumption.

Table 5-12 – Residential Sector Control Totals (2019)

Segment	Number of Households	Electricity Sales (GWh)	% of Total Usage	Avg. Use/ Customer (kWh)	Peak Demand Winter (MW)
Single Family, Non Low-Income	95,207	1,336	78%	14,030	448
Multi Family, Non Low-Income	9,623	73	4%	7,629	36
Single Family, Low-Income	24,585	282	17%	11,466	95

Multi Family, Low-Income	2,657	17	1%	6,450	9
Total	132,072	1,708	100%	12,934	588

Figure 5-5 and Figure 5-6 show the average distribution of annual electricity use and winter peak demand by end use for all residential customers. Three main electricity end uses — space heating, cooling, and appliances — account for 68% of total use. Appliances include refrigerators, freezers, stoves/ovens, clothes washers, clothes dryers, dishwashers, microwaves, dehumidifiers, and air purifiers. The remainder of the energy falls into the water heating, electronics, lighting, and the miscellaneous category – which is comprised of furnace fans, pool pumps, and other "plug" loads. This reflects average consumption and is used to describe residential consumption for the entire service territory.

Figure 5-5 – Residential Electricity Use by End Use (2019)

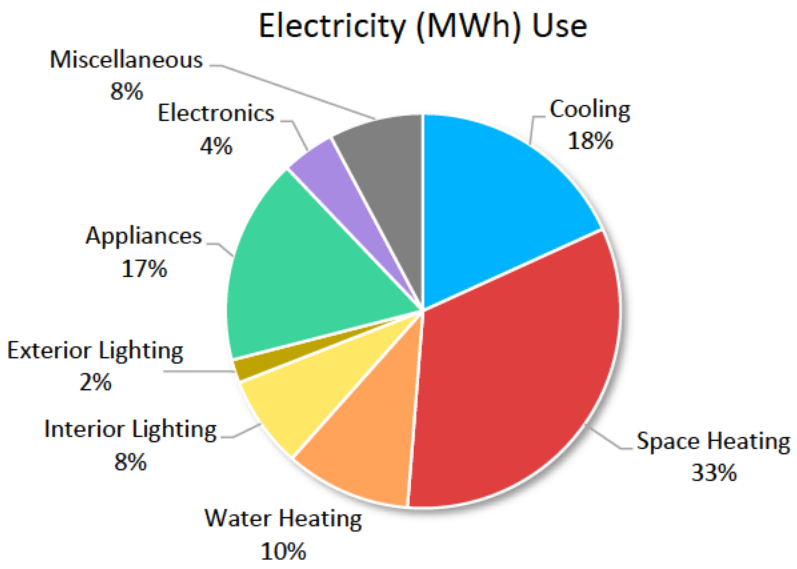


Figure 5-6 – Residential Electricity Winter Peak Demand by End Use (2019)

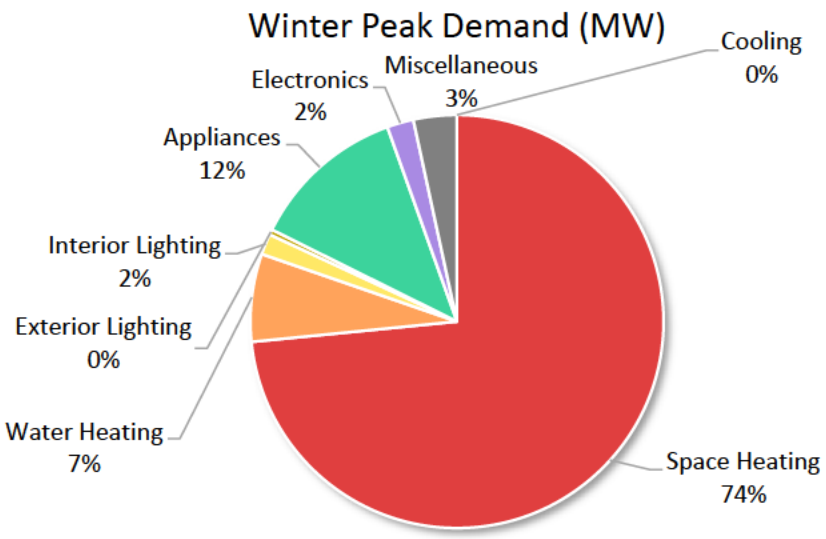
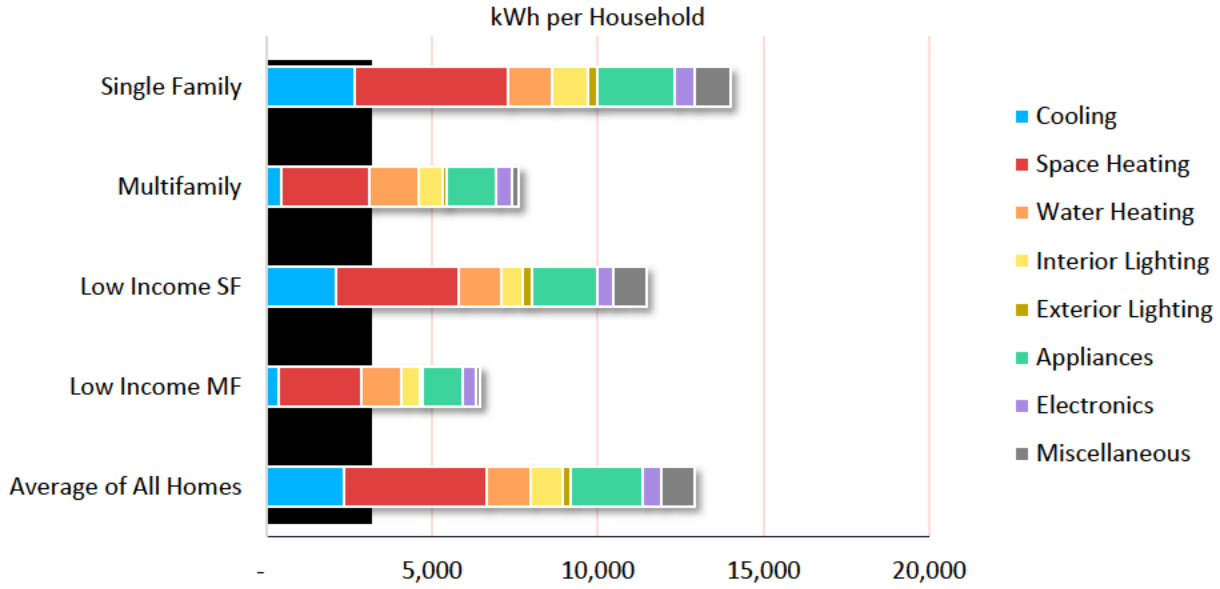


Figure 5-7 presents the electricity intensities (kWh per household) by end use and housing type. In residential households, space heating and cooling usage consumes the largest portion of total household energy use, followed by appliances. Compared to single family homes, multi-family homes allocate a smaller portion of their energy usage to cooling. Overall, low-income and non-low-income households use energy for different end uses in relatively similar proportions.

Figure 5-7 – Residential Intensity by End Use and Segment (2019) (Annual kWh/HH)



Commercial Sector

In 2019, the total electric energy consumed by commercial customers in Liberty-Empire's service area was 1,407 GWh. Liberty-Empire billing data and secondary data were used to allocate this energy usage among nine commercial segments and to develop estimates of energy intensity (annual kWh/square foot). AEG utilized electricity consumption and intensity estimates to infer floor space. These segments and sector totals are shown below in Table 5-13.

Table 5-13 – Commercial Sector Control Totals (2019)

Segment	Electricity Sales (GWh)	Intensity (Annual kWh/SqFt)	Floor Space (Million SqFt)	Winter Peak Demand (MW)
Office	370	16.9	21.84	111
Retail	185	19.8	9.31	39
Restaurant	100	22.8	4.37	19
Grocery	102	45.0	2.27	19
Education	153	9.4	16.32	35
Healthcare	183	25.2	7.25	37
Lodging	96	15.3	6.27	17
Warehouse	102	4.6	22.43	24
Miscellaneous	117	9.9	11.89	22
Total	**1,407**	**13.8**	**101.93**	**321**

As previously noted, the commercial sector excludes customers that opt-out of Liberty-Empire's DSIM charge (as of January 2019). 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 purposes of the analysis, the number of opt-out customers and the removed opt-out electricity load was assumed to be constant throughout the forecast, and that usage amount was removed annually. Additionally, specific municipalities that are projected to discontinue service from Liberty-Empire were removed.

Figure 5-8 presents the distribution of annual electricity consumption by end use for the commercial segments. Figure 5-9 shows the commercial peak winter demand by end use for the commercial segments. Most of the consumption is associated with lighting and HVAC usage, which comprises 62% of annual electricity usage and 64% of annual winter peak demand.

Figure 5-8 – Commercial Sector Electricity Consumption by End Use (2019)

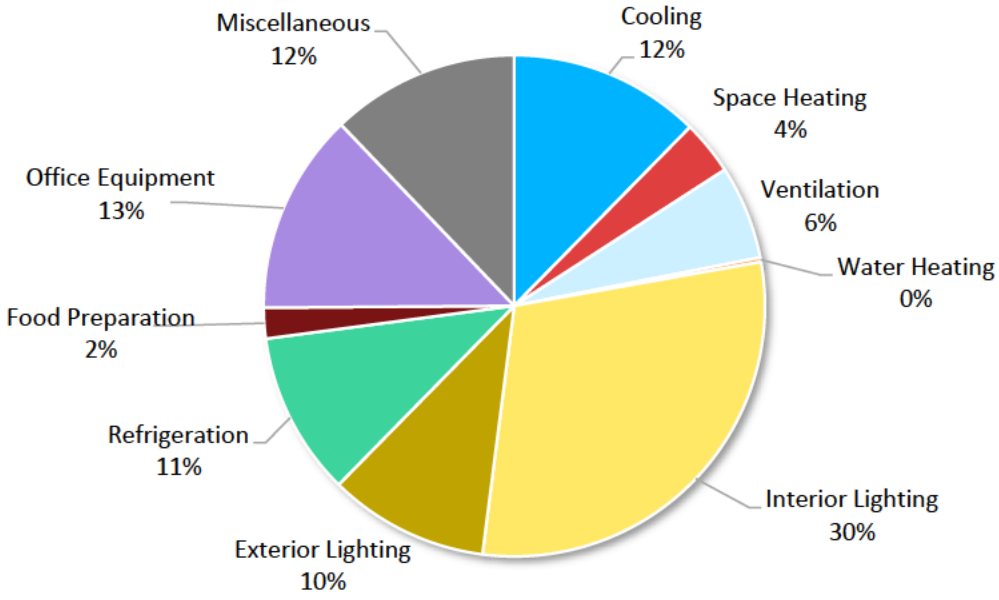
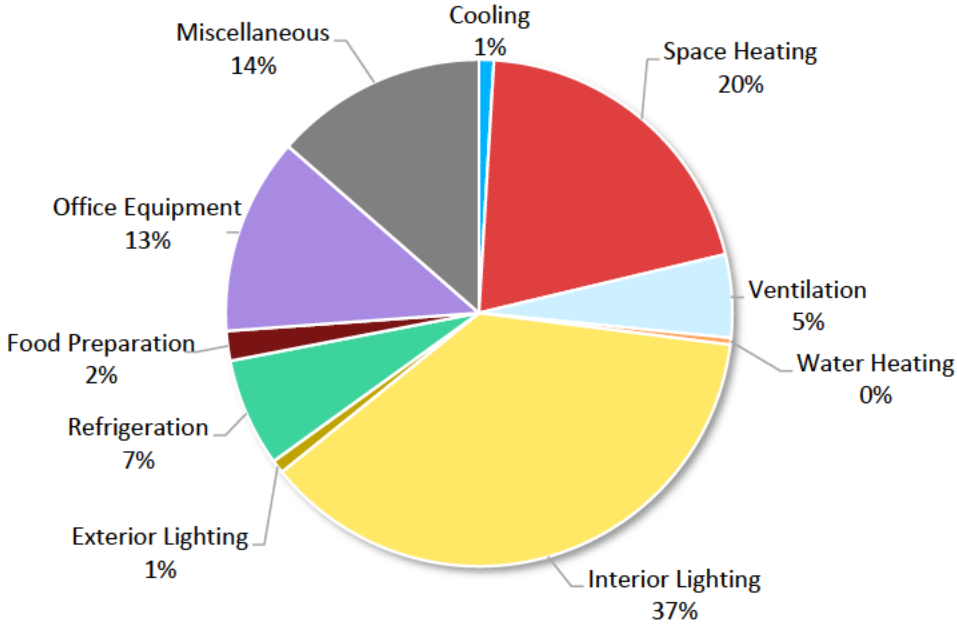


Figure 5-9 – Commercial Sector Electricity Peak Winter Demand by End Use (2019)



Industrial Sector

The total electricity used in 2019 by Liberty-Empire's industrial customers was 526 GWh. Liberty-Empire billing data, load forecast and secondary sources were used to allocate usage among end uses. Opt-out customers were not included in the 2019 total. 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 purposes of the analysis, the number of opt-out customers and the removed opt-out electricity load was assumed to be constant throughout the forecast, and that usage amount was removed annually. These segments and sector totals are shown below in Table 5-14.

Table 5-14 – Industrial Sector Control Totals (2019)

Segment	Electricity Sales (GWh)	Intensity (Annual kWh/Employee)	Employees	Winter Peak Demand (MW)
Food Production	117	14,756	7,934	17
Petroleum	80	214,245	371	12
Water & Wastewater	95	207,396	458	13
Stone Clay Glass Products	28	27,768	997	4
Chemicals	33	31,528	1,034	5
Paper Manufacturing	22	25,783	869	3
Primary Metals	15	2,508	6,017	2
Agriculture	16	12,097	1,291	2
Transportation Equipment	15	4,671	3,119	2
Other Industrial	106	23,514	4,509	15
Total	**526**	**19,762**	**26,599**	**76**

Figure 5-10 presents the distribution of annual electricity consumption by end use for the industrial segments. Figure 5-11 shows the commercial peak winter demand by end use for the industrial segments. Motors are the largest overall end use for the industrial sector, accounting for 47% of energy use. Note that this end use includes a wide range of industrial equipment, such as air and refrigeration compressors, pumps, conveyor motors, and fans. The process end use accounts for 24% of annual energy use, which includes heating, cooling, refrigeration, and

electro-chemical processes. Lighting is the next highest, followed by cooling, miscellaneous, ventilation, and space heating.

Figure 5-10 – Industrial Sector Electricity Consumption by End Use (2019)

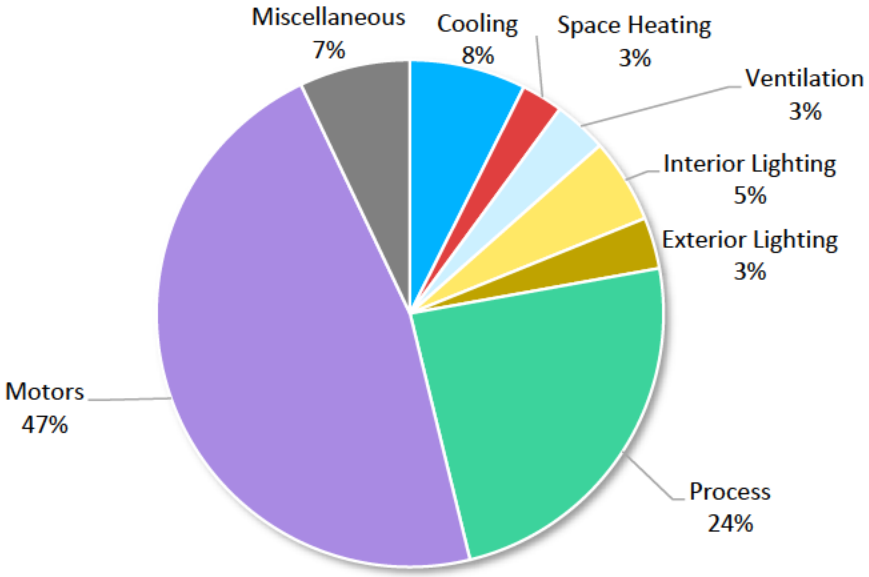
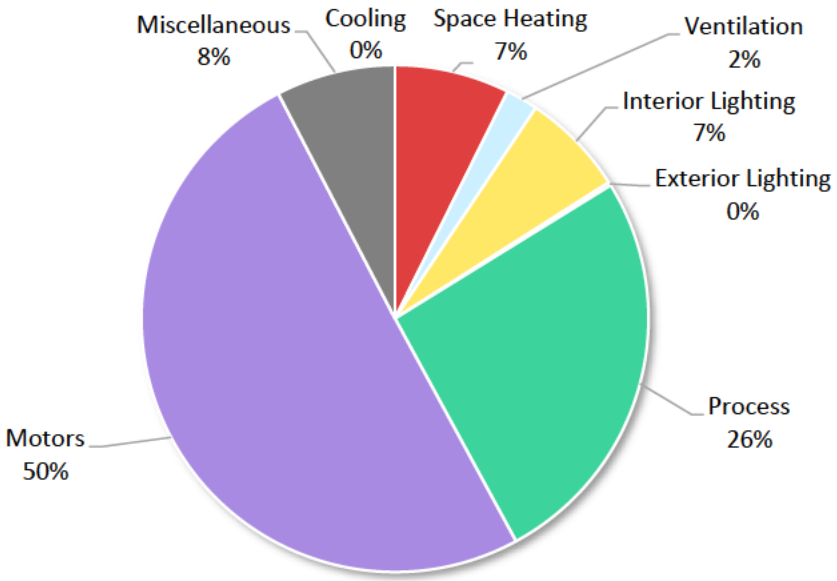


Figure 5-11 – Industrial Sector Electricity Peak Winter Demand by End Use (2019)



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 any energy efficiency programs. The savings from past programs are embedded in the forecast, but the baseline projection assumes that those past programs cease to exist in the future. Thus, the potential analysis captures all possible savings from future programs.

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
- Liberty-Empire's 2019 IRP Load Forecast
- Current demand side management program and solar PV impacts
- Future consumption of specific customer groups, such as nonresidential opt-out customers and contracted municipalities

AEG took the following steps to align the baseline projection with the Liberty-Empire 2019 IRP forecast developed by Itron:

- Updated market size forecast to be consistent with the Itron forecast.
- Added actual and forecasted HDD/CDD consistent with the Itron forecast.
- Updated forecasts of other utilization variables, indices for electricity price, income and HH size used in the development of the 2019 IRP load forecast.

- Reviewed and updated equipment saturation growth forecasts in light of actuals provided by Liberty-Empire and Itron.

Although AEG took steps to align closely, the baseline projection is not Liberty-Empire's forecast. Rather it was developed as an integral component of our modeling construct to serve as the metric against which energy efficiency potentials are measured.

Baseline projections for each sector are presented below, 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 5-15 and Figure 5-12 present the baseline projection for electricity at the end-use level for the residential sector, as a whole. Overall, residential use increases from 1,708 GWh in 2019 to 1,932 GWh in 2041, an increase of 13.1%. There are three high-level factors affecting growth.

- The first is a moderate increase in number of households (19% between 2019 and 2041).
- Increase in specific equipment saturations driven by growth trends developed by the Annual Energy Outlook.
- The final factor is an increase in household income. AEG applied a factor that represents Liberty-Empire's econometric relationship between income and energy consumption. Overall, there is an expected annual increase of 1.5% in household income. This has an upward pressure on electricity consumption.

The 2019 base-year data was calibrated to weather-actual statement of electric revenue, but future years are weather-normalized to provide a consistent baseline upon which potential is measured. As can be seen below, the majority of end uses increase throughout the forecast. These increases are primarily driven by the factors described above. The most noticeable change comes in the lighting usage, which decreases throughout the forecast. LEDs are a large source of naturally occurring efficiency, which models the market adoption of a more efficient technology.

Table 5-15 – Residential Sector Baseline Projection by End Use (Net GWh)

End Use	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	311	272	298	313	328	347	11.7%
Heating	565	546	590	612	630	650	15.1%
Water Heating	176	178	183	189	195	201	14.5%
Interior Lighting	128	131	127	96	91	97	-24.7%
Exterior Lighting	33	33	31	22	20	21	-34.6%
Appliances	289	292	302	311	320	332	15.1%
Electronics	74	76	84	92	100	111	49.1%
Miscellaneous	133	135	143	150	159	172	29.7%
Total	**1,708**	**1,664**	**1,757**	**1,785**	**1,843**	**1,932**	**13.1%**

Figure 5-12 – Residential Baseline Projection by End Use (Net GWh)

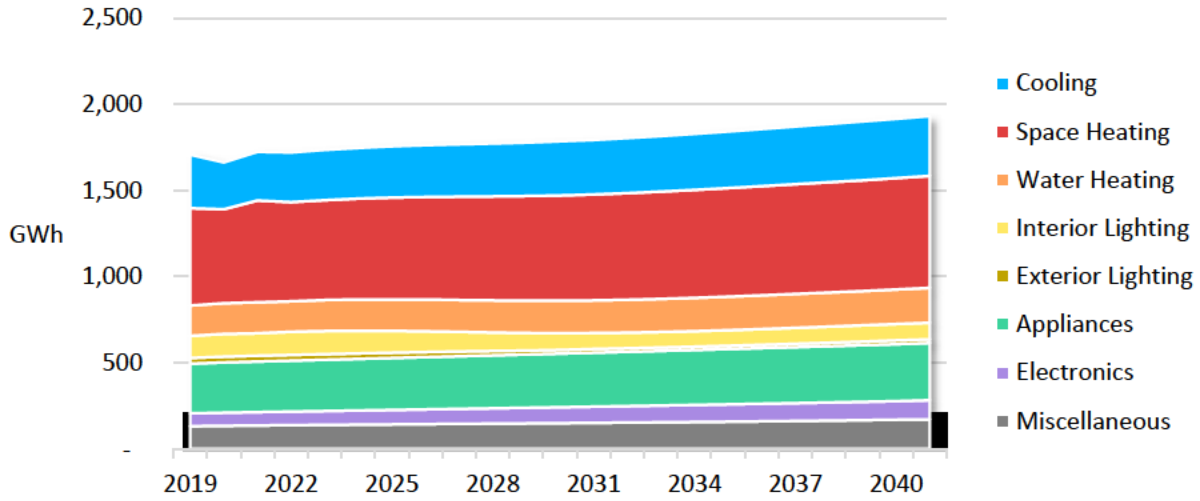


Table 5-16 shows the end-use projection at the technology level for select years. This projection is in general alignment with Liberty-Empire's residential load forecast. Specific observations include:

1) Overall lighting use begins to decline in the early years of the projection, reflecting the first phase of the EISA lighting standard.
2) Modest growth in the heating end use reflects a wider deployment of electric heating within the service territory.
3) 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 also grown consistently in the past. Future growth assumptions that are consistent with the Annual Energy Outlook are incorporated.

Table 5-16 – Residential Baseline Projection by End Use and Technology (Net GWh)

End Use	Technology	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	Air-Source Heat Pump	46	40	44	48	51	55	21.9%
	Central AC	257	224	246	258	269	284	10.6%
	Geothermal Heat Pump	5	4	4	4	4	4	-23.4%
	Room AC	4	4	4	4	4	4	2.5%
Heating	Air-Source Heat Pump	197	190	203	208	212	218	10.5%
	Electric Furnace	301	292	317	331	342	354	17.6%
	Electric Room Heat	60	58	63	65	68	70	17.3%
	Geothermal Heat Pump	7	7	7	8	8	8	21.1%
Water Heating	Water Heater <= 55 Gal	164	166	172	178	183	190	15.9%
	Water Heater > 55 Gal	12	12	11	11	11	11	-4.0%
Interior Lighting	Exempted Lighting	30	31	28	19	19	20	-33.8%
	General Service Lighting	93	94	93	71	65	70	-24.5%
	Linear Lighting	6	6	6	6	7	7	21.7%
Ext. Lighting	General Service Lighting	33	33	31	22	20	21	-34.6%
Appliances	Air Purifier	3	3	3	3	3	3	20.0%
	Clothes Dryer	103	104	109	114	119	123	20.2%
	Clothes Washer	14	14	15	16	16	17	20.0%
	Dehumidifiers	11	11	12	12	13	14	24.5%
	Dishwasher	10	11	11	12	13	13	27.8%
	Freezer	30	30	32	33	35	36	20.0%
	Microwave	16	16	17	18	19	20	24.4%
	Refrigerator	67	67	67	66	66	69	2.3%
	Second Refrigerator	17	17	16	15	15	15	-12.3%
	Stove	18	18	19	21	22	23	25.2%
Electronics	Devices and Gadgets	13	13	15	16	17	19	46.4%
	Laptops	5	5	5	5	5	5	20.0%
	Monitor	2	2	3	3	3	3	20.0%

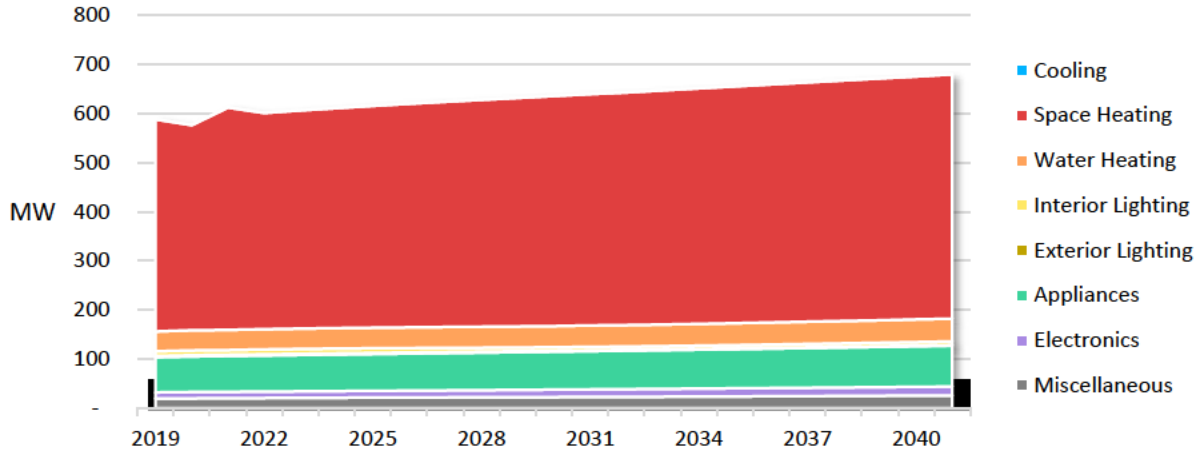
End Use	Technology	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
	Personal Computers	7	8	8	8	9	9	20.0%
	Printer/Fax/Copier	3	3	4	4	4	5	46.4%
	Set-top Boxes/DVR	13	13	14	16	17	19	49.3%
	TVs	31	32	36	40	45	51	64.7%
Misc.	Bathroom Exhaust Fan	2	2	2	2	2	2	21.9%
	Electric Vehicle Chargers	0	0	1	2	5	10	100.0%
	Furnace Fan	45	46	48	50	52	54	20.0%
	Hot Tub/Spa	11	12	12	13	13	14	20.0%
	Miscellaneous	53	54	58	62	66	71	33.3%
	Pool Heater	6	6	6	7	7	7	20.0%
	Pool Pump	5	5	5	3	2	2	-60.0%
	Well pump	10	10	10	11	11	12	20.0%
Total		**1,708**	**1,664**	**1,757**	**1,785**	**1,843**	**1,932**	**13.1%**

Table 5-17 and Figure 5-13 present the residential baseline projection for winter peak demand at the end-use level. Overall, residential summer peak increases from 588 MW in 2019 to 680 MW in 2041. The winter peak associated with electronics and miscellaneous uses increases substantially, corresponding to growth in annual energy use.

Table 5-17 – Residential Winter Peak Baseline Projection by End Use (Net MW)

End Use	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	0	0	0	0	0	0	0.0%
Heating	432	418	451	468	482	497	15.2%
Water Heating	40	41	42	43	45	46	14.5%
Interior Lighting	10	10	9	7	7	7	-24.6%
Exterior Lighting	2	2	2	2	1	2	-34.6%
Appliances	72	73	75	77	80	83	15.5%
Electronics	12	13	14	15	17	18	49.4%
Miscellaneous	20	20	22	23	24	26	30.6%
Total	**588**	**576**	**615**	**635**	**655**	**680**	**15.6%**

Figure 5-13 – Residential Winter Peak Baseline Projection by End Use (Net MW)



Commercial Sector Baseline Projection

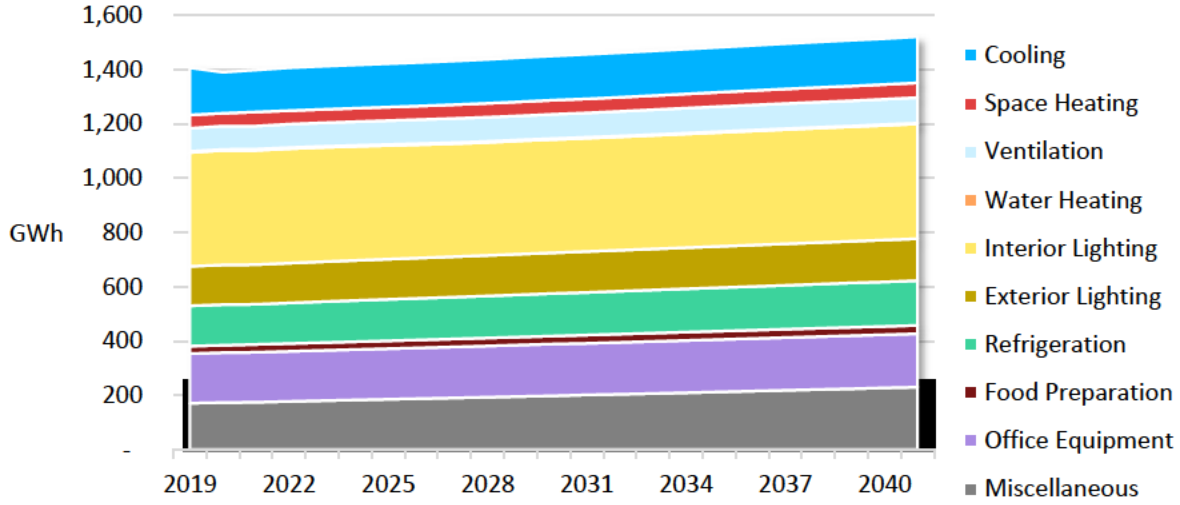
Annual electricity use in the commercial sector grows 8.1% during the overall forecast horizon, starting at 1,407 GWh in 2019, and increasing to 1,521 in 2041. Table 5-18 and Figure 5-14 present the baseline projection at the end-use level for the commercial sector. Three main factors contribute to growth in the commercial sector.

First, market size is expected to grow across the commercial sector, resulting in an increase in consumption. Rather than increasing consumption per square foot, AEG assumed that new spaces would develop, or underutilized/vacant spaces would be repurposed. This is reflected in the increase in square feet in each respective segment throughout the length of the study. Second, an increase in the saturations of office equipment and appliances (in food preparation and refrigeration) across most commercial segments. Finally, the miscellaneous end use represents a growing portion of energy consumption in commercial buildings that isn't captured in the other defined end uses.

Table 5-18 – Commercial Baseline Projection by End Use (Net GWh)

End Use	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	174	151	160	163	166	170	-2.5%
Space Heating	49	47	50	52	53	54	10.3%
Ventilation	85	85	88	90	92	94	10.9%
Water Heating	4	4	4	3	3	3	-29.6%
Interior Lighting	420	422	419	417	420	423	0.8%
Exterior Lighting	145	146	148	150	152	154	6.1%
Refrigeration	148	149	153	157	160	165	10.9%
Food Preparation	28	28	29	30	30	31	12.7%
Office Equipment	183	183	186	190	193	197	7.6%
Miscellaneous	171	173	185	198	212	230	34.7%
Total	**1,407**	**1,390**	**1,422**	**1,450**	**1,482**	**1,521**	**8.1%**

Figure 5-14 – Commercial Baseline Projection by End Use (GWh)



The majority of end uses increase throughout the forecast. These increases are primarily driven by the factors described above. The most noticeable differences are in the water heating and lighting end uses. The decrease in water heating is driven by naturally occurring efficiency. The Annual Energy Outlook projects that customers in the commercial sector will naturally purchase more efficient technologies without utility intervention.

Table 5-19 presents the commercial sector annual projection by technology for select years. General service screw-in and exempted lighting technologies decrease significantly over the study period as a result of efficiency standards. Some cooling technologies, including air- and ground-source heat pumps, also decline slightly due to shifts in efficiency standards. Large growth is seen within the office equipment technologies due to large projected growth in the applicable segments.

Table 5-19 – Commercial Baseline Projection by End Use and Technology (Net GWh)

End Use	Technology	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	Air-Cooled Chiller	51	44	45	45	45	45	-12.5%
	Air-Source Heat Pump	1	1	1	1	1	1	-11.3%
	Geothermal Heat Pump	1	1	1	1	1	1	-13.1%
	Packaged Terminal AC	13	11	12	12	13	13	3.3%
	Packaged Terminal HP	1	1	1	1	1	1	3.1%
	RTU	56	49	51	52	52	52	-7.0%
	Water-Cooled Chiller	50	44	48	51	54	56	11.3%
Space Heating	Air-Source Heat Pump	1	1	1	1	1	1	11.9%
	Electric Furnace	29	27	29	30	31	31	10.1%
	Electric Room Heat	16	15	16	17	17	18	10.1%
	Geothermal Heat Pump	1	1	1	1	1	1	8.9%
	Packaged Terminal HP	2	2	2	3	3	3	15.0%
Ventilation	Ventilation	85	85	88	90	92	94	10.9%
Water Heating	Water Heater	4	4	4	3	3	3	-29.6%
Interior Lighting	Exempted Lighting	31	31	26	22	23	22	-28.0%
	General Service Lighting	27	27	21	19	18	17	-36.7%
	High-Bay Lighting	161	162	166	169	172	175	8.2%
	Linear Lighting	200	201	205	207	208	209	4.4%
	Area Lighting	121	122	125	127	129	131	8.1%

End Use	Technology	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Exterior Lighting	General Service Lighting	5	5	3	3	3	3	-42.2%
	Linear Lighting	19	19	20	20	20	20	5.1%
Refrigeration	Glass Door Display	38	38	39	40	41	42	10.9%
	Icemaker	33	33	34	34	35	36	10.9%
	Open Display Case	51	51	52	54	55	56	10.9%
	Reach-in Refrigerator/Freezer	13	13	13	13	14	14	10.9%
	Vending Machine	6	6	6	7	7	7	10.9%
	Walk-in Refrigerator/Freezer	9	9	9	9	9	9	10.9%
Food Preparation	Dishwasher	4	4	5	5	5	5	13.4%
	Fryer	8	8	9	9	9	10	13.4%
	Griddle	6	6	7	7	7	7	10.9%
	Hot Food Container	1	1	1	1	1	1	10.9%
	Oven	3	3	4	4	4	4	13.4%
	Steamer	4	4	4	5	5	5	13.4%
Office Equipment	Desktop Computer	67	68	67	67	67	67	-0.7%
	Laptop	14	14	15	16	16	17	23.8%
	Monitor	12	12	12	13	13	13	10.9%
	POS Terminal	14	14	14	15	15	15	10.9%
	Printer/Copier/Fax	5	5	5	5	5	5	10.9%
	Server	71	71	73	75	76	78	10.9%
Misc.	Clothes Dryer	0	0	0	0	0	0	0.0%
	Clothes Washers	2	2	2	2	2	2	10.9%
	Electric Vehicle Chargers	0	0	0	0	0	0	0.0%
	Miscellaneous	151	154	165	178	192	209	38.1%
	Non-HVAC Motors	17	17	18	18	18	19	10.9%
	Pool Heater	0	0	0	0	0	0	10.9%
	Pool Pump	1	1	1	0	0	0	-43.7%
Total		**1,407**	**1,390**	**1,422**	**1,450**	**1,482**	**1,521**	**8.1%**

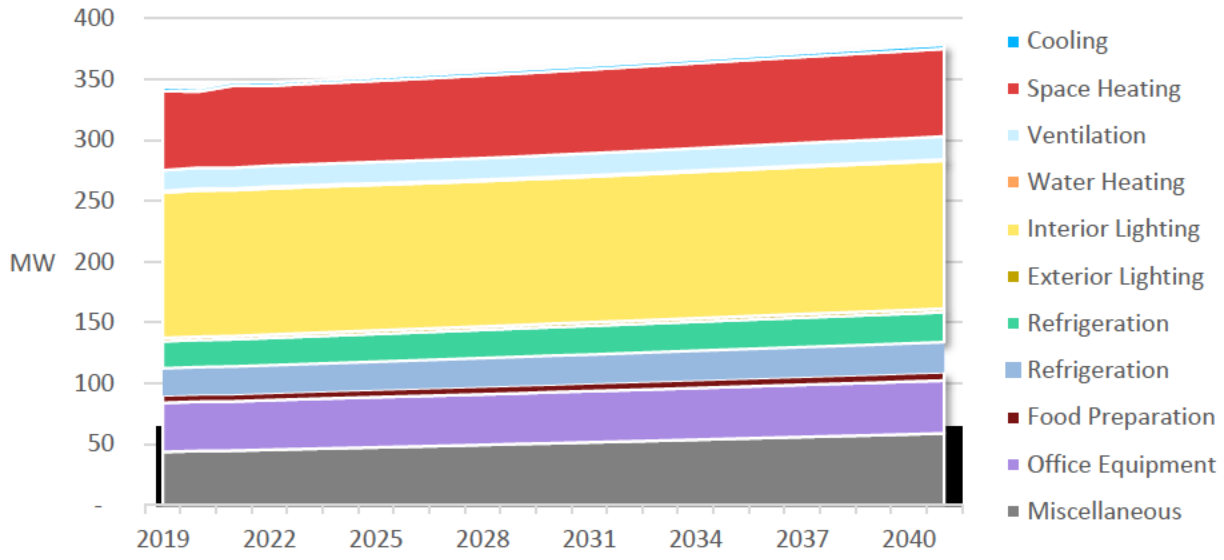
Table 5-20 and Figure 5-15 present the net winter peak baseline projection at the end-use level for the commercial sector as a whole. Winter peak demand increases over the planning period,

starting at 321 MW in 2019 and increasing to 354 MW in 2041. The peak increases primarily due to customer growth within the sector and anticipated growth in the miscellaneous end use.

Table 5-20 – Commercial Winter Peak Baseline Projection by End Use (Net MW)

End Use	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	3	3	**3**	**3**	3	3	7.5%
Space Heating	65	63	67	69	70	72	10.4%
Ventilation	17	17	18	18	**18**	19	10.9%
Water Heating	1	1	1	1	1	1	-29.6%
Interior Lighting	120	120	**120**	**120**	**121**	122	1.9%
Exterior Lighting	3	3	3	3	**3**	3	6.1%
Refrigeration	22	22	**23**	**23**	24	25	10.9%
Food Preparation	6	6	6	6	7	7	12.8%
Office Equipment	40	41	**41**	**42**	**43**	43	7.5%
Miscellaneous	44	44	**47**	**51**	**54**	59	35.0%
Total	**321**	**320**	**329**	**336**	**344**	**354**	**10.1%**

Figure 5-15 – Commercial Winter Peak Baseline Projection by End Use (Net MW)



Industrial Sector Baseline Projection

Annual electricity use in the industrial sector grows 10.6% during the overall forecast horizon, starting at 526 GWh in 2019, and increasing to 581 GWh in 2041. Table 5-21 and Figure 5-16 present the baseline projection at the end-use level for the industrial sector.

Unlike the residential and commercial sectors, growth is more consistent across end uses in the industrial sector. Naturally occurring efficiency is not as prevalent in the industrial sector. The primary driver of growth in the industrial sector is the market size change from 2021-2023. After accounting for the slight growth in market size in the early years, baseline energy usage is projected to be relatively constant through the end of the study period.

Table 5-21 – Industrial Baseline Projection by End Use (Net GWh)

End Use	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	39	34	38	38	37	37	-5.7%
Space Heating	14	13	16	16	16	16	12.3%
Ventilation	18	18	20	20	20	20	12.5%
Interior Lighting	28	28	32	32	31	31	10.6%
Exterior Lighting	17	17	18	18	17	17	-2.3%
Process	126	126	141	142	142	142	12.5%
Motors	246	245	275	275	276	276	12.5%
Miscellaneous	37	37	42	42	42	42	12.5%
Total	**526**	**519**	**582**	**581**	**581**	**581**	**10.6%**

Figure 5-16 – Industrial Baseline Projection by End Use (GWh)

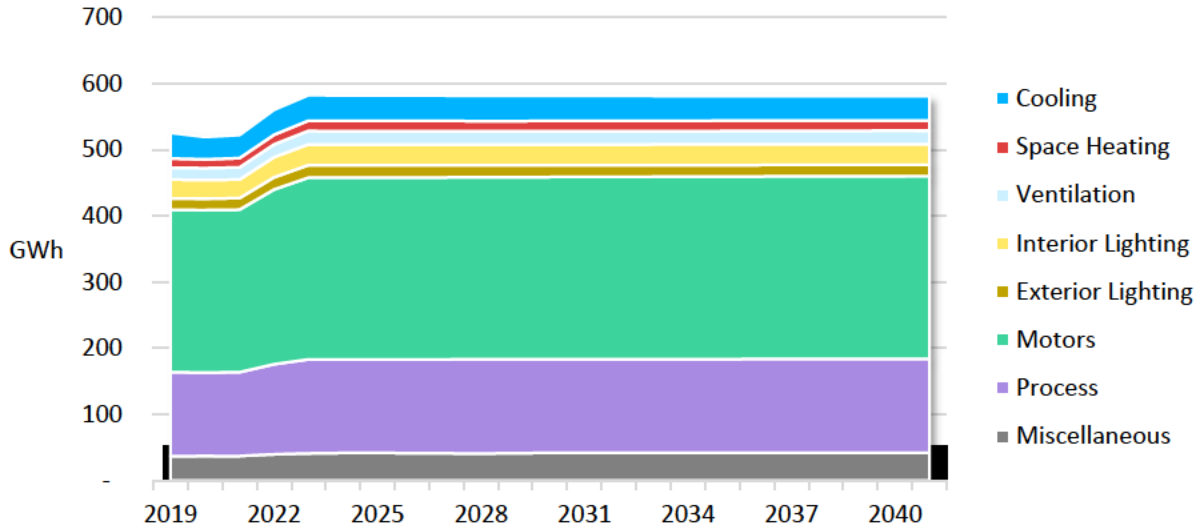


Table 5-22 presents the industrial sector annual projection by technology for select years. The majority of growth is due to the slight increase in the industrial market size. Some notable differences from this trend include the decrease in general service lighting and cooling technologies.

Table 5-22 – Industrial Baseline Projection by End Use and Technology (Net GWh)

End Use	Technology	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	**Air-Cooled Chiller**	**2**	**1**	**2**	**1**	**1**	**1**	**-11.2%**
	Air-Source Heat Pump	**4**	**4**	**4**	**4**	**4**	**4**	**-9.8%**
	Geothermal Heat Pump	**0**	**0**	**0**	**0**	**0**	**0**	**0.0%**
	RTU	**30**	**26**	**30**	**29**	**29**	**28**	**-5.1%**
	Water-Cooled Chiller	**3**	**3**	**3**	**3**	**3**	**3**	**-2.8%**
Space Heating	**Air-Source Heat Pump**	**5**	**4**	**5**	**5**	**5**	**5**	**13.5%**
	Electric Furnace	**2**	**1**	**2**	**2**	**2**	**2**	**11.7%**
	Electric Room Heat	**8**	**8**	**9**	**9**	**9**	**9**	**11.7%**
	Geothermal Heat Pump	**-**	**-**	**-**	**-**	**-**	**-**	**0.0%**
Ventilation	**Ventilation**	**18**	**18**	**20**	**20**	**20**	**20**	**12.5%**
Interior Lighting	General Service Lighting	3	3	3	3	3	3	-0.4%

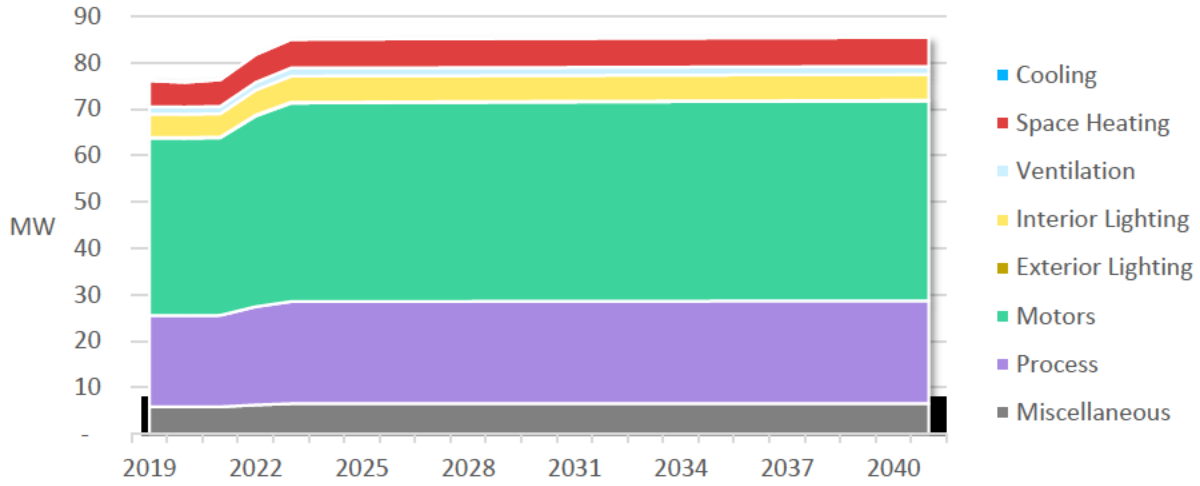
End Use	Technology	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
	High-Bay Lighting	14	14	16	16	16	16	12.5%
	Linear Lighting	11	11	13	13	13	13	10.9%
Exterior Lighting	Area Lighting	5	5	6	6	5	5	10.0%
	General Service Lighting	5	5	5	4	4	4	-27.9%
	Linear Lighting	7	7	8	8	8	8	7.5%
Process	Process Cooling	35	35	39	39	39	39	12.5%
	Process Electrochemical	12	12	14	14	14	14	12.5%
	Process Heating	47	47	53	53	53	53	12.5%
	Process Other	10	9	11	11	11	11	12.5%
	Process Refrigeration	23	23	25	25	25	26	12.5%
Motors	Compressed Air	38	38	43	43	43	43	12.5%
	Fans & Blowers	32	32	36	36	36	37	12.5%
	Material Handling	78	78	87	88	88	88	12.5%
	Other Motors	15	15	17	17	17	17	12.5%
	Pumps	81	81	91	91	91	92	12.5%
Miscellaneous	Miscellaneous	37	37	42	42	42	42	12.5%
Total		526	519	582	581	581	581	10.6%

Table 5-23 and Figure 5-17 present the net winter peak baseline projection at the end-use level for the industrial sector as a whole. Winter peak demand increases over the planning period, starting at 76 MW in 2019 and increasing to 86 MW in 2041. The growth in the peak forecast is due primarily to the growth of the industrial market, and therefore remains fairly consistent across end uses. One notable difference is the slight decrease in lighting peak usage.

Table 5-23 – Industrial Winter Peak Baseline Projection by End Use (Net MW)

End Use	2019	2020	2025	2030	2035	2041	% Change ('19-'41)
Cooling	0	0	**0**	**0**	0	0	0.0%
Space Heating	6	5	6	6	6	6	12.3%
Ventilation	2	2	2	2	**2**	2	12.5%
Interior Lighting	5	5	6	6	6	6	10.6%
Exterior Lighting	0	0	**0**	**0**	**0**	0	-2.3%
Process	20	20	22	22	**22**	22	12.5%
Motors	38	38	**43**	**43**	43	43	12.5%
Miscellaneous	6	6	6	7	7	7	12.5%
Total	**76**	**76**	**85**	**85**	**85**	**86**	**12.3%**

Figure 5-17 – Industrial Winter Peak Baseline Projection by End Use (Net MW)



Summary of Baseline Projection across Sectors

Table 5-24 provides a summary of the energy baseline projection for annual use by sector for the entire Liberty-Empire service territory. Table 5-25 provides a summary of the baseline projection for net winter peak demand. Overall, the forecast shows relatively modest growth in electricity use, driven primarily by the residential sector and moderated by the effects of future codes and standards that will be enacted per all current legislation.

Table 5-24 – Baseline Projection Summary (Net GWh)

Sector	2019	2020	2025	2030	2035	2041	% Change ('19-'41)	Avg. Growth
Residential	1,708	1,664	1,757	1,785	1,843	1,932	13.1%	0.6%
Commercial	1,407	1,390	1,422	2,189	1,482	1,521	8.1%	0.4%
Industrial	526	519	582	581	581	581	10.6%	0.5%
Total	**3,641**	**3,572**	**3,761**	**3,817**	**3,906**	**4,034**	**10.8%**	**0.5%**

Table 5-25 – Baseline Winter Peak Projection Summary (Net MW)

Sector	2019	2020	2025	2030	2035	2041	% Change ('19-'41)	Avg. Growth
Residential	588	612	615	635	655	680	15.6%	0.7%
Commercial	321	325	329	336	344	354	10.1%	0.4%
Industrial	76	76	85	85	85	86	12.3%	0.5%
Total	**986**	**972**	**1,029**	**1,057**	**1,085**	**1,119**	**13.5%**	**0.6%**

Energy Efficiency Potential

In this study, the energy efficiency potential estimates represent net savings[6] 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 defined as the theoretical upper limit of conservation potential. It assumes that customers adopt all feasible measures regardless of their cost. At the time

[6] 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.

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. Technical potential also assumes the adoption of measures that don't consume energy, also known as non-equipment measures. For example, it includes installation of high-efficiency windows in all new construction opportunities and air conditioner maintenance in all existing buildings with central and room air conditioning. These retrofit measures are phased in over several years to align with the stock turnover of related equipment units, rather than modeled as immediately available all at once.

- **Economic Potential** applies an economic cost-effectiveness screen. In this analysis, the cost-effectiveness is measured by the total resource cost (TRC) test, which compares lifetime energy and capacity benefits to the costs of delivering the measure through a utility program. These costs are the incremental cost of the given efficiency measure relative to the relevant baseline course of action, plus any administrative costs that are incurred by the program to deliver and implement the measure. If the benefits outweigh the costs (that is, if the TRC ratio is greater than 1.0), a given measure is included in the economic potential.
- **Maximum Achievable Potential ("MAP")** refines economic potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of efficiency measures. It is the maximum amount of savings that can be realized under ideal market, implementation, and customer preference conditions.
- **Realistic Achievable Potential ("RAP")** further refines achievable potential to reflect expected program participation given barriers to customer acceptance, non-ideal implementation conditions, and limited program budgets. This represents a lower bound on achievable potential.

Table 5-26, Figure 5-18 and Figure 5-19 summarize the energy efficiency savings in terms of annual energy use for the four levels of potential, described above. Savings are represented in

cumulative terms, which reflect the effects of persistent savings in prior years in addition to new savings in year. Key highlights are as follows:

- Technical potential savings reach approximately 45% by the end of the study period. This suggests that there continue to be ample savings available.
- Economic potential savings, however, are about half of the technical potential, reflecting relatively low avoided costs that result in low measure cost effectiveness.
- Achievable potential – RAP and MAP – are about half to two-thirds of economic potential throughout the study horizon.

Table 5-26 – Summary of Energy Efficiency Potential (Annual Energy, GWh)

Summary of Energy Savings	2022	2023	2024	2026	2031	2041
Baseline Projection (GWh)	**3,688**	**3,730**	**3,747**	**3,772**	**3,832**	**4,034**
Potential Forecasts (GWh)						
Realistic Achievable Potential	3,659	3,670	3,657	3,633	3,566	3,492
Maximum Achievable Potential	3,644	3,641	3,615	3,571	3,461	3,329
Economic Potential	3,605	3,559	3,494	3,381	3,104	2,659
Technical Potential	3,550	3,455	3,344	3,149	2,713	2,152
Cumulative Savings (GWh)						
Realistic Achievable Potential	29	60	90	139	266	542
Maximum Achievable Potential	43	90	132	201	371	705
Economic Potential	83	171	254	391	728	1,375
Technical Potential	138	275	403	623	1,119	1,882
Energy Savings (% of Baseline)						
Realistic Achievable Potential	0.8%	1.6%	2.4%	3.7%	6.9%	13.4%
Maximum Achievable Potential	1.2%	2.4%	3.5%	5.3%	9.7%	17.5%
Economic Potential	2.2%	4.6%	6.8%	10.4%	19.0%	34.1%
Technical Potential	3.7%	7.4%	10.8%	16.5%	29.2%	46.7%

Figure 5-18 – Energy Efficiency Potential as a Percent of Liberty-Empire Baseline Projection (Annual Energy)

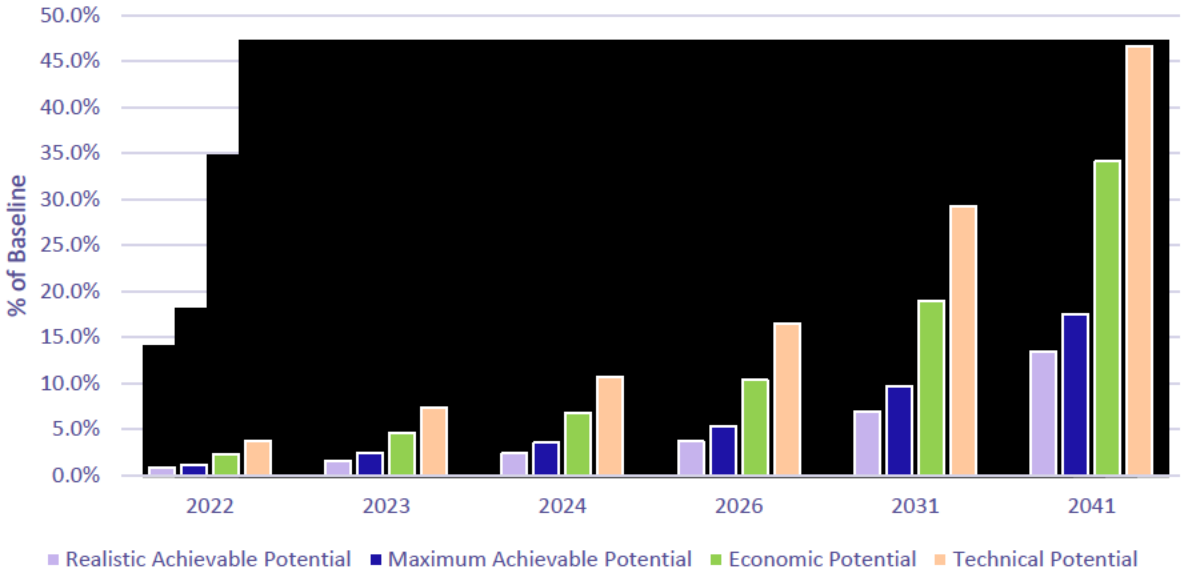


Figure 5-19 – Liberty-Empire Baseline Projection and Energy Efficiency Potential Cases (Annual Energy, GWh)

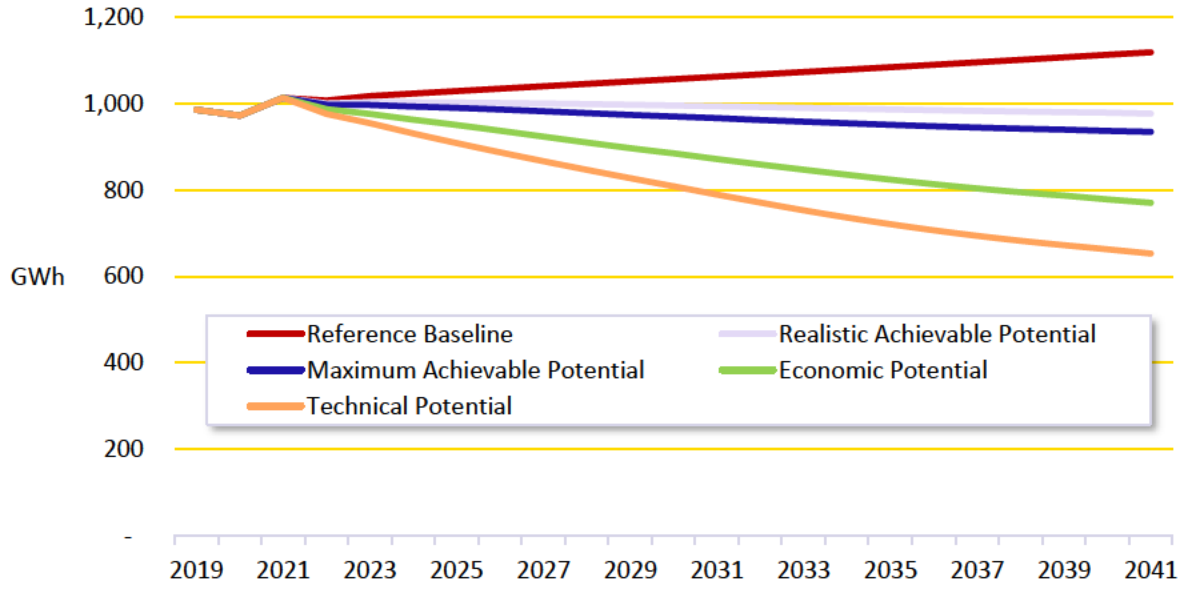


Table 5-27 and Figure 5-20 summarize the winter peak demand savings from all energy efficiency measures for four levels of potential *relative to the baseline projection.*

Table 5-27 – Summary of Energy Efficiency Potential (Winter Peak, MW)

Summary of Energy Savings	2022	2023	2024	2026	2031	2041
Baseline Projection (MW)	**1,008**	**1,017**	**1,024**	**1,035**	**1,062**	**1,119**
Potential Forecasts (MW)						
Realistic Achievable Potential	1,001	1,003	1,001	998	987	959
Maximum Achievable Potential	997	995	991	981	957	911
Economic Potential	986	973	957	927	855	732
Technical Potential	976	954	931	887	789	653
Cumulative Savings (MW)						
Realistic Achievable Potential	7	15	22	36	75	160
Maximum Achievable Potential	11	22	33	53	105	208
Economic Potential	21	45	67	108	207	387
Technical Potential	32	63	93	148	273	466
Energy Savings (% of Baseline)						
Realistic Achievable Potential	0.7%	1.4%	2.2%	3.5%	7.1%	14.3%
Maximum Achievable Potential	1.0%	2.2%	3.2%	5.2%	9.9%	18.6%
Economic Potential	2.1%	4.4%	6.5%	10.4%	19.5%	34.5%
Technical Potential	3.2%	6.2%	9.1%	14.3%	25.7%	41.6%

Figure 5-20 – Energy Efficiency Potential as a Percent of Liberty-Empire Baseline Projection (Peak Demand)

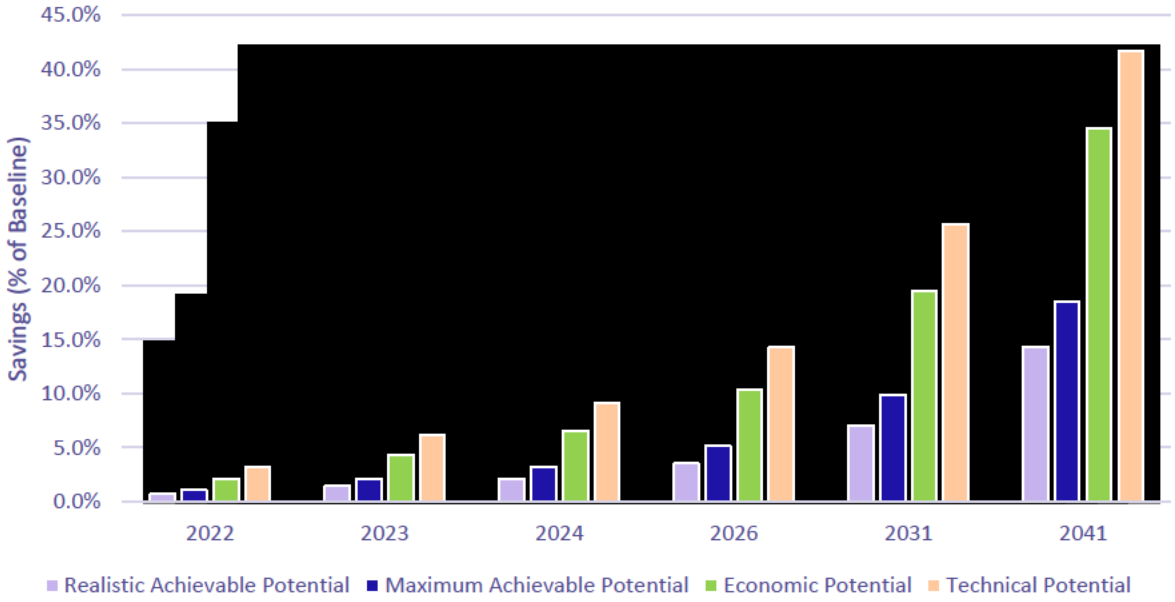


Table 5-28 and Figure 5-21 summarize the energy efficiency potential for the residential sector. In 2022, realistic achievable potential is 16 GWh, or 0.9% of the baseline projection. By 2026, cumulative savings are 75 GWh, or 4.2% of the baseline. The residential sector contributes slightly more to overall potential than the non-residential sector throughout the study period. Table 5-29 details the winter peak demand savings for the residential sector.

Table 5-28 – Residential Energy Efficiency Potential (Annual Energy, GWh)

Summary of Energy Savings	2022	2023	2024	2026	2031	2041
Baseline Projection (GWh)	**1,721**	**1,736**	**1,748**	**1,763**	**1,794**	**1,932**
Cumulative Savings (GWh)						
Realistic Achievable Potential	16	34	51	75	139	299
Maximum Achievable Potential	24	51	77	111	199	397
Economic Potential	46	97	145	216	396	784
Technical Potential	82	165	244	372	650	1,056
Energy Savings (% of Baseline)						
Realistic Achievable Potential	0.9%	1.9%	2.9%	4.2%	7.7%	15.5%
Maximum Achievable Potential	1.4%	3.0%	4.4%	6.3%	11.1%	20.6%
Economic Potential	2.6%	5.6%	8.3%	12.3%	22.0%	40.6%
Technical Potential	4.8%	9.5%	14.0%	21.1%	36.2%	54.6%

Figure 5-21 – Residential Energy Efficiency Savings as a Percent of Baseline (Annual Energy)

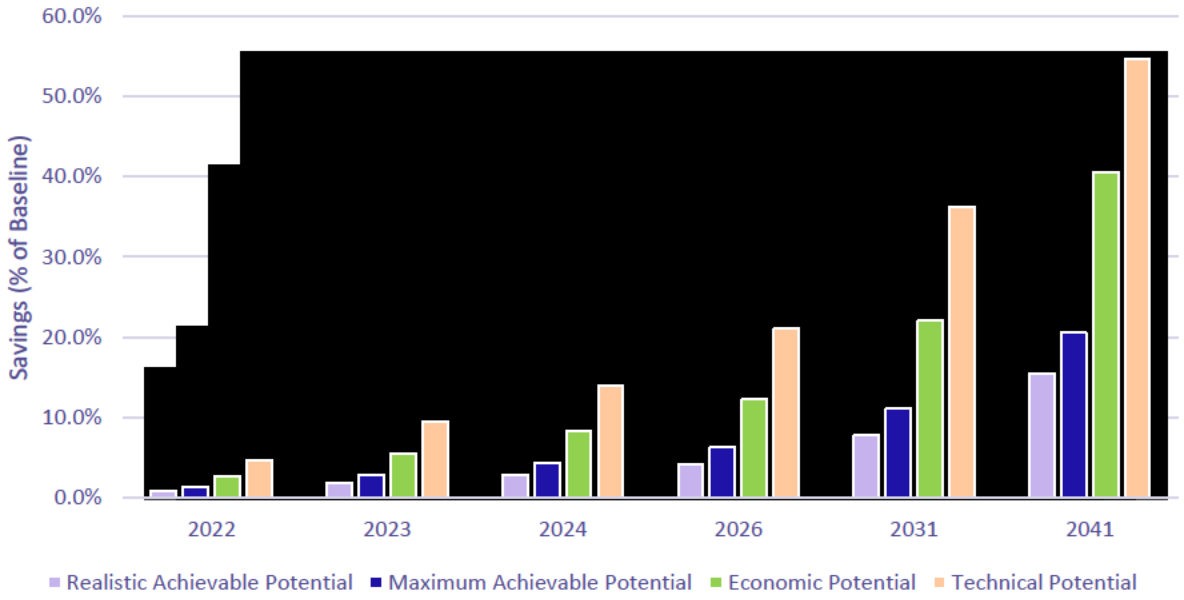


Table 5-29 – Residential Energy Efficiency Potential (Winter Peak, MW)

Summary of Energy Savings	2022	2023	2024	2026	2031	2041
Baseline Projection (MW)	**601**	**606**	**611**	**620**	**639**	**680**
Cumulative Savings (MW)						
Realistic Achievable Potential	4	10	15	25	53	119
Maximum Achievable Potential	7	15	23	37	76	156
Economic Potential	15	31	47	77	151	289
Technical Potential	24	48	71	114	212	362
Energy Savings (% of Baseline)						
Realistic Achievable Potential	0.7%	1.6%	2.4%	4.0%	8.4%	17.6%
Maximum Achievable Potential	1.2%	2.4%	3.7%	6.0%	11.9%	23.0%
Economic Potential	2.4%	5.1%	7.7%	12.4%	23.7%	42.5%
Technical Potential	4.0%	7.9%	11.6%	18.4%	33.2%	53.2%

Figure 5-22 and Figure 5-23 present projections of energy savings by end use in terms of cumulative savings and as a percent of total annual savings. Lighting savings account for a substantial portion of savings in the early years as the lighting stock turns over much quicker than HVAC and Appliance stock. Savings begin to decline due to market transformation but persist due to newer generations of LEDS. The overall share of non-lighting end use savings increases over the forecast horizon because savings for appliance and HVAC equipment are realized as their stock turnover later in the study.

Figure 5-22 – Residential Realistic Achievable Savings Forecast (Annual Energy, % of Total)

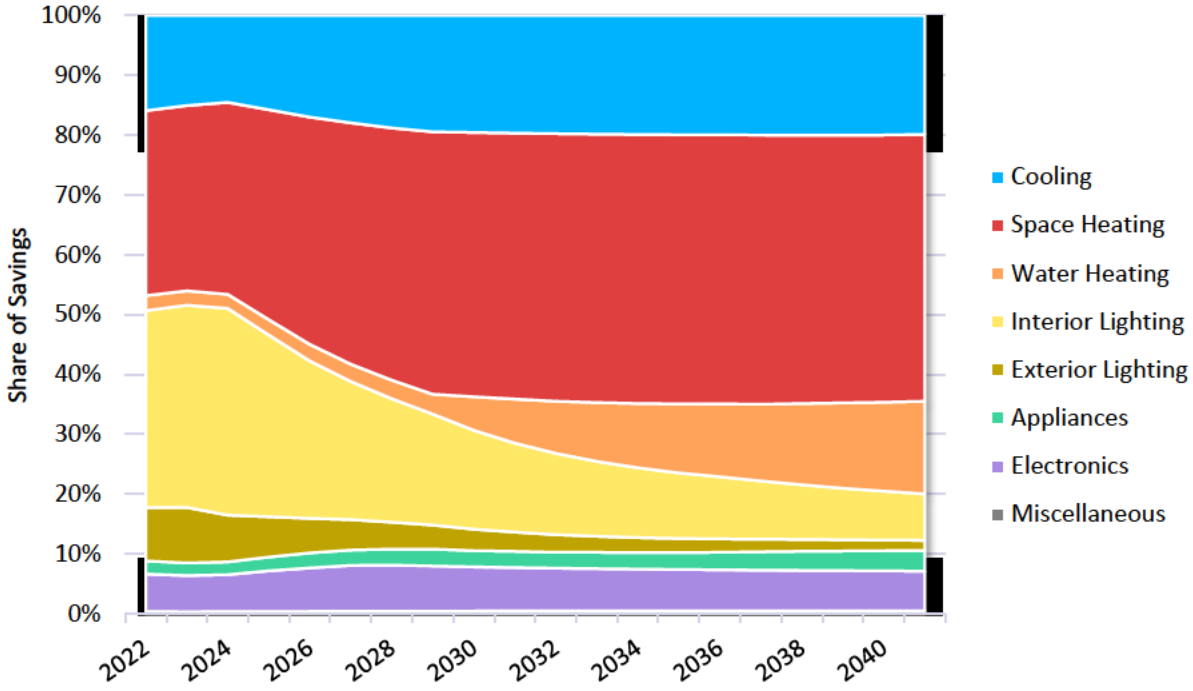


Figure 5-23 – Residential Realistic Achievable Savings Forecast (Annual Energy, GWh)

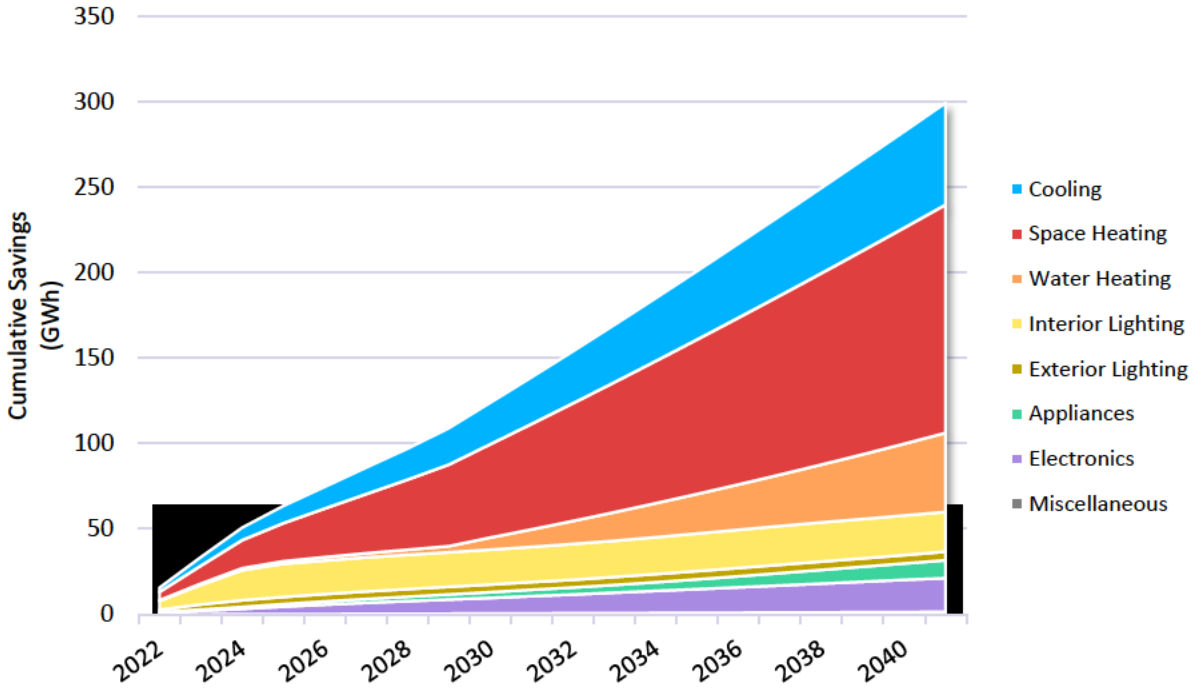


Table 5-30 and Figure 5-24 present estimates of annual energy savings for the four levels of energy efficiency potential for the commercial sector. In 2022, the first year of the projection, realistic achievable potential is 12 GWh, or 0.9% of the Liberty-Empire load forecast. By 2041, realistic achievable savings are 217 GWh, or 14.3% of the forecast. Table 5-31 details the winter peak demand savings for the commercial sector.

Table 5-30 – Commercial Energy Efficiency Potential (Energy Savings)

Summary of Energy Savings	2022	2023	2024	2026	2031	2041
Baseline Projection (GWh)	1,406	1,411	1,417	1,426	1,456	1,521
Cumulative Savings (GWh)						
Realistic Achievable Potential	12	24	36	58	114	217
Maximum Achievable Potential	18	35	51	81	154	275
Economic Potential	34	69	100	159	300	531
Technical Potential	46	92	134	213	397	697
Energy Savings (% of Baseline)						
Realistic Achievable Potential	0.9%	1.7%	2.5%	4.1%	7.8%	14.3%
Maximum Achievable Potential	1.2%	2.5%	3.6%	5.7%	10.6%	18.1%
Economic Potential	2.4%	4.9%	7.0%	11.2%	20.6%	34.9%
Technical Potential	3.3%	6.5%	9.5%	14.9%	27.3%	45.8%

Figure 5-24 – Commercial Energy Efficiency Savings as a Percent of Baseline

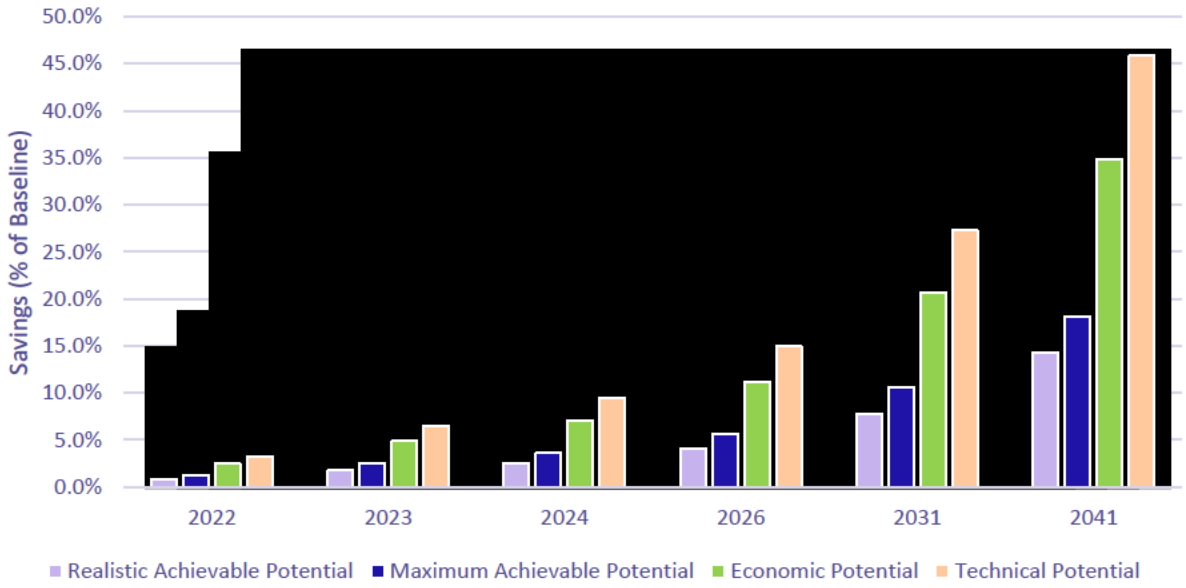


Table 5-31 – Commercial Energy Efficiency Potential (Winter Peak Savings)

Summary of Energy Savings	2022	2023	2024	2026	2031	2041
Baseline Projection (MW)	325	326	328	330	338	354
Cumulative Savings (MW)						
Realistic Achievable Potential	2	5	7	11	20	38
Maximum Achievable Potential	3	7	10	15	27	48
Economic Potential	7	13	19	29	53	91
Technical Potential	7	14	20	31	57	97
Energy Savings (% of Baseline)						
Realistic Achievable Potential	0.7%	1.5%	2.1%	3.3%	6.0%	10.7%
Maximum Achievable Potential	1.1%	2.1%	3.0%	4.6%	8.1%	13.6%
Economic Potential	2.0%	4.0%	5.8%	8.9%	15.7%	25.8%
Technical Potential	2.2%	4.4%	6.2%	9.5%	16.8%	27.4%

Figure 5-25 and Figure 5-26 present projections of commercial energy savings by end use in terms of cumulative savings and as a percent of total annual savings. Interior lighting makes up the majority of annual energy savings throughout the projection, followed by cooling and exterior lighting. The HVAC measures (VSDs, Water cooled chiller, etc.) become a substantial portion of the peak demand savings by the end of the projection.

Figure 5-25 – Commercial Achievable Savings Forecast (Annual Energy, % of Total)

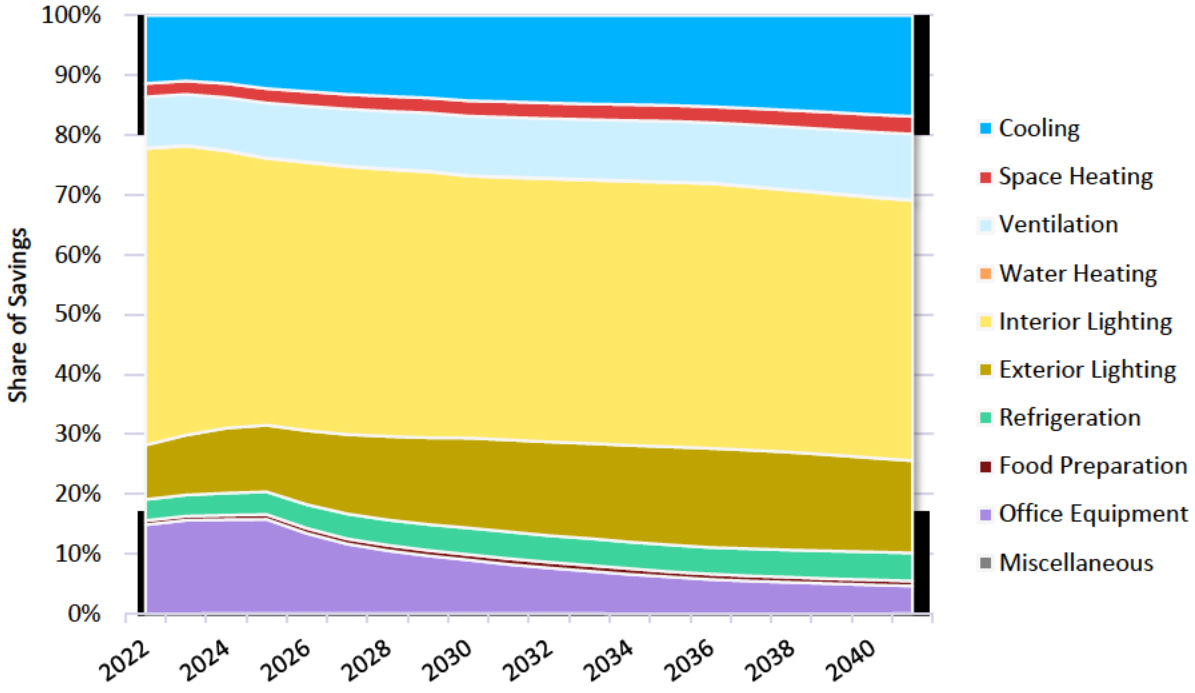


Figure 5-26 – Commercial Achievable Savings Forecast (Annual Energy, GWh)

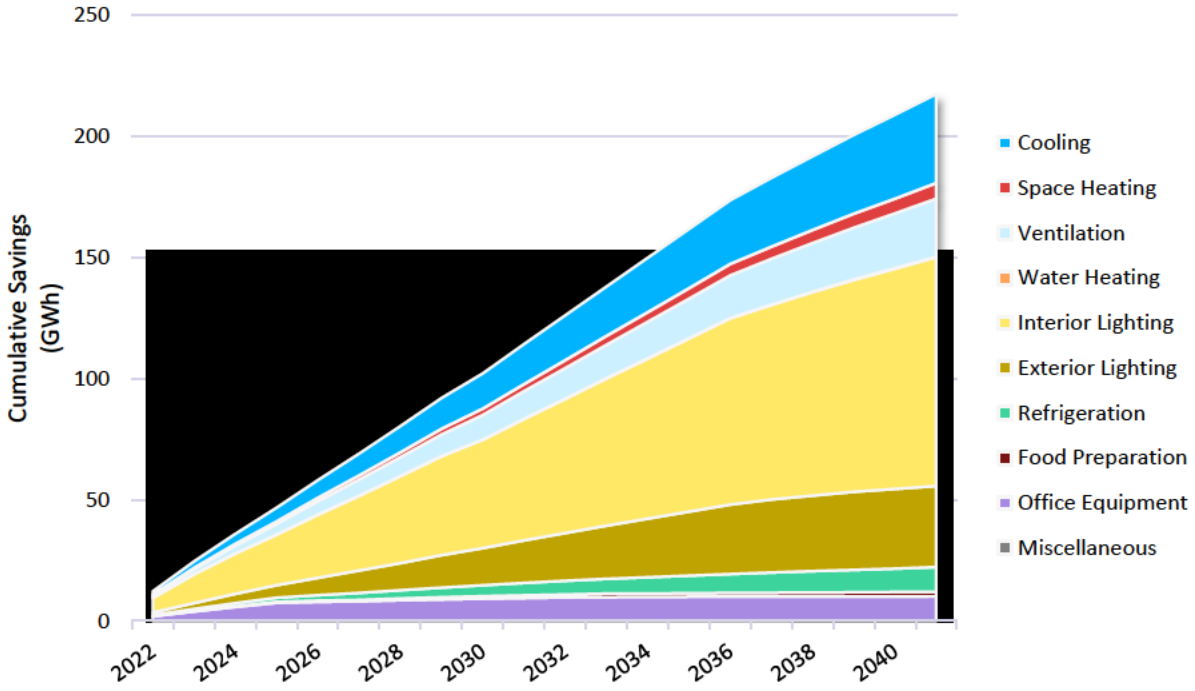


Table 5-32 and Figure 5-27 present estimates of annual energy savings for the four levels of energy efficiency potential for the industrial sector. In 2022, the first year of the projection, realistic achievable potential is 1 GWh, or 0.2% of the Liberty-Empire load forecast. By 2041, realistic achievable savings are 25 GWh, or 4.4% of the forecast. Table 5-33 details the winter peak demand savings for the industrial sector.

Table 5-32 – Industrial Energy Efficiency Potential (Energy Savings)

Summary of Energy Savings	2022	2023	2024	2026	2031	2041
Baseline Projection (GWh)	560	582	582	582	581	581
Cumulative Savings (GWh)						
Realistic Achievable Potential	1	2	3	6	13	25
Maximum Achievable Potential	2	3	5	8	17	32
Economic Potential	3	6	9	16	32	61
Technical Potential	10	18	25	38	72	130
Energy Savings (% of Baseline)						
Realistic Achievable Potential	0.2%	0.4%	0.6%	1.0%	2.2%	4.4%
Maximum Achievable Potential	0.3%	0.5%	0.8%	1.4%	2.9%	5.5%
Economic Potential	0.5%	1.0%	1.5%	2.7%	5.6%	10.4%
Technical Potential	1.7%	3.0%	4.2%	6.6%	12.4%	22.3%

Figure 5-27 – Industrial Energy Efficiency Savings as a Percent of Baseline

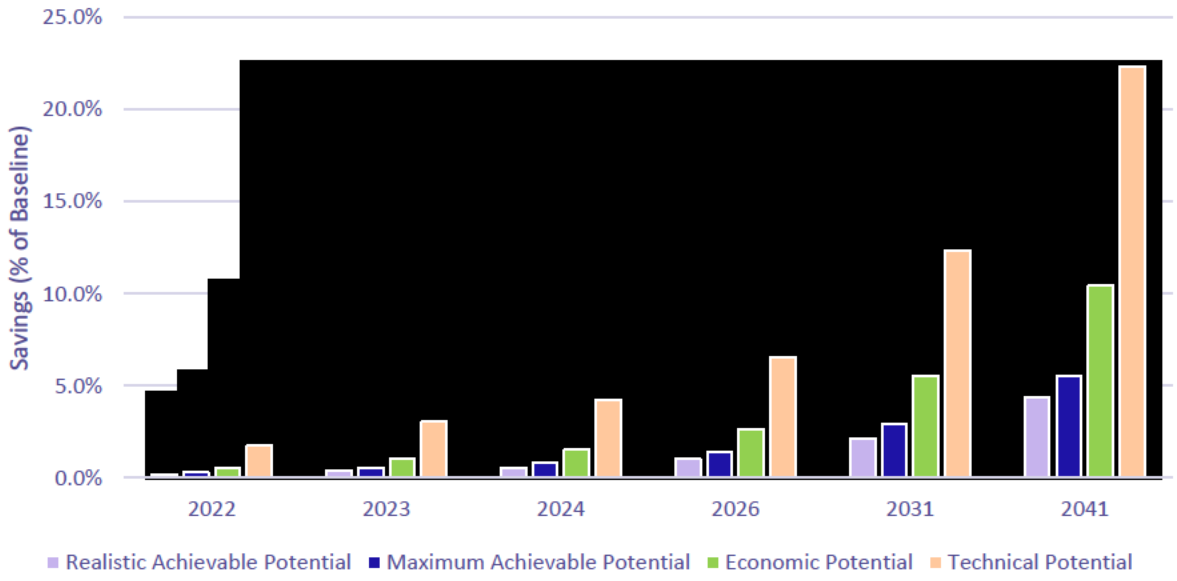


Table 5-33 – Industrial Energy Efficiency Potential (Winter Peak Savings)

Summary of Energy Savings	2022	2023	2024	2026	2031	2041
Baseline Projection (MW)	82	85	85	85	85	86
Cumulative Savings (MW)						
Realistic Achievable Potential	0	0	0	1	1	3
Maximum Achievable Potential	0	0	0	1	2	3
Economic Potential	0	1	1	2	3	6
Technical Potential	1	1	1	2	4	8
Energy Savings (% of Baseline)						
Realistic Achievable Potential	0.1%	0.3%	0.4%	0.7%	1.5%	3.0%
Maximum Achievable Potential	0.2%	0.4%	0.6%	1.0%	2.0%	3.8%
Economic Potential	0.4%	0.8%	1.1%	1.9%	4.0%	7.4%
Technical Potential	0.7%	1.3%	1.7%	2.7%	5.0%	8.8%

Figure 5-28 and Figure 5-29 present projections of industrial energy savings by end use in terms of cumulative savings and as a percent of total annual savings. Motors makes up the majority of annual energy savings throughout the projection, followed by interior and exterior lighting. The motor and interior lighting measures become a substantial portion of the peak demand savings by the end of the projection.

Figure 5-28 – Industrial Achievable Savings Forecast (Annual Energy, % of Total)

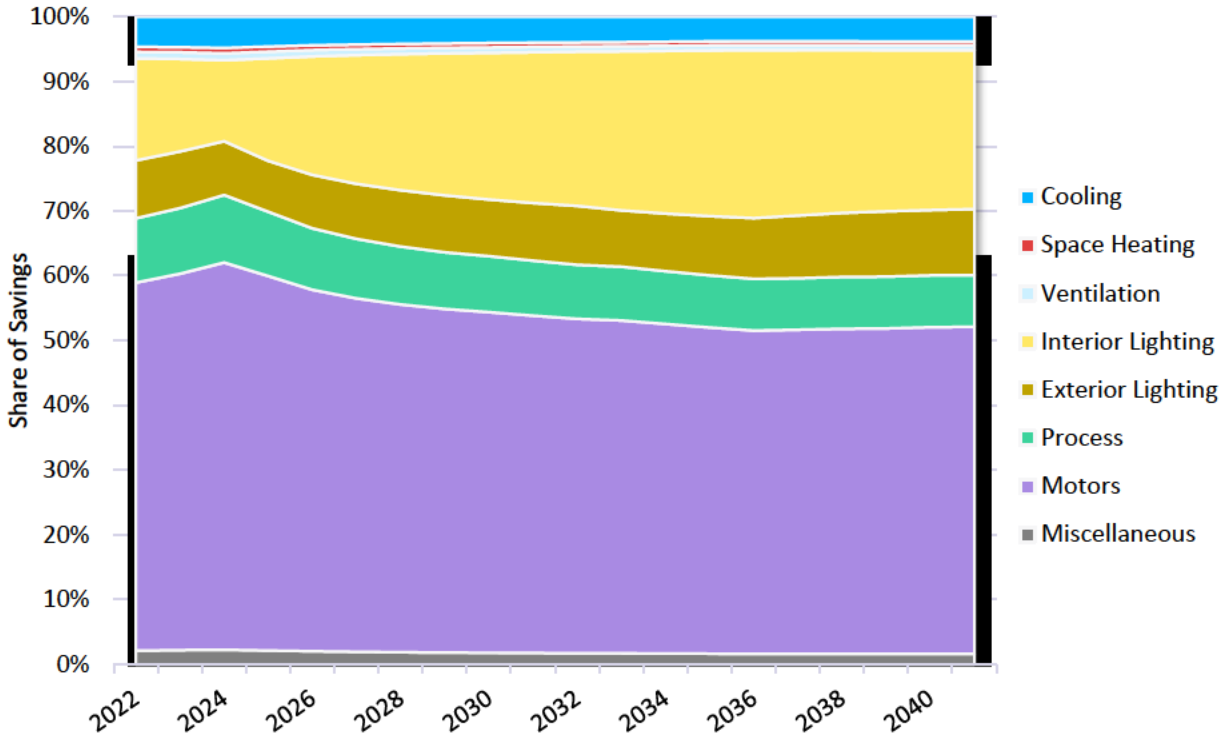
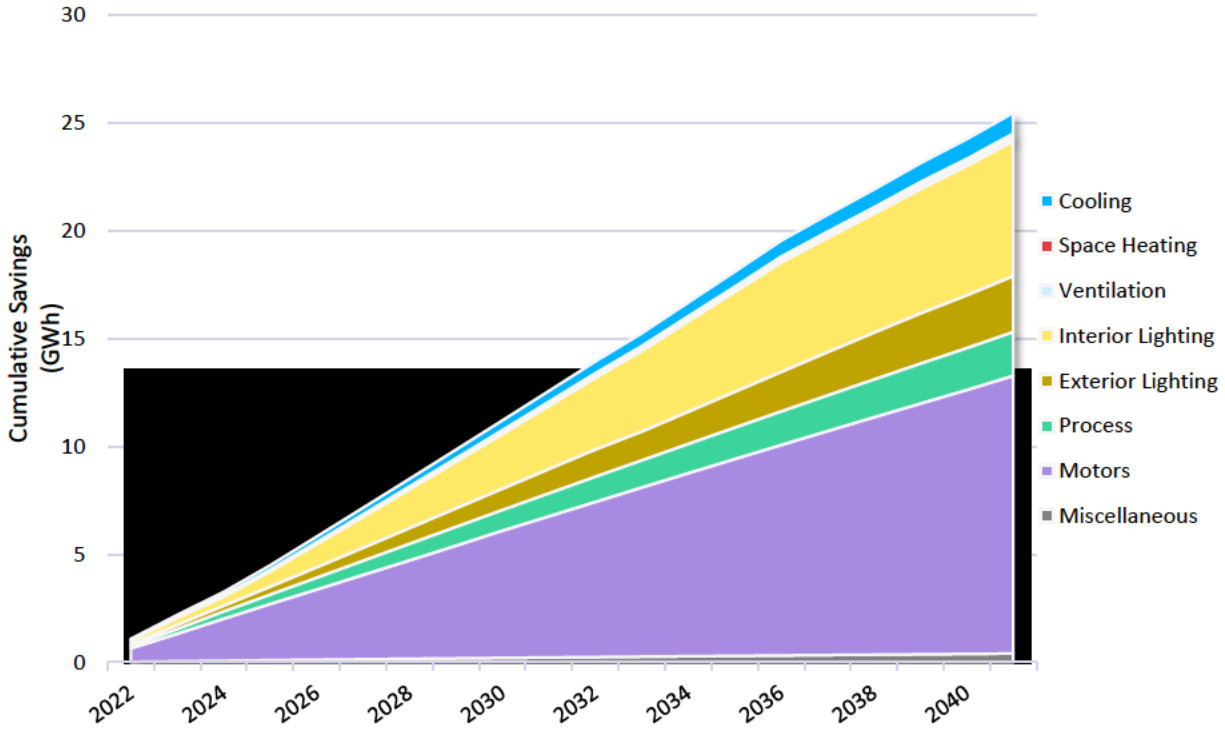


Figure 5-29 – Industrial Achievable Savings Forecast (Annual Energy, GWh)



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, Liberty-Empire analyzed the demand-side portfolios of Evergy and Ameren Missouri. These utilities were chosen due to their proximity to Liberty-Empire's service territory, although Liberty-Empire is smaller and more rural than other IOUs in Missouri.

In previous filings, Liberty-Empire 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 cited 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 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. Liberty-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.

Liberty-Empire designed the bundles based upon the potential study results and took into consideration potential program designs in future MEEIA filings. The bundles are designed to enhance Liberty-Empire's current DSM portfolio and to expand the available offerings to allow customers greater access to energy efficiency rebates and information while considering Liberty-Empire's historical program performance and the demographics of Liberty-Empire's customers.

While many commonalities exist between Liberty-Empire's proposed programs and Evergy or Ameren Missouri's programs, there are some programs that were deemed not cost-effective or

beneficial to Liberty-Empire's service territory. For example, Residential Appliance Recycling measures were found not to be cost-effective within the potential study until 2030.

Table 5-34 – Demand-Side Program Review

Program	Evergy[7]	Ameren MO[8]	Liberty-Empire IRP
Residential			
Retail Products/Online Store	-Retail & online marketplace -Instant incentives for LEDs -smart thermostat	– Instant incentives – Online lighting and smart thermostats	Screened/Included Retail Lighting offering and Online Store Option
Appliances	Included in Energy Saving Products Program	– Rebates for Energy Star pool pump, RAC, air purifier, heat pump water heater	Screened and included in Res Prescriptive and Whole Home offering
Appliance Recycling	N/A	$25 refrigerator or freezer RAC/dehumidifier pick-up. Sunsetting Dec 2021.	Included but not cost effective until 2030
HVAC	Rebates for replace on failure and early retirement – CAC, HP, HP ductless mini splits. Air sealing, ceiling insulation + bonus combo incentives. Includes option for audit & kits.	- Rebates available CAC, ASHP, GSHP, smart thermostat	Screened and included in Res Prescriptive and Whole Home offering
Whole House	Online home Energy audit, PAYS, MF Pilot	PAYS, Multifamily whole home option.	Screened/Included
Income Qualified	– MF IQ standard, custom, and DI	Single Family, Multi-family, and mobile home whole home – free assessment, free tenant upgrades, kits	No targeted bundles for income qualified customers included in analysis. Liberty-Empire offers program outside of DSM. IQ customers can be served through all bundles.
New Construction	N/A	Incentives for HVAC measures	No historic participation
Home Energy Report	Included	Included	Included
School Kits	N/A	Participating schools receive Energy efficiency kits include LEDs, showerhead, aerators, WH pipe insulation, flow test bag etc.	No targeted kits were included in the bundles, but measures typically included in kits are in multiple bundles.

[7] https://efis.psc.mo.gov/mpsc/commoncomponents/view_itemno_details.asp?caseno=EO-2019-0132&attach_id=2022001391
[8] https://www.ameren.com/missouri/company/energy-efficiency

Program	Evergy[7]	Ameren MO[8]	Liberty-Empire IRP
DIY Kits	Kits included in HVAC Program	Receive a one-time potential $150 bill credit on their statement	No targeted kits were included in the bundles, but measures typically included in kits are in multiple bundles.
Non-Residential Programs			
Business Prescriptive	Varying rebates for prescriptive measures	Varying rebates for prescriptive measures	Screened/Included
Business Custom	Incentive $/kWh, capped at 75% of incremental costs, $500,000 per year.	Incentive $/kWh by end use, 50% of total project cost or 100% of incremental cost, capped at $3,000,000.	Screened/Included
Small Business Direct Install	N/A	Free assessment and up to $5,000 incentives for lighting equipment and installation costs	Screened/Included
Strategic Energy Management	Included in Process Efficiency Program	N/A	Included but not cost effective until 2025
RCx	Included in Process Efficiency Program	Financial assistance for studies, purchase and implementation of upgrades and re-commissioning efforts. $0.01-$0.03 per kWh incentive	Screened/Included
New Construction	Included in Custom Program	Whole building performance; $/kWh incentives based on savings $0.02 kWh – $0.04 kWh	No historic participation
Demand Response			
Advanced Thermostat	*Residential & Small Business* Free communicating thermostat and $25 per year	Peak Time Savings - $50 Sign up Bonus, $25 annual incentive	Screened/Included
DR Incentive	Curtailment Program through automatic DERMS tool.	Program participants earn capacity payments for agreeing to be on standby and curtail electricity consumption.	Screened/Included

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;

Liberty-Empire engaged AEG to conduct a Demand-Side Management 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 Liberty-Empire's market. The market assessment defines the market segments (building types, end uses, and other dimensions) that are relevant in the Liberty-Empire service territory. The segmentation scheme for this project is presented in Table 5-1.

With the segmentation scheme defined, AEG then performed a high-level market characterization of electricity sales in the base year, 2019. AEG used detailed Liberty-Empire billing and customer data with minimal augmentation from secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count and energy consumption aligned with the Liberty-Empire system totals provided by Itron, detailed in Volume 3. This information provided control totals at a sector level for calibrating the LoadMAP™ model to known data for the base year. For the purposes of this analysis, impacts from solar PV were removed from the analysis in order to model the full unadjusted market energy consumption.

The total number of households and electricity sales for the service territory were obtained from Liberty-Empire data. In 2019, there were 132,072 households in the Liberty-Empire service territory that used a total of 1,708 GWh. AEG allocated these totals into four residential segments, identified from the Residential Customer Energy Survey that Liberty-Empire commissioned in 2015.

Table 5-35 – Residential Control Totals (2019)[9]

Segment	Number of Customers	Electricity Use (GWh)	% of Total Usage	Avg. Use/ Customer (kWh)
Single Family	95,207	1,336	78%	14,030
Multi Family	9,623	73	4%	7,629
Single Family, Low-Income	24,585	282	17%	11,466
Multi Family, Low-Income	2,657	17	1%	6,450
Total	**132,072**	**1,708**	**100%**	**12,934**

AEG utilized commercial and industrial customer billing data and secondary sources to develop the commercial and industrial market segments. The commercial and industrial sectors exclude customers that opt-out of Liberty-Empire's DSIM charge (as of January 2019). 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 purposes of the analysis, the number of opt-out customers and the removed opt-out electricity load were assumed to be constant throughout the forecast, and that usage amount was removed annually. Additionally, specific municipalities that are projected to discontinue service from Liberty-Empire were removed. Impacts from solar PV installations were also removed from the baseline projection in order to model the full unadjusted market unit consumption.

[9] Income Qualified defined as 200% FPL by household size, Moderate Income = >200% FPL up to state median income for household size based on American Community Survey information

Table 5-36 – Commercial Control Totals (2019)

Segment	Electricity Sales (GWh)	Intensity (Annual kWh/SqFt)	Floor Space (Million SqFt)
Office	370	16.9	21.84
Retail	185	19.8	9.31
Restaurant	100	22.8	4.37
Grocery	102	45.0	2.27
Education	153	9.4	16.32
Healthcare	183	25.2	7.25
Lodging	96	15.3	6.27
Warehouse	102	4.6	22.43
Miscellaneous	117	9.9	11.89
Total	**1,407**	**13.8**	**101.93**

Table 5-37 – Industrial Control Totals (2019)

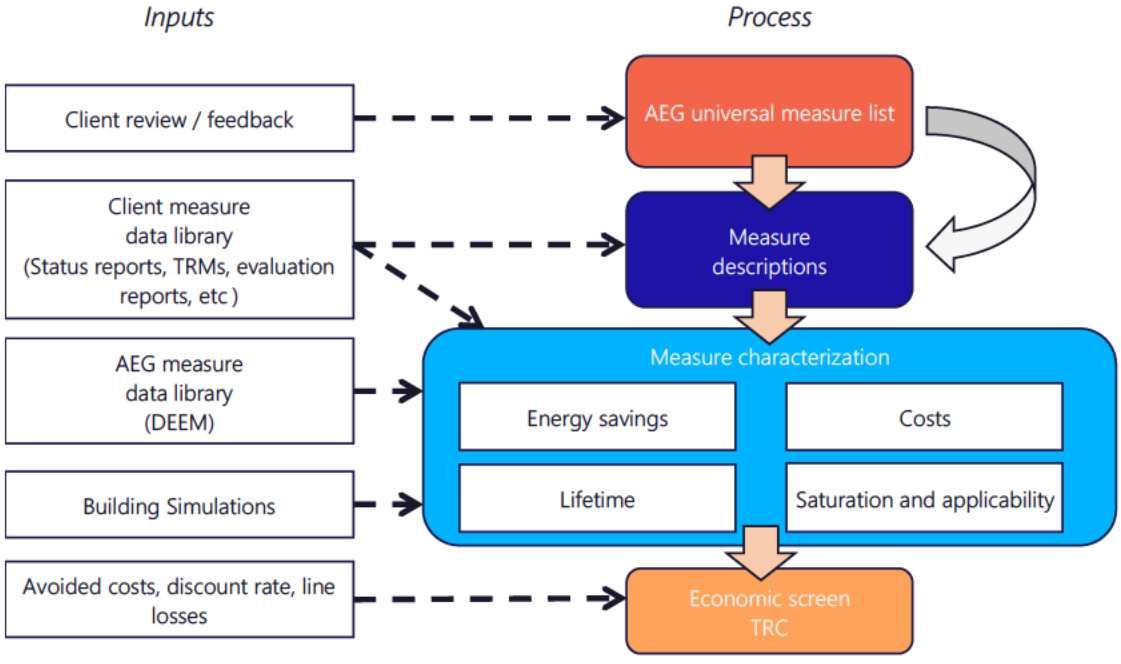
Segment	Electricity Sales (GWh)	Intensity (Annual kWh/Employee)	Employees
Food Production	117	14,756	7,934
Petroleum	80	214,245	371
Water & Wastewater	95	207,396	458
Stone Clay Glass Products	28	27,768	997
Chemicals	33	31,528	1,034
Paper Manufacturing	22	25,783	869
Primary Metals	15	2,508	6,017
Agriculture	16	12,097	1,291
Transportation Equipment	15	4,671	3,119
Other Industrial	106	23,514	4,509
Total	**526**	**19,762**	**26,599**

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 Liberty-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 Liberty-Empire for review.

Figure 5-30 – 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. 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 Liberty-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 TRC test is the primary method for assessing the cost-effectiveness of energy efficiency 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 costs over time. Thus, some measures pass the economic screen for some, but not all, of the years in the projection. Table 5-38 through Table 5-43 present the measures screened in LoadMAP.

Table 5-38 – Residential Equipment Measures

End Use	Measure	Efficient Definition
HVAC	Central AC	SEER 13.0
HVAC	Central AC	SEER 14.0
HVAC	Central AC	SEER 15.0 ENERGY STAR (5.0)
HVAC	Central AC	SEER 16.0 ENERGY STAR (6.0)
HVAC	Central AC	SEER 17.0

End Use	Measure	Efficient Definition
HVAC	Central AC	SEER 18.0
HVAC	Central AC	SEER 19.0
HVAC	Central AC	SEER 21.0
HVAC	Central AC	SEER 24.0 VRF
HVAC	Room AC	CEER 10.9
HVAC	Room AC	CEER 11.2
HVAC	Room AC	CEER 12.0 ENERGY STAR (4.1)
HVAC	Room AC	CEER 13.0
HVAC	Room AC	Dual Invertor CEER 14.7
HVAC	Air-Source Heat Pump	SEER 14.0 / HSPF 8.2
HVAC	Air-Source Heat Pump	SEER 15.0 / HSPF 8.5 ENERGY STAR (5.0)
HVAC	Air-Source Heat Pump	SEER 16.0 / HSPF 8.8
HVAC	Air-Source Heat Pump	SEER 17.0 / HSPF 8.8
HVAC	Air-Source Heat Pump	SEER 18.0 / HSPF 9.0
HVAC	Air-Source Heat Pump	SEER 21.0 / HSPF 9.1 Variable Capacity (CEE)
HVAC	Air-Source Heat Pump	SEER 24.0 / HSPF 10.9 EIA 2030 Projection
HVAC	Geothermal Heat Pump	EER 14.1 / COP 3.2
HVAC	Geothermal Heat Pump	EER 17.1 / COP 3.6 - ENERGY STAR (3.2)
HVAC	Geothermal Heat Pump	EER 28.0 / COP 4.5
HVAC	Geothermal Heat Pump	EER 42.0 / COP 5.2
Water Heating	Water Heater <= 55 Gal	Federal Standard EF 0.95
Water Heating	Water Heater <= 55 Gal	CEE Tier 1 (UEF 2.0)
Water Heating	Water Heater <= 55 Gal	CEE Tier 2 (UEF 3.1)
Water Heating	Water Heater <= 55 Gal	CEE Advanced Tier (UEF 3.75)
Water Heating	Water Heater > 55 Gal	UEF 2.0 - Federal Standard (NEEA Tier 1)
Water Heating	Water Heater > 55 Gal	CEE Tier 1 (UEF 2.2)
Water Heating	Water Heater > 55 Gal	CEE Tier 2 (UEF 3.1)
Water Heating	Water Heater > 55 Gal	CEE Advanced Tier (UEF 3.75)
Interior Lighting	General Service Lighting	EISA Compliant (18.6 lm/W)
Interior Lighting	General Service Lighting	EISA Compliant (45.0 lm/W)
Interior Lighting	General Service Lighting	CFL (70.6 lm/W)
Interior Lighting	General Service Lighting	LED 2020 (105 lm/W)
Interior Lighting	General Service Lighting	LED 2025 (122 lm/W)
Interior Lighting	General Service Lighting	LED 2030 (136 lm/W)
Interior Lighting	Linear Lighting	T8 - F32 (80.0 lm/W lm/W system)
Interior Lighting	Linear Lighting	T8 - F28HE (85.0 lm/W system)
Interior Lighting	Linear Lighting	LED 2020 (109 lm/W system)
Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Interior Lighting	Exempted Lighting	Incandescent (9.8 lm/W)
Interior Lighting	Exempted Lighting	Halogen (16.7 lm/W)

End Use	Measure	Efficient Definition
Interior Lighting	Exempted Lighting	CFL (47.4 lm/W)
Interior Lighting	Exempted Lighting	LED 2020 (95 lm/W)
Interior Lighting	Exempted Lighting	LED 2025 (112 lm/W)
Interior Lighting	Exempted Lighting	LED 2030 (125 lm/W)
Exterior Lighting	General Service Lighting	EISA Compliant (19.8 lm/W)
Exterior Lighting	General Service Lighting	EISA Compliant (45.0 lm/W)
Exterior Lighting	General Service Lighting	CFL (65.0 lm/W)
Exterior Lighting	General Service Lighting	LED 2020 (110 lm/W)
Exterior Lighting	General Service Lighting	LED 2025 (132 lm/W)
Exterior Lighting	General Service Lighting	LED 2030 (150 lm/W)
Appliances	Clothes Washer	2018 Standard Front Load (IMEF 1.84 / IWF 4.7)
Appliances	Clothes Dryer	CEF 3.11 - Federal Standard
Appliances	Clothes Dryer	CEF 3.93 - ENERGY STAR (1.1)
Appliances	Clothes Dryer	CEF 4.3 - Heat Pump
Appliances	Clothes Dryer	CEF 5.1 - Hybrid Heat Pump
Appliances	Clothes Dryer	CEF 8.0 - Heat Pump
Appliances	Clothes Dryer	CEF 10.1 - Heat Pump
Appliances	Dishwasher	Standard 2013 (180-307 kWh)
Appliances	Refrigerator	Standard 2014
Appliances	Refrigerator	ENERGY STAR (5.0) - Tier 1 (10-15% above standard)
Appliances	Refrigerator	CEE Tier 2 (15% above standard)
Appliances	Refrigerator	CEE Tier 3 (20% above standard)
Appliances	Freezer	Standard 2014
Appliances	Freezer	ENERGY STAR (5.0)
Appliances	Freezer	ENERGY STAR - Tier 2 (15-20% above standard)
Appliances	Second Refrigerator	Standard 2014
Appliances	Second Refrigerator	ENERGY STAR (5.0) - Tier 1 (10-15% above standard)
Appliances	Second Refrigerator	CEE Tier 2 (15% above standard)
Appliances	Second Refrigerator	CEE Tier 3 (20% above standard)
Appliances	Stove	Standard
Appliances	Stove	High Efficiency
Appliances	Stove	Induction
Appliances	Microwave	2016 Code
Appliances	Microwave	2016 Efficient (Level 4)
Appliances	Dehumidifiers	Standard
Appliances	Dehumidifiers	ENERGY STAR (5.0)
Appliances	Air Purifier	Standard

End Use	Measure	Efficient Definition
Appliances	Air Purifier	ENERGY STAR (2.0) (2.4 CADR/W)
Electronics	Personal Computers	Standard
Electronics	Personal Computers	Personal Computers - ENERGY STAR (8.0)
Electronics	Monitor	Standard
Electronics	Monitor	ENERGY STAR (8.0)
Electronics	Laptops	Standard
Electronics	Laptops	ENERGY STAR (8.0)
Electronics	TVs	Standard
Electronics	TVs	ENERGY STAR (8.0)
Electronics	Printer/Fax/Copier	Standard
Electronics	Printer/Fax/Copier	ENERGY STAR (3.1)
Electronics	Set-top Boxes/DVR	Standard
Electronics	Set-top Boxes/DVR	ENERGY STAR (5.1)
Electronics	Devices and Gadgets	Standard
Miscellaneous	Electric Vehicle Chargers	Standard
Miscellaneous	Electric Vehicle Chargers	ENERGY STAR (1.0)
Miscellaneous	Electric Vehicle Chargers	Connected- ENERGY STAR (1.0)
Miscellaneous	Pool Pump	Pool Pump - Single Speed
Miscellaneous	Pool Pump	Pool Pump - Two Speed
Miscellaneous	Pool Pump	Pool Pump - Variable Speed 2021 Standard
Miscellaneous	Pool Pump	Pool Pump - Variable Speed ENERGY STAR (3.1)
Miscellaneous	Pool Heater	Electric Resistance
Miscellaneous	Pool Heater	Heat Pump
Miscellaneous	Hot Tub/Spa	Standard
Miscellaneous	Hot Tub/Spa	Improved Controls and Pumps
Miscellaneous	Furnace Fan	Standard
Miscellaneous	Bathroom Exhaust Fan	Standard - 2.2 CFM/Watts
Miscellaneous	Bathroom Exhaust Fan	ENERGY STAR - 5.3 CFM/Watts
Miscellaneous	Bathroom Exhaust Fan	ENERGY STAR Most Efficient - 12.9 CFM/Watts
Miscellaneous	Well pump	Standard (40% EF)
Miscellaneous	Well pump	High Efficiency (69% EF)
Miscellaneous	Miscellaneous	Standard

Table 5-39 – Residential Non-Equipment Measures

End Use	Measure
HVAC	Insulation - Ceiling
HVAC	Insulation - Radiant Barrier

End Use	Measure
HVAC	Insulation - Wall Cavity
HVAC	Insulation - Wall Sheathing
HVAC	Insulation - External Wall Sheathing - Insulated Vinyl Siding
HVAC	Insulation - Floor
HVAC	Insulation - Basement Sidewall Installation
HVAC	Insulation - Foundation
HVAC	Insulation - Ducting
HVAC	Insulation - Rim/Band Joist
HVAC	Ducting - Repair and Sealing
HVAC	Ducting - Repair and Sealing - Aerosol
HVAC	Building Shell - Air Sealing (Infiltration Control)
HVAC	Building Shell - Liquid-Applied Weather-Resistive Barrier
HVAC	Building Shell - Whole-Home Aerosol Sealing
HVAC	Building Shell - High Reflectivity Roofs
HVAC	Windows - High Efficiency
HVAC	Windows - Low-e Storm Addition
HVAC	Windows - Install Reflective Film
HVAC	Windows - Cellular Shades
HVAC	Doors - Storm and Thermal
HVAC	Doors - ENERGY STAR Glass Door
HVAC	Supplement Central System with Ductless Mini Split Heat Pump
HVAC	Convert Zonal System to Ductless Mini Split Heat Pump
HVAC	HVAC - Maintenance and Tune-Up
HVAC	Circulation Pump - High Efficiency Motor
HVAC	Space Heating - Heat Recovery Ventilator
HVAC	Room AC - Recycling
HVAC	Connected Thermostat - ENERGY STAR (1.0)
HVAC	Connected Thermostat - Line-Voltage
All Systems	Home Energy Management System (HEMS)
Water Heating	Water Heater - Faucet Aerators
Water Heating	Water Heater - Low-Flow Showerheads
Water Heating	Water Heater - Tank Blanket/Insulation
Water Heating	Water Heater - Drain Water Heat Recovery
Water Heating	Water Heater - Pipe Insulation
Water Heating	Water Heater - Desuperheater
Water Heating	Water Heater - Temperature Setback
Water Heating	Water Heater - Thermostatic Shower Restriction Valve
Water Heating	Water Heater - Shower Timer
Interior Lighting	Interior Lighting - Occupancy Sensors
Interior Lighting	Interior Lighting - ENERGY STAR Skylights
Exterior Lighting	Exterior Lighting - Photosensor Control

End Use	Measure
Exterior Lighting	Exterior Lighting - Photovoltaic Installation
Appliances	Refrigerator - Decommissioning and Recycling
Appliances	Freezer - Decommissioning and Recycling
Appliances	Clothes Washer - ENERGY STAR (8.0)
Appliances	Dishwasher ENERGY STAR (6.0) (203-283 kWh)
Appliances	Stove - Smart Burners
Appliances	Dehumidifier Recycling
Appliances	Advanced Power Strips - Tier 1 - Peripheral Controls
Appliances	Advanced Power Strips - Tier 2 - Active Controls
Miscellaneous	Pool Heater - Solar System
Miscellaneous	Pool Cleaner - Robotic
Miscellaneous	Pool Covers
Miscellaneous	LED Pool and Spa Lighting
All Systems	ENERGY STAR Home Design
Appliances	Advanced New Construction Design - Zero Net Energy
Appliances	Behavioral Programs
Appliances	Manufactured Home Replacement
Appliances	Furnace - Conversion to Air-Source Heat Pump
Miscellaneous	Furnace Fan - ECM Retrofit
Miscellaneous	Ceiling Fan - ENERGY STAR
HVAC	Combination Heat Pump Water Heater/Space Heating

Table 5-40 – Commericial Equipment Measures

End Use	Efficient Technology	Baseline
Cooling	Air-Cooled Chiller	COP 3.11 (EER 10.6)
Cooling	Air-Cooled Chiller	COP 4.10 (EER 14.0)
Cooling	Air-Cooled Chiller	COP 4.45 (EER 15.2)
Cooling	Air-Cooled Chiller	COP 6.17 (EER 21.0)
Cooling	Air-Cooled Chiller	COP 7.18 (EER 24.5)
Cooling	Air-Cooled Chiller	COP 7.88 (EER 26.7)
Cooling	Water-Cooled Chiller	COP 7.03 (0.50 kW/ton)
Cooling	Water-Cooled Chiller	COP 9.77 (0.36 kW/ton)
Cooling	Water-Cooled Chiller	COP 12.13 (0.29 kW/ton)
Cooling	Water-Cooled Chiller	COP 13.03 (0.27 kW/ton)
Cooling	Water-Cooled Chiller	COP 14.07 (0.25 kW/ton)
Cooling	RTU	IEER 12.9 - Federal Standard 2018
Cooling	RTU	IEER 14 - Tier 1 / ENERGY STAR (3.1)
Cooling	RTU	IEER 14.8 - Federal Standard 2023
Cooling	RTU	IEER 15.4 - Tier 2

End Use	Efficient Technology	Baseline
Cooling	RTU	IEER 18 - Advanced Tier VRF
Cooling	RTU	IEER 21.5 - EIA High Efficiency VRF
Cooling	Packaged Terminal AC	EER 10.4 - Federal Standard
Cooling	Packaged Terminal AC	EER 11.7
Cooling	Packaged Terminal AC	EER 13
Cooling	Packaged Terminal HP	EER 10.4 / COP 3.1 - Federal Standard
Cooling	Packaged Terminal HP	EER 11.7 / COP 3.4
Cooling	Packaged Terminal HP	EER 13 / COP 3.6
Cooling	Air-Source Heat Pump	IEER 12.2 / COP 3.3 - Federal Standard
Cooling	Air-Source Heat Pump	IEER 12.8 / COP 3.4 - ENERGY STAR (3.1)
Cooling	Air-Source Heat Pump	IEER 14.1 / COP 3.4 - Federal Standard 2023
Cooling	Air-Source Heat Pump	IEER 17.4 / COP 3.4, VRF - ENERGY STAR (3.1)
Cooling	Air-Source Heat Pump	IEER 20.3 / COP 3.7 - EIA High Efficiency
Cooling	Geothermal Heat Pump	EER 14.1 / COP 3.2 - Federal Standard
Cooling	Geothermal Heat Pump	EER 17.1 / COP 3.6 - ENERGY STAR (3.1)
Cooling	Geothermal Heat Pump	EER 22.4 / COP 4.5
Cooling	Geothermal Heat Pump	EER 25 / COP 4.5 EIA High Efficiency
Space Heating	Electric Furnace	Standard
Space Heating	Electric Room Heat	Standard
Space Heating	Packaged Terminal HP	EER 10.4 / COP 3.1 - Federal Standard
Space Heating	Packaged Terminal HP	EER 11.7 / COP 3.4
Space Heating	Packaged Terminal HP	EER 13 / COP 3.6
Space Heating	Air-Source Heat Pump	IEER 12.2 / COP 3.3 - Federal Standard
Space Heating	Air-Source Heat Pump	IEER 12.8 / COP 3.4 - ENERGY STAR (3.1)
Space Heating	Air-Source Heat Pump	IEER 14.1 / COP 3.4 - Federal Standard 2023
Space Heating	Air-Source Heat Pump	IEER 17.4 / COP 3.4, VRF - ENERGY STAR (3.1)
Space Heating	Air-Source Heat Pump	IEER 20.3 / COP 3.7 - EIA High Efficiency
Space Heating	Geothermal Heat Pump	EER 14.1 / COP 3.2 - Federal Standard
Space Heating	Geothermal Heat Pump	EER 17.1 / COP 3.6 - ENERGY STAR (3.1)
Space Heating	Geothermal Heat Pump	EER 22.4 / COP 4.5
Space Heating	Geothermal Heat Pump	EER 25 / COP 4.5 EIA High Efficiency
Ventilation	Ventilation	Constant Volume
Ventilation	Ventilation	Variable Air Volume
Water Heating	Water Heater	Resistance Heater, Standard Standby Wattage
Water Heating	Water Heater	Resistance Heater, Reduced Standby Wattage
Water Heating	Water Heater	UEF 2.20 - Heat Pump - ENERGY STAR (4.0)
Water Heating	Water Heater	UEF 3.10 - Heat Pump - CEE Tier 2
Water Heating	Water Heater	UEF 3.75 - Heat Pump - CEE Advanced Tier
Interior Lighting	General Service Lighting	EISA Compliant (18.6 lm/W)
Interior Lighting	General Service Lighting	EISA Compliant (45.0 lm/W)
Interior Lighting	General Service Lighting	CFL (70.6 lm/W)

End Use	Efficient Technology	Baseline
Interior Lighting	General Service Lighting	LED 2020 (105 lm/W)
Interior Lighting	General Service Lighting	LED 2025 (122 lm/W)
Interior Lighting	General Service Lighting	LED 2030 (136 lm/W)
Interior Lighting	Exempted Lighting	Incandescent (9.8 lm/W)
Interior Lighting	Exempted Lighting	Halogen (16.7 lm/W)
Interior Lighting	Exempted Lighting	CFL (47.4 lm/W)
Interior Lighting	Exempted Lighting	LED 2020 (95 lm/W)
Interior Lighting	Exempted Lighting	LED 2025 (112 lm/W)
Interior Lighting	Exempted Lighting	LED 2030 (125 lm/W)
Interior Lighting	Linear Lighting	T8 - F32 (80.0 lm/W lm/W system)
Interior Lighting	Linear Lighting	T8 - F28HE (85.0 lm/W system)
Interior Lighting	Linear Lighting	LED 2020 (109 lm/W system)
Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Interior Lighting	Linear Lighting	LED 2020 (109 lm/W system) w/ Controls
Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system) w/ Controls
Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system) w/ Controls
Interior Lighting	High-Bay Lighting	Metal Halide (55.6 lm/W)
Interior Lighting	High-Bay Lighting	High Pressure Sodium (56.6 lm/W)
Interior Lighting	High-Bay Lighting	High Output T5 (75.5 lm/W)
Interior Lighting	High-Bay Lighting	LED 2020 (132 lm/W)
Interior Lighting	High-Bay Lighting	LED 2025 (152 lm/W)
Interior Lighting	High-Bay Lighting	LED 2030 (167 lm/W)
Interior Lighting	High-Bay Lighting	LED 2020 (132 lm/W) w/ Controls
Interior Lighting	High-Bay Lighting	LED 2025 (152 lm/W) w/ Controls
Interior Lighting	High-Bay Lighting	LED 2030 (167 lm/W) w/ Controls
Exterior Lighting	General Service Lighting	EISA Compliant (18.6 lm/W)
Exterior Lighting	General Service Lighting	EISA Compliant (45.0 lm/W)
Exterior Lighting	General Service Lighting	CFL (70.6 lm/W)
Exterior Lighting	General Service Lighting	LED 2020 (105 lm/W)
Exterior Lighting	General Service Lighting	LED 2025 (122 lm/W)
Exterior Lighting	General Service Lighting	LED 2030 (136 lm/W)
Exterior Lighting	Linear Lighting	T8 - F32 (80.0 lm/W lm/W system)
Exterior Lighting	Linear Lighting	T8 - F28HE (85.0 lm/W system)
Exterior Lighting	Linear Lighting	LED 2020 (109 lm/W system)
Exterior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Exterior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Exterior Lighting	Linear Lighting	LED 2020 (109 lm/W system) w/ Controls
Exterior Lighting	Linear Lighting	LED 2025 (126 lm/W system) w/ Controls
Exterior Lighting	Linear Lighting	LED 2030 (140 lm/W system) w/ Controls
Exterior Lighting	Area Lighting	Metal Halide (55.6 lm/W)

End Use	Efficient Technology	Baseline
Exterior Lighting	Area Lighting	High Pressure Sodium (56.6 lm/W)
Exterior Lighting	Area Lighting	LED 2020 (120 lm/W)
Exterior Lighting	Area Lighting	LED 2025 (138 lm/W)
Exterior Lighting	Area Lighting	LED 2030 (152 lm/W)
Exterior Lighting	Area Lighting	LED 2020 (120 lm/W) w/ Controls
Exterior Lighting	Area Lighting	LED 2025 (138 lm/W) w/ Controls
Exterior Lighting	Area Lighting	LED 2030 (152 lm/W) w/ Controls
Refrigeration	Walk-in Refrigerator/Freezer	Standard
Refrigeration	Walk-in Refrigerator/Freezer	Standard 2020
Refrigeration	Reach-in Refrigerator/Freezer	Current Standard
Refrigeration	Reach-in Refrigerator/Freezer	ENERGY STAR (4.0)
Refrigeration	Glass Door Display	Current Standard
Refrigeration	Open Display Case	Current Standard
Refrigeration	Icemaker	Current Standard
Refrigeration	Icemaker	ENERGY STAR (3.0)
Refrigeration	Vending Machine	Current Standard
Refrigeration	Vending Machine	ENERGY STAR (4.0)
Food Preparation	Oven	Standard
Food Preparation	Oven	ENERGY STAR (3.0)
Food Preparation	Fryer	Standard
Food Preparation	Fryer	ENERGY STAR (3.0)
Food Preparation	Dishwasher	Standard
Food Preparation	Hot Food Container	Standard
Food Preparation	Hot Food Container	ENERGY STAR (2.0)
Food Preparation	Steamer	Standard
Food Preparation	Steamer	ENERGY STAR (1.2)
Food Preparation	Griddle	Standard
Food Preparation	Griddle	ENERGY STAR (1.2)
Office Equipment	Desktop Computer	Standard
Office Equipment	Desktop Computer	ENERGY STAR (8.0)
Office Equipment	Laptop	Standard
Office Equipment	Laptop	ENERGY STAR (8.0)
Office Equipment	Monitor	Standard
Office Equipment	Monitor	ENERGY STAR (8.0)
Office Equipment	Server	Standard
Office Equipment	Printer/Copier/Fax	Standard
Office Equipment	Printer/Copier/Fax	ENERGY STAR (3.1)
Office Equipment	POS Terminal	Standard
Office Equipment	POS Terminal	ENERGY STAR (7.1)
Miscellaneous	Non-HVAC Motors	Standard (NEMA Premium)
Miscellaneous	Pool Pump	Single Speed

End Use	Efficient Technology	Baseline
Miscellaneous	Pool Pump	Two-Speed ENERGY STAR (2.0)
Miscellaneous	Pool Pump	Variable Speed ENERGY STAR (2.0)
Miscellaneous	Pool Pump	Variable Speed ENERGY STAR (3.0)
Miscellaneous	Pool Heater	Electric Resistance
Miscellaneous	Pool Heater	Heat Pump
Miscellaneous	Electric Vehicle Chargers	Standard
Miscellaneous	Electric Vehicle Chargers	Energy Star (1.1)
Miscellaneous	Clothes Washers	Standard
Miscellaneous	Clothes Dryer	CEF 3.73 - Baseline
Miscellaneous	Clothes Dryer	CEF 3.93 - ENERGY STAR
Miscellaneous	Clothes Dryer	CEF 5.1 - Hybrid Heat Pump
Miscellaneous	Clothes Dryer	CEF 8.0 - Heat Pump
Miscellaneous	Miscellaneous	Standard

Table 5-41 – Commericial Non-Equipment Measures

End Use	Baseline
HVAC	Insulation - Ceiling
HVAC	Insulation - Ducting
HVAC	Building Shell - Cool Roofs
HVAC	Insulation - Wall Cavity
HVAC	HVAC - Duct Repair and Sealing
HVAC	Windows - High Efficiency Glazing
HVAC	Chiller - Chilled Water Reset
HVAC	Chiller - Variable Flow Chilled Water Pump
HVAC	Chiller - Variable Speed Fans
HVAC	Water-Cooled Chiller - Variable Flow Condenser Water Pump
HVAC	Water-Cooled Chiller - Condenser Water Temperature Reset
HVAC	HVAC - Economizer
HVAC	HVAC - Economizer Maintenance and Repair
HVAC	Space Heating - Heat Recovery Ventilator
HVAC	Building Shell - Air Sealing (Infiltration Control)
HVAC	HVAC - Industrial Air Curtains
HVAC	Ventilation - ECM on VAV Boxes
HVAC	Ventilation - Permanent Magnet Synchronous Fan Motor
HVAC	Ventilation - Fan Drive Improvements
HVAC	Ventilation - Variable Speed Control
HVAC	Ventilation - Demand Controlled
HVAC	HVAC - Dedicated Outdoor Air System (DOAS)
HVAC	HVAC - Adsorbent Air Cleaning
HVAC	Destratification Fans (HVLS)

End Use	Baseline
HVAC	RTU - Advanced Controls
HVAC	HVAC - Maintenance
HVAC	Supplement Central System with Ductless Mini Split Heat Pump
HVAC	Convert Zonal System to Ductless Mini Split Heat Pump
HVAC	Thermostat - Connected
Water Heating	Water Heater - Faucet Aerators/Low Flow Nozzles
Water Heating	Water Heater - Low-Flow Showerheads
Water Heating	Water Heater - Thermostatic Shower Restriction Valve
Water Heating	Water Heater - Pre-Rinse Spray Valve
Water Heating	Water Heater - Temperature Setback
Water Heating	Water Heater - Pipe Insulation
Water Heating	Water Heater - Circulation Pump Controls
Miscellaneous	Circulation Pump - High Efficiency Motor
Water Heating	Commercial Laundry - Ozone Treatment
Water Heating	Commercial Laundry - ENERGY STAR Washer
Water Heating	Commercial Laundry - Alternative Dry-Cleaning Methods
Water Heating	Dishwasher - ENERGY STAR (3.0)
Lighting	Interior Lighting - Luminaire Level Lighting Controls
Lighting	Interior Lighting - Networked Lighting Controls
Lighting	Interior Lighting - LEC Exit Lighting
Lighting	Interior Lighting - Photoluminescent Exit Lighting
Lighting	Interior Lighting - Skylights
Lighting	Exterior Lighting - LED Exterior Signage
Lighting	Exterior Lighting - Enhanced Controls
Lighting	Exterior Lighting - Photovoltaic Installation
Refrigeration	Refrigeration - Walk-in - Strip Curtain
Refrigeration	Refrigeration - Walk-in - Air Curtain
Refrigeration	Refrigeration - Anti-Sweat Heater Controls
Refrigeration	Refrigeration - Door Gasket Replacement
Refrigeration	Refrigeration - Automatic High-Speed Doors
Refrigeration	Refrigeration - Low-Heat/No-Heat Doors
Refrigeration	Refrigeration - High Efficiency Compressor
Refrigeration	Refrigeration - Replace Single-Compressor with Subcooled Multiplex
Refrigeration	Refrigeration - ECM Compressor Head Fan Motor
Refrigeration	Refrigeration - Evaporator Fan Controls
Refrigeration	Refrigeration - High Efficiency Evaporator Fan Motors
Refrigeration	Refrigeration - Permanent Magnet Synchronous Fan Motor
Refrigeration	Refrigeration - Variable Speed Condenser Fans
Refrigeration	Refrigeration - Floating Head Pressure
Refrigeration	Refrigeration - Demand Defrost
Refrigeration	Refrigeration - Economizer

End Use	Baseline
Refrigeration	Refrigeration - Suction Line Insulation
Refrigeration	Grocery - Display Case - Anti-Fogging Film
Refrigeration	Grocery - Display Case - Door Retrofit
Refrigeration	Grocery - Display Case - LED Lighting
Refrigeration	Grocery - Display Case Motion Sensors
Refrigeration	Grocery - Open Display Case - Night Covers
Refrigeration	Grocery - On-Demand Overwrappers
Refrigeration	Vending Machine - Occupancy Sensor
HVAC	Kitchen - Exhaust Hoods with Sensor Control
HVAC	Lodging - Guest Room Controls
Appliances	Office Equipment - Advanced Power Strips
All systems	Data Center - Best Practice Measures
All systems	Data Center - Commercially Available Measures
All systems	Data Center - Cutting Edge Measures
Interior Lighting	Ultra-Low Temperature Freezer - ENERGY STAR (1.1)
Interior Lighting	Water Coolers - ENERGY STAR (2.0)
Interior Lighting	Miscellaneous - Improved Vertical Lift Technology
All systems	Advanced New Construction Designs
All systems	Strategic Energy Management
All systems	Commissioning
All systems	Retrocommissioning
Miscellaneous	Engine Block Heater Controls
Miscellaneous	Circulating Engine Block Heater
Miscellaneous	High Efficiency Transformer
Miscellaneous	High Frequency Battery Chargers

Table 5-42 – Industrial Equipment Measures

End Use	Efficient Technology	Baseline
Cooling	Air-Cooled Chiller	COP 3.11 (EER 10.6)
Cooling	Air-Cooled Chiller	COP 4.10 (EER 14.0)
Cooling	Air-Cooled Chiller	COP 4.45 (EER 15.2)
Cooling	Air-Cooled Chiller	COP 6.17 (EER 21.0)
Cooling	Air-Cooled Chiller	COP 7.18 (EER 24.5)
Cooling	Air-Cooled Chiller	COP 7.88 (EER 26.7)
Cooling	Water-Cooled Chiller	COP 7.03 (0.50 kW/ton)
Cooling	Water-Cooled Chiller	COP 9.77 (0.36 kW/ton)
Cooling	Water-Cooled Chiller	COP 12.13 (0.29 kW/ton)
Cooling	Water-Cooled Chiller	COP 13.03 (0.27 kW/ton)
Cooling	Water-Cooled Chiller	COP 14.07 (0.25 kW/ton)
Cooling	RTU	IEER 12.9 - Federal Standard 2018

End Use	Efficient Technology	Baseline
Cooling	RTU	IEER 14 - Tier 1 / ENERGY STAR (3.1)
Cooling	RTU	IEER 14.8 - Federal Standard 2023
Cooling	RTU	IEER 15.4 - Tier 2
Cooling	RTU	IEER 18 - Advanced Tier VRF
Cooling	RTU	IEER 21.5 - EIA High Efficiency VRF
Cooling	Air-Source Heat Pump	IEER 12.2 / COP 3.3 - Federal Standard
Cooling	Air-Source Heat Pump	IEER 12.8 / COP 3.4 - ENERGY STAR (3.1)
Cooling	Air-Source Heat Pump	IEER 14.1 / COP 3.4 - Federal Standard 2023
Cooling	Air-Source Heat Pump	IEER 17.4 / COP 3.4, VRF - ENERGY STAR (3.1)
Cooling	Air-Source Heat Pump	IEER 20.3 / COP 3.7 - EIA High Efficiency
Cooling	Geothermal Heat Pump	EER 14.1 / COP 3.2 - Federal Standard
Cooling	Geothermal Heat Pump	EER 17.1 / COP 3.6 - ENERGY STAR (3.1)
Cooling	Geothermal Heat Pump	EER 22.4 / COP 4.5
Cooling	Geothermal Heat Pump	EER 25 / COP 4.5 EIA High Efficiency
Space Heating	Electric Furnace	Standard
Space Heating	Electric Room Heat	Standard
Space Heating	Air-Source Heat Pump	IEER 12.2 / COP 3.3 - Federal Standard
Space Heating	Air-Source Heat Pump	IEER 12.8 / COP 3.4 - ENERGY STAR (3.1)
Space Heating	Air-Source Heat Pump	IEER 14.1 / COP 3.4 - Federal Standard 2023
Space Heating	Air-Source Heat Pump	IEER 17.4 / COP 3.4, VRF - ENERGY STAR (3.1)
Space Heating	Air-Source Heat Pump	IEER 20.3 / COP 3.7 - EIA High Efficiency
Space Heating	Geothermal Heat Pump	EER 14.1 / COP 3.2 - Federal Standard
Space Heating	Geothermal Heat Pump	EER 17.1 / COP 3.6 - ENERGY STAR (3.1)
Space Heating	Geothermal Heat Pump	EER 22.4 / COP 4.5
Space Heating	Geothermal Heat Pump	EER 25 / COP 4.5 EIA High Efficiency
Ventilation	Ventilation	Constant Volume
Ventilation	Ventilation	Variable Air Volume
Interior Lighting	General Service Lighting	EISA Compliant (18.6 lm/W)
Interior Lighting	General Service Lighting	EISA Compliant (45.0 lm/W)
Interior Lighting	General Service Lighting	CFL (70.6 lm/W)
Interior Lighting	General Service Lighting	LED 2020 (105 lm/W)
Interior Lighting	General Service Lighting	LED 2025 (122 lm/W)
Interior Lighting	General Service Lighting	LED 2030 (136 lm/W)
Interior Lighting	High-Bay Lighting	Metal Halide (55.6 lm/W)
Interior Lighting	High-Bay Lighting	High Pressure Sodium (56.6 lm/W)
Interior Lighting	High-Bay Lighting	High Output T5 (75.5 lm/W)
Interior Lighting	High-Bay Lighting	LED 2020 (132 lm/W)
Interior Lighting	High-Bay Lighting	LED 2025 (152 lm/W)
Interior Lighting	High-Bay Lighting	LED 2030 (167 lm/W)
Interior Lighting	High-Bay Lighting	LED 2020 (132 lm/W) w/ Controls
Interior Lighting	High-Bay Lighting	LED 2025 (152 lm/W) w/ Controls

End Use	Efficient Technology	Baseline
Interior Lighting	High-Bay Lighting	LED 2030 (167 lm/W) w/ Controls
Interior Lighting	Linear Lighting	T8 - F32 (80.0 lm/W lm/W system)
Interior Lighting	Linear Lighting	T8 - F28HE (85.0 lm/W system)
Interior Lighting	Linear Lighting	LED 2020 (109 lm/W system)
Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Interior Lighting	Linear Lighting	LED 2020 (109 lm/W system) w/ Controls
Interior Lighting	Linear Lighting	LED 2025 (126 lm/W system) w/ Controls
Interior Lighting	Linear Lighting	LED 2030 (140 lm/W system) w/ Controls
Exterior Lighting	General Service Lighting	EISA Compliant (18.6 lm/W)
Exterior Lighting	General Service Lighting	EISA Compliant (45.0 lm/W)
Exterior Lighting	General Service Lighting	CFL (70.6 lm/W)
Exterior Lighting	General Service Lighting	LED 2020 (105 lm/W)
Exterior Lighting	General Service Lighting	LED 2025 (122 lm/W)
Exterior Lighting	General Service Lighting	LED 2030 (136 lm/W)
Exterior Lighting	Area Lighting	Metal Halide (55.6 lm/W)
Exterior Lighting	Area Lighting	High Pressure Sodium (56.6 lm/W)
Exterior Lighting	Area Lighting	LED 2020 (120 lm/W)
Exterior Lighting	Area Lighting	LED 2025 (138 lm/W)
Exterior Lighting	Area Lighting	LED 2030 (152 lm/W)
Exterior Lighting	Area Lighting	LED 2020 (120 lm/W) w/ Controls
Exterior Lighting	Area Lighting	LED 2025 (138 lm/W) w/ Controls
Exterior Lighting	Area Lighting	LED 2030 (152 lm/W) w/ Controls
Exterior Lighting	Linear Lighting	T8 - F32 (80.0 lm/W lm/W system)
Exterior Lighting	Linear Lighting	T8 - F28HE (85.0 lm/W system)
Exterior Lighting	Linear Lighting	LED 2020 (109 lm/W system)
Exterior Lighting	Linear Lighting	LED 2025 (126 lm/W system)
Exterior Lighting	Linear Lighting	LED 2030 (140 lm/W system)
Exterior Lighting	Linear Lighting	LED 2020 (109 lm/W system) w/ Controls
Exterior Lighting	Linear Lighting	LED 2025 (126 lm/W system) w/ Controls
Exterior Lighting	Linear Lighting	LED 2030 (140 lm/W system) w/ Controls
Motors	Pumps	Standard NEMA Premium
Motors	Fans & Blowers	Standard NEMA Premium
Motors	Compressed Air	Standard NEMA Premium
Motors	Material Handling	Standard NEMA Premium
Motors	Other Motors	Standard NEMA Premium
Process	Process Heating	Standard
Process	Process Cooling	Standard
Process	Process Refrigeration	Standard NEMA Premium
Process	Process Electrochemical	Standard
Process	Process Other	Standard

End Use	Efficient Technology	Baseline
Miscellaneous	Miscellaneous	Standard

Table 5-43 – Industrial Non-Equipment Measures

	Baseline
HVAC	Insulation - Ceiling
HVAC	Insulation - Ducting
HVAC	Insulation - Wall Cavity
HVAC	HVAC - Duct Repair and Sealing
HVAC	Building Shell - Air Sealing (Infiltration Control)
HVAC	Chiller - Chilled Water Reset
HVAC	Chiller - Variable Flow Chilled Water Pump
HVAC	Chiller - Variable Speed Fans
HVAC	Water-Cooled Chiller - Variable Flow Condenser Water Pump
HVAC	Water-Cooled Chiller - Condenser Water Temperature Reset
HVAC	Ventilation - Demand Controlled
HVAC	Destratification Fans (HVLS)
HVAC	HVAC - Maintenance
HVAC	RTU - Advanced Controls
HVAC	Thermostat - Connected
Lighting	Interior Lighting - Luminaire Level Lighting Controls
Lighting	Interior Lighting - Networked Lighting Controls
Lighting	Interior Lighting - LEC Exit Lighting
Lighting	Interior Lighting - Photoluminescent Exit Lighting
Lighting	Interior Lighting - Skylights
Lighting	Exterior Lighting - Enhanced Controls
Lighting	Exterior Lighting - Photovoltaic Installation
Refrigeration	Refrigeration - Floating Head Pressure
Refrigeration	Engine Block Heater Controls
Refrigeration	Circulating Engine Block Heater
Process	Refrigeration - System Optimization
Motors	Pumping System - Equipment Upgrade
Motors	Pumping System - System Optimization
Motors	Pumping System - Variable Speed Drive
Motors	Fan System - Variable Speed Drive
Motors	Fan System - Equipment Upgrade
Motors	Fan System - Flow Optimization
Motors	Compressed Air - Equipment Upgrade
Motors	Compressed Air - Dryer Optimization and Replacement
Motors	Compressed Air - System Controls
Motors	Compressed Air - Variable Speed Drive

	Baseline
Motors	Compressed Air - Low Pressure-Drop Filters
Motors	Compressed Air - Zero-Loss Condensate Drain
Motors	Compressed Air - Efficient Compressed Air Nozzles
Motors	Compressed Air - Outside Air Intake
Motors	Compressed Air - Receiver Capacity Addition
Motors	Compressed Air - End Use Optimization
Motors	Motors - Efficient Rewind (<100 HP)
Motors	Motors - Efficient Rewind (100 HP+)
Motors	Switch from Belt Drive to Direct Drive
Motors	Motors - Synchronous Belts
Motors	Motors - Energy Efficient Hydraulic Oils
Miscellaneous	Agriculture - Efficient Stock Watering Tanks
Miscellaneous	Agriculture - Stock Tank De-Icer
Miscellaneous	Agriculture - Thermostatically Controlled Outlets
Miscellaneous	Agriculture - Swine Heat Pads
Process	Dairy - Milk Precoolers
Process	Dairy - Heat Recovery from Refrigeration
Process	Dairy - Variable Speed Milk Vacuum Pump
Process	Dairy - Scroll Compressor for Dairy Refrigeration
Process	Metal - New Arc Furnace
Process	Municipal Water Treatment - UV-C LED Disinfection
Process	Municipal Water Treatment - Pulsed Air Mixing
Process	Municipal Sewage Treatment - Optimization
Miscellaneous	High Frequency Battery Chargers
All systems	Strategic Energy Management
All systems	Commissioning
All systems	Retrocommissioning

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 in real-time with the customer and provide customers with a better understanding of their energy consumption. These technologies could improve demand-side programs, particularly customer behavior

programs. The demand response programs were modeled to take advantage of advanced metering technology (such as AMI or smart meters) that the Company has recently deployed.

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 Liberty-Empire's website
- Direct customer outreach (via Liberty-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. Liberty-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;

Liberty-Empire will cooperatively market options jointly run with outside organizations, such as non-profit organizations and other Missouri electric and natural gas utilities. Liberty-Empire is currently cooperatively marketing the Low-Income Weatherization, Low-Income New Homes, Building Operating Certificate and whole-home programs with partnering organizations. Liberty-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 IRP Bundles. Measure list and measure details are shown in Appendix C of the Technical Volume 5 Appendix 5B document.

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;

Measures that were cost-effective within LoadMAP were included in the economic and achievable potential study. The DSM Potential Study measure-level MAP and RAP results were

vetted for inclusion in a DSM bundles and measures were bundled into programs and re-screened for cost-effectiveness. Measures were added to bundles as they became cost-effective throughout the timeframe.

All bundles were designed with cost effectiveness measures. Measures were bundled based on the end-use, sector and implementation strategy. Incentive costs and non-incentive costs were assigned to bundles. Options were rescreened at the after measure bundling and cost assignment. Cost effectiveness at the option level was balanced with implementation concerns.[10] Finally, the bundles were placed into three levels of first year $/kWh (low, medium, and high), and DR/DSR bundle.

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 RAP Portfolio incremental and cumulative end-use measure installations and participants is shown in the tables below.

[10] Strategic Energy Management falls just below a 1.0 TRC in the first three of the projection. To balance cost effectiveness and implementation concerns, the program was left within the portfolio to allow for time to ramp up.

Table 5-44 – Incremental Residential End-Use Measure Installations

Bundle	Measure	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential Prescriptive	Air-Source Heat Pump	187	206	224	240	256	270	284	296	310	321	331	317	307	301	298	297	124	116	109	109	111
Residential Prescriptive	Geothermal Heat Pump	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	8	8	8	9	9
Residential Prescriptive	Central AC	549	596	670	715	759	799	839	877	915	948	982	1,014	1,046	1,025	1,012	1,005	1,005	1,009	1,018	495	505
Residential Prescriptive	Freezer	288	313	337	359	381	402	422	441	459	477	494	510	526	541	556	570	554	542	533	534	545
Residential Prescriptive	Dehumidifiers	24	27	30	33	35	37	39	41	38	37	36	35	12	10	8	13	13	12	11	10	11
Residential Prescriptive	Air Purifier	55	63	70	75	80	85	76	72	71	17	11	18	17	16	13	20	23	23	22	19	20
Residential Prescriptive	Pool Pump	33	38	42	45	48	51	53	49	47	46	46	9	6	12	12	11	10	14	16	17	17
Residential Prescriptive	Well pump	75	82	88	94	100	106	111	116	121	125	130	134	138	142	138	134	132	131	130	132	135
Residential Prescriptive	Supplement Central System with Ductless Mini Split Heat Pump	295	301	307	314	320	326	332	338	345	351	357	363	370	376	383	389	396	402	409	421	430
Residential Prescriptive	Convert Zonal System to Ductless Mini Split Heat Pump	-	-	25	26	26	27	27	27	28	28	29	29	29	30	30	30	31	31	32	32	33
Residential Prescriptive	Circulation Pump - High Efficiency Motor	313	318	323	328	333	338	343	347	352	357	362	367	371	376	381	386	390	395	400	410	418
Residential Prescriptive	Space Heating - Heat Recovery Ventilator	-	-	-	-	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	65
Residential Prescriptive	Connected Thermostat - ENERGY STAR (1.0)	579	591	603	615	628	640	652	665	677	690	703	716	728	741	754	768	781	794	808	832	848
Residential Prescriptive	Connected Thermostat - Line-Voltage	542	554	565	577	588	600	612	623	635	647	659	671	684	696	708	721	733	746	759	781	797
Residential Prescriptive	Water Heater - Faucet Aerators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential Prescriptive	Water Heater - Low-Flow Showerheads	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential Prescriptive	Water Heater - Temperature Setback	165	167	170	172	175	178	180	183	186	188	191	193	196	198	201	203	206	209	211	216	221
Residential Prescriptive	Advanced Power Strips - Tier 1 - Peripheral Controls	726	737	748	760	771	782	793	804	815	826	837	847	858	869	880	890	901	912	922	945	964
Residential Prescriptive	Advanced Power Strips - Tier 2 - Active Controls	651	661	672	756	767	778	789	800	811	822	833	844	855	865	876	887	897	908	918	940	959
Retail Lighting	General Service Lighting - Interior	75,317	92,016	106,723	21,887	768	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retail Lighting	Linear Lighting	-	-	-	2,374	2,526	2,657	2,770	2,871	2,960	3,040	3,112	3,178	3,240	3,297	3,351	3,402	3,452	3,075	2,859	2,758	2,813
Retail Lighting	Exempted Lighting	25,738	31,527	18,876	4,811	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retail Lighting	General Service Lighting - Exterior	20,296	24,964	12,610	3,652	-	-	-	-	-	-	-	298	-	-	-	-	-	-	-	-	-
Appliance Recycling	Room AC - Recycling	-	-	-	-	-	-	-	-	13	13	13	13	13	13	13	13	13	13	13	14	14
Appliance Recycling	Refrigerator - Decommissioning and Recycling	-	-	-	-	-	-	-	-	123	125	127	128	130	132	133	135	137	138	140	143	146
Appliance Recycling	Freezer - Decommissioning and Recycling	-	-	-	-	-	-	-	-	164	166	168	170	172	174	176	178	180	182	184	188	192
Appliance Recycling	Dehumidifier Recycling	-	-	-	-	-	-	-	-	41	42	43	43	44	44	45	46	46	47	47	49	50
Whole Home Efficiency	Audit	598	608	617	627	636	646	655	665	674	684	693	702	712	721	730	739	749	758	767	786	802
Whole Home Efficiency	Air-Source Heat Pump	84	93	101	108	115	121	127	133	139	144	148	142	138	135	134	133	55	52	49	48	49
Whole Home Efficiency	Geothermal Heat Pump	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4
Whole Home Efficiency	Central AC	258	280	315	336	356	375	393	411	428	444	459	474	488	478	472	469	468	470	474	227	231
Whole Home Efficiency	Freezer	145	157	169	180	191	201	211	220	229	237	245	253	261	268	275	282	274	267	263	263	268
Whole Home Efficiency	Dehumidifiers	12	13	14	16	17	18	19	19	18	18	17	17	6	4	4	6	6	6	5	5	5
Whole Home Efficiency	Air Purifier	27	31	34	36	39	41	37	35	34	8	5	8	8	7	6	9	11	11	10	9	9
Whole Home Efficiency	Pool Pump	14	16	18	19	21	22	23	21	20	20	20	4	3	5	5	5	4	6	7	7	7
Whole Home Efficiency	Well pump	40	44	47	51	54	56	59	62	64	67	69	71	73	75	72	71	69	69	68	69	70
Whole Home Efficiency	Insulation - Ceiling	79	81	83	84	86	87	89	90	92	94	95	97	99	100	102	104	105	107	109	112	114
Whole Home Efficiency	Insulation - Radiant Barrier	54	55	56	57	58	59	61	62	63	64	65	66	67	68	70	71	72	73	74	76	78
Whole Home Efficiency	Insulation - Floor	12	13	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16	17	17	17	18
Whole Home Efficiency	Insulation - Basement Sidewall Installation	84	86	88	90	92	93	95	97	99	101	103	105	106	108	110	112	114	116	118	122	124
Whole Home Efficiency	Ducting - Repair and Sealing	131	133	136	138	141	144	146	149	152	154	157	160	163	165	168	171	174	177	180	185	189
Whole Home Efficiency	Ducting - Repair and Sealing - Aerosol	113	116	118	120	123	125	127	130	132	135	137	139	142	144	147	149	152	154	157	162	165
Whole Home Efficiency	Building Shell - Air Sealing (Infiltration Control)	143	146	149	151	154	157	160	163	165	168	171	174	177	180	183	186	189	192	195	200	204
Whole Home Efficiency	Building Shell - Whole-Home Aerosol Sealing	143	146	149	151	154	157	160	163	165	168	171	174	177	180	183	186	189	192	195	200	204
Whole Home Efficiency	Windows - Cellular Shades	-	140	165	168	171	174	177	180	184	187	190	194	197	200	204	207	211	214	217	221	225
Whole Home Efficiency	Supplement Central System with Ductless Mini Split Heat Pump	137	142	144	147	150	152	155	158	161	164	167	169	172	175	178	181	184	187	190	195	199
Whole Home Efficiency	Convert Zonal System to Ductless Mini Split Heat Pump	-	-	14	14	14	15	15	15	15	15	16	16	16	16	16	17	17	17	17	17	18
Whole Home Efficiency	Circulation Pump - High Efficiency Motor	149	151	153	155	158	160	162	164	166	168	171	173	175	177	179	181	183	185	187	192	196
Whole Home Efficiency	Space Heating - Heat Recovery Ventilator	-	-	-	-	20	21	24	24	25	25	25	26	26	27	27	28	28	29	29	30	30
Whole Home Efficiency	Connected Thermostat - ENERGY STAR (1.0)	299	304	310	316	321	327	333	339	345	351	357	363	369	375	381	387	393	399	406	417	425
Whole Home Efficiency	Connected Thermostat - Line-Voltage	280	285	290	296	301	306	312	317	323	329	334	340	346	351	357	363	369	375	381	391	399
Whole Home Efficiency	Water Heater - Faucet Aerators	422	428	433	439	445	451	457	462	468	474	480	485	491	497	502	508	513	519	525	536	547
Whole Home Efficiency	Water Heater - Low-Flow Showerheads	252	255	259	262	266	270	273	277	280	283	287	290	294	297	301	304	307	311	314	321	328
Whole Home Efficiency	General Service Lighting - Interior	5,251	5,426	5,590	3,669	512	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Whole Home Efficiency	Exempted Lighting	2,868	3,238	2,410	1,563	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Whole Home Efficiency	Refrigerator	461	506	547	585	621	655	687	716	744	771	796	819	793	776	766	764	767	313	280	263	268
Whole Home Efficiency	Advanced Power Strips - Tier 1 - Peripheral Controls	84	85	85	86	86	87	87	87	88	88	89	89	89	90	90	91	91	91	92	93	95
Whole Home Efficiency	Advanced Power Strips - Tier 2 - Active Controls	75	76	76	76	86	86	87	87	88	88	88	89	89	90	90	90	91	91	92	92	94
Residential Behavioral	Behavioral Programs	6,194	6,312	6,430	6,550	6,670	290	100	102	104	106	109	111	113	116	118	121	123	126	128	132	135
Critical Peak Pricing (Res)	Critical Peak Pricing Rates	-	3,708	7,086	10,091	12,626	15,293	14,712	14,035	14,097	14,156	14,209	14,259	14,305	14,348	14,389	14,427	14,463	14,496	14,528	14,562	14,638
DLC Smart Thermostat	DLC Smart Thermostats - Heating	-	777	1,766	2,974	4,606	6,268	8,162	10,293	10,381	10,466	10,548	10,629	10,707	10,784	10,860	10,935	11,009	11,081	11,154	11,195	11,238
DLC Smart Thermostat	DLC Smart Thermostats - Cooling	-	1,469	3,349	5,654	8,780	11,981	15,644	19,781	20,002	20,219	20,432	20,641	20,847	21,051	21,253	21,454	21,653	21,851	22,049	22,130	22,215
Time of Use Rate (Res)	Time-of-Use Opt-In	4,016	7,964	11,788	15,425	18,723	18,144	17,454	16,650	16,725	16,794	16,858	16,917	16,971	17,023	17,071	17,116	17,158	17,198	17,236	17,299	17,366

Table 5-45 – Incremental Non-Residential End-Use Measure Installations

Bundle	Measure	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Commercial Prescriptive	Air-Cooled Chiller	3,125	3,357	3,567	3,756	3,927	4,081	4,219	4,342	4,453	4,551	4,638	4,715	4,783	4,843	4,619	4,439	4,298	4,189	4,107	4,097	4,178
Commercial Prescriptive	Grocery - Display Case - Door Retrofit	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Commercial Prescriptive	Chiller - Variable Speed Fans	-	-	-	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Commercial Prescriptive	RTU	197	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Prescriptive	Packaged Terminal HP	24	27	29	31	32	34	34	31	28	27	3	1	3	2	2	1	0	3	4	4	4
Commercial Prescriptive	Air-Source Heat Pump	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Prescriptive	Ventilation	62	67	71	74	78	81	83	85	87	89	91	92	93	94	90	86	83	81	79	79	80
Commercial Prescriptive	Water Heater	77	86	91	91	93	92	91	89	87	85	83	82	62	55	-	-	-	-	-	-	-
Commercial Prescriptive	General Service Lighting - Interior	8,060	5,717	4,394	506	759	80	8	10	7	60	153	187	17	26	32	23	16	13	14	14	14
Commercial Prescriptive	General Service Lighting - Exterior	2,071	1,453	1,090	415	639	8	35	110	73	6	8	9	30	48	61	42	30	23	19	16	17
Commercial Prescriptive	Exempted Lighting	8,709	7,429	1,352	1,562	2,258	-	-	60	213	213	-	-	-	-	-	-	-	-	-	-	-
Commercial Prescriptive	Linear Lighting - Interior	7,643	8,571	9,302	9,879	10,326	10,670	10,933	11,131	11,276	11,378	11,447	11,488	11,506	11,507	11,493	11,467	11,432	10,010	9,146	8,774	8,949
Commercial Prescriptive	High-Bay Lighting	1,338	1,435	1,522	1,604	1,674	1,737	1,792	1,842	1,885	1,905	1,743	1,696	1,661	1,637	1,621	280	181	96	33	20	20
Commercial Prescriptive	Linear Lighting - Exterior	734	823	894	953	998	1,032	1,058	1,077	1,092	1,103	1,110	1,115	1,117	1,118	1,117	1,115	1,112	975	891	855	872
Commercial Prescriptive	Area Lighting	498	745	880	1,252	1,306	1,355	1,399	1,437	1,471	1,409	1,361	1,328	1,300	1,281	1,269	589	246	79	29	14	14
Commercial Prescriptive	Icemaker	68	76	83	88	92	95	97	86	80	77	8	1	7	4	2	1	-	6	9	10	11
Commercial Prescriptive	Server	1,197	1,361	1,093	1,039	-	-	189	202	15	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Prescriptive	POS Terminal	1,907	2,172	2,347	1,861	1,737	-	-	-	341	350	101	-	-	-	22	-	-	-	-	-	-
Commercial Prescriptive	Pool Pump	3	3	4	4	4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Prescriptive	Pool Heater	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-
Commercial Prescriptive	Chiller - Chilled Water Reset	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Commercial Prescriptive	HVAC - Economizer	115	114	114	114	114	114	114	113	113	113	113	112	112	112	111	111	111	110	110	111	113
Commercial Prescriptive	Space Heating - Heat Recovery Ventilator	11	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Commercial Prescriptive	Ventilation - ECM on VAV Boxes	38	38	38	38	38	38	38	38	37	37	37	37	37	37	36	36	36	36	36	36	37
Commercial Prescriptive	Ventilation - Demand Controlled	57	57	57	57	57	57	56	56	56	56	56	55	55	55	55	54	54	54	53	54	55
Commercial Prescriptive	Water Heater - Faucet Aerators/Low Flow Nozzles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Prescriptive	Water Heater - Low-Flow Showerheads	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Prescriptive	Water Heater - Pre-Rinse Spray Valve	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Prescriptive	Refrigeration - Low-Heat/Mo-Heat Doors	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2
Commercial Prescriptive	Refrigeration - Evaporator Fan Controls	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Commercial Prescriptive	Refrigeration - Floating Head Pressure	48	48	48	47	47	47	47	47	47	47	46	46	46	46	46	45	45	45	45	45	46
Commercial Prescriptive	Refrigeration - Economizer	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Commercial Prescriptive	Lodging - Guest Room Controls	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Commercial Prescriptive	Refrigeration - Door Gasket Replacement	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2
SBDI	Audit	92	103	112	119	125	129	132	135	137	139	140	140	141	141	141	141	141	124	113	109	111
SBDI	General Service Lighting - Interior	1,360	938	678	-	-	-	-	-	-	46	103	102	-	-	-	-	-	-	-	-	-
SBDI	General Service Lighting - Exterior	1,089	787	628	103	230	-	10	21	7	-	-	-	-	-	-	-	-	-	-	-	-
SBDI	Exempted Lighting	1,404	1,123	144	-	17	-	-	-	93	142	-	-	-	-	-	-	-	-	-	-	-
SBDI	Linear Lighting - Interior	1,831	2,057	2,237	2,379	2,492	2,580	2,648	2,701	2,742	2,772	2,794	2,809	2,819	2,825	2,827	2,826	2,823	2,476	2,267	2,179	2,222
SBDI	High-Bay Lighting	235	252	267	282	294	306	316	325	333	319	308	300	295	291	288	52	35	20	7	1	1
SBDI	Linear Lighting - Exterior	54	60	65	69	73	75	77	79	80	81	81	82	82	82	82	82	82	72	66	63	65
SBDI	Area Lighting	110	118	125	252	263	273	282	290	297	285	276	268	263	259	257	46	31	17	6	1	1
SBDI	Water Heater - Faucet Aerators/Low Flow Nozzles	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
SBDI	Water Heater - Pre-Rinse Spray Valve	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Midstream Food Service	Fryer	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Midstream Food Service	Hot Food Container	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Midstream Food Service	Steamer	5	6	6	7	7	7	8	8	8	7	6	6	1	0	1	0	0	0	0	0	0
Midstream Food Service	Griddle	6	7	7	8	8	8	8	9	9	8	7	7	1	0	1	0	0	0	0	0	0
Midstream Food Service	Dishwasher - ENERGY STAR (3.0)	8	8	9	9	10	10	9	8	8	8	8	9	9	10	10	10	9	9	9	-	-
Commercial Custom	Water-Cooled Chiller	427	459	487	513	536	557	575	592	607	620	632	642	651	658	628	603	584	569	557	556	567
Commercial Custom	HVAC - Duct Repair and Sealing	109	109	109	109	109	109	108	108	108	108	107	107	107	106	106	106	105	105	104	105	107
Commercial Custom	Refrigeration - Floating Head Pressure	28	28	28	28	28	27	27	27	27	27	27	27	27	27	26	26	26	26	26	26	27
Commercial Custom	Grocery - Display Case - Door Retrofit	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Commercial Custom	Chiller - Variable Speed Fans	-	-	-	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Commercial Custom	Space Heating - Heat Recovery Ventilator	1	1	1	1	2	2	2	3	3	3	3	4	4	4	5	4	4	4	4	4	4
Commercial Custom	Ventilation - ECM on VAV Boxes	3	4	5	5	6	7	8	10	11	12	13	14	15	16	17	15	16	16	16	16	17
SEM	Strategic Energy Management	24	24	24	24	24	24	24	24	24	24	24	24	23	23	23	23	23	23	23	23	23
Retrocommissioning	Retrocommissioning	306	305	304	304	303	302	301	300	299	297	296	295	294	292	291	289	288	286	285	286	292
Commercial Prescriptive	Pumping System - Variable Speed Drive	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5	5	5	5	5	5	6
Commercial Prescriptive	Fan System - Variable Speed Drive	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Commercial Prescriptive	Compressed Air - Variable Speed Drive	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Commercial Prescriptive	Compressed Air - Zero-Loss Condensate Drain	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Commercial Prescriptive	Compressed Air - Efficient Compressed Air Nozzles	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Commercial Prescriptive	Compressed Air - Outside Air Intake	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Commercial Prescriptive	Motors - Efficient Rewind (100 HP+)	38	38	38	38	38	37	37	37	37	37	37	37	37	36	36	36	36	36	36	36	36
Commercial Custom	Pumping System - Variable Speed Drive	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Commercial Custom	Chiller - Chilled Water Reset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Custom	Pumping System - System Optimization	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Commercial Custom	Compressed Air - Dryer Optimization and Replacement	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Commercial Custom	Compressed Air - System Controls	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Commercial Custom	Compressed Air - End Use Optimization	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Commercial Custom	Switch from Belt Drive to Direct Drive	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	7
Commercial Custom	Motors - Synchronous Belts	38	38	38	38	38	37	37	37	37	37	37	37	37	36	36	36	36	36	36	36	36
Commercial Custom	Motors - Energy Efficient Hydraulic Oils	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Custom	Agriculture - Thermostatically Controlled Outlets	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Commercial Custom	Agriculture - Swine Heat Pads	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Custom	Dairy - Scroll Compressor for Dairy Refrigeration	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Commercial Custom	Metal - New Arc Furnace	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Custom	Municipal Water Treatment - UV-C LED Disinfection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Custom	Fan System - Equipment Upgrade	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Retrocommissioning	Commissioning	3	4	4	5	5	5	6	6	7	8	10	11	16	19	21	31	38	41	64	77	78
Critical Peak Pricing (Non Re	Critical Peak Pricing Rates	-	810	1,605	2,375	3,121	3,843	3,752	3,659	3,583	3,567	3,583	3,598	3,613	3,628	3,642	3,657	3,671	3,685	3,698	3,712	3,725
	DLC Smart Thermostats - Cooling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Real Time Pricing	Real Time Pricing	-	265	509	729	927	1,104	1,078	1,051	1,029	1,025	1,029	1,033	1,038	1,042	1,046	1,050	1,054	1,058	1,062	1,066	1,070
Time of Use Rate (Non Res)	Time-of-Use Opt-In	165	498	832	1,251	1,670	2,089	2,716	3,342	3,986	4,215	4,233	4,251	4,269	4,286	4,303	4,320	4,337	4,354	4,370	4,386	4,402

Table 5-46 – Cumulative Residential End-Use Measure Installations

Bundle	Measure	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential Prescriptive	Air-Source Heat Pump	187	393	617	857	1,113	1,383	1,667	1,963	2,273	2,593	2,924	3,241	3,548	3,849	4,147	4,444	4,568	4,684	4,793	4,902	5,013
Residential Prescriptive	Geothermal Heat Pump	4	9	14	19	25	30	36	43	49	56	63	70	77	85	93	101	109	117	126	134	143
Residential Prescriptive	Central AC	549	1,144	1,814	2,529	3,288	4,087	4,926	5,803	6,716	7,664	8,646	9,661	10,707	11,732	12,744	13,749	14,754	15,763	16,782	17,277	17,782
Residential Prescriptive	Freezer	288	601	937	1,297	1,678	2,079	2,501	2,942	3,402	3,879	4,373	4,883	5,409	5,950	6,506	7,076	7,630	8,172	8,705	9,240	9,785
Residential Prescriptive	Dehumidifiers	24	52	82	115	150	187	225	266	304	341	377	413	425	435	442	456	468	480	491	502	512
Residential Prescriptive	Air Purifier	55	118	188	264	344	429	505	577	643	665	676	694	710	726	739	753	782	805	827	846	866
Residential Prescriptive	Pool Pump	33	71	113	158	206	257	310	359	406	452	498	507	514	526	538	549	559	572	588	605	622
Residential Prescriptive	Well pump	75	156	244	339	439	545	656	772	892	1,018	1,148	1,282	1,420	1,562	1,700	1,834	1,966	2,097	2,227	2,359	2,494
Residential Prescriptive	Supplement Central System with Ductless Mini Split Heat Pump	295	597	904	1,218	1,537	1,863	2,195	2,534	2,878	3,229	3,586	3,949	4,319	4,696	5,078	5,468	5,864	6,266	6,675	7,096	7,526
Residential Prescriptive	Convert Zonal System to Ductless Mini Split Heat Pump	-	-	25	51	77	104	131	158	186	214	242	271	301	330	360	391	422	453	484	516	549
Residential Prescriptive	Circulation Pump - High Efficiency Motor	313	631	954	1,282	1,615	1,953	2,295	2,643	2,995	3,352	3,714	4,081	4,452	4,828	5,209	5,595	5,986	6,381	6,780	7,190	7,608
Residential Prescriptive	Space Heating - Heat Recovery Ventilator	-	-	-	-	48	96	146	196	248	301	355	409	465	522	580	639	699	760	822	885	950
Residential Prescriptive	Connected Thermostat - ENERGY STAR (1.0)	579	1,170	1,773	2,388	3,016	3,656	4,308	4,973	5,650	6,340	7,043	7,759	8,487	9,228	9,983	10,750	11,531	12,325	13,133	13,965	14,813
Residential Prescriptive	Connected Thermostat - Line-Voltage	542	1,096	1,662	2,238	2,827	3,427	4,038	4,662	5,297	5,944	6,604	7,275	7,959	8,655	9,363	10,084	10,817	11,563	12,321	13,103	13,900
Residential Prescriptive	Water Heater - Faucet Aerators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential Prescriptive	Water Heater - Low-Flow Showerheads	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential Prescriptive	Water Heater - Temperature Setback	165	332	502	674	849	1,027	1,207	1,390	1,576	1,764	1,954	2,148	2,343	2,542	2,743	2,946	3,152	3,361	3,572	3,788	4,009
Residential Prescriptive	Advanced Power Strips - Tier 1 - Peripheral Controls	726	1,463	2,212	2,971	3,742	4,524	5,317	6,121	6,936	7,761	8,598	9,445	10,304	11,173	12,052	12,943	13,844	14,755	15,677	16,622	17,585
Residential Prescriptive	Advanced Power Strips - Tier 2 - Active Controls	651	1,313	1,984	2,740	3,507	4,285	5,074	5,874	6,685	7,507	8,340	9,184	10,038	10,903	11,779	12,666	13,563	14,471	15,390	16,330	17,288
Retail Lighting	General Service Lighting - Interior	75,317	167,333	274,056	295,943	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711	296,711
Retail Lighting	Linear Lighting	-	-	-	2,374	4,900	7,556	10,327	13,197	16,157	19,197	22,309	25,487	28,727	32,024	35,375	38,778	42,229	45,305	48,164	50,921	53,734
Retail Lighting	Exempted Lighting	25,738	57,266	76,142	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953	80,953
Retail Lighting	General Service Lighting - Exterior	20,296	45,260	57,870	61,522	61,522	61,522	61,522	61,522	61,522	61,522	61,522	61,820	61,820	61,820	61,820	61,820	61,820	61,820	61,820	61,820	61,820
Appliance Recycling	Room AC - Recycling	-	-	-	-	-	-	-	-	13	26	39	52	65	78	91	104	117	131	144	158	172
Appliance Recycling	Refrigerator - Decommissioning and Recycling	-	-	-	-	-	-	-	-	123	248	374	503	633	764	898	1,033	1,169	1,308	1,448	1,591	1,737
Appliance Recycling	Freezer - Decommissioning and Recycling	-	-	-	-	-	-	-	-	164	331	499	670	842	1,017	1,193	1,371	1,552	1,734	1,918	2,107	2,299
Appliance Recycling	Dehumidifier Recycling	-	-	-	-	-	-	-	-	41	84	126	169	213	258	303	348	395	441	489	538	587
Whole Home Efficiency	Audit	598	1,206	1,823	2,450	3,086	3,732	4,387	5,052	5,726	6,410	7,103	7,805	8,517	9,238	9,968	10,707	11,456	12,214	12,981	13,767	14,569
Whole Home Efficiency	Air-Source Heat Pump	84	177	278	386	500	622	749	881	1,020	1,164	1,312	1,454	1,591	1,726	1,860	1,994	2,049	2,100	2,149	2,197	2,246
Whole Home Efficiency	Geothermal Heat Pump	2	4	6	8	11	13	16	18	21	24	27	30	33	37	40	44	47	51	54	58	62
Whole Home Efficiency	Central AC	258	539	854	1,190	1,547	1,922	2,315	2,726	3,154	3,598	4,057	4,531	5,019	5,498	5,969	6,438	6,906	7,376	7,850	8,076	8,308
Whole Home Efficiency	Freezer	145	302	471	651	842	1,043	1,254	1,474	1,702	1,940	2,185	2,438	2,699	2,967	3,242	3,524	3,798	4,065	4,328	4,591	4,859
Whole Home Efficiency	Dehumidifiers	12	25	39	55	72	89	108	127	145	163	180	197	203	207	211	217	223	228	233	238	243
Whole Home Efficiency	Air Purifier	27	57	91	127	166	207	244	278	312	320	325	333	341	348	354	363	374	385	395	404	413
Whole Home Efficiency	Pool Pump	14	31	48	68	88	110	133	154	174	194	214	217	220	225	230	235	239	245	252	259	267
Whole Home Efficiency	Well pump	40	84	132	182	236	292	351	413	477	544	612	683	756	831	904	974	1,044	1,112	1,180	1,249	1,319
Whole Home Efficiency	Insulation - Ceiling	79	160	243	327	413	500	589	679	771	865	960	1,057	1,156	1,256	1,358	1,462	1,567	1,674	1,783	1,895	2,009
Whole Home Efficiency	Insulation - Radiant Barrier	54	109	166	223	281	341	401	463	526	590	655	721	788	856	926	997	1,068	1,141	1,216	1,292	1,370
Whole Home Efficiency	Insulation - Floor	12	25	38	51	64	77	91	105	119	134	148	163	179	194	210	226	242	259	275	293	310
Whole Home Efficiency	Insulation - Basement Sidewall Installation	84	171	259	348	440	533	629	726	825	925	1,028	1,132	1,239	1,347	1,457	1,570	1,684	1,800	1,918	2,040	2,164
Whole Home Efficiency	Ducting - Repair and Sealing	131	264	400	538	679	823	969	1,118	1,270	1,424	1,581	1,741	1,904	2,069	2,238	2,409	2,583	2,760	2,939	3,124	3,313
Whole Home Efficiency	Ducting - Repair and Sealing - Aerosol	113	229	347	468	590	715	843	972	1,104	1,239	1,376	1,515	1,657	1,802	1,948	2,098	2,250	2,404	2,561	2,723	2,887
Whole Home Efficiency	Building Shell - Air Sealing (Infiltration Control)	143	289	437	589	743	900	1,059	1,222	1,387	1,556	1,727	1,901	2,077	2,257	2,440	2,626	2,815	3,006	3,201	3,401	3,605
Whole Home Efficiency	Building Shell - Whole-Home Aerosol Sealing	143	289	437	589	743	900	1,059	1,222	1,387	1,556	1,727	1,901	2,077	2,257	2,440	2,626	2,815	3,006	3,201	3,401	3,605
Whole Home Efficiency	Windows - Cellular Shades	-	140	304	472	643	817	994	1,174	1,358	1,545	1,735	1,929	2,126	2,326	2,530	2,737	2,948	3,162	3,379	3,600	3,825
Whole Home Efficiency	Supplement Central System with Ductless Mini Split Heat Pump	137	279	423	570	720	872	1,028	1,186	1,347	1,510	1,677	1,846	2,018	2,194	2,372	2,553	2,736	2,923	3,113	3,308	3,507
Whole Home Efficiency	Convert Zonal System to Ductless Mini Split Heat Pump	-	-	14	28	43	58	72	87	103	118	134	149	165	182	198	214	231	248	265	282	300
Whole Home Efficiency	Circulation Pump - High Efficiency Motor	149	300	453	609	766	926	1,088	1,252	1,418	1,587	1,757	1,930	2,105	2,282	2,461	2,642	2,825	3,010	3,198	3,389	3,585
Whole Home Efficiency	Space Heating - Heat Recovery Ventilator	-	-	-	-	20	41	65	89	113	138	164	190	216	243	270	298	326	355	384	414	444
Whole Home Efficiency	Connected Thermostat - ENERGY STAR (1.0)	299	603	913	1,229	1,550	1,878	2,211	2,549	2,894	3,245	3,601	3,964	4,333	4,707	5,088	5,475	5,868	6,268	6,673	7,090	7,516
Whole Home Efficiency	Connected Thermostat - Line-Voltage	280	564	855	1,150	1,451	1,759	2,069	2,387	2,710	3,038	3,373	3,713	4,058	4,409	4,767	5,130	5,498	5,873	6,254	6,645	7,044
Whole Home Efficiency	Water Heater - Faucet Aerators	422	849	1,283	1,722	2,167	2,618	3,075	3,538	4,006	4,480	4,959	5,445	5,936	6,432	6,935	7,442	7,956	8,475	8,999	9,536	10,083
Whole Home Efficiency	Water Heater - Low-Flow Showerheads	252	507	766	1,029	1,295	1,564	1,837	2,114	2,394	2,677	2,964	3,254	3,548	3,846	4,146	4,450	4,758	5,069	5,383	5,704	6,032
Whole Home Efficiency	General Service Lighting - Interior	5,251	10,678	16,268	19,937	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449	20,449
Whole Home Efficiency	Exempted Lighting	2,868	6,105	8,515	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078	10,078
Whole Home Efficiency	Refrigerator	461	967	1,514	2,100	2,721	3,376	4,063	4,779	5,523	6,294	7,089	7,909	8,702	9,477	10,244	11,007	11,774	12,087	12,367	12,630	12,899
Whole Home Efficiency	Advanced Power Strips - Tier 1 - Peripheral Controls	84	169	255	340	426	513	600	687	775	863	952	1,041	1,130	1,220	1,310	1,400	1,491	1,583	1,675	1,767	1,862
Whole Home Efficiency	Advanced Power Strips - Tier 2 - Active Controls	75	151	227	303	389	475	562	649	736	824	913	1,001	1,091	1,180	1,270	1,360	1,451	1,542	1,634	1,726	1,820
Residential Behavioral	Behavioral Programs	6,194	12,505	18,936	25,486	32,156	32,446	32,546	32,648	32,752	32,858	32,967	33,078	33,191	33,307	33,425	33,546	33,669	33,794	33,923	34,055	34,190
Critical Peak Pricing (Res)	Critical Peak Pricing Rates	-	3,708	10,794	20,885	33,511	48,804	63,516	77,551	91,648	105,803	120,012	134,271	148,577	162,925	177,314	191,741	206,203	220,699	235,228	249,810	264,447
DLC Smart Thermostat	DLC Smart Thermostats - Heating	-	777	2,543	5,517	10,123	16,391	24,553	34,847	45,227	55,693	66,242	76,870	87,578	98,362	109,222	120,157	131,165	142,246	153,400	164,595	175,833
DLC Smart Thermostat	DLC Smart Thermostats - Cooling	-	1,469	4,817	10,472	19,252	31,233	46,877	66,657	86,659	106,878	127,309	147,950	168,797	189,848	211,101	232,556	254,209	276,059	298,108	320,238	342,453
Time of Use Rate (Res)	Time-of-Use Opt-In	4,016	11,980	23,768	39,193	57,917	76,060	93,514	110,164	126,889	143,683	160,540	177,457	194,428	211,451	228,521	245,637	262,796	279,993	297,230	314,529	331,895

Table 5-47 – Cumulative Non-Residential End-Use Measure Installations

Bundle	Measure	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Commercial Prescriptive	Air-Cooled Chiller	3,125	6,482	10,049	13,806	17,733	21,814	26,033	30,375	34,828	39,379	44,017	48,733	53,516	58,359	62,978	67,417	71,715	75,904	80,010	84,107	88,285
Commercial Prescriptive	Grocery - Display Case - Door Retrofit	3	7	10	13	16	20	23	26	30	33	36	39	42	46	49	52	55	58	61	64	68
Commercial Prescriptive	Chiller - Variable Speed Fans	-	-	-	9	18	27	36	46	55	64	73	82	91	100	108	117	126	135	144	153	162
Commercial Prescriptive	RTU	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197	197
Commercial Prescriptive	Packaged Terminal HP	24	50	79	110	142	176	210	241	269	297	300	301	304	306	308	309	309	312	315	320	324
Commercial Prescriptive	Air-Source Heat Pump	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Commercial Prescriptive	Ventilation	62	129	200	274	352	432	515	601	688	777	868	960	1,053	1,148	1,237	1,323	1,406	1,487	1,566	1,645	1,726
Commercial Prescriptive	Water Heater	77	163	255	346	439	531	622	711	798	883	966	1,048	1,111	1,165	1,165	1,165	1,165	1,165	1,165	1,165	1,165
Commercial Prescriptive	General Service Lighting - Interior	8,060	13,776	18,170	18,676	19,434	19,515	19,523	19,533	19,539	19,599	19,752	19,938	19,955	19,981	20,013	20,036	20,052	20,066	20,080	20,094	20,108
Commercial Prescriptive	General Service Lighting - Exterior	2,071	3,524	4,614	5,029	5,668	5,676	5,711	5,821	5,893	5,900	5,908	5,917	5,947	5,995	6,056	6,098	6,128	6,151	6,171	6,187	6,204
Commercial Prescriptive	Exempted Lighting	8,709	16,138	17,490	19,052	21,310	21,310	21,310	21,370	21,583	21,796	21,796	21,796	21,796	21,796	21,796	21,796	21,796	21,796	21,796	21,796	21,796
Commercial Prescriptive	Linear Lighting - Interior	7,643	16,214	25,516	35,396	45,721	56,391	67,324	78,455	89,731	101,109	112,556	124,044	135,550	147,057	158,550	170,017	181,443	191,459	200,604	209,378	218,327
Commercial Prescriptive	High-Bay Lighting	1,338	2,773	4,294	5,899	7,573	9,310	11,102	12,944	14,829	16,635	18,378	20,074	21,735	23,371	24,992	25,272	25,453	25,549	25,582	25,602	25,622
Commercial Prescriptive	Linear Lighting - Exterior	734	1,557	2,451	3,404	4,402	5,434	6,491	7,569	8,661	9,763	10,873	11,988	13,105	14,222	15,339	16,455	17,567	18,541	19,432	20,288	21,160
Commercial Prescriptive	Area Lighting	498	1,243	2,122	3,374	4,680	6,035	7,434	8,871	10,343	11,752	13,113	14,441	15,741	17,022	18,291	18,880	19,126	19,204	19,233	19,247	19,262
Commercial Prescriptive	Icemaker	68	144	226	314	406	501	598	685	765	841	850	850	857	861	864	865	865	870	879	890	900
Commercial Prescriptive	Server	1,197	2,558	3,651	4,690	4,690	4,690	4,879	5,081	5,096	5,096	5,096	5,096	5,096	5,096	5,096	5,096	5,096	5,096	5,096	5,096	5,096
Commercial Prescriptive	POS Terminal	1,907	4,079	6,426	8,287	10,024	10,024	10,024	10,024	10,365	10,715	10,816	10,816	10,816	10,816	10,839	10,839	10,839	10,839	10,839	10,839	10,839
Commercial Prescriptive	Pool Pump	3	6	10	13	17	20	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
Commercial Prescriptive	Pool Heater	0	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
Commercial Prescriptive	Chiller - Chilled Water Reset	11	22	33	44	55	66	77	88	99	110	121	131	142	153	164	174	185	196	206	217	228
Commercial Prescriptive	HVAC - Economizer	115	229	343	458	572	686	799	913	1,026	1,139	1,251	1,364	1,476	1,587	1,699	1,810	1,920	2,030	2,140	2,250	2,363
Commercial Prescriptive	Space Heating - Heat Recovery Ventilator	11	21	31	42	52	63	73	83	93	104	114	124	134	144	154	164	174	183	193	203	213
Commercial Prescriptive	Ventilation - ECM on VAV Boxes	38	77	115	153	191	229	266	304	341	378	415	452	489	526	562	598	634	670	706	741	778
Commercial Prescriptive	Ventilation - Demand Controlled	57	115	172	228	285	342	398	454	510	566	622	677	732	787	841	895	949	1,003	1,056	1,110	1,165
Commercial Prescriptive	Water Heater - Faucet Aerators/Low Flow Nozzles	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	5	6	6	6	7
Commercial Prescriptive	Water Heater - Low-Flow Showerheads	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
Commercial Prescriptive	Water Heater - Pre-Rinse Spray Valve	0	1	1	2	2	2	3	3	3	4	4	4	5	5	6	6	6	7	7	7	8
Commercial Prescriptive	Refrigeration - Low-Heat/No-Heat Doors	3	5	8	10	13	15	18	20	23	25	28	30	33	35	38	40	43	45	48	50	52
Commercial Prescriptive	Refrigeration - Evaporator Fan Controls	8	16	24	33	41	49	57	65	73	81	89	97	105	113	121	129	137	144	152	160	168
Commercial Prescriptive	Refrigeration - Floating Head Pressure	48	96	143	191	238	285	332	379	426	472	519	565	611	657	702	747	792	837	882	927	973
Commercial Prescriptive	Refrigeration - Economizer	2	3	5	7	9	10	12	14	15	17	19	21	22	24	26	27	29	31	32	34	35
Commercial Prescriptive	Lodging - Guest Room Controls	2	4	6	8	10	12	14	15	17	19	21	23	25	27	29	31	32	34	36	38	40
Commercial Prescriptive	Refrigeration - Door Gasket Replacement	3	5	8	10	13	16	18	21	23	26	28	31	33	36	38	41	43	45	48	50	53
SBDI	Audit	92	194	306	425	550	679	811	946	1,083	1,222	1,362	1,502	1,643	1,784	1,926	2,067	2,208	2,332	2,445	2,554	2,665
SBDI	General Service Lighting - Interior	1,360	2,297	2,976	2,976	2,976	2,976	2,976	2,976	2,976	3,022	3,125	3,227	3,227	3,227	3,227	3,227	3,227	3,227	3,227	3,227	3,227
SBDI	General Service Lighting - Exterior	1,089	1,876	2,504	2,607	2,837	2,837	2,847	2,868	2,874	2,874	2,874	2,874	2,874	2,874	2,874	2,874	2,874	2,874	2,874	2,874	2,874
SBDI	Exempted Lighting	1,404	2,526	2,670	2,670	2,687	2,687	2,687	2,687	2,780	2,922	2,922	2,922	2,922	2,922	2,922	2,922	2,922	2,922	2,922	2,922	2,922
SBDI	Linear Lighting - Interior	1,831	3,888	6,125	8,505	10,996	13,576	16,225	18,926	21,668	24,440	27,234	30,044	32,863	35,688	38,515	41,341	44,163	46,639	48,906	51,085	53,307
SBDI	High-Bay Lighting	235	487	754	1,036	1,330	1,635	1,951	2,276	2,608	2,927	3,236	3,536	3,831	4,122	4,410	4,462	4,497	4,516	4,524	4,524	4,525
SBDI	Linear Lighting - Exterior	54	114	179	248	321	396	474	553	633	713	795	877	959	1,041	1,123	1,206	1,288	1,360	1,426	1,489	1,554
SBDI	Area Lighting	110	228	353	604	867	1,140	1,422	1,713	2,010	2,295	2,570	2,839	3,102	3,361	3,618	3,665	3,695	3,712	3,718	3,719	3,719
SBDI	Water Heater - Faucet Aerators/Low Flow Nozzles	4	9	13	18	22	26	31	35	39	44	48	52	57	61	65	70	74	78	82	86	91
SBDI	Water Heater - Pre-Rinse Spray Valve	5	10	15	20	25	30	35	40	45	50	54	59	64	69	74	79	84	88	93	98	103
Midstream Food Service	Fryer	-	-	-	-	-	-	-	-	0	0	0	0	0	1	1	1	1	1	1	1	1
Midstream Food Service	Hot Food Container	0	0	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
Midstream Food Service	Steamer	5	11	17	24	31	38	46	54	61	68	75	81	81	82	82	83	83	83	83	83	84
Midstream Food Service	Griddle	6	12	19	27	35	43	51	60	69	76	83	90	91	91	92	92	92	93	93	93	93
Midstream Food Service	Dishwasher - ENERGY STAR (3.0)	8	16	25	35	44	54	63	71	79	87	95	104	113	123	133	142	152	161	170	170	170
Commercial Custom	Water-Cooled Chiller	427	886	1,373	1,886	2,423	2,979	3,555	4,147	4,753	5,373	6,005	6,647	7,297	7,956	8,583	9,187	9,770	10,339	10,896	11,452	12,018
Commercial Custom	HVAC - Duct Repair and Sealing	109	218	327	436	545	653	762	870	978	1,085	1,193	1,300	1,406	1,513	1,619	1,724	1,830	1,935	2,039	2,144	2,252
Commercial Custom	Refrigeration - Floating Head Pressure	28	56	83	111	138	166	193	220	247	275	301	328	355	382	408	435	461	487	513	539	566
Commercial Custom	Grocery - Display Case - Door Retrofit	1	3	4	6	7	8	10	11	13	14	15	17	18	20	21	22	24	25	26	28	29
Commercial Custom	Chiller - Variable Speed Fans	-	-	-	4	8	12	16	20	23	27	31	35	39	43	46	50	54	58	62	65	69
Commercial Custom	Space Heating - Heat Recovery Ventilator	1	2	3	4	6	8	10	13	16	19	22	26	30	34	39	43	47	51	55	60	64
Commercial Custom	Ventilation - ECM on VAV Boxes	3	6	11	16	23	30	39	48	59	70	83	97	111	127	144	160	175	191	207	223	240
SEM	Strategic Energy Management	24	49	73	98	122	146	170	194	218	242	265	289	312	336	359	382	405	428	451	474	497
Retrocommissioning	Retrocommissioning	306	611	915	1,219	1,522	1,824	2,124	2,424	2,722	3,020	3,316	3,611	3,904	4,196	4,487	4,776	5,064	5,350	5,635	5,922	6,214
Commercial Prescriptive	Pumping System - Variable Speed Drive	6	11	17	23	28	34	40	45	51	57	62	68	73	79	84	90	95	100	106	111	117
Commercial Prescriptive	Fan System - Variable Speed Drive	8	17	25	34	42	50	59	67	75	84	92	100	108	116	124	133	141	149	156	164	173
Commercial Prescriptive	Compressed Air - Variable Speed Drive	2	3	5	6	8	9	11	12	14	15	17	18	19	21	22	24	25	27	28	30	31
Commercial Prescriptive	Compressed Air - Zero-Loss Condensate Drain	8	16	24	32	40	48	56	64	71	79	87	95	103	110	118	126	133	141	148	156	164
Commercial Prescriptive	Compressed Air - Efficient Compressed Air Nozzles	8	16	24	32	40	48	56	64	71	79	87	95	103	110	118	126	133	141	148	156	164
Commercial Prescriptive	Compressed Air - Outside Air Intake	8	16	24	32	40	48	56	64	71	79	87	95	103	110	118	126	133	141	148	156	164
Commercial Prescriptive	Motors - Efficient Rewind (100 HP+)	38	76	113	151	188	226	263	300	337	374	411	448	484	521	557	593	629	665	700	736	772
Commercial Custom	Pumping System - Variable Speed Drive	2	5	7	10	12	15	17	19	22	24	27	29	31	34	36	38	41	43	45	48	50
Commercial Custom	Chiller - Chilled Water Reset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Commercial Custom	Pumping System - System Optimization	8	16	24	33	41	49	57	65	73	81	89	97	105	112	120	128	136	143	151	159	167
Commercial Custom	Compressed Air - Dryer Optimization and Replacement	8	16	24	32	40	48	56	64	71	79	87	95	103	110	118	126	133	141	148	156	164
Commercial Custom	Compressed Air - System Controls	7	14	21	28	35	42	49	56	63	70	77	84	91	98	104	111	118	125	131	138	145
Commercial Custom	Compressed Air - End Use Optimization	5	10	15	20	25	30	35	40	44	49	54	59	64	69	73	78	83	88	92	97	102
Commercial Custom	Switch from Belt Drive to Direct Drive	7	14	20	27	34	41	47	54	61	67	74	81	87	94	100	107	113	120	126	132	139
Commercial Custom	Motors - Synchronous Belts	38	76	113	151	188	226	263	300	337	374	411	448	484	521	557	593	629	665	700	736	772
Commercial Custom	Motors - Energy Efficient Hydraulic Oils	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
Commercial Custom	Agriculture - Thermostatically Controlled Outlets	1	2	2	3	4	5	5	6	7	8	9	9	10	11	12	12	13	14	15	15	16
Commercial Custom	Agriculture - Swine Heat Pads	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commercial Custom	Dairy - Scroll Compressor for Dairy Refrigeration	1	2	3	4	4	5	6	7	8	9	10	10	11	12	13	14	15	16	16	17	18
Commercial Custom	Metal - New Arc Furnace	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3
Commercial Custom	Municipal Water Treatment - UV-C LED Disinfection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial Custom	Fan System - Equipment Upgrade	8	17	25	34	42	50	59	67	75	84	92	100	108	116	124	133	141	149	156	164	173
Retrocommissioning	Commissioning	3	6	11	15	20	26	32	38	44	53	63	74	89	108	129	160	198	239	303	380	459
Critical Peak Pricing (Non Res	Critical Peak Pricing Rates	-	810	2,415	4,790	7,912	11,755	15,507	19,166	22,748	26,316	29,898	33,496	37,109	40,737	44,379	48,036	51,706	55,391	59,089	62,801	66,526
	DLC Smart Thermostats - Cooling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Real Time Pricing	Real Time Pricing	-	265	773	1,503	2,430	3,534	4,612	5,663	6,692	7,716	8,746	9,779	10,817	11,859	12,905	13,955	15,010	16,068	17,130	18,196	19,266
Time of Use Rate (Non Res)	Time-of-Use Opt-In	165	664	1,496	2,747	4,417	6,505	9,222	12,563	16,550	20,764	24,997	29,248	33,517	37,803	42,106	46,427	50,764	55,117	59,487	63,873	68,275

Table 5-48 – Incremental Participation by Program

Sector	Bundle	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	4,487	4,660	4,879	5,115	5,319	5,471	5,607	5,737	5,866	5,939	6,060	6,131	6,207	6,264	6,314	6,393	6,264	6,313	6,368	5,966	6,085
Residential	Retail Lighting	121,351	148,508	138,210	32,724	3,294	2,657	2,770	2,871	2,960	3,040	3,112	3,476	3,240	3,297	3,351	3,402	3,452	3,075	2,859	2,758	2,813
Residential	Appliance Recycling	0	0	0	0	0	0	0	0	342	346	351	355	359	364	368	372	377	381	385	394	402
Residential	Whole Home Efficiency	12,220	13,054	12,585	9,958	5,403	5,022	5,146	5,262	5,377	5,464	5,572	5,657	5,693	5,730	5,771	5,832	5,804	5,399	5,419	5,261	5,366
Residential	Residential Behavioral	6,194	6,312	6,430	6,550	6,670	290	100	102	104	106	109	111	113	116	118	121	123	126	128	132	135
Residential	**Subtotal**	**144,252**	**172,533**	**162,105**	**54,346**	**20,686**	**13,440**	**13,623**	**13,972**	**14,649**	**14,895**	**15,203**	**15,730**	**15,612**	**15,770**	**15,922**	**16,120**	**16,019**	**15,294**	**15,160**	**14,511**	**14,801**
Commercial	Commercial Prescriptive	36,097	33,700	27,094	23,502	24,306	19,650	20,324	20,884	21,489	21,534	21,125	21,089	20,955	20,988	20,699	18,414	17,767	15,840	14,697	14,250	14,535
Commercial	Commercial Custom	655	687	717	747	771	792	812	829	844	858	871	881	891	899	869	842	821	806	793	794	810
Commercial	SBDI	6,182	5,447	4,266	3,213	3,502	3,372	3,475	3,561	3,697	3,793	3,712	3,711	3,609	3,608	3,605	3,157	3,120	2,718	2,468	2,361	2,408
Commercial	Midstream Food Service	19	21	22	24	25	26	25	25	25	23	21	22	11	10	11	11	10	10	9	0	0
Commercial	SEM	24	24	24	24	24	24	24	24	24	24	24	24	23	23	23	23	23	23	23	23	23
Commercial	Retrocommissioning	308	309	309	308	308	307	307	306	305	306	306	306	309	311	311	320	326	327	349	363	371
Commercial	**Subtotal**	**43,285**	**40,189**	**32,432**	**27,818**	**28,936**	**24,171**	**24,966**	**25,628**	**26,385**	**26,538**	**26,059**	**26,033**	**25,799**	**25,839**	**25,519**	**22,766**	**22,067**	**19,724**	**18,339**	**17,792**	**18,148**
Portfolio	**EE Programs**	**187,537**	**212,722**	**194,536**	**82,164**	**49,622**	**37,611**	**38,589**	**39,600**	**41,033**	**41,432**	**41,262**	**41,763**	**41,411**	**41,609**	**41,441**	**38,886**	**38,087**	**35,018**	**33,498**	**32,303**	**32,949**
Residential	Critical Peak Pricing (Res)	0	3,708	7,086	10,091	12,626	15,293	14,712	14,035	14,097	14,156	14,209	14,259	14,305	14,348	14,389	14,427	14,463	14,496	14,528	14,582	14,638
Residential	DLC Smart Thermostat	0	2,245	5,115	8,629	13,386	18,248	23,806	30,074	30,382	30,685	30,980	31,270	31,554	31,835	32,113	32,389	32,662	32,932	33,203	33,324	33,453
Residential	Time of Use Rate (Res)	4,016	7,964	11,788	15,425	18,723	18,144	17,454	16,650	16,725	16,794	16,858	16,917	16,971	17,023	17,071	17,116	17,158	17,198	17,236	17,299	17,366
Commercial	Critical Peak Pricing (Non Res)	0	810	1,605	2,375	3,121	3,843	3,752	3,659	3,583	3,567	3,583	3,598	3,613	3,628	3,642	3,657	3,671	3,685	3,698	3,712	3,725
Commercial	Real Time Pricing	0	265	509	729	927	1,104	1,078	1,051	1,029	1,025	1,029	1,033	1,038	1,042	1,046	1,050	1,054	1,058	1,062	1,066	1,070
Commercial	Time of Use Rate (Non Res)	165	498	832	1,251	1,670	2,089	2,716	3,342	3,986	4,215	4,233	4,251	4,269	4,286	4,303	4,320	4,337	4,354	4,370	4,386	4,402
Portfolio	**Subtotal DR Programs**	**4,181**	**15,490**	**26,936**	**38,501**	**50,453**	**58,721**	**63,518**	**68,810**	**69,802**	**70,441**	**70,891**	**71,327**	**71,750**	**72,162**	**72,564**	**72,959**	**73,345**	**73,722**	**74,098**	**74,370**	**74,654**
Portfolio	**All Programs**	**191,718**	**228,212**	**221,472**	**120,665**	**100,075**	**96,332**	**102,107**	**108,410**	**110,835**	**111,873**	**112,153**	**113,090**	**113,161**	**113,771**	**114,005**	**111,845**	**111,431**	**108,739**	**107,596**	**106,672**	**107,602**

Table 5-49 – Cumulative Participation by Program

Sector	Bundle	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	4,487	9,147	14,026	19,141	24,460	29,931	35,538	41,275	47,141	53,080	59,141	65,272	71,478	77,742	84,056	90,449	96,713	103,026	109,394	115,360	121,445
Residential	Retail Lighting	121,351	269,858	408,068	440,792	444,086	446,742	449,513	452,383	455,343	458,383	461,495	464,971	468,210	471,507	474,859	478,261	481,713	484,788	487,647	490,405	493,218
Residential	Appliance Recycling	0	0	0	0	0	0	0	0	342	688	1,038	1,393	1,753	2,116	2,484	2,856	3,233	3,614	3,999	4,393	4,795
Residential	Whole Home Efficiency	12,220	25,274	37,859	47,816	53,219	58,241	63,387	68,649	74,026	79,490	85,061	90,719	96,412	102,141	107,912	113,744	119,548	124,947	130,366	135,627	140,993
Residential	Residential Behavioral	6,194	12,505	18,936	25,486	32,156	32,446	32,546	32,648	32,752	32,858	32,967	33,078	33,191	33,307	33,425	33,546	33,669	33,794	33,923	34,055	34,190
Residential	**Subtotal**	**144,252**	**316,784**	**478,889**	**533,235**	**553,920**	**567,360**	**580,983**	**594,955**	**609,604**	**624,499**	**639,702**	**655,432**	**671,044**	**686,814**	**702,736**	**718,856**	**734,875**	**750,170**	**765,329**	**779,840**	**794,641**
Commercial	Commercial Prescriptive	36,097	69,797	96,891	120,392	144,699	164,349	184,673	205,557	227,046	248,579	269,705	290,793	311,748	332,736	353,435	371,848	389,616	405,456	420,152	434,403	448,938
Commercial	Commercial Custom	655	1,342	2,059	2,805	3,576	4,369	5,180	6,009	6,854	7,712	8,583	9,464	10,355	11,254	12,123	12,965	13,786	14,592	15,385	16,179	16,988
Commercial	SBDI	6,182	11,629	15,895	19,109	22,611	25,983	29,458	33,018	36,716	40,509	44,221	47,932	51,542	55,149	58,754	61,911	65,031	67,749	70,217	72,578	74,986
Commercial	Midstream Food Service	19	40	62	86	111	136	161	186	210	233	254	276	288	298	309	320	330	339	349	349	349
Commercial	SEM	24	49	73	98	122	146	170	194	218	242	265	289	312	336	359	382	405	428	451	474	497
Commercial	Retrocommissioning	308	617	926	1,234	1,542	1,849	2,156	2,462	2,767	3,073	3,379	3,685	3,994	4,305	4,616	4,936	5,262	5,589	5,938	6,302	6,672
Commercial	**Subtotal**	**43,285**	**83,474**	**115,906**	**143,724**	**172,660**	**196,831**	**221,798**	**247,426**	**273,810**	**300,348**	**326,407**	**352,439**	**378,238**	**404,078**	**429,596**	**452,363**	**474,430**	**494,153**	**512,492**	**530,284**	**548,432**
Portfolio	**EE Programs**	**187,537**	**400,258**	**594,795**	**676,959**	**726,581**	**764,192**	**802,781**	**842,381**	**883,414**	**924,847**	**966,108**	**1,007,872**	**1,049,282**	**1,090,892**	**1,132,332**	**1,171,219**	**1,209,305**	**1,244,323**	**1,277,821**	**1,310,124**	**1,343,073**
Residential	Critical Peak Pricing (Res)	0	3,708	10,794	20,885	33,511	48,804	63,516	77,551	91,648	105,803	120,012	134,271	148,577	162,925	177,314	191,741	206,203	220,699	235,228	249,810	264,447
Residential	DLC Smart Thermostat	0	2,245	7,360	15,989	29,375	47,624	71,430	101,504	131,886	162,571	193,551	224,821	256,375	288,210	320,324	352,712	385,374	418,306	451,508	484,833	518,286
Residential	Time of Use Rate (Res)	4,016	11,980	23,768	39,193	57,917	76,060	93,514	110,164	126,889	143,683	160,540	177,457	194,428	211,451	228,521	245,637	262,796	279,993	297,230	314,529	331,895
Commercial	Critical Peak Pricing (Non Res)	0	810	2,415	4,790	7,912	11,755	15,507	19,166	22,748	26,316	29,898	33,496	37,109	40,737	44,379	48,036	51,706	55,391	59,089	62,801	66,526
Commercial	Real Time Pricing	0	265	773	1,503	2,430	3,534	4,612	5,663	6,692	7,716	8,746	9,779	10,817	11,859	12,905	13,955	15,010	16,068	17,130	18,196	19,266
Commercial	Time of Use Rate (Non Res)	165	664	1,496	2,747	4,417	6,505	9,222	12,563	16,550	20,764	24,997	29,248	33,517	37,803	42,106	46,427	50,764	55,117	59,487	63,873	68,275
Portfolio	**Subtotal DR Programs**	**4,181**	**19,672**	**46,607**	**85,108**	**135,561**	**194,282**	**257,800**	**326,610**	**396,413**	**466,853**	**537,745**	**609,072**	**680,823**	**752,984**	**825,549**	**898,508**	**971,853**	**1,045,574**	**1,119,672**	**1,194,042**	**1,268,696**
Portfolio	**All Programs**	**191,718**	**419,930**	**641,402**	**762,067**	**862,142**	**958,474**	**1,060,581**	**1,168,991**	**1,279,827**	**1,391,700**	**1,503,853**	**1,616,944**	**1,730,105**	**1,843,876**	**1,957,881**	**2,069,727**	**2,181,158**	**2,289,897**	**2,397,494**	**2,504,166**	**2,611,769**

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 5-50 – Incremental Net Demand Reductions by Program (MW)

Sector	Bundle	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Sector_Sector	Bundle_Bundle	MW Savings_20	MW Savings_20	MW Savings_20	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings_2
Residential	Residential Prescriptive	1.44	1.46	1.56	1.59	1.65	1.68	1.71	1.74	1.77	1.79	1.82	1.84	1.86	1.88	1.90	1.92	1.89	1.91	1.93	1.98	2.02
Residential	Retail Lighting	0.35	0.43	0.38	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	Appliance Recycling	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	Whole Home Efficiency	1.58	1.88	1.99	2.02	2.05	2.08	2.11	2.14	2.18	2.21	2.24	2.26	2.29	2.32	2.35	2.38	2.38	2.40	2.43	2.48	2.53
Residential	Residential Behavioral	0.35	0.36	0.36	0.36	0.37	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Residential	**Subtotal**	**3.72**	**4.13**	**4.29**	**4.06**	**4.07**	**3.78**	**3.83**	**3.89**	**3.95**	**4.01**	**4.07**	**4.11**	**4.16**	**4.21**	**4.26**	**4.31**	**4.29**	**4.33**	**4.37**	**4.47**	**4.56**
Commercial	Commercial Prescriptive	1.20	1.23	1.02	1.07	0.92	0.84	0.89	0.91	0.93	0.91	0.88	0.87	0.87	0.86	0.86	0.56	0.53	0.48	0.44	0.43	0.44
Commercial	Commercial Custom	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Commercial	SBDI	0.12	0.11	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.05	0.04	0.04	0.03	0.03	0.03
Commercial	Midstream Food Service	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	SEM	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Commercial	Retrocommissioning	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.07	0.08	0.09	0.10	0.13	0.15	0.16	0.23	0.27	0.28
Commercial	**Subtotal**	**1.43**	**1.46**	**1.22**	**1.27**	**1.14**	**1.06**	**1.12**	**1.15**	**1.17**	**1.16**	**1.13**	**1.12**	**1.13**	**1.13**	**1.14**	**0.84**	**0.83**	**0.77**	**0.80**	**0.83**	**0.85**
Portfolio	**EE Programs**	**5.16**	**5.59**	**5.52**	**5.34**	**5.20**	**4.84**	**4.95**	**5.04**	**5.13**	**5.17**	**5.20**	**5.24**	**5.29**	**5.34**	**5.39**	**5.15**	**5.12**	**5.10**	**5.18**	**5.30**	**5.41**
Residential	Critical Peak Pricing (Res)	-	0.72	1.38	1.97	2.47	2.99	2.87	2.74	2.75	2.76	2.78	2.79	2.80	2.82	2.83	2.84	2.86	2.87	2.88	2.90	2.91
Residential	DLC Smart Thermostat	-	1.05	2.38	4.01	6.21	8.45	11.01	13.88	14.00	14.12	14.23	14.34	14.44	14.55	14.65	14.75	14.85	14.95	15.04	15.10	15.16
Residential	Time of Use Rate (Res)	0.81	1.60	2.37	3.10	3.77	3.65	3.51	3.35	3.36	3.37	3.39	3.41	3.42	3.44	3.46	3.47	3.49	3.51	3.52	3.54	3.56
Commercial	Critical Peak Pricing (Non Res)	-	0.50	0.99	1.47	1.92	2.37	2.31	2.25	2.21	2.20	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.30	2.31	2.31
Commercial	Real Time Pricing	-	0.16	0.31	0.45	0.57	0.68	0.66	0.65	0.63	0.63	0.63	0.64	0.64	0.64	0.65	0.65	0.65	0.66	0.66	0.66	0.66
Commercial	Time of Use Rate (Non Res)	0.01	0.04	0.06	0.10	0.13	0.16	0.21	0.26	0.30	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Portfolio	**Subtotal DR Programs**	**0.82**	**4.08**	**7.51**	**11.10**	**15.07**	**18.30**	**20.57**	**23.12**	**23.25**	**23.40**	**23.55**	**23.70**	**23.86**	**24.00**	**24.15**	**24.30**	**24.44**	**24.58**	**24.73**	**24.83**	**24.93**
Portfolio	**All Programs**	**5.98**	**9.66**	**13.02**	**16.44**	**20.27**	**23.13**	**25.52**	**28.16**	**28.38**	**28.57**	**28.75**	**28.94**	**29.14**	**29.35**	**29.54**	**29.45**	**29.56**	**29.69**	**29.90**	**30.13**	**30.33**

Table 5-51 – Cumulative Net Demand Reductions by Program (MW)

Sector	Bundle	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	1.44	2.90	4.46	6.05	7.70	9.38	11.08	12.82	14.58	16.37	17.83	19.30	20.77	22.26	23.77	25.10	25.52	25.94	26.28	26.61	26.94
Residential	Retail Lighting	0.35	0.77	1.16	1.25	1.25	1.25	1.25	1.26	1.26	1.26	1.19	1.10	0.78	0.43	0.11	0.04	0.04	0.04	0.05	0.05	0.05
Residential	Appliance Recycling	-	-	-	-	-	-	-	-	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Residential	Whole Home Efficiency	1.58	3.46	5.45	7.47	9.52	11.59	13.71	15.85	18.03	20.23	22.27	24.00	25.73	27.49	29.27	30.97	32.01	33.01	33.78	34.56	35.04
Residential	Residential Behavioral	0.35	0.36	0.36	0.36	0.37	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Residential	**Subtotal**	**3.72**	**7.49**	**11.43**	**15.13**	**18.83**	**22.24**	**26.05**	**29.93**	**33.88**	**37.88**	**41.30**	**44.41**	**47.30**	**50.20**	**53.16**	**56.12**	**57.58**	**59.00**	**60.11**	**61.23**	**62.05**
Commercial	Commercial Prescriptive	1.20	2.42	3.44	4.51	5.20	5.74	6.38	7.05	7.94	8.82	9.38	9.96	10.71	11.45	12.18	12.36	12.49	12.56	12.52	12.47	12.19
Commercial	Commercial Custom	0.04	0.08	0.12	0.16	0.21	0.26	0.32	0.37	0.43	0.49	0.54	0.60	0.65	0.71	0.77	0.81	0.85	0.89	0.92	0.95	0.98
Commercial	SBDI	0.12	0.22	0.30	0.37	0.44	0.52	0.59	0.67	0.76	0.85	0.88	0.92	0.98	1.05	1.13	1.14	1.16	1.16	1.15	1.14	1.11
Commercial	Midstream Food Service	0.01	0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.13	0.15	0.16	0.15	0.14	0.13	0.12	0.10	0.09	0.08	0.06	0.05
Commercial	SEM	0.03	0.06	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08
Commercial	Retrocommissioning	0.04	0.09	0.14	0.14	0.15	0.15	0.15	0.16	0.16	0.17	0.18	0.19	0.21	0.24	0.27	0.32	0.38	0.44	0.55	0.67	0.79
Commercial	**Subtotal**	**1.43**	**2.89**	**4.12**	**5.32**	**6.15**	**6.83**	**7.62**	**8.45**	**9.50**	**10.55**	**11.21**	**11.91**	**12.79**	**13.68**	**14.56**	**14.84**	**15.07**	**15.22**	**15.31**	**15.37**	**15.19**
Portfolio	**EE Programs**	**5.16**	**10.74**	**16.26**	**21.60**	**26.80**	**31.64**	**36.59**	**41.63**	**46.75**	**51.93**	**57.12**	**62.36**	**67.65**	**72.99**	**78.39**	**83.54**	**88.66**	**93.76**	**98.94**	**104.24**	**109.65**
Residential	Critical Peak Pricing (Res)	-	0.72	1.38	1.97	2.47	2.99	2.87	2.74	2.75	2.76	2.78	2.79	2.80	2.82	2.83	2.84	2.86	2.87	2.88	2.90	2.91
Residential	DLC Smart Thermostat	-	1.05	2.38	4.01	6.21	8.45	11.01	13.88	14.00	14.12	14.23	14.34	14.44	14.55	14.65	14.75	14.85	14.95	15.04	15.10	15.16
Residential	Time of Use Rate (Res)	0.81	1.60	2.37	3.10	3.77	3.65	3.51	3.35	3.36	3.37	3.39	3.41	3.42	3.44	3.46	3.47	3.49	3.51	3.52	3.54	3.56
Commercial	Critical Peak Pricing (Non Res)	-	0.59	1.16	1.71	2.25	2.77	2.71	2.65	2.59	2.58	2.59	2.60	2.61	2.63	2.64	2.65	2.66	2.67	2.68	2.69	2.70
Commercial	Real Time Pricing	-	0.19	0.37	0.53	0.67	0.80	0.78	0.76	0.74	0.74	0.74	0.75	0.75	0.75	0.76	0.76	0.76	0.77	0.77	0.77	0.78
Commercial	Time of Use Rate (Non Res)	0.01	0.04	0.06	0.10	0.13	0.16	0.21	0.26	0.30	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Portfolio	**Subtotal DR Programs**	**0.82**	**4.19**	**7.73**	**11.42**	**15.49**	**18.82**	**21.09**	**23.63**	**23.75**	**23.90**	**24.05**	**24.20**	**24.35**	**24.50**	**24.65**	**24.80**	**24.94**	**25.08**	**25.22**	**25.33**	**25.42**
Portfolio	**All Programs**	**5.98**	**15.64**	**28.66**	**45.10**	**65.37**	**88.51**	**114.03**	**142.19**	**170.57**	**199.14**	**227.89**	**256.83**	**285.97**	**315.32**	**344.87**	**374.32**	**403.88**	**433.56**	**463.47**	**493.60**	**523.93**

Table 5-52 – Incremental Net Energy Savings by Program (MWh)

Sector	Bundle	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings	MWh Savings
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	2,823	2,887	3,019	3,100	3,213	3,280	3,344	3,408	3,471	3,519	3,575	3,617	3,656	3,690	3,726	3,769	3,682	3,717	3,755	3,715	3,789
Residential	Retail Lighting	4,679	5,744	5,109	1,212	56	30	31	32	39	41	42	60	44	45	45	46	47	42	39	38	39
Residential	Appliance Recycling	-	-	-	-	-	-	-	-	125	126	127	128	130	131	132	133	134	136	137	140	143
Residential	Whole Home Efficiency	3,020	3,465	3,593	3,557	3,461	3,503	3,564	3,622	3,678	3,727	3,778	3,824	3,865	3,905	3,945	3,990	3,976	3,984	4,024	4,048	4,129
Residential	Residential Behavioral	719	725	731	738	743	32	11	11	11	11	11	11	11	12	12	12	12	12	12	12	13
Residential	**Subtotal**	**11,241**	**12,822**	**12,453**	**8,606**	**7,473**	**6,845**	**6,950**	**7,073**	**7,325**	**7,424**	**7,534**	**7,641**	**7,706**	**7,781**	**7,860**	**7,949**	**7,851**	**7,892**	**7,967**	**7,953**	**8,112**
Commercial	Commercial Prescriptive	5,380	5,609	4,868	5,470	4,796	4,451	4,730	4,840	4,927	4,826	4,666	4,612	4,692	4,745	4,744	3,256	2,897	2,552	2,365	2,307	2,353
Commercial	Commercial Custom	611	627	641	692	704	715	724	733	741	749	755	761	766	771	759	742	732	724	717	682	696
Commercial	SBDI	610	569	417	431	457	465	480	493	528	526	495	488	479	475	473	230	212	175	149	138	141
Commercial	Midstream Food Service	47	53	58	62	65	67	69	70	71	63	58	56	9	4	7	6	4	3	2	1	1
Commercial	SEM	318	317	316	315	313	312	310	309	307	306	304	302	301	299	297	295	293	292	290	291	297
Commercial	Retrocommissioning	1,793	1,807	1,807	1,806	1,805	1,803	1,802	1,800	1,798	1,815	1,833	1,836	1,900	1,943	1,959	2,115	2,211	2,252	2,605	2,812	2,868
Commercial	**Subtotal**	**8,759**	**8,983**	**8,108**	**8,775**	**8,139**	**7,813**	**8,115**	**8,245**	**8,372**	**8,285**	**8,112**	**8,055**	**8,146**	**8,237**	**8,239**	**6,644**	**6,350**	**5,997**	**6,128**	**6,230**	**6,355**
Portfolio	**EE Programs**	**20,000**	**21,804**	**20,561**	**17,382**	**15,613**	**14,659**	**15,065**	**15,318**	**15,697**	**15,709**	**15,645**	**15,696**	**15,852**	**16,018**	**16,099**	**14,594**	**14,201**	**13,888**	**14,096**	**14,184**	**14,468**
Residential	Critical Peak Pricing (Res)	-	14	28	39	49	60	57	55	55	55	56	56	56	56	57	57	57	57	58	58	58
Residential	DLC Smart Thermostat	-	42	95	160	248	338	440	555	560	565	569	573	578	582	586	590	594	598	602	604	606
Residential	Time of Use Rate (Res)	547	1,083	1,603	2,098	2,546	2,466	2,372	2,261	2,270	2,281	2,291	2,303	2,314	2,325	2,337	2,348	2,359	2,370	2,382	2,396	2,405
Commercial	Critical Peak Pricing (Non Res)	-	10	20	29	39	48	47	46	45	44	45	45	45	45	45	45	46	46	46	46	46
Commercial	Real Time Pricing	-	129	248	356	452	539	526	514	504	501	503	505	508	510	512	515	517	519	521	523	524
Commercial	Time of Use Rate (Non Res)	8	26	43	65	86	108	140	172	205	216	216	216	216	216	216	216	216	216	216	216	216
Portfolio	**Subtotal DR Programs**	**555**	**1,305**	**2,037**	**2,748**	**3,421**	**3,558**	**3,583**	**3,603**	**3,638**	**3,662**	**3,680**	**3,698**	**3,716**	**3,734**	**3,752**	**3,770**	**3,788**	**3,806**	**3,823**	**3,842**	**3,856**
Portfolio	**All Programs**	**20,555**	**23,109**	**22,597**	**20,129**	**19,034**	**18,217**	**18,648**	**18,922**	**19,335**	**19,372**	**19,325**	**19,394**	**19,568**	**19,753**	**19,851**	**18,364**	**17,989**	**17,694**	**17,919**	**18,026**	**18,324**

Table 5-53 – Cumulative Net Energy Savings by Program (MWh)

Sector	Bundle	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings	Cumulative MWh Savings
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	2,823	5,710	8,718	11,806	15,008	18,277	21,610	25,006	28,465	31,961	34,798	37,662	40,477	43,300	46,144	48,691	49,634	50,565	51,394	51,927	52,454
Residential	Retail Lighting	4,679	10,423	15,532	16,744	16,800	16,829	16,861	16,893	16,933	16,973	16,002	14,819	10,450	5,799	1,482	538	557	599	638	676	714
Residential	Appliance Recycling	-	-	-	-	-	-	-	-	125	252	379	497	614	732	851	859	866	874	882	892	903
Residential	Whole Home Efficiency	3,020	6,486	10,079	13,636	17,097	20,600	24,164	27,786	31,464	35,185	38,440	41,285	43,967	46,699	49,513	52,256	54,024	55,695	56,947	58,087	58,780
Residential	Residential Behavioral	719	725	731	738	743	32	11	11	11	11	11	11	11	12	12	12	12	12	12	12	13
Residential	**Subtotal**	**11,241**	**23,344**	**35,060**	**42,924**	**49,648**	**55,739**	**62,645**	**69,696**	**76,998**	**84,382**	**89,631**	**94,274**	**95,519**	**96,542**	**98,002**	**102,355**	**105,093**	**107,745**	**109,874**	**111,594**	**112,863**
Commercial	Commercial Prescriptive	5,380	10,989	15,857	21,327	25,083	28,157	31,715	35,412	40,147	44,787	48,080	51,460	55,446	59,470	63,439	64,863	65,726	66,137	65,755	65,222	63,695
Commercial	Commercial Custom	611	1,238	1,879	2,571	3,274	3,987	4,710	5,442	6,182	6,929	7,559	8,195	8,785	9,367	9,937	10,376	10,804	11,222	11,473	11,686	11,726
Commercial	SBDI	610	1,179	1,595	2,027	2,484	2,948	3,428	3,920	4,447	4,973	5,233	5,532	5,909	6,330	6,760	6,798	6,800	6,759	6,611	6,430	6,154
Commercial	Midstream Food Service	47	100	158	220	285	352	421	491	562	625	681	736	697	648	597	541	481	417	351	282	212
Commercial	SEM	318	635	951	948	944	940	936	931	927	922	917	912	907	902	896	891	886	880	875	873	878
Commercial	Retrocommissioning	1,793	3,601	5,408	6,998	8,568	10,130	11,685	11,655	11,622	11,607	11,611	11,619	11,672	11,751	11,840	12,022	12,255	12,513	12,968	13,532	14,112
Commercial	**Subtotal**	**8,759**	**17,742**	**25,849**	**34,090**	**40,638**	**46,514**	**52,894**	**57,850**	**63,886**	**69,842**	**74,081**	**78,453**	**83,416**	**88,467**	**93,469**	**95,491**	**96,952**	**97,929**	**98,032**	**98,025**	**96,777**
Portfolio	**EE Programs**	**20,000**	**41,086**	**60,910**	**77,014**	**90,286**	**102,253**	**115,539**	**127,546**	**140,885**	**154,224**	**163,712**	**172,727**	**178,935**	**185,009**	**191,470**	**197,846**	**202,044**	**205,674**	**207,906**	**209,620**	**209,640**
Residential	Critical Peak Pricing (Res)	-	14	28	39	49	60	57	55	55	55	56	56	56	56	57	57	57	57	58	58	58
Residential	DLC Smart Thermostat	-	42	95	160	248	338	440	555	560	565	569	573	578	582	586	590	594	598	602	604	606
Residential	Time of Use Rate (Res)	547	1,083	1,603	2,098	2,546	2,466	2,372	2,261	2,270	2,281	2,291	2,303	2,314	2,325	2,337	2,348	2,359	2,370	2,382	2,396	2,405
Commercial	Critical Peak Pricing (Non Res)	-	10	20	29	39	48	47	46	45	44	45	45	45	45	45	45	46	46	46	46	46
Commercial	Real Time Pricing	-	129	248	356	452	539	526	514	504	501	503	505	508	510	512	515	517	519	521	523	524
Commercial	Time of Use Rate (Non Res)	8	26	43	65	86	108	140	172	205	216	216	216	216	216	216	216	216	216	216	216	216
Portfolio	**Subtotal DR Programs**	**555**	**1,305**	**2,037**	**2,748**	**3,421**	**3,558**	**3,583**	**3,603**	**3,638**	**3,662**	**3,680**	**3,698**	**3,716**	**3,734**	**3,752**	**3,770**	**3,788**	**3,806**	**3,823**	**3,842**	**3,856**
Portfolio	**All Programs**	**20,555**	**42,391**	**62,946**	**79,762**	**93,707**	**105,812**	**119,122**	**131,150**	**144,522**	**157,886**	**167,391**	**176,425**	**182,651**	**188,743**	**195,222**	**201,617**	**205,833**	**209,480**	**211,729**	**213,462**	**213,496**

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 costs of each end-use measure are shown in Appendix C of the Technical Volume 5 Appendix 5B document.

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;

Liberty-Empire considered multiple lets of incentives as a part of the different bundle scenarios. The incentives varied depending on the scenario analyzed (e.g. the RAP scenario versus the MAP scenario).

- RAP – Incentives are 25% of incremental cost
- RAP – Incentives are 50% of incremental cost
- RAP + - Incentives are 75% of incremental cost
- MAP – Incentives are 100% of incremental cost
- RAP + TOU Opt-Out – Incentives are 50% of incremental cost

The incentive costs of each end-use measure included in the DSM Bundles are shown in Appendix C of the Technical Volume 5B Appendix document.

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 Portfolio cost of incentives to customers to participate in the DSM Programs is shown in the table below.

Table 5-54 – Total Incentives per Program

Sector	Bundle	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$416,413	$426,781	$478,280	$494,664	$574,015	$588,659	$602,870	$616,859	$630,743	$643,683	$656,993	$665,509	$674,617	$681,578	$689,075	$697,726	$671,927	$679,279	$687,281	$671,025	$684,445
Residential	Retail Lighting	$222,366	$272,881	$176,583	$48,216	$3,994	$3,772	$3,934	$4,076	$4,203	$4,316	$4,419	$6,317	$4,600	$4,682	$4,759	$4,832	$4,901	$4,367	$4,060	$3,916	$3,994
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$8,081	$8,185	$8,289	$8,393	$8,496	$8,599	$8,702	$8,805	$8,907	$9,010	$9,112	$9,326	$9,512
Residential	Whole Home Efficiency	$554,903	$761,328	$829,745	$843,942	$884,409	$901,786	$920,446	$937,803	$955,118	$974,068	$991,205	$1,006,246	$1,020,540	$1,034,055	$1,047,983	$1,062,628	$1,061,837	$1,066,649	$1,080,503	$1,088,829	$1,110,606
Residential	Residential Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residential	**Subtotal**	**$1,193,682**	**$1,460,990**	**$1,484,609**	**$1,386,822**	**$1,462,417**	**$1,494,217**	**$1,527,250**	**$1,558,738**	**$1,598,145**	**$1,630,252**	**$1,660,906**	**$1,686,465**	**$1,708,254**	**$1,728,914**	**$1,750,519**	**$1,773,991**	**$1,747,573**	**$1,759,305**	**$1,780,956**	**$1,773,095**	**$1,808,557**
Commercial	Commercial Prescriptive	$668,034	$754,604	$798,655	$936,980	$957,136	$982,814	$1,012,684	$1,034,734	$1,049,797	$1,029,348	$1,009,179	$1,004,307	$999,465	$995,377	$988,560	$674,410	$589,371	$500,743	$455,205	$439,934	$448,733
Commercial	Commercial Custom	$62,218	$64,866	$67,260	$80,776	$82,715	$84,454	$86,012	$87,402	$88,639	$89,735	$90,702	$91,550	$92,289	$92,929	$90,429	$88,063	$86,341	$84,970	$83,894	$83,950	$85,629
Commercial	SBDI	$137,159	$149,885	$158,721	$186,519	$195,226	$202,229	$208,202	$213,174	$217,506	$214,938	$212,471	$210,777	$209,437	$208,497	$207,847	$138,532	$133,246	$113,734	$100,882	$95,232	$97,137
Commercial	Midstream Food Service	$8,212	$9,223	$10,144	$10,790	$11,319	$11,722	$11,998	$12,275	$12,447	$11,026	$10,202	$9,825	$1,716	$772	$1,364	$1,077	$813	$609	$466	$152	$155
Commercial	SEM	$18,269	$18,229	$18,186	$18,139	$18,087	$18,032	$17,973	$17,911	$17,845	$17,777	$17,705	$17,630	$17,552	$17,472	$17,389	$17,304	$17,216	$17,126	$17,034	$17,145	$17,488
Commercial	Retrocommissioning	$15,107	$16,321	$16,683	$17,046	$17,411	$17,777	$18,145	$18,513	$18,883	$20,489	$22,086	$22,837	$27,295	$30,518	$32,049	$42,230	$48,722	$51,834	$74,260	$86,599	$88,331
Commercial	**Subtotal**	**$908,998**	**$1,013,127**	**$1,069,648**	**$1,250,249**	**$1,281,893**	**$1,317,028**	**$1,355,014**	**$1,384,010**	**$1,405,118**	**$1,383,312**	**$1,362,344**	**$1,356,926**	**$1,347,755**	**$1,345,564**	**$1,337,639**	**$961,617**	**$875,709**	**$769,015**	**$731,741**	**$723,012**	**$737,472**
Portfolio	**EE Programs**	**$2,102,680**	**$2,474,118**	**$2,554,258**	**$2,637,071**	**$2,744,310**	**$2,811,245**	**$2,882,264**	**$2,942,748**	**$3,003,263**	**$3,013,565**	**$3,023,250**	**$3,043,391**	**$3,056,009**	**$3,074,478**	**$3,088,157**	**$2,735,607**	**$2,623,282**	**$2,528,321**	**$2,512,697**	**$2,496,107**	**$2,546,029**
Residential	Critical Peak Pricing (Res)	$0	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197
Residential	DLC Smart Thermostat	$0	$105,223	$152,489	$210,379	$288,790	$368,954	$460,625	$564,040	$569,232	$574,327	$579,306	$584,193	$589,005	$593,751	$598,450	$603,112	$607,728	$612,300	$616,892	$618,902	$621,019
Residential	Time of Use Rate (Res)	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116
Commercial	Critical Peak Pricing (Non Res)	$0	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803
Commercial	Real Time Pricing	$0	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000
Commercial	Time of Use Rate (Non Res)	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884
Portfolio	**Subtotal DR Programs**	**$75,000**	**$330,223**	**$377,489**	**$435,379**	**$513,790**	**$593,954**	**$685,625**	**$789,040**	**$794,232**	**$799,327**	**$804,306**	**$809,193**	**$814,005**	**$818,751**	**$823,450**	**$828,112**	**$832,728**	**$837,300**	**$841,892**	**$843,902**	**$846,019**
Portfolio	**All Programs**	**$2,177,680**	**$2,804,340**	**$2,931,746**	**$3,072,450**	**$3,258,100**	**$3,405,199**	**$3,567,889**	**$3,731,788**	**$3,797,495**	**$3,812,891**	**$3,827,556**	**$3,852,585**	**$3,870,013**	**$3,893,228**	**$3,911,608**	**$3,563,719**	**$3,456,010**	**$3,365,620**	**$3,354,589**	**$3,340,009**	**$3,392,048**

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

The RAP Portfolio cost to the customer and utility to implement the DSM Programs is shown in the tables below. Budget categories for the total utility costs include program delivery, administration, education/marketing, tracking/reporting, and evaluation. Incentives are not included in this total.

Table 5-55 – Total Utility Costs per Program

Sector	Bundle	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$582,834	$597,346	$669,427	$692,359	$803,422	$823,919	$843,809	$863,388	$882,822	$900,933	$919,562	$931,482	$944,230	$953,973	$964,466	$976,575	$940,465	$950,756	$961,956	$939,202	$957,986
Residential	Retail Lighting	$327,673	$402,111	$260,209	$71,049	$5,885	$5,559	$5,797	$6,007	$6,193	$6,360	$6,512	$9,308	$6,779	$6,899	$7,012	$7,120	$7,222	$6,435	$5,983	$5,770	$5,886
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$0	$23,189	$23,488	$23,786	$24,083	$24,676	$24,972	$25,267	$25,561	$25,854	$26,147	$26,761	$27,296
Residential	Whole Home Efficiency	$918,677	$1,260,428	$1,373,697	$1,397,200	$1,464,196	$1,492,964	$1,523,858	$1,552,593	$1,581,259	$1,612,632	$1,641,004	$1,665,906	$1,689,570	$1,711,944	$1,735,003	$1,759,248	$1,757,940	$1,765,907	$1,788,842	$1,802,626	$1,838,679
Residential	Residential Behavioral	$29,792	$30,359	$30,930	$31,505	$32,083	$1,395	$482	$490	$500	$511	$522	$534	$545	$557	$568	$580	$592	$604	$617	$637	$0
Residential	**Subtotal**	**$1,858,976**	**$2,290,244**	**$2,334,263**	**$2,192,113**	**$2,305,586**	**$2,323,837**	**$2,373,946**	**$2,422,478**	**$2,493,963**	**$2,543,925**	**$2,591,386**	**$2,631,314**	**$2,665,505**	**$2,698,049**	**$2,732,022**	**$2,768,790**	**$2,731,780**	**$2,749,556**	**$2,783,544**	**$2,774,997**	**$2,829,847**
Commercial	Commercial Prescriptive	$911,633	$1,029,771	$1,089,885	$1,278,650	$1,306,156	$1,341,197	$1,381,960	$1,412,051	$1,432,606	$1,404,700	$1,377,176	$1,370,528	$1,363,921	$1,358,341	$1,349,038	$920,334	$804,285	$683,339	$621,195	$600,356	$612,363
Commercial	Commercial Custom	$102,224	$106,574	$110,508	$132,716	$135,900	$138,759	$141,318	$143,602	$145,634	$147,435	$149,023	$150,416	$151,631	$152,682	$148,575	$144,688	$141,859	$139,606	$137,839	$137,930	$140,688
Commercial	SBDI	$193,223	$211,151	$223,599	$262,759	$275,025	$284,891	$293,306	$300,310	$306,413	$302,795	$299,320	$296,934	$295,046	$293,721	$292,806	$195,157	$187,711	$160,224	$142,118	$134,159	$136,842
Commercial	Midstream Food Service	$11,206	$12,586	$13,842	$14,724	$15,447	$15,997	$16,373	$16,752	$16,986	$15,047	$13,922	$13,408	$2,341	$1,054	$1,862	$1,470	$1,109	$831	$635	$208	$212
Commercial	SEM	$28,273	$28,212	$28,145	$28,071	$27,992	$27,906	$27,815	$27,719	$27,618	$27,511	$27,400	$27,284	$27,164	$27,040	$26,911	$26,779	$26,643	$26,504	$26,362	$26,534	$27,064
Commercial	Retrocommissioning	$21,739	$23,485	$24,006	$24,529	$25,054	$25,581	$26,110	$26,641	$27,173	$29,484	$31,782	$32,863	$39,277	$43,915	$46,119	$60,770	$70,111	$74,589	$106,861	$124,616	$127,108
Commercial	**Subtotal**	**$1,268,298**	**$1,411,779**	**$1,489,986**	**$1,741,450**	**$1,785,574**	**$1,834,331**	**$1,886,882**	**$1,927,074**	**$1,956,430**	**$1,926,971**	**$1,898,623**	**$1,891,432**	**$1,879,381**	**$1,876,753**	**$1,865,312**	**$1,349,199**	**$1,231,719**	**$1,085,092**	**$1,035,010**	**$1,023,802**	**$1,044,278**
Portfolio	**EE Programs**	**$3,127,274**	**$3,702,023**	**$3,824,249**	**$3,933,563**	**$4,091,160**	**$4,158,168**	**$4,260,828**	**$4,349,552**	**$4,450,393**	**$4,470,896**	**$4,490,009**	**$4,522,746**	**$4,544,885**	**$4,574,802**	**$4,597,333**	**$4,117,989**	**$3,963,499**	**$3,834,648**	**$3,818,554**	**$3,798,799**	**$3,874,125**
Residential	Critical Peak Pricing (Res)	$0	$318,106	$293,705	$266,019	$231,127	$241,019	$43,312	$43,312	$47,952	$47,636	$47,289	$46,997	$46,738	$46,506	$46,315	$46,143	$45,956	$45,775	$45,724	$47,257	$47,467
Residential	DLC Smart Thermostat	$0	$243,695	$327,183	$422,417	$572,968	$659,244	$791,335	$935,981	$595,742	$600,488	$605,060	$609,624	$614,165	$618,679	$623,215	$627,743	$632,195	$636,608	$641,272	$634,379	$636,873
Residential	Time of Use Rate (Res)	$345,486	$340,522	$331,281	$317,390	$292,334	$47,876	$47,876	$47,876	$53,380	$53,006	$52,595	$52,247	$51,941	$51,665	$51,438	$51,235	$51,013	$50,798	$50,738	$52,556	$52,806
Commercial	Critical Peak Pricing (Non Res)	$0	$101,553	$100,411	$98,619	$96,782	$95,035	$41,512	$41,512	$41,512	$41,512	$42,655	$42,638	$42,622	$42,605	$42,590	$42,572	$42,555	$42,543	$42,525	$42,521	$42,512
Commercial	Real Time Pricing	$0	$106,953	$105,402	$103,685	$102,009	$100,413	$87,329	$87,329	$87,329	$87,329	$87,657	$87,652	$87,648	$87,643	$87,639	$87,634	$87,629	$87,625	$87,620	$87,619	$87,616
Commercial	Time of Use Rate (Non Res)	$51,718	$64,106	$64,223	$70,485	$70,479	$70,521	$85,945	$85,815	$87,218	$56,378	$40,810	$40,789	$40,770	$40,751	$40,732	$40,711	$40,692	$40,677	$40,656	$40,651	$40,640
Portfolio	**Subtotal DR Programs**	**$397,204**	**$1,174,935**	**$1,222,204**	**$1,278,615**	**$1,365,699**	**$1,214,107**	**$1,097,309**	**$1,241,825**	**$913,133**	**$886,349**	**$876,067**	**$879,947**	**$883,884**	**$887,849**	**$891,929**	**$896,036**	**$900,040**	**$904,026**	**$908,535**	**$904,982**	**$907,915**
Portfolio	**All Programs**	**$3,876,926**	**$5,364,654**	**$5,551,098**	**$5,733,396**	**$6,002,545**	**$5,909,503**	**$5,893,950**	**$6,150,514**	**$5,899,879**	**$5,892,969**	**$5,902,684**	**$5,942,963**	**$5,971,646**	**$6,008,916**	**$6,038,188**	**$5,515,428**	**$5,349,894**	**$5,212,542**	**$5,190,798**	**$5,174,159**	**$5,260,243**

Table 5-56 – Total Customer Incremental Costs per Program (NPV)

Sector	Bundle	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$687,063	$704,170	$789,148	$816,181	$947,109	$971,272	$994,719	$1,017,800	$1,040,710	$1,062,061	$1,084,021	$1,098,073	$1,113,100	$1,124,585	$1,136,955	$1,151,230	$1,108,661	$1,120,792	$1,133,995	$1,107,172	$1,129,315
Residential	Retail Lighting	$365,902	$449,029	$290,223	$79,305	$6,583	$6,224	$6,491	$6,726	$6,935	$7,122	$7,291	$10,420	$7,591	$7,725	$7,852	$7,972	$8,087	$7,206	$6,699	$6,461	$6,590
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$13,331	$13,503	$13,674	$13,845	$14,016	$14,186	$14,356	$14,525	$14,694	$14,863	$15,031	$15,384	$15,692
Residential	Whole Home Efficiency	$757,616	$1,095,676	$1,206,043	$1,226,967	$1,291,262	$1,317,428	$1,345,716	$1,371,859	$1,397,940	$1,426,726	$1,452,527	$1,474,876	$1,496,000	$1,515,843	$1,536,376	$1,558,098	$1,554,358	$1,559,873	$1,580,309	$1,588,953	$1,620,733
Residential	Residential Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residential	**Subtotal**	**$1,810,581**	**$2,248,875**	**$2,285,414**	**$2,122,454**	**$2,244,954**	**$2,294,924**	**$2,346,926**	**$2,396,386**	**$2,458,915**	**$2,509,411**	**$2,557,514**	**$2,597,215**	**$2,630,707**	**$2,662,339**	**$2,695,539**	**$2,731,825**	**$2,685,800**	**$2,702,733**	**$2,736,035**	**$2,717,971**	**$2,772,330**
Commercial	Commercial Prescriptive	$1,046,807	$1,185,254	$1,254,440	$1,435,337	$1,465,026	$1,503,284	$1,549,543	$1,583,391	$1,606,880	$1,575,871	$1,544,687	$1,525,323	$1,511,514	$1,500,907	$1,487,070	$974,104	$837,184	$698,099	$627,133	$602,160	$614,203
Commercial	Commercial Custom	$69,244	$73,671	$77,689	$100,066	$103,346	$106,305	$108,971	$111,367	$113,516	$115,439	$117,154	$118,679	$120,030	$121,221	$117,238	$113,481	$110,789	$108,682	$107,065	$106,941	$109,080
Commercial	SBDI	$202,106	$220,121	$232,331	$276,328	$289,210	$299,603	$308,552	$316,055	$322,670	$318,032	$313,671	$310,674	$308,332	$306,708	$305,609	$191,252	$182,576	$154,956	$136,515	$128,357	$130,924
Commercial	Midstream Food Service	$11,955	$13,439	$14,813	$15,764	$16,548	$17,142	$17,603	$18,053	$18,324	$16,201	$14,966	$14,351	$2,225	$807	$1,672	$1,250	$862	$568	$362	$240	$245
Commercial	SEM	$14,233	$14,195	$14,155	$14,111	$14,065	$14,015	$13,963	$13,908	$13,851	$13,791	$13,729	$13,664	$13,598	$13,529	$13,459	$13,387	$13,313	$13,237	$13,160	$13,240	$13,505
Commercial	Retrocommissioning	$2,419	$2,414	$2,408	$2,402	$2,395	$2,388	$2,380	$2,372	$2,364	$2,355	$2,346	$2,336	$2,326	$2,315	$2,304	$2,293	$2,282	$2,270	$2,258	$2,273	$2,318
Commercial	**Subtotal**	**$1,346,763**	**$1,509,094**	**$1,595,836**	**$1,844,008**	**$1,890,589**	**$1,942,739**	**$2,001,012**	**$2,045,146**	**$2,077,604**	**$2,041,689**	**$2,006,553**	**$1,985,027**	**$1,958,025**	**$1,945,487**	**$1,927,353**	**$1,295,766**	**$1,147,006**	**$977,812**	**$886,494**	**$853,211**	**$870,275**
Portfolio	**EE Programs**	**$3,157,344**	**$3,757,969**	**$3,881,250**	**$3,966,462**	**$4,135,543**	**$4,237,663**	**$4,347,938**	**$4,441,532**	**$4,536,519**	**$4,551,100**	**$4,564,067**	**$4,582,242**	**$4,588,732**	**$4,607,827**	**$4,622,892**	**$4,027,591**	**$3,832,806**	**$3,680,545**	**$3,622,528**	**$3,571,182**	**$3,642,605**
Residential	Critical Peak Pricing (Res)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residential	DLC Smart Thermostat	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residential	Time of Use Rate (Res)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commercial	Critical Peak Pricing (Non Res)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commercial	Real Time Pricing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commercial	Time of Use Rate (Non Res)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Portfolio	**Subtotal DR Programs**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Portfolio	**All Programs**	**$3,157,344**	**$3,757,969**	**$3,881,250**	**$3,966,462**	**$4,135,543**	**$4,237,663**	**$4,347,938**	**$4,441,532**	**$4,536,519**	**$4,551,100**	**$4,564,067**	**$4,582,242**	**$4,588,732**	**$4,607,827**	**$4,622,892**	**$4,027,591**	**$3,832,806**	**$3,680,545**	**$3,622,528**	**$3,571,182**	**$3,642,605**

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

The RAP Portfolio utility's cost to administer the DSM Programs is shown in the tables below. The administrative budget includes the portfolio level costs within the All Programs row associated with evaluation (5%), portfolio administration (3%), and portfolio marketing (3%).

Table 5-57 – Total Utility Non-Incentive Cost per Program

Sector	Bundle	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget	Total Electric Non-Incentive Budget
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$166,421	$170,565	$191,146	$197,694	$229,407	$235,260	$240,939	$246,530	$252,079	$257,250	$262,569	$265,973	$269,613	$272,395	$275,391	$278,849	$268,538	$271,476	$274,674	$268,177	$273,541
Residential	Retail Lighting	$105,307	$129,230	$83,626	$22,834	$1,891	$1,786	$1,863	$1,930	$1,990	$2,044	$2,093	$2,992	$2,179	$2,217	$2,254	$2,288	$2,321	$2,068	$1,923	$1,854	$1,892
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$15,108	$15,303	$15,497	$15,691	$15,884	$16,077	$16,270	$16,462	$16,653	$16,844	$17,035	$17,435	$17,784
Residential	Whole Home Efficiency	$363,775	$499,099	$543,951	$553,258	$579,787	$591,178	$603,412	$614,790	$626,141	$638,564	$649,799	$659,659	$669,030	$677,889	$687,020	$696,621	$696,102	$699,257	$708,339	$713,797	$728,073
Residential	Residential Behavioral	$29,792	$30,359	$30,930	$31,505	$32,083	$1,395	$482	$490	$500	$511	$522	$534	$545	$557	$568	$580	$592	$604	$617	$637	$0
Residential	**Subtotal**	**$665,294**	**$829,253**	**$849,654**	**$805,291**	**$843,169**	**$829,620**	**$846,696**	**$863,740**	**$895,818**	**$913,672**	**$930,480**	**$944,848**	**$957,251**	**$969,135**	**$981,503**	**$994,800**	**$984,207**	**$990,250**	**$1,002,588**	**$1,001,902**	**$1,021,290**
Commercial	Commercial Prescriptive	$243,599	$275,167	$291,230	$341,670	$349,020	$358,383	$369,276	$377,316	$382,809	$375,352	$367,997	$366,221	$364,455	$362,964	$360,479	$245,924	$214,914	$182,596	$165,991	$160,422	$163,631
Commercial	Commercial Custom	$40,006	$41,709	$43,248	$51,939	$53,186	$54,304	$55,306	$56,200	$56,995	$57,700	$58,321	$58,867	$59,342	$59,753	$58,146	$56,625	$55,518	$54,636	$53,944	$53,980	$55,060
Commercial	SBDI	$56,064	$61,266	$64,878	$76,241	$79,800	$82,662	$85,104	$87,136	$88,907	$87,857	$86,849	$86,157	$85,609	$85,224	$84,959	$56,626	$54,465	$46,490	$41,236	$38,927	$39,705
Commercial	Midstream Food Service	$2,994	$3,363	$3,699	$3,934	$4,128	$4,275	$4,375	$4,476	$4,539	$4,021	$3,720	$3,583	$626	$282	$498	$393	$296	$222	$170	$55	$57
Commercial	SEM	$10,004	$9,983	$9,959	$9,933	$9,905	$9,874	$9,842	$9,808	$9,772	$9,735	$9,695	$9,654	$9,612	$9,568	$9,522	$9,476	$9,428	$9,378	$9,328	$9,389	$9,577
Commercial	Retrocommissioning	$6,632	$7,165	$7,324	$7,483	$7,643	$7,804	$7,966	$8,127	$8,290	$8,995	$9,696	$10,026	$11,983	$13,397	$14,070	$18,539	$21,389	$22,755	$32,601	$38,017	$38,777
Commercial	**Subtotal**	**$359,300**	**$398,652**	**$420,338**	**$491,201**	**$503,681**	**$517,303**	**$531,868**	**$543,064**	**$551,312**	**$543,659**	**$536,279**	**$534,506**	**$531,626**	**$531,189**	**$527,673**	**$387,582**	**$356,010**	**$316,077**	**$303,269**	**$300,790**	**$306,806**
Portfolio	**EE Programs**	**$1,024,594**	**$1,227,905**	**$1,269,992**	**$1,296,492**	**$1,346,849**	**$1,346,923**	**$1,378,564**	**$1,406,804**	**$1,447,130**	**$1,457,331**	**$1,466,759**	**$1,479,355**	**$1,488,877**	**$1,500,324**	**$1,509,176**	**$1,382,382**	**$1,340,217**	**$1,306,327**	**$1,305,857**	**$1,302,692**	**$1,328,095**
Residential	Critical Peak Pricing (Res)	$0	$280,909	$256,508	$228,822	$193,930	$203,822	$6,115	$6,115	$10,755	$10,439	$10,092	$9,800	$9,541	$9,309	$9,118	$8,946	$8,759	$8,578	$8,527	$10,060	$10,270
Residential	DLC Smart Thermostat	$0	$138,472	$174,694	$212,038	$284,178	$290,290	$330,710	$371,941	$26,510	$26,162	$25,754	$25,431	$25,180	$24,929	$24,765	$24,630	$24,467	$24,309	$24,381	$15,477	$15,854
Residential	Time of Use Rate (Res)	$304,370	$299,406	$290,164	$276,274	$251,217	$6,759	$6,759	$6,759	$12,264	$11,889	$11,478	$11,131	$10,824	$10,549	$10,322	$10,118	$9,897	$9,682	$9,621	$11,439	$11,689
Commercial	Critical Peak Pricing (Non Res)	$0	$63,750	$62,608	$60,816	$58,979	$57,232	$3,709	$3,709	$3,709	$3,709	$4,852	$4,835	$4,819	$4,802	$4,787	$4,769	$4,752	$4,740	$4,722	$4,718	$4,709
Commercial	Real Time Pricing	$0	$31,953	$30,402	$28,685	$27,009	$25,413	$12,329	$12,329	$12,329	$12,329	$12,657	$12,652	$12,648	$12,643	$12,639	$12,634	$12,629	$12,625	$12,620	$12,619	$12,616
Commercial	Time of Use Rate (Non Res)	$17,834	$30,222	$30,340	$36,602	$36,595	$36,637	$52,062	$51,932	$53,335	$22,494	$6,926	$6,906	$6,887	$6,867	$6,849	$6,828	$6,808	$6,793	$6,772	$6,767	$6,757
Portfolio	**Subtotal DR Programs**	**$322,204**	**$844,712**	**$844,715**	**$843,236**	**$851,909**	**$620,153**	**$411,683**	**$452,785**	**$118,901**	**$87,022**	**$71,761**	**$70,754**	**$69,879**	**$69,099**	**$68,479**	**$67,924**	**$67,312**	**$66,727**	**$66,643**	**$61,080**	**$61,896**
Portfolio	**All Programs**	**$1,699,246**	**$2,560,314**	**$2,619,352**	**$2,660,946**	**$2,744,444**	**$2,504,304**	**$2,326,060**	**$2,418,726**	**$2,102,384**	**$2,080,078**	**$2,075,127**	**$2,090,378**	**$2,101,633**	**$2,115,688**	**$2,126,581**	**$1,951,708**	**$1,893,884**	**$1,846,922**	**$1,845,209**	**$1,834,150**	**$1,868,195**

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 5-58 – Incremental Participation by Program

Sector	Bundle	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures	Total Measures
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	4,487	4,660	4,879	5,115	5,319	5,471	5,607	5,737	5,866	5,939	6,060	6,131	6,207	6,264	6,314	6,393	6,264	6,313	6,368	5,966	6,085
Residential	Retail Lighting	121,351	148,508	138,210	32,724	3,294	2,657	2,770	2,871	2,960	3,040	3,112	3,476	3,240	3,297	3,351	3,402	3,452	3,075	2,859	2,758	2,813
Residential	Appliance Recycling	0	0	0	0	0	0	0	0	342	346	351	355	359	364	368	372	377	381	385	394	402
Residential	Whole Home Efficiency	12,220	13,054	12,585	9,958	5,403	5,022	5,146	5,262	5,377	5,464	5,572	5,657	5,693	5,730	5,771	5,832	5,804	5,399	5,419	5,261	5,366
Residential	Residential Behavioral	6,194	6,312	6,430	6,550	6,670	290	100	102	104	106	109	111	113	116	118	121	123	126	128	132	135
Residential	**Subtotal**	**144,252**	**172,533**	**162,105**	**54,346**	**20,686**	**13,440**	**13,623**	**13,972**	**14,649**	**14,895**	**15,203**	**15,730**	**15,612**	**15,770**	**15,922**	**16,120**	**16,019**	**15,294**	**15,160**	**14,511**	**14,801**
Commercial	Commercial Prescriptive	36,097	33,700	27,094	23,502	24,306	19,650	20,324	20,884	21,489	21,534	21,125	21,089	20,955	20,988	20,699	18,414	17,767	15,840	14,697	14,250	14,535
Commercial	Commercial Custom	655	687	717	747	771	792	812	829	844	858	871	881	891	899	869	842	821	806	793	794	810
Commercial	SBDI	6,182	5,447	4,266	3,213	3,502	3,372	3,475	3,561	3,697	3,793	3,712	3,711	3,609	3,608	3,605	3,157	3,120	2,718	2,468	2,361	2,408
Commercial	Midstream Food Service	19	21	22	24	25	26	25	25	25	23	21	22	11	10	11	11	10	10	9	0	0
Commercial	SEM	24	24	24	24	24	24	24	24	24	24	24	24	23	23	23	23	23	23	23	23	23
Commercial	Retrocommissioning	308	309	309	308	308	307	307	306	305	306	306	306	309	311	311	320	326	327	349	363	371
Commercial	**Subtotal**	**43,285**	**40,189**	**32,432**	**27,818**	**28,936**	**24,171**	**24,966**	**25,628**	**26,385**	**26,538**	**26,059**	**26,033**	**25,799**	**25,839**	**25,519**	**22,766**	**22,067**	**19,724**	**18,339**	**17,792**	**18,148**
Portfolio	**EE Programs**	**187,537**	**212,722**	**194,536**	**82,164**	**49,622**	**37,611**	**38,589**	**39,600**	**41,033**	**41,432**	**41,262**	**41,763**	**41,411**	**41,609**	**41,441**	**38,886**	**38,087**	**35,018**	**33,498**	**32,303**	**32,949**
Residential	Critical Peak Pricing (Res)	0	3,708	7,086	10,091	12,626	15,293	14,712	14,035	14,097	14,156	14,209	14,259	14,305	14,348	14,389	14,427	14,463	14,496	14,528	14,582	14,638
Residential	DLC Smart Thermostat	0	2,245	5,115	8,629	13,386	18,248	23,806	30,074	30,382	30,685	30,980	31,270	31,554	31,835	32,113	32,389	32,662	32,932	33,203	33,324	33,453
Residential	Time of Use Rate (Res)	4,016	7,964	11,788	15,425	18,723	18,144	17,454	16,650	16,725	16,794	16,858	16,917	16,971	17,023	17,071	17,116	17,158	17,198	17,236	17,299	17,366
Commercial	Critical Peak Pricing (Non Res)	0	810	1,605	2,375	3,121	3,843	3,752	3,659	3,583	3,567	3,583	3,598	3,613	3,628	3,642	3,657	3,671	3,685	3,698	3,712	3,725
Commercial	Real Time Pricing	0	265	509	729	927	1,104	1,078	1,051	1,029	1,025	1,029	1,033	1,038	1,042	1,046	1,050	1,054	1,058	1,062	1,066	1,070
Commercial	Time of Use Rate (Non Res)	165	498	832	1,251	1,670	2,089	2,716	3,342	3,986	4,215	4,233	4,251	4,269	4,286	4,303	4,320	4,337	4,354	4,370	4,386	4,402
Portfolio	**Subtotal DR Programs**	**4,181**	**15,490**	**26,936**	**38,501**	**50,453**	**58,721**	**63,518**	**68,810**	**69,802**	**70,441**	**70,891**	**71,327**	**71,750**	**72,162**	**72,564**	**72,959**	**73,345**	**73,722**	**74,098**	**74,370**	**74,654**
Portfolio	**All Programs**	**191,718**	**228,212**	**221,472**	**120,665**	**100,075**	**96,332**	**102,107**	**108,410**	**110,835**	**111,873**	**112,153**	**113,090**	**113,161**	**113,771**	**114,005**	**111,845**	**111,431**	**108,739**	**107,596**	**106,672**	**107,602**

Table 5-59 – Cumulative Participation by Program

Sector	Bundle	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures	Cumulative Measures
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	4,487	9,147	14,026	19,141	24,460	29,931	35,538	41,275	47,141	53,080	59,141	65,272	71,478	77,742	84,056	90,449	96,713	103,026	109,394	115,360	121,445
Residential	Retail Lighting	121,351	269,858	408,068	440,792	444,086	446,742	449,513	452,383	455,343	458,383	461,495	464,971	468,210	471,507	474,859	478,261	481,713	484,788	487,647	490,405	493,218
Residential	Appliance Recycling	0	0	0	0	0	0	0	0	342	688	1,038	1,393	1,753	2,116	2,484	2,856	3,233	3,614	3,999	4,393	4,795
Residential	Whole Home Efficiency	12,220	25,274	37,859	47,816	53,219	58,241	63,387	68,649	74,026	79,490	85,061	90,719	96,412	102,141	107,912	113,744	119,548	124,947	130,366	135,627	140,993
Residential	Residential Behavioral	6,194	12,505	18,936	25,486	32,156	32,446	32,546	32,648	32,752	32,858	32,967	33,078	33,191	33,307	33,425	33,546	33,669	33,794	33,923	34,055	34,190
Residential	**Subtotal**	**144,252**	**316,784**	**478,889**	**533,235**	**553,920**	**567,360**	**580,983**	**594,955**	**609,604**	**624,499**	**639,702**	**655,432**	**671,044**	**686,814**	**702,736**	**718,856**	**734,875**	**750,170**	**765,329**	**779,840**	**794,641**
Commercial	Commercial Prescriptive	36,097	69,797	96,891	120,392	144,699	164,349	184,673	205,557	227,046	248,579	269,705	290,793	311,748	332,736	353,435	371,848	389,616	405,456	420,152	434,403	448,938
Commercial	Commercial Custom	655	1,342	2,059	2,805	3,576	4,369	5,180	6,009	6,854	7,712	8,583	9,464	10,355	11,254	12,123	12,965	13,786	14,592	15,385	16,179	16,988
Commercial	SBDI	6,182	11,629	15,895	19,109	22,611	25,983	29,458	33,018	36,716	40,509	44,221	47,932	51,542	55,149	58,754	61,911	65,031	67,749	70,217	72,578	74,986
Commercial	Midstream Food Service	19	40	62	86	111	136	161	186	210	233	254	276	288	298	309	320	330	339	349	349	349
Commercial	SEM	24	49	73	98	122	146	170	194	218	242	265	289	312	336	359	382	405	428	451	474	497
Commercial	Retrocommissioning	308	617	926	1,234	1,542	1,849	2,156	2,462	2,767	3,073	3,379	3,685	3,994	4,305	4,616	4,936	5,262	5,589	5,938	6,302	6,672
Commercial	**Subtotal**	**43,285**	**83,474**	**115,906**	**143,724**	**172,660**	**196,831**	**221,798**	**247,426**	**273,810**	**300,348**	**326,407**	**352,439**	**378,238**	**404,078**	**429,596**	**452,363**	**474,430**	**494,153**	**512,492**	**530,284**	**548,432**
Portfolio	**EE Programs**	**187,537**	**400,258**	**594,795**	**676,959**	**726,581**	**764,192**	**802,781**	**842,381**	**883,414**	**924,847**	**966,108**	**1,007,872**	**1,049,282**	**1,090,892**	**1,132,332**	**1,171,219**	**1,209,305**	**1,244,323**	**1,277,821**	**1,310,124**	**1,343,073**
Residential	Critical Peak Pricing (Res)	0	3,708	10,794	20,885	33,511	48,804	63,516	77,551	91,648	105,803	120,012	134,271	148,577	162,925	177,314	191,741	206,203	220,699	235,228	249,810	264,447
Residential	DLC Smart Thermostat	0	2,245	7,360	15,989	29,375	47,624	71,430	101,504	131,886	162,571	193,551	224,821	256,375	288,210	320,324	352,712	385,374	418,306	451,508	484,833	518,286
Residential	Time of Use Rate (Res)	4,016	11,980	23,768	39,193	57,917	76,060	93,514	110,164	126,889	143,683	160,540	177,457	194,428	211,451	228,521	245,637	262,796	279,993	297,230	314,529	331,895
Commercial	Critical Peak Pricing (Non Res)	0	810	2,415	4,790	7,912	11,755	15,507	19,166	22,748	26,316	29,898	33,496	37,109	40,737	44,379	48,036	51,706	55,391	59,089	62,801	66,526
Commercial	Real Time Pricing	0	265	773	1,503	2,430	3,534	4,612	5,663	6,692	7,716	8,746	9,779	10,817	11,859	12,905	13,955	15,010	16,068	17,130	18,196	19,266
Commercial	Time of Use Rate (Non Res)	165	664	1,496	2,747	4,417	6,505	9,222	12,563	16,550	20,764	24,997	29,248	33,517	37,803	42,106	46,427	50,764	55,117	59,487	63,873	68,275
Portfolio	**Subtotal DR Programs**	**4,181**	**19,672**	**46,607**	**85,108**	**135,561**	**194,282**	**257,800**	**326,610**	**396,413**	**466,853**	**537,745**	**609,072**	**680,823**	**752,984**	**825,549**	**898,508**	**971,853**	**1,045,574**	**1,119,672**	**1,194,042**	**1,268,696**
Portfolio	**All Programs**	**191,718**	**419,930**	**641,402**	**762,067**	**862,142**	**958,474**	**1,060,581**	**1,168,991**	**1,279,827**	**1,391,700**	**1,503,853**	**1,616,944**	**1,730,105**	**1,843,876**	**1,957,881**	**2,069,727**	**2,181,158**	**2,289,897**	**2,397,494**	**2,504,166**	**2,611,769**

Table 5-60 – Incremental Net Demand Reductions by Program (MW)

Sector	Bundle	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Sector_Sector	Bundle_Bundle	MW Savings_20	MW Savings_20	MW Savings_20	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings	MW Savings_2
Residential	Residential Prescriptive	1.44	1.46	1.56	1.59	1.65	1.68	1.71	1.74	1.77	1.79	1.82	1.84	1.86	1.88	1.90	1.92	1.89	1.91	1.93	1.98	2.02
Residential	Retail Lighting	0.35	0.43	0.38	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	Appliance Recycling	-	-	-	-	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	Whole Home Efficiency	1.58	1.88	1.99	2.02	2.05	2.08	2.11	2.14	2.18	2.21	2.24	2.26	2.29	2.32	2.35	2.38	2.38	2.40	2.43	2.48	2.53
Residential	Residential Behavioral	0.35	0.36	0.36	0.36	0.37	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Residential	**Subtotal**	**3.72**	**4.13**	**4.29**	**4.06**	**4.07**	**3.78**	**3.83**	**3.89**	**3.95**	**4.01**	**4.07**	**4.11**	**4.16**	**4.21**	**4.26**	**4.31**	**4.29**	**4.33**	**4.37**	**4.47**	**4.56**
Commercial	Commercial Prescriptive	1.20	1.23	1.02	1.07	0.92	0.84	0.89	0.91	0.93	0.91	0.88	0.87	0.87	0.86	0.86	0.56	0.53	0.48	0.44	0.43	0.44
Commercial	Commercial Custom	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Commercial	SBDI	0.12	0.11	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.05	0.04	0.04	0.03	0.03	0.03
Commercial	Midstream Food Service	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	SEM	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Commercial	Retrocommissioning	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.07	0.07	0.08	0.09	0.10	0.13	0.15	0.16	0.23	0.27	0.28
Commercial	**Subtotal**	**1.43**	**1.46**	**1.22**	**1.27**	**1.14**	**1.06**	**1.12**	**1.15**	**1.17**	**1.16**	**1.13**	**1.12**	**1.13**	**1.13**	**1.14**	**0.84**	**0.83**	**0.77**	**0.80**	**0.83**	**0.85**
Portfolio	**EE Programs**	**5.16**	**5.59**	**5.52**	**5.34**	**5.20**	**4.84**	**4.95**	**5.04**	**5.13**	**5.17**	**5.20**	**5.24**	**5.29**	**5.34**	**5.39**	**5.15**	**5.12**	**5.10**	**5.18**	**5.30**	**5.41**
Residential	Critical Peak Pricing (Res)	-	0.72	1.38	1.97	2.47	2.99	2.87	2.74	2.75	2.76	2.78	2.79	2.80	2.82	2.83	2.84	2.86	2.87	2.88	2.90	2.91
Residential	DLC Smart Thermostat	-	1.05	2.38	4.01	6.21	8.45	11.01	13.88	14.00	14.12	14.23	14.34	14.44	14.55	14.65	14.75	14.85	14.95	15.04	15.10	15.16
Residential	Time of Use Rate (Res)	0.81	1.60	2.37	3.10	3.77	3.65	3.51	3.35	3.36	3.37	3.39	3.41	3.42	3.44	3.46	3.47	3.49	3.51	3.52	3.54	3.56
Commercial	Critical Peak Pricing (Non Res)	-	0.50	0.99	1.47	1.92	2.37	2.31	2.25	2.21	2.20	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.30	2.31	2.31
Commercial	Real Time Pricing	-	0.16	0.31	0.45	0.57	0.68	0.66	0.65	0.63	0.63	0.63	0.64	0.64	0.64	0.65	0.65	0.65	0.66	0.66	0.66	0.66
Commercial	Time of Use Rate (Non Res)	0.01	0.04	0.06	0.10	0.13	0.16	0.21	0.26	0.30	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Portfolio	**Subtotal DR Programs**	**0.82**	**4.08**	**7.51**	**11.10**	**15.07**	**18.30**	**20.57**	**23.12**	**23.25**	**23.40**	**23.55**	**23.70**	**23.86**	**24.00**	**24.15**	**24.30**	**24.44**	**24.58**	**24.73**	**24.83**	**24.93**
Portfolio	**All Programs**	**5.98**	**9.66**	**13.02**	**16.44**	**20.27**	**23.13**	**25.52**	**28.16**	**28.38**	**28.57**	**28.75**	**28.94**	**29.14**	**29.35**	**29.54**	**29.45**	**29.56**	**29.69**	**29.90**	**30.13**	**30.33**

Table 5-61 – Cumulative Net Demand Reductions by Program (MW)

Sector	Bundle	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings	Cumulative MW Savings
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	1.44	2.90	4.46	6.05	7.70	9.38	11.08	12.82	14.58	16.37	17.83	19.30	20.77	22.26	23.77	25.10	25.52	25.94	26.28	26.61	26.94
Residential	Retail Lighting	0.35	0.77	1.16	1.25	1.25	1.25	1.25	1.26	1.26	1.26	1.19	1.10	0.78	0.43	0.11	0.04	0.04	0.04	0.05	0.05	0.05
Residential	Appliance Recycling	-	-	-	-	-	-	-	-	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Residential	Whole Home Efficiency	1.58	3.46	5.45	7.47	9.52	11.59	13.71	15.85	18.03	20.23	22.27	24.00	25.73	27.49	29.27	30.97	32.01	33.01	33.78	34.56	35.04
Residential	Residential Behavioral	0.35	0.36	0.36	0.36	0.37	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Residential	**Subtotal**	**3.72**	**7.49**	**11.43**	**15.13**	**18.83**	**22.24**	**26.05**	**29.93**	**33.88**	**37.88**	**41.30**	**44.41**	**47.30**	**50.20**	**53.16**	**56.12**	**57.58**	**59.00**	**60.11**	**61.23**	**62.05**
Commercial	Commercial Prescriptive	1.20	2.42	3.44	4.51	5.20	5.74	6.38	7.05	7.94	8.82	9.38	9.96	10.71	11.45	12.18	12.36	12.49	12.56	12.52	12.47	12.19
Commercial	Commercial Custom	0.04	0.08	0.12	0.16	0.21	0.26	0.32	0.37	0.43	0.49	0.54	0.60	0.65	0.71	0.77	0.81	0.85	0.89	0.92	0.95	0.98
Commercial	SBDI	0.12	0.22	0.30	0.37	0.44	0.52	0.59	0.67	0.76	0.85	0.88	0.92	0.98	1.05	1.13	1.14	1.16	1.16	1.15	1.14	1.11
Commercial	Midstream Food Service	0.01	0.02	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.13	0.15	0.16	0.15	0.14	0.13	0.12	0.10	0.09	0.08	0.06	0.05
Commercial	SEM	0.03	0.06	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08
Commercial	Retrocommissioning	0.04	0.09	0.14	0.14	0.15	0.15	0.15	0.16	0.16	0.17	0.18	0.19	0.21	0.24	0.27	0.32	0.38	0.44	0.55	0.67	0.79
Commercial	**Subtotal**	**1.43**	**2.89**	**4.12**	**5.32**	**6.15**	**6.83**	**7.62**	**8.45**	**9.50**	**10.55**	**11.21**	**11.91**	**12.79**	**13.68**	**14.56**	**14.84**	**15.07**	**15.22**	**15.31**	**15.37**	**15.19**
Portfolio	**EE Programs**	**5.16**	**10.74**	**16.26**	**21.60**	**26.80**	**31.64**	**36.59**	**41.63**	**46.75**	**51.93**	**57.12**	**62.36**	**67.65**	**72.99**	**78.39**	**83.54**	**88.66**	**93.76**	**98.94**	**104.24**	**109.65**
Residential	Critical Peak Pricing (Res)	-	0.72	1.38	1.97	2.47	2.99	2.87	2.74	2.75	2.76	2.78	2.79	2.80	2.82	2.83	2.84	2.86	2.87	2.88	2.90	2.91
Residential	DLC Smart Thermostat	-	1.05	2.38	4.01	6.21	8.45	11.01	13.88	14.00	14.12	14.23	14.34	14.44	14.55	14.65	14.75	14.85	14.95	15.04	15.10	15.16
Residential	Time of Use Rate (Res)	0.81	1.60	2.37	3.10	3.77	3.65	3.51	3.35	3.36	3.37	3.39	3.41	3.42	3.44	3.46	3.47	3.49	3.51	3.52	3.54	3.56
Commercial	Critical Peak Pricing (Non Res)	-	0.59	1.16	1.71	2.25	2.77	2.71	2.65	2.59	2.58	2.59	2.60	2.61	2.63	2.64	2.65	2.66	2.67	2.68	2.69	2.70
Commercial	Real Time Pricing	-	0.19	0.37	0.53	0.67	0.80	0.78	0.76	0.74	0.74	0.74	0.75	0.75	0.75	0.76	0.76	0.76	0.77	0.77	0.77	0.78
Commercial	Time of Use Rate (Non Res)	0.01	0.04	0.06	0.10	0.13	0.16	0.21	0.26	0.30	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Portfolio	**Subtotal DR Programs**	**0.82**	**4.19**	**7.73**	**11.42**	**15.49**	**18.82**	**21.09**	**23.63**	**23.75**	**23.90**	**24.05**	**24.20**	**24.35**	**24.50**	**24.65**	**24.80**	**24.94**	**25.08**	**25.22**	**25.33**	**25.42**
Portfolio	**All Programs**	**5.98**	**15.64**	**28.66**	**45.10**	**65.37**	**88.51**	**114.03**	**142.19**	**170.57**	**199.14**	**227.89**	**256.83**	**285.97**	**315.32**	**344.87**	**374.32**	**403.88**	**433.56**	**463.47**	**493.60**	**523.93**

Table 5-62 – Total Incentives per Program

Sector	Bundle	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget	Electric Incentive Budget
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$416,413	$426,781	$478,280	$494,664	$574,015	$588,659	$602,870	$616,859	$630,743	$643,683	$656,993	$665,509	$674,617	$681,578	$689,075	$697,726	$671,927	$679,279	$687,281	$671,025	$684,445
Residential	Retail Lighting	$222,366	$272,881	$176,583	$48,216	$3,994	$3,772	$3,934	$4,076	$4,203	$4,316	$4,419	$6,317	$4,600	$4,682	$4,759	$4,832	$4,901	$4,367	$4,060	$3,916	$3,994
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$8,081	$8,185	$8,289	$8,393	$8,496	$8,599	$8,702	$8,805	$8,907	$9,010	$9,112	$9,326	$9,512
Residential	Whole Home Efficiency	$554,903	$761,328	$829,745	$843,942	$884,409	$901,786	$920,446	$937,803	$955,118	$974,068	$991,205	$1,006,246	$1,020,540	$1,034,055	$1,047,983	$1,062,628	$1,061,837	$1,066,649	$1,080,503	$1,088,829	$1,110,606
Residential	Residential Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residential	**Subtotal**	**$1,193,682**	**$1,460,990**	**$1,484,609**	**$1,386,822**	**$1,462,417**	**$1,494,217**	**$1,527,250**	**$1,558,738**	**$1,598,145**	**$1,630,252**	**$1,660,906**	**$1,686,465**	**$1,708,254**	**$1,728,914**	**$1,750,519**	**$1,773,991**	**$1,747,573**	**$1,759,305**	**$1,780,956**	**$1,773,095**	**$1,808,557**
Commercial	Commercial Prescriptive	$668,034	$754,604	$798,655	$936,980	$957,136	$982,814	$1,012,684	$1,034,734	$1,049,797	$1,029,348	$1,009,179	$1,004,307	$999,465	$995,377	$988,560	$674,410	$589,371	$500,743	$455,205	$439,934	$448,733
Commercial	Commercial Custom	$62,218	$64,866	$67,260	$80,776	$82,715	$84,454	$86,012	$87,402	$88,639	$89,735	$90,702	$91,550	$92,289	$92,929	$90,429	$88,063	$86,341	$84,970	$83,894	$83,950	$85,629
Commercial	SBDI	$137,159	$149,885	$158,721	$186,519	$195,226	$202,229	$208,202	$213,174	$217,506	$214,938	$212,471	$210,777	$209,437	$208,497	$207,847	$138,532	$133,246	$113,734	$100,882	$95,232	$97,137
Commercial	Midstream Food Service	$8,212	$9,223	$10,144	$10,790	$11,319	$11,722	$11,998	$12,275	$12,447	$11,026	$10,202	$9,825	$1,716	$772	$1,364	$1,077	$813	$609	$466	$152	$155
Commercial	SEM	$18,269	$18,229	$18,186	$18,139	$18,087	$18,032	$17,973	$17,911	$17,845	$17,777	$17,705	$17,630	$17,552	$17,472	$17,389	$17,304	$17,216	$17,126	$17,034	$17,145	$17,488
Commercial	Retrocommissioning	$15,107	$16,321	$16,683	$17,046	$17,411	$17,777	$18,145	$18,513	$18,883	$20,489	$22,086	$22,837	$27,295	$30,518	$32,049	$42,230	$48,722	$51,834	$74,260	$86,599	$88,331
Commercial	**Subtotal**	**$908,998**	**$1,013,127**	**$1,069,648**	**$1,250,249**	**$1,281,893**	**$1,317,028**	**$1,355,014**	**$1,384,010**	**$1,405,118**	**$1,383,312**	**$1,362,344**	**$1,356,926**	**$1,347,755**	**$1,345,564**	**$1,337,639**	**$961,617**	**$875,709**	**$769,015**	**$731,741**	**$723,012**	**$737,472**
Portfolio	**EE Programs**	**$2,102,680**	**$2,474,118**	**$2,554,258**	**$2,637,071**	**$2,744,310**	**$2,811,245**	**$2,882,264**	**$2,942,748**	**$3,003,263**	**$3,013,565**	**$3,023,250**	**$3,043,391**	**$3,056,009**	**$3,074,478**	**$3,088,157**	**$2,735,607**	**$2,623,282**	**$2,528,321**	**$2,512,697**	**$2,496,107**	**$2,546,029**
Residential	Critical Peak Pricing (Res)	$0	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197	$37,197
Residential	DLC Smart Thermostat	$0	$105,223	$152,489	$210,379	$288,790	$368,954	$460,625	$564,040	$569,232	$574,327	$579,306	$584,193	$589,005	$593,751	$598,450	$603,112	$607,728	$612,300	$616,892	$618,902	$621,019
Residential	Time of Use Rate (Res)	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116	$41,116
Commercial	Critical Peak Pricing (Non Res)	$0	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803	$37,803
Commercial	Real Time Pricing	$0	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000
Commercial	Time of Use Rate (Non Res)	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884	$33,884
Portfolio	**Subtotal DR Programs**	**$75,000**	**$330,223**	**$377,489**	**$435,379**	**$513,790**	**$593,954**	**$685,625**	**$789,040**	**$794,232**	**$799,327**	**$804,306**	**$809,193**	**$814,005**	**$818,751**	**$823,450**	**$828,112**	**$832,728**	**$837,300**	**$841,892**	**$843,902**	**$846,019**
Portfolio	**All Programs**	**$2,177,680**	**$2,804,340**	**$2,931,746**	**$3,072,450**	**$3,258,100**	**$3,405,199**	**$3,567,889**	**$3,731,788**	**$3,797,495**	**$3,812,891**	**$3,827,556**	**$3,852,585**	**$3,870,013**	**$3,893,228**	**$3,911,608**	**$3,563,719**	**$3,456,010**	**$3,365,620**	**$3,354,589**	**$3,340,009**	**$3,392,048**

Table 5-63 – Total Utility Administrative Costs per Program

Sector	Bundle	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget	Total Electric Budget
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$582,834	$597,346	$669,427	$692,359	$803,422	$823,919	$843,809	$863,388	$882,822	$900,933	$919,562	$931,482	$944,230	$953,973	$964,466	$976,575	$940,465	$950,756	$961,956	$939,202	$957,986
Residential	Retail Lighting	$327,673	$402,111	$260,209	$71,049	$5,885	$5,559	$5,797	$6,007	$6,193	$6,360	$6,512	$9,308	$6,779	$6,899	$7,012	$7,120	$7,222	$6,435	$5,983	$5,770	$5,886
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$23,189	$23,488	$23,786	$24,083	$24,380	$24,676	$24,972	$25,267	$25,561	$25,854	$26,147	$26,761	$27,296
Residential	Whole Home Efficiency	$918,677	$1,260,428	$1,373,697	$1,397,200	$1,464,196	$1,492,964	$1,523,858	$1,552,593	$1,581,259	$1,612,632	$1,641,004	$1,665,906	$1,689,570	$1,711,944	$1,735,003	$1,759,248	$1,757,940	$1,765,907	$1,788,842	$1,802,626	$1,838,679
Residential	Residential Behavioral	$29,792	$30,359	$30,930	$31,505	$32,083	$1,395	$482	$490	$500	$511	$522	$534	$545	$557	$568	$580	$592	$604	$617	$637	$0
Residential	**Subtotal**	**$1,858,976**	**$2,290,244**	**$2,334,263**	**$2,192,113**	**$2,305,586**	**$2,323,837**	**$2,373,946**	**$2,422,478**	**$2,493,963**	**$2,543,925**	**$2,591,386**	**$2,631,314**	**$2,665,505**	**$2,698,049**	**$2,732,022**	**$2,768,790**	**$2,731,780**	**$2,749,556**	**$2,783,544**	**$2,774,997**	**$2,829,847**
Commercial	Commercial Prescriptive	$911,633	$1,029,771	$1,089,885	$1,278,650	$1,306,156	$1,341,197	$1,381,960	$1,412,051	$1,432,606	$1,404,700	$1,377,176	$1,370,528	$1,363,921	$1,358,341	$1,349,038	$920,334	$804,285	$683,339	$621,195	$600,356	$612,363
Commercial	Commercial Custom	$102,224	$106,574	$110,508	$132,716	$135,900	$138,759	$141,318	$143,602	$145,634	$147,435	$149,023	$150,416	$151,631	$152,682	$148,575	$144,688	$141,859	$139,606	$137,839	$137,930	$140,688
Commercial	SBDI	$193,223	$211,151	$223,599	$262,759	$275,025	$284,891	$293,306	$300,310	$306,413	$302,795	$299,320	$296,934	$295,046	$293,721	$292,806	$195,157	$187,711	$160,224	$142,118	$134,159	$136,842
Commercial	Midstream Food Service	$11,206	$12,586	$13,842	$14,724	$15,447	$15,997	$16,373	$16,752	$16,986	$15,047	$13,922	$13,408	$2,341	$1,054	$1,862	$1,470	$1,109	$831	$635	$208	$212
Commercial	SEM	$28,273	$28,212	$28,145	$28,071	$27,992	$27,906	$27,815	$27,719	$27,618	$27,511	$27,400	$27,284	$27,164	$27,040	$26,911	$26,779	$26,643	$26,504	$26,362	$26,534	$27,064
Commercial	Retrocommissioning	$21,739	$23,485	$24,006	$24,529	$25,054	$25,581	$26,110	$26,641	$27,173	$29,484	$31,782	$32,863	$39,277	$43,915	$46,119	$60,770	$70,111	$74,589	$106,861	$124,616	$127,108
Commercial	**Subtotal**	**$1,268,298**	**$1,411,779**	**$1,489,986**	**$1,741,450**	**$1,785,574**	**$1,834,331**	**$1,886,882**	**$1,927,074**	**$1,956,430**	**$1,926,971**	**$1,898,623**	**$1,891,432**	**$1,879,381**	**$1,876,753**	**$1,865,312**	**$1,349,199**	**$1,231,719**	**$1,085,092**	**$1,035,010**	**$1,023,802**	**$1,044,278**
Portfolio	**EE Programs**	**$3,127,274**	**$3,702,023**	**$3,824,249**	**$3,933,563**	**$4,091,160**	**$4,158,168**	**$4,260,828**	**$4,349,552**	**$4,450,393**	**$4,470,896**	**$4,490,009**	**$4,522,746**	**$4,544,885**	**$4,574,802**	**$4,597,333**	**$4,117,989**	**$3,963,499**	**$3,834,648**	**$3,818,554**	**$3,798,799**	**$3,874,125**
Residential	Critical Peak Pricing (Res)	$0	$318,106	$293,705	$266,019	$231,127	$241,019	$43,312	$43,312	$47,952	$47,636	$47,289	$46,997	$46,738	$46,506	$46,315	$46,143	$45,956	$45,775	$45,724	$47,257	$47,467
Residential	DLC Smart Thermostat	$0	$243,695	$327,183	$422,417	$572,968	$659,244	$791,335	$935,981	$595,742	$600,488	$605,060	$609,624	$614,165	$618,679	$623,215	$627,743	$632,195	$636,608	$641,272	$634,379	$636,873
Residential	Time of Use Rate (Res)	$345,486	$340,522	$331,281	$317,390	$292,334	$47,876	$47,876	$47,876	$53,380	$53,006	$52,595	$52,247	$51,941	$51,665	$51,438	$51,235	$51,013	$50,798	$50,738	$52,556	$52,806
Commercial	Critical Peak Pricing (Non Res)	$0	$101,553	$100,411	$98,619	$96,782	$95,035	$41,512	$41,512	$41,512	$41,512	$42,655	$42,638	$42,622	$42,605	$42,590	$42,572	$42,555	$42,543	$42,525	$42,521	$42,512
Commercial	Real Time Pricing	$0	$106,953	$105,402	$103,685	$102,009	$100,413	$87,329	$87,329	$87,329	$87,329	$87,657	$87,652	$87,648	$87,643	$87,639	$87,634	$87,629	$87,625	$87,620	$87,619	$87,616
Commercial	Time of Use Rate (Non Res)	$51,718	$64,106	$64,223	$70,485	$70,479	$70,521	$85,945	$85,815	$87,218	$56,378	$40,810	$40,789	$40,770	$40,751	$40,732	$40,711	$40,692	$40,677	$40,656	$40,651	$40,640
Portfolio	**Subtotal DR Programs**	**$397,204**	**$1,174,935**	**$1,222,204**	**$1,278,615**	**$1,365,699**	**$1,214,107**	**$1,097,309**	**$1,241,825**	**$913,133**	**$886,349**	**$876,067**	**$879,947**	**$883,884**	**$887,849**	**$891,929**	**$896,036**	**$900,040**	**$904,026**	**$908,535**	**$904,982**	**$907,915**
Portfolio	**All Programs**	**$3,876,926**	**$5,364,654**	**$5,551,098**	**$5,733,396**	**$6,002,545**	**$5,909,503**	**$5,893,950**	**$6,150,514**	**$5,899,879**	**$5,892,969**	**$5,902,684**	**$5,942,963**	**$5,971,646**	**$6,008,916**	**$6,038,188**	**$5,515,428**	**$5,349,894**	**$5,212,542**	**$5,199,798**	**$5,174,159**	**$5,260,243**

Table 5-64 – Customer Incremental Costs (NPV)

Sector	Bundle	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs	Total Electric Incremental Costs
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$687,063	$704,170	$789,148	$816,181	$947,109	$971,272	$994,719	$1,017,800	$1,040,710	$1,062,061	$1,084,021	$1,098,073	$1,113,100	$1,124,585	$1,136,955	$1,151,230	$1,108,661	$1,120,792	$1,133,995	$1,107,172	$1,129,315
Residential	Retail Lighting	$365,902	$449,029	$290,223	$79,305	$6,583	$6,224	$6,491	$6,726	$6,935	$7,122	$7,291	$10,420	$7,591	$7,725	$7,852	$7,972	$8,087	$7,206	$6,699	$6,461	$6,590
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$13,331	$13,503	$13,674	$13,845	$14,016	$14,186	$14,356	$14,525	$14,694	$14,863	$15,031	$15,384	$15,692
Residential	Whole Home Efficiency	$757,616	$1,095,676	$1,206,043	$1,226,967	$1,291,262	$1,317,428	$1,345,716	$1,371,859	$1,397,940	$1,426,726	$1,452,527	$1,474,876	$1,496,000	$1,515,843	$1,536,376	$1,558,098	$1,554,358	$1,559,873	$1,580,309	$1,588,953	$1,620,733
Residential	Residential Behavioral	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residential	**Subtotal**	**$1,810,581**	**$2,248,875**	**$2,285,414**	**$2,122,454**	**$2,244,954**	**$2,294,924**	**$2,346,926**	**$2,396,386**	**$2,458,915**	**$2,509,411**	**$2,557,514**	**$2,597,215**	**$2,630,707**	**$2,662,339**	**$2,695,539**	**$2,731,825**	**$2,685,800**	**$2,702,733**	**$2,736,035**	**$2,717,971**	**$2,772,330**
Commercial	Commercial Prescriptive	$1,046,807	$1,185,254	$1,254,440	$1,435,337	$1,465,026	$1,503,284	$1,549,543	$1,583,391	$1,606,880	$1,575,871	$1,544,687	$1,525,323	$1,511,514	$1,500,907	$1,487,070	$974,104	$837,184	$698,099	$627,133	$602,160	$614,203
Commercial	Commercial Custom	$69,244	$73,671	$77,689	$100,066	$103,346	$106,305	$108,971	$111,367	$113,516	$115,439	$117,154	$118,679	$120,030	$121,221	$117,238	$113,481	$110,789	$108,682	$107,065	$106,941	$109,080
Commercial	SBDI	$202,106	$220,121	$232,331	$276,328	$289,210	$299,603	$308,552	$316,055	$322,670	$318,032	$313,671	$310,674	$308,332	$306,708	$305,609	$191,252	$182,576	$154,956	$136,515	$128,357	$130,924
Commercial	Midstream Food Service	$11,955	$13,439	$14,813	$15,764	$16,548	$17,142	$17,603	$18,053	$18,324	$16,201	$14,966	$14,351	$2,225	$807	$1,672	$1,250	$862	$568	$362	$240	$245
Commercial	SEM	$14,233	$14,195	$14,155	$14,111	$14,065	$14,015	$13,963	$13,908	$13,851	$13,791	$13,729	$13,664	$13,598	$13,529	$13,459	$13,387	$13,313	$13,237	$13,160	$13,240	$13,505
Commercial	Retrocommissioning	$2,419	$2,414	$2,408	$2,402	$2,395	$2,388	$2,380	$2,372	$2,364	$2,355	$2,346	$2,336	$2,326	$2,315	$2,304	$2,293	$2,282	$2,270	$2,258	$2,273	$2,318
Commercial	**Subtotal**	**$1,346,763**	**$1,509,094**	**$1,595,836**	**$1,844,008**	**$1,890,589**	**$1,942,739**	**$2,001,012**	**$2,045,146**	**$2,077,604**	**$2,041,689**	**$2,006,553**	**$1,985,027**	**$1,958,025**	**$1,945,487**	**$1,927,353**	**$1,295,766**	**$1,147,006**	**$977,812**	**$886,494**	**$853,211**	**$870,275**
Portfolio	**EE Programs**	**$3,157,344**	**$3,757,969**	**$3,881,250**	**$3,966,462**	**$4,135,543**	**$4,237,663**	**$4,347,938**	**$4,441,532**	**$4,536,519**	**$4,551,100**	**$4,564,067**	**$4,582,242**	**$4,588,732**	**$4,607,827**	**$4,622,892**	**$4,027,591**	**$3,832,806**	**$3,680,545**	**$3,622,528**	**$3,571,182**	**$3,642,605**
Residential	Critical Peak Pricing (Res)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residential	DLC Smart Thermostat	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residential	Time of Use Rate (Res)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commercial	Critical Peak Pricing (Non Res)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commercial	Real Time Pricing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Commercial	Time of Use Rate (Non Res)	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Portfolio	**Subtotal DR Programs**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Portfolio	**All Programs**	**$3,157,344**	**$3,757,969**	**$3,881,250**	**$3,966,462**	**$4,135,543**	**$4,237,663**	**$4,347,938**	**$4,441,532**	**$4,536,519**	**$4,551,100**	**$4,564,067**	**$4,582,242**	**$4,588,732**	**$4,607,827**	**$4,622,892**	**$4,027,591**	**$3,832,806**	**$3,680,545**	**$3,622,528**	**$3,571,182**	**$3,642,605**

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, demand savings per unit, and incremental cost per unit are detailed in the Technical Volume 5 Appendix 5B document.

As required by 20 CSR 4240-22.050, Liberty-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 IRP Bundles. 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 MAP and RAP were vetted for inclusion in a DSM program. Measures were bundled into programs and re-screened for cost-effectiveness. All bundles were designed with cost effectiveness measures. Measures were bundled based on the end-use, sector and implementation strategy. Incentive costs and non-incentive costs were assigned to bundles. Options were rescreened at the after measure bundling and cost assignment. Cost effectiveness at the option level was balanced with implementation

concerns[11]. Finally, the bundles were placed into three levels of first year $/kWh (low, medium, and high), and DR/DSR bundle.

The TRC test 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. AEG used recent studies performed for the Midwest, AEG data (e.g., DEEM database), and national and well-vetted regional data sources:

Data Specific to Liberty-Empire Service Territory

Our highest priority data sources for this study were those that were specific to Liberty-Empire, including the primary market research.

[11] Strategic Energy Management falls just below a 1.0 TRC in the first three of the projection. To balance cost effectiveness and implementation concerns, the program was left within the portfolio to allow for time to ramp up.

- Liberty-Empire 2019 customer billing data
- Load forecasts: most recent load and peak forecasts, economic growth forecast by sector, and retail electricity price history and forecasts.
- Economic information: avoided cost forecasts, discount rate, and line loss factor.
- Residential saturation survey: 2015 Residential Customer Energy Survey completed by Opinion Research Specialists, LLC.
- Secondary saturation information from EIA's Annual Energy Outlook. Other primary market research from regional studies were used to benchmark values.
- Liberty-Empire current and historical DSM program data
- Measure characterizations from local technical reference manuals such as IL TRM and ARK TRM

AEG Data

AEG maintains several databases and modeling tools that we use for forecasting and 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, commercial, and industrial sectors. These profiles include market size, fuel shares, unit consumption estimates, and annual energy use by fuel (electricity and natural gas), 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). AEG's BEST is a derivative of the DOE 2.2 building simulation model, used to estimate base-year UECs and EUIs, as well as measure savings for the HVAC-related measures.

AEG's Database of Energy Efficiency Measures (DEEM). AEG maintains an extensive database of measure data for our studies. Our database draws upon reliable sources including the California Database for Energy Efficient Resources (DEER), the EIA Technology Forecast Updates – Residential and Commercial Building Technologies – Reference Case, RS Means cost data, and Grainger Catalog Cost data.

Recent studies. AEG has conducted numerous studies of EE potential in the last five years. We checked our input assumptions and analysis results against the results from these other studies, as well as the results from the prior Liberty-Empire EE potential study completed in 2019. In addition, we used the information about impacts of building codes and appliance standards from recent reports for the Edison Electric Institute.[12]

Other Secondary Data and Reports

Finally, a variety of secondary data sources and reports were used for this study. The main sources are identified below.

Annual Energy Outlook. The Annual Energy Outlook (AEO), conducted each year by the U.S. Energy Information Administration (EIA), presents yearly projections and analysis of energy topics. For this study, we used data from the 2020 AEO and 2021 AEO where available.

American Community Survey. The US Census American Community Survey is an ongoing survey that provides data every year on household characteristics. Data for Liberty-Empire were available for this study at http://www.census.gov/acs/www/

[12] AEG staff has prepared three white papers on the topic of factors that affect U.S. electricity consumption, including appliance standards and building codes. Links to all three white papers are provided:
http://www.edisonfoundation.net/IEE/Documents/IEE_RohmundApplianceStandardsEfficiencyCodes1209.pdf
http://www.edisonfoundation.net/iee/Documents/IEE_CodesandStandardsAssessment_2010-2025_UPDATE.pdf.
http://www.edisonfoundation.net/iee/Documents/IEE_FactorsAffectingUSElecConsumption_Final.pdf

Local Weather Data. Weather from NOAA's National Climatic Data Center for Joplin, MO was used where applicable.

EPRI End-Use Models (REEPS and COMMEND). These models provide the energy-use elasticities we apply to electricity prices, household income, home size and heating and cooling.

Database for Energy Efficient Resources (DEER). The California Energy Commission and California Public Utilities Commission (CPUC) sponsor this database, which is designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) for the state of California. We used the DEER database to cross check the measure savings we developed using BEST and DEEM.

Other relevant resources: These include reports from the Consortium for Energy Efficiency, the US Environmental Protection Agency, and the American Council for an Energy-Efficient Economy

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. Table 5-65 details the different rate options in the region. Almost all of the options below require advanced metering technology.

Table 5-65 – Comparison of Demand-Side Rates

State	Utility	Rate Type	Status	Sector	Description
Missouri	Evergy	Time of Use	Active	Residential	Varying prices for seasonal peaks. On-Peak: 4-8pm M-F excluding holidays, Super Off-Peak: 12-6am, Off-Peak: all other hours.[13]
Missouri	Evergy	Time of Day	Frozen	Residential	Varying prices for seasonal peaks. Summer: On-Peak 1-8pm M-F, Off-Peak 10pm-6am. Winter: On-Peak 7am-10pm M-F, Off-Peak 10pm-7am M-F and weekends. Shoulder: all other hours.[14]
Missouri	Evergy	Time of Day	Frozen	C&I	Varying prices for seasonal peaks. Summer: On-Peak 1-8pm M-F, Off-Peak 10pm-6am. Winter: On-Peak 7am-10pm M-F, Off-Peak 10pm-7am M-F and weekends. Shoulder: all other hours.[15]
Missouri	Evergy	Real Time Pricing	Frozen	C&I	24-hour hourly prices released by 4pm for the following day.[16]
Missouri	Ameren	Time of Use	Active	Residential	Varying prices for seasonal peaks and TOU rate (summer only). Summer: On-Peak 2-8pm M-F excluding holidays, Off-Peak 10pm-6am. Winter: On-Peak 6-8am and 6-8pm M-F excluding holidays, Off-Peak 10pm-6am. Shoulder: all other hours.[17]

[13] www.evergy.com/-/media/documents/billing/missouri/detailed_tariffs_mo/gmo/residential-time-of-use-040519.pdf?la=en
[14] www.evergy.com/-/media/documents/billing/missouri/detailed_tariffs_mo/gmo/residential-service-time-of-day-frozen-081419.pdf?la=en
[15] www.evergy.com/-/media/documents/billing/missouri/detailed_tariffs_mo/gmo/general-service-time-of-day-frozen-081419.pdf?la=en
[16] www.evergy.com/-/media/documents/billing/missouri/detailed_tariffs_mo/gmo/real-time-pricing-program-frozen-022217.pdf?la=en
[17] www.ameren.com/missouri/residential/rates/electric-rates

State	Utility	Rate Type	Status	Sector	Description
Missouri	Ameren	Time of Use	Active	Residential	Varying prices for seasonal peaks and TOU rate (summer only). On-Peak 6am-10pm, Off-Peak 10pm-6am.
Missouri	Ameren	Time of Use	Active	Residential	Varying prices for seasonal peaks. Summer: On-Peak 3-7pm M-F excluding holidays. Winter: On-Peak 6-8am and 6-8pm M-F excluding holidays. Off-Peak all other hours.
Missouri	Ameren	Time of Day	Active	C&I	Optional TOD rates (adjustments to rates). Varying prices for different service rate classifications and seasons. On Peak 10am-10pm M-F excluding holidays.[18]
Illinois	Ameren	Real Time Pricing	Active	Residential	Day ahead, hourly supply pricing.[19]
Illinois	Ameren	Peak Time Rebate	Active	Residential	Customers earn bill credits for participating in Peak Events.[20]
Illinois	Ameren	Real Time Pricing	Active	C&I	Day ahead, hourly supply pricing.[21]
Illinois	ComEd	Time of Use	Active	Residential	Pilot 2020-2024. On-Peak: 6am-2pm and 7-10 pm, Super Peak: 2-7pm, Off-Peak: all other hours.[22]
Illinois	ComEd	Real Time Pricing	Active	Residential	Real-time hourly pricing.
Illinois	ComEd	Peak Time Rebate	Active	Residential	Customers earn bill credits for participating in Peak Events. Typically called between 11am-7pm, 3-6 days in the summer.

This review provided a general sense of what kind of rates are implemented by utilities in the region. The utilities supply different rate options depending on the type of service territory, customer population, and the utilities' needs. To fully assess the applicability of a rate, a detailed rate design and pilot would have to be implemented. For the purposes of this IRP, AEG assessed potential at a high level using inputs from secondary data in regional demand-side rate impact evaluations.

(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;***

[18] www.ameren.com/-/media/rates/files/missouri/uecdsheet55rate2msgs.pdf
[19] www.ameren.com/illinois/account/customer-service/bill/power-smart-pricing
[20] www.ameren.com/-/media/rates/files/illinois/aiel51rdptr.pdf
[21] www.ameren.com/-/media/rates/files/illinois/aiel27rdrtp.pdf
[22] www.comed.com/WaysToSave/ForYourHome/Pages/ManageMyEnergy.aspx

AEG assessed the three most common demand-side rate options for the Liberty-Empire service territory for a variety of different customer segments. The three most common types of demand-side rates are as follows:

- **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 an interval meter.
- **Critical Peak Price**. Customers pay higher peak period prices during a critical peak event day and pay a discounted off-peak price for the remainder of the year. A critical peak event day occurs multiple times a year and is typically called a day in advanced when wholesale prices are forecasted to be highest. Requires an interval meter.
- **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 an interval meter.

(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 interactive/wifi thermostats, which allow Liberty-Empire to communicate with customers in real-time. While interactive/wifi thermostats are not yet prevalent throughout Liberty-Empire's territory, advanced metering infrastructure (AMI) has been rolled out to the majority of customers. Over the past two years, Liberty-Empire has made significant strides to implement two-way communicating meters (or smart meters) across the service territory. Widespread AMI implementation has laid the groundwork for Liberty-Empire to begin exploring many demand response options. Aside from the TOU rate, which was modeled to start in 2022 in alignment with

Liberty-Empire's TOU pilot, all demand response options were modeled to start in 2023 to allow for the necessary time to complete the planning/regulatory phase for new demand response and demand-side rate options.

(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 Table 5-66 below.

Table 5-66 – Demand-Side Rate Impacts (Potential kW Savings)

Customer Class	Option	Peak Season	Unit	Per Unit Reduction	
				RAP	MAP
Residential	Battery Energy Storage	Summer Peak	kW @meter	2.00	2.00
Residential	Battery Energy Storage	Winter Peak	kW @meter	2.00	2.00
Residential	Behavioral	Summer Peak	% of Peak	2.30%	1.73%
Residential	Behavioral	Winter Peak	% of Peak	2.30%	1.73%
Residential	Critical Peak Pricing Rates	Summer Peak	% of Peak	10.75%	11.13%
Residential	Critical Peak Pricing Rates	Winter Peak	% of Peak	5.38%	5.56%
Residential	DLC Smart Thermostats - Heating	Winter Peak	kW @meter	1.63	1.63
Residential	DLC Smart Thermostats - Cooling	Summer Peak	kW @meter	1.21	1.21
Residential	DLC Smart Appliances	Summer Peak	kW @meter	0.14	0.14
Residential	DLC Smart Appliances	Winter Peak	kW @meter	0.14	0.14
Residential	DLC Electric Vehicle Charging	Summer Peak	kW @meter	0.80	0.80
Residential	DLC Electric Vehicle Charging	Winter Peak	kW @meter	0.80	0.80
Residential	Grid-Interactive Water Heater	Summer Peak	kW @meter	0.54	0.54
Residential	Grid-Interactive Water Heater	Winter Peak	kW @meter	0.54	0.54
Residential	Time-of-Use	Summer Peak	% of Peak	13.10%	6.55%
Residential	Time-of-Use	Winter Peak	% of Peak	5.53%	2.77%
Commercial	Battery Energy Storage	Summer Peak	kW @meter	2.00	2.00
Commercial	Battery Energy Storage	Winter Peak	kW @meter	2.00	2.00
Commercial	Critical Peak Pricing Rates	Summer Peak	% of Peak	13.00%	14.50%
Commercial	Critical Peak Pricing Rates	Winter Peak	% of Peak	6.50%	7.25%
Commercial	Curtailment - Firm	Summer Peak	% of Peak	21.00%	21.00%
Commercial	Curtailment - Firm	Winter Peak	% of Peak	21.00%	21.00%
Commercial	Curtailment – Non-Firm	Summer Peak	% of Peak	21.00%	21.00%
Commercial	Curtailment – Non-Firm	Winter Peak	% of Peak	21.00%	21.00%
Commercial	DLC Electric Vehicle Charging	Winter Peak	kW @meter	0.80	0.80
Commercial	DLC Smart Thermostats - Heating	Winter Peak	% of Peak	4.45%	4.45%
Commercial	DLC Smart Thermostats - Cooling	Summer Peak	kW @meter	3.52	3.52
Commercial	Real Time Pricing	Summer Peak	% of Peak	13.00%	14.50%
Commercial	Real Time Pricing	Winter Peak	% of Peak	6.50%	7.25%
Commercial	Thermal Energy Storage	Summer Peak	% of Peak	50.00%	50.00%

Commercial	Time-of-Use	Summer Peak	% of Peak	13.10%	6.55%
Commercial	Time-of-Use	Summer Peak	% of Peak	13.10%	3.28%
Industrial	Critical Peak Pricing Rates	Summer Peak	% of Peak	10.00%	10.00%
Industrial	Critical Peak Pricing Rates	Winter Peak	% of Peak	5.00%	5.00%
Industrial	Curtailment - Firm	Summer Peak	% of Peak	21.00%	21.00%
Industrial	Curtailment - Firm	Winter Peak	% of Peak	21.00%	21.00%
Industrial	Curtailment – Non-Firm	Summer Peak	% of Peak	21.00%	21.00%
Industrial	Curtailment – Non-Firm	Winter Peak	% of Peak	21.00%	21.00%
Industrial	Real Time Pricing	Summer Peak	% of Peak	10.00%	10.00%
Industrial	Real Time Pricing	Winter Peak	% of Peak	5.00%	5.00%
Industrial	Thermal Energy Storage	Summer Peak	% of Peak	50.00%	50.00%
Industrial	Time-of-Use	Summer Peak	% of Peak	13.10%	13.10%
Industrial	Time-of-Use	Winter Peak	% of Peak	5.53%	1.55%

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 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 Time of Use Rate and a Critical Peak Pricing option. A program hierarchy, or loading order, was developed to prevent double counting the potential estimates among programs. Table 5-67 the participation hierarchy by customer sector for applicable DR/DSR options. With the hierarchy activated, each successive resource that is run in the model stack has a newly updated pool of eligible participants where customers enrolled in previously-stacked, competing resource options have been removed. The participation rate for that resource is then applied to the new pool of eligible participants, rather than the entire, original pool.

Table 5-67 – Program Hierarchy by Segment

	Customer Class	Residential	Commercial	Industrial
Loaded First	DLC Smart Thermostats	x	x	
	Grid-Interactive Water Heater	x		
	DLC Smart Appliances	x		
	DLC Electric Vehicle Charging	x		
	Curtailment - Firm		x	x
	Curtailment – Non-Firm		x	x
	Time of Use Rates	x	x	x
	Critical Peak Pricing Rates	x	x	x
	Real Time Pricing		x	x
	Behavioral	x		
	Battery Energy Storage	x	x	
Loaded Last	Thermal Energy Storage		x	x

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, demand response options (DSR/DR) and the demand-side programs were accounted for through the integration of the demand-side program potential assessment results into the demand-side rate and demand response option analysis. The potential assessment produced demand projections across the study period for the baseline usage, and for all the potential cases (including RAP and MAP potential cases). These RAP and MAP demand projections incorporate the demand savings associated with the energy efficiency measures that pass cost effectiveness. The RAP and MAP potential demand projections were used as the baseline demand projections in the DSR/DR analysis in which to measure the DSR/DR potential against. This was done to reduce any possible double counting and to account for energy efficiency savings before the DSR/DR savings are estimated.

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 and energy savings due to the cost-effective smart thermostat DLC and demand-side rate options can be found in Table 5-

68 through Table 5-75 separately for the winter and summer peak forecasts. These savings are estimated using an average demand reduction per unit. A detailed rate design study would need to be performed to assess the precise impact of the demand side rate options within the Liberty-Empire service territory. While resources were identified as cost-effective and included in the modeling, it is recommended that Liberty-Empire follow up with additional scoping studies and/or pilots to further study implementation designs. Liberty-Empire is currently planning to run a residential time of use rate pilot in 2022, which may provide insight into implementation designs for other rate options.

Table 5-68 – Summer Realistic Achievable Potential Incremental Net Coincident Demand Savings (MW)

Incremental Summer Peak Reduction @Generation (MW) - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.78	4 06	6 85	10.64	14.52	18 96	23 98	24.25	24.51	24.77	25 02	25 27	25 52	25.76	26.01	26 25	26.49	26.73	26 83
DLC Smart Thermostats	Commercial	-	0.19	0.43	0.72	1.11	1.51	1 96	2.47	2.48	2.5	2.52	2 53	2 55	2.56	2 58	2.59	2.61	2.63	2.64	2.65
Time-of-Use Opt-In	Residential	1.7	3.37	4 99	6 53	7.92	7.67	7 38	7 05	7.09	7.13	7.17	7 21	7 26	7.31	7 37	7.42	7.47	7.53	7 59	7.66
Time-of-Use Opt-In	Commercial	0.26	0.79	1 32	1 98	2.64	3 3	4 28	5 27	6.28	6.63	6.66	6.69	6.72	6.74	6.77	6.81	6 83	6.86	6 89	6 92
Time-of-Use Opt-In	Industrial	0.04	0.13	0 21	0 32	0.43	0.53	0.69	0 85	1.01	1.06	1.06	1 06	1 06	1.05	1 05	1.05	1 05	1.05	1 05	1 05
Critical Peak Pricing Rates	Residential	-	1.29	2.46	3.5	4.38	5.31	5.11	4 87	4 9	4.93	4.96	4 99	5 02	5.06	5 09	5.13	5.17	5.21	5 25	5.3
Critical Peak Pricing Rates	Commercial	-	1.27	2 52	3.72	4.88	6	5 85	5.7	5.57	5.55	5.57	5 59	5.62	5.64	5.66	5.69	5.72	5.74	5.76	5.79
Critical Peak Pricing Rates	Industrial	-	0.24	0.47	0.7	0.93	1.15	1.13	1.11	1.09	1.08	1.08	1 08	1 08	1.08	1 08	1.08	1 07	1.07	1 07	1 07
Real Time Pricing	Commercial	-	0.42	0.8	1.14	1.45	1.72	1.68	1.64	1.6	1.59	1.6	1.61	1.61	1.62	1.63	1.64	1.64	1.65	1.66	1.66
Real Time Pricing	Industrial	-	0.08	0.15	0 22	0.28	0.33	0 32	0 32	0.31	0.31	0.31	0 31	0 31	0.31	0 31	0.31	0 31	0.31	0 31	0 31
Total		**2**	**9.55**	**17.41**	**25.69**	**34.66**	**42.05**	**47.37**	**53.25**	**54.58**	**55.29**	**55.69**	**56.09**	**56.5**	**56.9**	**57.3**	**57.72**	**58.13**	**58.54**	**58.94**	**59.24**

Table 5-69 – Winter Realistic Achievable Potential Incremental Net Coincident Demand Savings (MW)

Incremental Winter Peak Reduction @Generation (MW) - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.27	2 89	4 86	7.53	10.25	13 34	16 83	16.97	17.11	17.25	17 38	17.5	17.63	17.75	17.88	18	18.12	18 24	18.3
DLC Smart Thermostats	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-In	Residential	0.98	1.94	2 88	3.77	4.57	4.42	4 25	4 06	4.08	4.1	4.12	4.14	4.16	4.18	4.2	4.22	4 24	4.26	4 28	4.3
Time-of-Use Opt-In	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-In	Industrial	0.01	0.05	0 08	0.12	0.15	0.19	0 25	0 31	0.37	0.39	0.39	0 39	0 39	0.39	0 39	0.39	0 39	0.39	0 39	0 39
Critical Peak Pricing Rates	Residential	-	0.88	1.68	2 39	2.99	3.62	3.48	3 32	3.34	3.36	3.37	3 39	3.4	3.42	3.44	3.45	3.47	3.49	3.5	3 52
Critical Peak Pricing Rates	Commercial	-	0.61	1.2	1.78	2.33	2.87	2.8	2.73	2.67	2.66	2.68	2.69	2.7	2.71	2.73	2.74	2.76	2.77	2.78	2.79
Critical Peak Pricing Rates	Industrial	-	0.1	0.2	0.3	0.4	0.49	0.49	0.48	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Real Time Pricing	Commercial	-	0.2	0 38	0 55	0.69	0.82	0.8	0.78	0.77	0.76	0.77	0.77	0.78	0.78	0.78	0.79	0.79	0.8	0.8	0.8
Real Time Pricing	Industrial	-	0.03	0 06	0 09	0.12	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Total		**1**	**5.08**	**9.37**	**13.85**	**18.79**	**22.82**	**25.56**	**28.65**	**28.8**	**28.98**	**29.16**	**29.35**	**29.53**	**29.71**	**29.89**	**30.07**	**30.24**	**30.42**	**30.58**	**30.71**

Table 5-70 – Summer Maximum Achievable Potential Incremental Net Coincident Demand Savings (MW)

Incremental Summer Peak Reduction @Generation (MW) - Maximum Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	2.67	6 09	10.28	15.97	21.78	28.44	35 97	36.37	36.76	37.15	37.53	37.91	38 28	38.64	39.01	39.37	39.73	40 09	40.24
DLC Smart Thermostats	Commercial	-	0.28	0.64	1.08	1.67	2.26	2.94	3.7	3.73	3.75	3.77	3 8	3.82	3.84	3 87	3.89	3.91	3.94	3 96	3.98
Time-of-Use Opt-Out	Residential	4.33	8.52	12.47	16.11	19.15	18.13	16.94	15 58	15.65	15.73	15.81	15 9	15.99	16 09	16.19	16.29	16.41	16.52	16.63	16.8
Time-of-Use Opt-Out	Commercial	3.95	7.9	11 86	15.79	19.69	19.65	19.59	19 51	19.58	19.66	19.74	19.82	19.91	20	20 08	20.2	20.28	20.36	20.44	20.53
Time-of-Use Opt-Out	Industrial	0.23	0.48	0.72	0.95	1.19	1.19	1.19	1.19	1.19	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.17	1.17	1.17
Critical Peak Pricing Rates	Residential	-	2.33	4 55	6.61	8.38	9.92	9.27	8 53	8.57	8.61	8.65	8.7	8.75	8.81	8 86	8.92	8.98	9.04	9.1	9.19
Critical Peak Pricing Rates	Commercial	-	2.4	4.8	7.19	9.57	11.93	11.9	11 85	11.89	11.94	11.99	12.04	12.09	12.15	12.2	12.27	12.32	12.37	12.42	12.47
Critical Peak Pricing Rates	Industrial	-	0.4	0 81	1.21	1.61	2.01	2.01	2	2	2	2	2	1.99	1.99	1 99	1.99	1.99	1.98	1 98	1.98
Real Time Pricing	Commercial	-	0.92	1.75	2.48	3.11	3.64	3.63	3.62	3.63	3.64	3.66	3.67	3.69	3.71	3.72	3.74	3.76	3.77	3.79	3.81
Real Time Pricing	Industrial	-	0.16	0 29	0.42	0.52	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.6	0.6
Total		**8.5**	**26.06**	**43.99**	**62.11**	**80.85**	**91.13**	**96.52**	**102.56**	**103.22**	**103.9**	**104.57**	**105.25**	**105.95**	**106.64**	**107.33**	**108.09**	**108.79**	**109.5**	**110.19**	**110.78**

Table 5-71 – Winter Maximum Achievable Potential Incremental Net Coincident Demand Savings (MW)

Incremental Summer Peak Reduction @Generation (MW) - Maximum Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.9	4 33	7.29	11.3	15.37	20.02	25 24	25.46	25.67	25.87	26.06	26.26	26.45	26.63	26.82	27	27.17	27 35	27.45
DLC Smart Thermostats	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-Out	Residential	2 5	4.92	7.2	9.29	11.04	10.44	9.76	8 97	9	9.04	9.07	9.11	9.15	9.19	9 22	9.26	9 3	9.34	9 37	9.43
Time-of-Use Opt-Out	Commercial	1.88	3.77	5.66	7.54	9.41	9.4	9.38	9 35	9.39	9.43	9.48	9.52	9.57	9.62	9.67	9.74	9.78	9.82	9 87	9.91
Time-of-Use Opt-Out	Industrial	0.1	0.2	0 31	0.41	0.51	0.51	0.51	0 51	0.51	0.51	0.51	0.51	0.51	0.51	0 51	0.51	0.51	0.51	0 51	0.51
Critical Peak Pricing Rates	Residential	-	1.59	3.11	4.51	5.72	6.77	6.32	5 81	5.83	5.86	5.88	5 9	5.93	5.95	5 98	6	6.03	6.05	6 07	6.11
Critical Peak Pricing Rates	Commercial	-	1.14	2 29	3.43	4.57	5.71	5.69	5.68	5.7	5.73	5.76	5.79	5.81	5.84	5 87	5.91	5.94	5.97	5 99	6.02
Critical Peak Pricing Rates	Industrial	-	0.17	0 35	0.52	0.69	0.86	0.86	0 86	0.86	0.86	0.86	0.86	0.86	0.87	0 87	0.86	0.87	0.87	0 87	0.86
Real Time Pricing	Commercial	-	0.44	0 84	1.18	1.49	1.74	1.74	1.73	1.74	1.75	1.76	1.76	1.77	1.78	1.79	1.8	1.81	1.82	1 83	1.84
Real Time Pricing	Industrial	-	0.07	0.13	0.18	0.22	0.26	0.26	0 26	0.26	0.26	0.26	0.26	0.26	0.26	0 26	0.26	0.26	0.26	0 26	0.26
Total		**4.48**	**14.21**	**24.2**	**34.36**	**44.96**	**51.07**	**54.54**	**58.42**	**58.77**	**59.12**	**59.46**	**59.8**	**60.14**	**60.47**	**60.8**	**61.17**	**61.5**	**61.81**	**62.12**	**62.40**

Table 5-72 – Summer Realistic Achievable Potential Cumulative Net Coincident Demand Savings (MW)

Cumulative Summer Peak Reduction @Generation (MW) - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.78	5 84	12.69	23.34	37.86	56 82	80.8	105.05	129.56	154.32	179 34	204.61	230.13	255 89	281.9	308.15	334.64	361 36	388.19
DLC Smart Thermostats	Commercial	-	0.19	0.62	1 34	2.45	3.96	5 92	8 39	10.87	13.37	15.89	18.42	20 97	23 53	26.11	28.7	31 31	33.94	36 58	39 23
Time-of-Use Opt-In	Residential	1.7	5.07	10 05	16.58	24 5	32.18	39 56	46.61	53.69	60.82	67.99	75 2	82.47	89.78	97.15	104.56	112 04	119.57	127.16	134 82
Time-of-Use Opt-In	Commercial	0.26	1.05	2 37	4 36	7	10.29	14 58	19 85	26.12	32.76	39.42	46.1	52 82	59 56	66 33	73.14	79 98	86.84	93.73	100.65
Time-of-Use Opt-In	Industrial	0.04	0.17	0 38	0.7	1.13	1.66	2 35	3.2	4.21	5.27	6.33	7 38	8.44	9.49	10 55	11.6	12.65	13.7	14.75	15.8
Critical Peak Pricing Rates	Residential	-	1.29	3.75	7 25	11.64	16.94	22 05	26 93	31.83	36.76	41.72	46.71	51.73	56.79	61 88	67.01	72.18	77.39	82.64	87 94
Critical Peak Pricing Rates	Commercial	-	1.27	3.79	7 51	12.39	18.39	24 24	29 94	35.51	41.06	46.63	52 22	57 84	63.48	69.15	74.84	80 56	86.3	92 06	97 85
Critical Peak Pricing Rates	Industrial	-	0.24	0.71	1.42	2.35	3.49	4.62	5.73	6.82	7.9	8.98	10 06	11.14	12 21	13 29	14.37	15.44	16.51	17 59	18.66
Real Time Pricing	Commercial	-	0.42	1 21	2 36	3 8	5.53	7 21	8 85	10.45	12.04	13.64	15 25	16 86	18.48	20.11	21.74	23 39	25.03	26.69	28 35
Real Time Pricing	Industrial	-	0.08	0 23	0.44	0.72	1.05	1 37	1.69	2	2.32	2.63	2 94	3 25	3.56	3 86	4.17	4.48	4.79	5.1	5.41
Total		**1.99**	**10.88**	**26.74**	**49.59**	**79.64**	**115.02**	**152.81**	**193.28**	**233.91**	**274.76**	**315.84**	**357.16**	**398.72**	**440.51**	**482.53**	**524.8**	**567.29**	**610.01**	**652.94**	**696.06**

Table 5-73 – Winter Realistic Achievable Potential Cumulative Net Coincident Demand Savings (MW)

Cumulative Winter Peak Reduction @Generation (MW) - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.27	4.16	9 02	16.55	26 8	40.14	56 97	73.94	91.05	108 3	125.67	143.18	160 81	178 56	196.44	214.44	232.55	250.79	269 09
DLC Smart Thermostats	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-In	Residential	0.98	2.92	5.8	9 57	14.14	18.56	22 82	26 88	30.95	35.05	39.17	43 3	47.46	51.64	55 84	60.05	64 29	68.55	72 83	77.13
Time-of-Use Opt-In	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-In	Industrial	0.01	0.06	0.14	0 25	0.41	0.6	0 85	1.16	1.53	1.92	2 3	2.69	3 08	3.46	3 85	4.24	4.63	5.01	5.4	5.79
Critical Peak Pricing Rates	Residential	-	0.88	2 56	4 95	7.95	11.57	15 05	18 38	21.71	25.07	28.44	31 83	35 23	38.65	42 09	45.54	49 01	52.50	56 00	59 52
Critical Peak Pricing Rates	Commercial	-	0.61	1 81	3 59	5.92	8.79	11 59	14 32	16.99	19.65	22.33	25 02	27.72	30.43	33.16	35.9	38.66	41.43	44 21	47 01
Critical Peak Pricing Rates	Industrial	-	0.1	0 31	0.61	1.01	1 5	1 98	2.46	2.93	3.4	3.87	4 33	4.8	5.27	5.74	6.21	6.67	7.14	7.61	8 08
Real Time Pricing	Commercial	-	0.2	0 58	1.12	1.82	2.64	3.45	4 23	5	5.76	6.53	7 3	8 08	8.86	9.64	10.43	11 22	12.02	12 82	13.62
Real Time Pricing	Industrial	-	0.03	0.1	0.19	0.31	0.45	0 59	0.73	0.86	1	1.13	1 27	1.4	1.53	1.67	1.8	1 94	2.07	2 21	2 34
Total		**1**	**6.08**	**15.45**	**29.3**	**48.09**	**70.91**	**96.47**	**125.12**	**153.92**	**182.9**	**212.07**	**241.42**	**270.95**	**300.66**	**330.55**	**360.62**	**390.86**	**421.28**	**451.86**	**482.58**

Table 5-74 – Summer Maximum Achievable Potential Cumulative Net Coincident Demand Savings (MW)

Cumulative Summer Peak Reduction @Generation (MW) - Maximum Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	2.67	8.76	19.04	35.01	56.79	85.23	121.2	157.57	194.33	231.48	269.01	306.92	345.2	383 84	422.85	462.22	501.95	542 04	582.28
DLC Smart Thermostats	Commercial	-	0.28	0 93	2.01	3.68	5.94	8.88	12 58	16.31	20.06	23.83	27.63	31.45	35 29	39.16	43.05	46.97	50.91	54 87	58.84
Time-of-Use Opt-Out	Residential	4.33	12.85	25 32	41.43	60.57	78.7	95.64	111 22	126.88	142.61	158.42	174.32	190.32	206.41	222.6	238.89	255 3	271.82	288.45	305.24
Time-of-Use Opt-Out	Commercial	3.95	11.84	23.7	39.49	59.18	78.83	98.41	117 93	137.51	157.17	176.91	196.74	216.65	236.64	256.72	276.92	297 2	317.56	338	358.54
Time-of-Use Opt-Out	Industrial	0.23	0.71	1.43	2.38	3.57	4.76	5.95	7.13	8.32	9.5	10.68	11.87	13.05	14 23	15.4	16.58	17.76	18.93	20.1	21.28
Critical Peak Pricing Rates	Residential	-	2.33	6 88	13.49	21.88	31 8	41.07	49.6	58.17	66.78	75.43	84.13	92.89	101.69	110 55	119.47	128.45	137.49	146 59	155.79
Critical Peak Pricing Rates	Commercial	-	2.4	7.2	14.39	23.96	35.89	47.79	59.64	71.54	83.48	95.47	107.51	119.61	131.75	143 95	156.22	168.53	180.9	193 32	205.79
Critical Peak Pricing Rates	Industrial	-	0.4	1 21	2.42	4.03	6.04	8.04	10 05	12.05	14.05	16.05	18.05	20.04	22 03	24 02	26.01	28	29.98	31 96	33.94
Real Time Pricing	Commercial	-	0.92	2.67	5.15	8.26	11 9	15.53	19.15	22.77	26.42	30.08	33.75	37.44	41.14	44 87	48.61	52.37	56.14	59 93	63.73
Real Time Pricing	Industrial	-	0.16	0.45	0.87	1.39	2	2.61	3 23	3.84	4.45	5.06	5.67	6.27	6.88	7.49	8.09	8.7	9.31	9 91	10.52
Total		**8.5**	**34.57**	**78.55**	**140.67**	**221.52**	**312.65**	**409.17**	**511.73**	**614.95**	**718.85**	**823.42**	**928.67**	**1034.63**	**1141.27**	**1248.6**	**1356.7**	**1465.49**	**1574.99**	**1685.18**	**1,795.95**

Table 5-75 – Winter Maximum Achievable Potential Cumulative Net Coincident Demand Savings (MW)

Cumulative Winter Peak Reduction @Generation (MW) - Maximum Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.9	6 24	13.53	24.82	40 2	60.21	85.45	110.91	136.58	162.44	188.51	214.77	241 21	267 85	294.66	321.66	348.83	376.18	403.64
DLC Smart Thermostats	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-Out	Residential	2 5	7.42	14.61	23.9	34.95	45.39	55.15	64.11	73.12	82.16	91.23	100.35	109.5	118.68	127 91	137.17	146.47	155.81	165.18	174.6
Time-of-Use Opt-Out	Commercial	1.88	5.65	11 31	18.85	28.26	37.66	47.04	56 38	65.77	75.21	84.69	94.21	103.78	113.4	123 07	132.81	142.59	152.41	162 28	172.19
Time-of-Use Opt-Out	Industrial	0.1	0.3	0.61	1.02	1.53	2.04	2.55	3 06	3.57	4.09	4.6	5.11	5.62	6.13	6.65	7.16	7.67	8.18	8.69	9.21
Critical Peak Pricing Rates	Residential	-	1.59	4.7	9.21	14.94	21.7	28.02	33 84	39.67	45.53	51.4	57.31	63.24	69.19	75.17	81.17	87.19	93.24	99 31	105.42
Critical Peak Pricing Rates	Commercial	-	1.14	3.44	6.87	11.44	17.15	22.85	28 53	34.23	39.96	45.72	51 5	57.32	63.16	69 03	74.95	80.89	86.85	92 85	98.87
Critical Peak Pricing Rates	Industrial	-	0.17	0 52	1.04	1.73	2.59	3.45	4 32	5.18	6.05	6.91	7.78	8.64	9.51	10 37	11.24	12.1	12.97	13 83	14.7
Real Time Pricing	Commercial	-	0.44	1 28	2.46	3.95	5.69	7.42	9.16	10.9	12.64	14.4	16.17	17.94	19.72	21 51	23.32	25.13	26.95	28.78	30.62
Real Time Pricing	Industrial	-	0.07	0.19	0.37	0.6	0.86	1.12	1 39	1.65	1.91	2.18	2.44	2.7	2.97	3 23	3.5	3.76	4.02	4 29	4.55
Total		**4.48**	**18.69**	**42.89**	**77.25**	**122.21**	**173.28**	**227.82**	**286.24**	**345**	**404.12**	**463.57**	**523.37**	**583.51**	**643.98**	**704.79**	**765.96**	**827.45**	**889.27**	**951.39**	**1,013.78**

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 demand ride rates that were found to be cost effective do not include a direct incentive to customers paid by the utility.

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 demand-side rate programs. The total cost to the utility to implement the potential demand side rate is displayed in Table 5-76 and Table 5-77 below for the realistic achievable potential scenarios and maximum achievable potential scenarios.

Table 5-76 – Non-Incentive Costs for DR and DSR Options for Realistic Achievable Potential

Non-Incentive Costs - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	$0	$138,472	$174,694	$212,038	$284,178	$290,290	$330,710	$371,941	$26,510	$26,162	$25,754	$25,431	$25,160	$24,929	$24,765	$24,630	$24,467	$24,309	$24,381	$15,477
DLC Smart Thermostats	Commercial	$0	$3,754	$4,641	$5,547	$7,322	$7,414	$8,370	$9,343	$703	$701	$699	$697	$695	$693	$692	$690	$688	$687	$684	$589
Time-of-Use Opt-In	Residential	$304,370	$299,406	$290,164	$276,274	$251,217	$6,759	$6,759	$6,759	$12,264	$11,889	$11,478	$11,131	$10,824	$10,549	$10,322	$10,118	$9,897	$9,682	$9,621	$11,439
Time-of-Use Opt-In	Commercial	$17,032	$29,324	$29,445	$35,662	$35,656	$35,698	$51,011	$50,881	$52,284	$21,666	$6,210	$6,189	$6,170	$6,151	$6,132	$6,111	$6,092	$6,077	$6,056	$6,051
Time-of-Use Opt-In	Industrial	$802	$898	$895	$940	$940	$940	$1,051	$1,051	$1,051	$828	$717	$717	$717	$717	$717	$717	$717	$717	$717	$717
Critical Peak Pricing Rates	Residential	$0	$280,909	$256,508	$228,822	$193,930	$203,822	$6,115	$6,115	$10,755	$10,439	$10,092	$9,800	$9,541	$9,309	$9,118	$8,946	$8,759	$8,578	$8,527	$10,060
Critical Peak Pricing Rates	Commercial	$0	$62,556	$61,424	$59,646	$57,823	$56,088	$3,169	$3,169	$3,169	$3,169	$4,312	$4,295	$4,279	$4,262	$4,247	$4,229	$4,213	$4,200	$4,182	$4,178
Critical Peak Pricing Rates	Industrial	$0	$1,194	$1,184	$1,169	$1,156	$1,143	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540
Real Time Pricing	Commercial	$0	$29,944	$28,410	$26,710	$25,050	$23,470	$10,535	$10,535	$10,535	$10,535	$10,863	$10,858	$10,853	$10,849	$10,844	$10,839	$10,834	$10,831	$10,826	$10,824
Real Time Pricing	Industrial	$0	$2,008	$1,992	$1,975	$1,959	$1,943	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795
Total		**$322,204**	**$848,466**	**$849,357**	**$848,783**	**$859,230**	**$627,568**	**$420,054**	**$462,128**	**$119,604**	**$87,723**	**$72,460**	**$71,451**	**$70,574**	**$69,792**	**$69,170**	**$68,614**	**$68,000**	**$67,413**	**$67,328**	**$61,669**

Table 5-77 – Non-Incentive Costs for DR and DSR Options for Maximum Achievable Potential

Non-Incentive Costs - Maximum Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	$0	$223,009	$282,776	$344,392	$463,424	$473,509	$540,201	$608,233	$38,271	$37,696	$37,024	$36,490	$36,044	$35,662	$35,391	$35,170	$34,900	$34,639	$34,758	$20,067
DLC Smart Thermostats	Commercial	$0	$5,924	$7,388	$8,882	$11,810	$11,964	$13,541	$15,146	$890	$886	$883	$880	$877	$874	$871	$868	$865	$863	$859	$701
Time-of-Use Opt-Out	Residential	$459,526	$444,441	$419,700	$384,610	$324,250	$6,303	$6,303	$6,303	$12,102	$11,583	$11,016	$10,534	$10,107	$9,721	$9,399	$9,109	$8,795	$8,491	$8,389	$12,411
Time-of-Use Opt-Out	Commercial	$114 305	$114 770	$114 986	$114 936	$114 189	$5 400	$5 400	$5 400	$7 854	$7 815	$7 781	$7 744	$7 710	$7 676	$7 643	$7 605	$7 571	$7 545	$7 507	$7 513
Time-of-Use Opt-Out	Industrial	$1,229	$1,277	$1,253	$1,253	$1,253	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626
Critical Peak Pricing Rates	Residential	$0	$585,518	$557,538	$516,330	$446,193	$388,354	$6,115	$6,115	$13,654	$12,978	$12,242	$11,615	$11,060	$10,558	$10,140	$9,762	$9,355	$8,959	$8,827	$14,055
Critical Peak Pricing Rates	Commercial	$0	$123,981	$124,312	$124,354	$123,720	$123,385	$3,169	$3,169	$5,886	$5,842	$5,805	$5,764	$5,727	$5,688	$5,652	$5,611	$5,572	$5,543	$5,502	$5,509
Critical Peak Pricing Rates	Industrial	$0	$1,864	$1,864	$1,864	$1,864	$1,864	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540
Real Time Pricing	Commercial	$0	$56,960	$52,297	$47,514	$42,509	$37,633	$10,535	$10,535	$11,363	$11,350	$11,339	$11,326	$11,315	$11,303	$11,292	$11,279	$11,268	$11,259	$11,246	$11,248
Real Time Pricing	Industrial	$0	$2,304	$2,251	$2,199	$2,146	$2,094	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795
Total		**$575,060**	**$1,560,048**	**$1,564,364**	**$1,546,335**	**$1,531,359**	**$1,051,132**	**$588,224**	**$657,861**	**$92,981**	**$91,111**	**$89,049**	**$87,314**	**$85,800**	**$84,442**	**$83,350**	**$82,364**	**$81,287**	**$80,260**	**$80,048**	**$74,466**

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

Below are the cost assumptions for the different components of a utility's cost to implement potential demand-side rates and demand response options. The different cost categories per option include development, administration, annual marketing and recruitment, equipment and installation, and customer incentives. Inputs were developed using secondary research.

Table 5-78 – Program Cost Assumptions for DR and DSR Options

Option	Cost Type	Unit	RAP Cost ($)	MAP Cost ($)
Battery Energy Storage	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$50	$60
	Cost of Equip + Install	$/tech	$660	$660
	Per kW Annual Incentive	$/kW @meter/year	$400	$400
Behavioral	Option Development Cost	$/option	$100,000	$100,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$21	$21
	Annual O&M Cost	$/participant/year	$4	$4
Critical Peak Pricing	Option Development Cost	$/option	$100,000	$100,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$74	$89
DLC Smart Thermostats - Heating	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$50	$55
	Per Participant Annual Incentive	$/participant/year	$13	$13
DLC Smart Thermostats - Cooling	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$62	$68
	Per Participant Annual Incentive	$/participant/year	$19	$19
DLC Smart Appliances	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$50	$60
	Cost of Equip + Install	$/tech	$300	$300
	Per Participant Annual Incentive	$/participant/year	$13	$13
DLC Electric Vehicle Charging	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$90	$100
	Annual O&M Cost	$/participant/year	$11	$11
	Cost of Equip + Install	$/tech	$2,000	$2,000

	Per Participant Annual Incentive	$/participant/year	$100	$100
Grid-Interactive Water Heater	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$125	$150
	Cost of Equip + Install	$/tech	$325	$325
	Per Participant Annual Incentive	$/participant/year	$25	$25
Time-of-Use	Option Development Cost	$/option	$100,000	$100,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$74	$22
Curtailment - Firm, Non-Firm	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per kW Annual Incentive	$/kW @meter/year	$28	$28
Real Time Pricing	Option Development Cost	$/option	$100,000	$100,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$74	$89
Thermal Energy Storage	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$50	$60
	Cost of Equip + Install	$/tech	$2,000	$2,000
	Per kW Annual Incentive	$/kW @meter/year	$875	$875

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;

Table 5-79 through Table 5-86 detail the number of participants, load reductions, and program costs for the realistic achievable scenario. Incremental participants for DR and DSRs represent the number of new customers each year. The cumulative number of participants is used to calculate savings due to the nature of continued enrollment within the program or rate.

Table 5-79 – Incremental Participants for DR and DSR Options

Incremental Participants for DR and DSR Options

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	2,245	2,870	3,514	4,758	4,862	5,558	6,268	308	302	295	290	285	281	278	276	273	270	271	122
DLC Smart Thermostats	Commercial	-	54	68	83	111	113	128	144	5	5	5	5	5	4	4	4	4	4	4	3
Time-of-Use Opt-In	Residential	4,016	3,949	3,824	3,637	3,298	-	-	-	74	69	64	59	55	51	48	45	42	39	39	63
Time-of-Use Opt-In	Commercial	164	330	332	416	416	416	623	621	640	227	18	18	18	18	17	17	17	17	16	16
Time-of-Use Opt-In	Industrial	1	2	2	3	3	3	5	5	5	2	-	-	-	-	-	-	-	-	-	-
Critical Peak Pricing Rates	Residential	-	3,708	3,379	3,005	2,534	2,668	-	-	63	58	54	50	46	43	41	38	36	33	33	53
Critical Peak Pricing Rates	Commercial	-	801	786	762	737	714	-	-	-	-	15	15	15	15	15	14	14	14	14	14
Critical Peak Pricing Rates	Industrial	-	9	9	8	8	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Real Time Pricing	Commercial	-	262	241	218	196	175	-	-	-	-	4	4	4	4	4	4	4	4	4	4
Real Time Pricing	Industrial	-	3	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		**4,181**	**11,363**	**11,513**	**11,648**	**12,064**	**8,960**	**6,313**	**7,037**	**1,094**	**663**	**455**	**440**	**428**	**416**	**407**	**399**	**390**	**381**	**381**	**274**

Table 5-80 – Cumulative Participants for DR and DSR Options

Cumulative Participants for DR and DSR Options

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	2,245	5,115	8,629	13,386	18,248	23,806	30,074	30,382	30,685	30,980	31,270	31,554	31,835	32,113	32,389	32,662	32,932	33,203	33,324
DLC Smart Thermostats	Commercial	-	54	122	204	316	428	556	700	705	709	714	718	723	727	732	736	741	745	749	752
Time-of-Use Opt-In	Residential	4,016	7,964	11,788	15,425	18,723	18,144	17,454	16,650	16,725	16,794	16,858	16,917	16,971	17,023	17,071	17,116	17,158	17,198	17,236	17,299
Time-of-Use Opt-In	Commercial	164	495	826	1,242	1,658	2,074	2,697	3,318	3,958	4,184	4,203	4,221	4,239	4,256	4,273	4,290	4,307	4,324	4,340	4,356
Time-of-Use Opt-In	Industrial	1	4	6	9	12	15	20	24	29	30	30	30	30	30	30	30	30	30	30	30
Critical Peak Pricing Rates	Residential	-	3,708	7,086	10,091	12,626	15,293	14,712	14,035	14,097	14,156	14,209	14,259	14,305	14,348	14,389	14,427	14,463	14,496	14,528	14,582
Critical Peak Pricing Rates	Commercial	-	801	1,587	2,349	3,087	3,801	3,710	3,617	3,542	3,527	3,543	3,558	3,573	3,587	3,602	3,616	3,630	3,644	3,658	3,672
Critical Peak Pricing Rates	Industrial	-	9	18	26	34	42	42	41	40	40	40	40	40	40	40	40	40	40	40	40
Real Time Pricing	Commercial	-	262	503	721	917	1,092	1,066	1,039	1,017	1,013	1,018	1,022	1,026	1,030	1,035	1,039	1,043	1,047	1,051	1,055
Real Time Pricing	Industrial	-	3	6	8	10	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Total		**4,181**	**15,544**	**27,057**	**38,705**	**50,769**	**59,149**	**64,074**	**69,510**	**70,507**	**71,150**	**71,605**	**72,046**	**72,473**	**72,889**	**73,296**	**73,695**	**74,085**	**74,467**	**74,847**	**75,122**

Table 5-81 – Incremental Summer Peak Reduction @Generation (MW) for DR and DSR Options

Incremental Summer Peak Reduction @Generation (MW) - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.78	4 06	6 85	10.64	14.52	18 96	23 98	24.25	24.51	24.77	25 02	25 27	25 52	25.76	26.01	26 25	26.49	26.73	26 83
DLC Smart Thermostats	Commercial	-	0.19	0.43	0.72	1.11	1.51	1 96	2.47	2.48	2.5	2.52	2 53	2 55	2.56	2 58	2.59	2.61	2.63	2.64	2.65
Time-of-Use Opt-In	Residential	1.7	3.37	4 99	6 53	7.92	7.67	7 38	7 05	7.09	7.13	7.17	7 21	7 26	7.31	7 37	7.42	7.47	7.53	7 59	7.66
Time-of-Use Opt-In	Commercial	0.26	0.79	1 32	1 98	2.64	3 3	4 28	5 27	6.28	6.63	6.66	6.69	6.72	6.74	6.77	6.81	6 83	6.86	6 89	6 92
Time-of-Use Opt-In	Industrial	0.04	0.13	0 21	0 32	0.43	0.53	0.69	0 85	1.01	1.06	1.06	1 06	1 06	1.05	1 05	1.05	1 05	1.05	1 05	1 05
Critical Peak Pricing Rates	Residential	-	1.29	2.46	3.5	4.38	5.31	5.11	4 87	4 9	4.93	4.96	4 99	5 02	5.06	5 09	5.13	5.17	5.21	5 25	5.3
Critical Peak Pricing Rates	Commercial	-	1.27	2 52	3.72	4.88	6	5 85	5.7	5.57	5.55	5.57	5 59	5.62	5.64	5.66	5.69	5.72	5.74	5.76	5.79
Critical Peak Pricing Rates	Industrial	-	0.24	0.47	0.7	0.93	1.15	1.13	1.11	1.09	1.08	1.08	1 08	1 08	1.08	1 08	1.08	1 07	1.07	1 07	1 07
Real Time Pricing	Commercial	-	0.42	0.8	1.14	1.45	1.72	1.68	1.64	1.6	1.59	1.6	1.61	1.61	1.62	1.63	1.64	1.64	1.65	1.66	1.66
Real Time Pricing	Industrial	-	0.08	0.15	0 22	0.28	0.33	0 32	0 32	0.31	0.31	0.31	0 31	0 31	0.31	0 31	0.31	0 31	0.31	0 31	0 31
Total		**2**	**9.55**	**17.41**	**25.69**	**34.66**	**42.05**	**47.37**	**53.25**	**54.58**	**55.29**	**55.69**	**56.09**	**56.5**	**56.9**	**57.3**	**57.72**	**58.13**	**58.54**	**58.94**	**59.24**

Table 5-82 – Cumulative Summer Peak Reduction @Generation (MW) for DR and DR Options

Cumulative Summer Peak Reduction @Generation (MW) - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.78	5 84	12.69	23.34	37.86	56 82	80.8	105.05	129.56	154.32	179 34	204.61	230.13	255 89	281.9	308.15	334.64	361 36	388.19
DLC Smart Thermostats	Commercial	-	0.19	0.62	1 34	2.45	3.96	5 92	8 39	10.87	13.37	15.89	18.42	20 97	23 53	26.11	28.7	31 31	33.94	36 58	39 23
Time-of-Use Opt-In	Residential	1.7	5.07	10 05	16.58	24 5	32.18	39 56	46.61	53.69	60.82	67.99	75 2	82.47	89.78	97.15	104.56	112 04	119.57	127.16	134 82
Time-of-Use Opt-In	Commercial	0.26	1.05	2 37	4 36	7	10.29	14 58	19 85	26.12	32.76	39.42	46.1	52 82	59 56	66 33	73.14	79 98	86.84	93.73	100.65
Time-of-Use Opt-In	Industrial	0.04	0.17	0 38	0.7	1.13	1.66	2 35	3.2	4.21	5.27	6.33	7 38	8.44	9.49	10 55	11.6	12.65	13.7	14.75	15.8
Critical Peak Pricing Rates	Residential	-	1.29	3.75	7 25	11.64	16.94	22 05	26 93	31.83	36.76	41.72	46.71	51.73	56.79	61 88	67.01	72.18	77.39	82.64	87 94
Critical Peak Pricing Rates	Commercial	-	1.27	3.79	7 51	12.39	18.39	24 24	29 94	35.51	41.06	46.63	52 22	57 84	63.48	69.15	74.84	80 56	86.3	92 06	97 85
Critical Peak Pricing Rates	Industrial	-	0.24	0.71	1.42	2.35	3.49	4.62	5.73	6.82	7.9	8.98	10 06	11.14	12 21	13 29	14.37	15.44	16.51	17 59	18.66
Real Time Pricing	Commercial	-	0.42	1 21	2 36	3 8	5.53	7 21	8 85	10.45	12.04	13.64	15 25	16 86	18.48	20.11	21.74	23 39	25.03	26.69	28 35
Real Time Pricing	Industrial	-	0.08	0 23	0.44	0.72	1.05	1 37	1.69	2	2.32	2.63	2 94	3 25	3.56	3 86	4.17	4.48	4.79	5.1	5.41
Total		**1.99**	**10.88**	**26.74**	**49.59**	**79.64**	**115.02**	**152.81**	**193.28**	**233.91**	**274.76**	**315.84**	**357.16**	**398.72**	**440.51**	**482.53**	**524.8**	**567.29**	**610.01**	**652.94**	**696.06**

Table 5-83 – Incremental Winter Peak Reduction @Generation (MW) for DR and DR Options

Incremental Winter Peak Reduction @Generation (MW) - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.27	2 89	4 86	7.53	10.25	13 34	16 83	16.97	17.11	17.25	17 38	17.5	17.63	17.75	17.88	18	18.12	18 24	18.3
DLC Smart Thermostats	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-In	Residential	0.98	1.94	2 88	3.77	4.57	4.42	4 25	4 06	4.08	4.1	4.12	4.14	4.16	4.18	4.2	4.22	4 24	4.26	4 28	4.3
Time-of-Use Opt-In	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-In	Industrial	0.01	0.05	0 08	0.12	0.15	0.19	0 25	0 31	0.37	0.39	0.39	0 39	0 39	0.39	0 39	0.39	0 39	0.39	0 39	0 39
Critical Peak Pricing Rates	Residential	-	0.88	1.68	2 39	2.99	3.62	3.48	3 32	3.34	3.36	3.37	3 39	3.4	3.42	3.44	3.45	3.47	3.49	3.5	3 52
Critical Peak Pricing Rates	Commercial	-	0.61	1.2	1.78	2.33	2.87	2.8	2.73	2.67	2.66	2.68	2.69	2.7	2.71	2.73	2.74	2.76	2.77	2.78	2.79
Critical Peak Pricing Rates	Industrial	-	0.1	0.2	0.3	0.4	0.49	0.49	0.48	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
Real Time Pricing	Commercial	-	0.2	0 38	0 55	0.69	0.82	0.8	0.78	0.77	0.76	0.77	0.77	0.78	0.78	0.78	0.79	0.79	0.8	0.8	0.8
Real Time Pricing	Industrial	-	0.03	0 06	0 09	0.12	0.14	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Total		**1**	**5.08**	**9.37**	**13.85**	**18.79**	**22.82**	**25.56**	**28.65**	**28.8**	**28.98**	**29.16**	**29.35**	**29.53**	**29.71**	**29.89**	**30.07**	**30.24**	**30.42**	**30.58**	**30.71**

Table 5-84 – Cumulative Winter Peak Reduction @Generation (MW) for DR and DR Options

Cumulative Winter Peak Reduction @Generation (MW) - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	-	1.27	4.16	9 02	16.55	26 8	40.14	56 97	73.94	91.05	108 3	125.67	143.18	160 81	178 56	196.44	214.44	232.55	250.79	269 09
DLC Smart Thermostats	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-In	Residential	0.98	2.92	5.8	9 57	14.14	18.56	22 82	26 88	30.95	35.05	39.17	43 3	47.46	51.64	55 84	60.05	64 29	68.55	72 83	77.13
Time-of-Use Opt-In	Commercial	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time-of-Use Opt-In	Industrial	0.01	0.06	0.14	0 25	0.41	0.6	0 85	1.16	1.53	1.92	2 3	2.69	3 08	3.46	3 85	4.24	4.63	5.01	5.4	5.79
Critical Peak Pricing Rates	Residential	-	0.88	2 56	4 95	7.95	11.57	15 05	18 38	21.71	25.07	28.44	31 83	35 23	38.65	42 09	45.54	49 01	52.50	56 00	59 52
Critical Peak Pricing Rates	Commercial	-	0.61	1 81	3 59	5.92	8.79	11 59	14 32	16.99	19.65	22.33	25 02	27.72	30.43	33.16	35.9	38.66	41.43	44 21	47 01
Critical Peak Pricing Rates	Industrial	-	0.1	0 31	0.61	1.01	1 5	1 98	2.46	2.93	3.4	3.87	4 33	4.8	5.27	5.74	6.21	6.67	7.14	7.61	8 08
Real Time Pricing	Commercial	-	0.2	0 58	1.12	1.82	2.64	3.45	4 23	5	5.76	6.53	7 3	8 08	8.86	9.64	10.43	11 22	12.02	12 82	13.62
Real Time Pricing	Industrial	-	0.03	0.1	0.19	0.31	0.45	0 59	0.73	0.86	1	1.13	1 27	1.4	1.53	1.67	1.8	1 94	2.07	2 21	2 34
Total		**1**	**6.08**	**15.45**	**29.3**	**48.09**	**70.91**	**96.47**	**125.12**	**153.92**	**182.9**	**212.07**	**241.42**	**270.95**	**300.66**	**330.55**	**360.62**	**390.86**	**421.28**	**451.86**	**482.58**

Table 5-85 – Non-Incentive Utility Costs for DR and DR Options

Non-Incentive Costs - Maximum Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	$0	$223,009	$282,776	$344,392	$463,424	$473,509	$540,201	$608,233	$38,271	$37,696	$37,024	$36,490	$36,044	$35,662	$35,391	$35,170	$34,900	$34,639	$34,758	$20,067
DLC Smart Thermostats	Commercial	$0	$5,924	$7,388	$8,882	$11,810	$11,964	$13,541	$15,146	$890	$886	$883	$880	$877	$874	$871	$868	$865	$863	$859	$701
Time-of-Use Opt-Out	Residential	$459,526	$444,441	$419,700	$384,610	$324,250	$6,303	$6,303	$6,303	$12,102	$11,583	$11,016	$10,534	$10,107	$9,721	$9,399	$9,109	$8,795	$8,491	$8,389	$12,411
Time-of-Use Opt-Out	Commercial	$114 305	$114 770	$114 986	$114 936	$114 189	$5 400	$5 400	$5 400	$7 854	$7 815	$7 781	$7 744	$7 710	$7 676	$7 643	$7 605	$7 571	$7 545	$7 507	$7 513
Time-of-Use Opt-Out	Industrial	$1,229	$1,277	$1,253	$1,253	$1,253	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626	$626
Critical Peak Pricing Rates	Residential	$0	$585,518	$557,538	$516,330	$446,193	$388,354	$6,115	$6,115	$13,654	$12,978	$12,242	$11,615	$11,060	$10,558	$10,140	$9,762	$9,355	$8,959	$8,827	$14,055
Critical Peak Pricing Rates	Commercial	$0	$123,981	$124,312	$124,354	$123,720	$123,385	$3,169	$3,169	$5,886	$5,842	$5,805	$5,764	$5,727	$5,688	$5,652	$5,611	$5,572	$5,543	$5,502	$5,509
Critical Peak Pricing Rates	Industrial	$0	$1,864	$1,864	$1,864	$1,864	$1,864	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540	$540
Real Time Pricing	Commercial	$0	$56,960	$52,297	$47,514	$42,509	$37,633	$10,535	$10,535	$11,363	$11,350	$11,339	$11,326	$11,315	$11,303	$11,292	$11,279	$11,268	$11,259	$11,246	$11,248
Real Time Pricing	Industrial	$0	$2,304	$2,251	$2,199	$2,146	$2,094	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795	$1,795
Total		**$575,060**	**$1,560,048**	**$1,564,364**	**$1,546,335**	**$1,531,359**	**$1,051,132**	**$588,224**	**$657,861**	**$92,981**	**$91,111**	**$89,049**	**$87,314**	**$85,800**	**$84,442**	**$83,350**	**$82,364**	**$81,287**	**$80,260**	**$80,048**	**$74,466**

Table 5-86 – Annual DR and DSR Option Benefits (NPV)

Program Annual Benefits - Realistic Achievable Potential

Program	Customer Segment	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
DLC Smart Thermostats	Residential	$0	$70,316	$116,071	$326,543	$559,566	$652,666	$1,121,197	$2,090,350	$2,282,431	$2,140,938	$2,172,694	$2,223,297	$2,260,577	$2,265,088	$2,538,563	$2,677,359	$2,777,903	$3,021,587	$3,351,335	$3,413,603
DLC Smart Thermostats	Commercial	$0	$4,367	$7,171	$20,076	$34,244	$39,769	$68,041	$126,384	$137,524	$128,584	$130,103	$132,762	$134,632	$134,562	$150,444	$158,296	$163,867	$177,853	$196,822	$200,491
Time-of-Use Opt-In	Residential	$96,248	$181,761	$217,912	$399,514	$555,377	$488,510	$570,989	$731,465	$782,600	$745,286	$751,778	$767,838	$778,421	$781,363	$854,137	$892,022	$917,668	$982,374	$1,071,800	$1,095,117
Time-of-Use Opt-In	Commercial	$8,495	$24,536	$32,453	$70,685	$107,056	$119,991	$192,651	$324,912	$413,654	$412,117	$415,455	$423,393	$428,478	$428,891	$470,347	$491,680	$505,358	$541,552	$591,771	$602,464
Time-of-Use Opt-In	Industrial	$1,960	$5,823	$7,814	$16,549	$25,194	$28,492	$45,174	$75,000	$94,818	$94,358	$94,644	$96,030	$96,699	$96,400	$104,815	$108,742	$111,140	$118,252	$128,222	$129,843
Critical Peak Pricing Rate:	Residential	$0	$49,356	$68,043	$162,782	$224,669	$232,244	$295,077	$416,978	$453,323	$423,159	$427,634	$436,155	$442,210	$441,847	$494,394	$520,424	$539,187	$585,827	$648,775	$663,917
Critical Peak Pricing Rate:	Commercial	$0	$42,933	$61,412	$152,029	$220,214	$231,469	$297,935	$429,567	$454,521	$420,119	$424,218	$431,950	$437,271	$436,248	$487,095	$512,422	$529,601	$574,026	$634,483	$646,737
Critical Peak Pricing Rate:	Industrial	$0	$8,119	$11,787	$28,706	$41,930	$44,591	$57,364	$82,638	$87,724	$81,111	$81,482	$82,576	$83,157	$82,580	$91,559	$95,622	$98,313	$105,916	$116,301	$117,928
Real Time Pricing	Commercial	$0	$20,773	$32,243	$64,859	$94,278	$101,703	$120,745	$158,325	$164,954	$155,454	$156,696	$159,775	$161,734	$162,081	$176,933	$184,718	$189,608	$202,580	$220,693	$224,613
Real Time Pricing	Industrial	$0	$3,759	$5,834	$11,813	$17,239	$18,673	$22,386	$29,662	$31,061	$29,218	$29,307	$29,738	$29,946	$29,858	$32,449	$33,661	$34,399	$36,590	$39,664	$40,165
Total		**$106,703**	**$411,743**	**$560,740**	**$1,253,556**	**$1,879,765**	**$1,958,108**	**$2,791,559**	**$4,465,280**	**$4,902,610**	**$4,630,345**	**$4,684,011**	**$4,783,513**	**$4,853,125**	**$4,858,918**	**$5,400,737**	**$5,674,945**	**$5,867,045**	**$6,346,556**	**$6,999,865**	**$7,134,877**

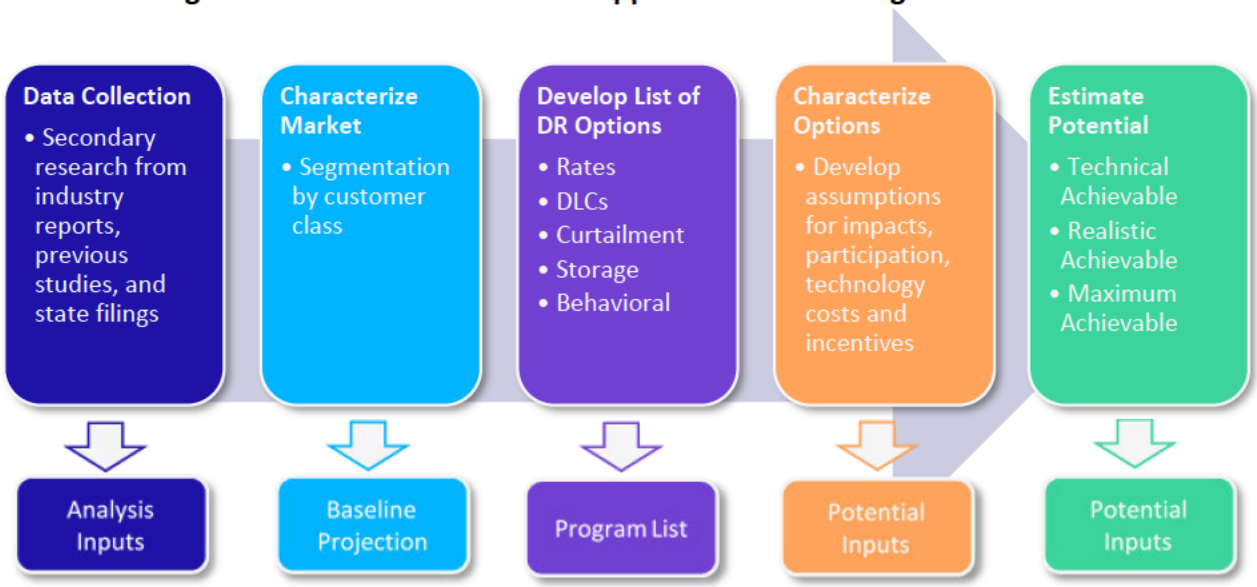
(F) Evaluate how each demand-side rate would be considered by the utility's Regional Transmission Organization (RTO) in resource adequacy determinations, eligibility to participate as a demand response resource in RTO markets for energy, capacity, and ancillary services; and

Liberty-Empire's analysis did not include consideration of RTO treatment at this time. Liberty-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. Liberty-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 demand response potential assessment follows a similar process to the measure-level energy efficiency potential assessment.[23] Figure 5-31 illustrates this process. Each box in the figure corresponds to a key step in the study. Each arrow points to a corresponding key study element which drives the analysis toward the final results. The steps and key elements in the process used to complete the study are described below.

Figure 5-31 – Overview of AEG's Approach to Estimating DR Potential



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

Data collection consisted of regional and national secondary research. The data collection process yields many of the key analysis inputs which allow us to characterize the options.

Market characterization establishes which customer classes will be included and determines if there are any additional segments of interest. It incorporates the utility data provided during the data collection effort and develops a baseline forecast of demand by segment over the study horizon. This step is important because it frames the space in which the study will take place and defines the customer groups which the study will investigate.

A list of DR and DSR options is developed and then assessed for applicability to the Liberty-Empire market as characterized in the previous step. The outcome of this step finalizes a list of DR and DSR options which will be included in the study.

Next, each of the DR and DSR options is characterized using the best available information to describe the option as it might be implemented and estimate the option impacts, participation and costs. This step yields the inputs to the potential analysis that will result in estimates at each level of potential.

Finally, AEG estimates the technical achievable, realistic achievable and maximum achievable potential for the set of options AEG characterized across the entire service area. In order to estimate the technical achievable potential, each option is first looked at on a standalone basis (and without an economic screen). Secondly, a participation hierarchy is imposed so that customers can only participate in a maximum of one option of the same type.[24] This eliminates double counting. In this "integrated" case, an economic screen is also applied to remove options that do not have a TRC benefit to cost ratio >1.0. These are achievable potential estimates.

[24] The participation hierarchy applies only to programs that are similar or are targeting the same load. For example, DLC CAC participants cannot participant in the DLC Smart Thermostat program and TOU participants cannot participant in a Critical Peak Pricing Rate.

Market Characterization

The analysis begins with segmentation of the Liberty-Empire customer base and a description of how customers use energy during summer and winter peak hours.

The DR analysis is conducted for the same three sectors as the EE analysis: residential, commercial, and industrial. For programs where only large commercial and industrial customers are eligible (i.e. Curtailment), participation rates were adjusted to reflect only those customers with peak usage of 300 kW or higher in the study base year. Similar to the EE portion of the analysis, opt out customers are excluded throughout the DR and DSR potential analysis.

Demand Response Options

The structure of, and process for, the DR and DSR potential assessment is similar to the EE potential analysis. The key difference is that DR and DSR are "program" options (not measures), meaning that customers will not take these actions without a utility offering. DR requires an option to induce savings (i.e., there is no naturally occurring DR). Similarly, DSR requires a "rate structure" to supply a price signal to induce savings or shift demand.

While DR and DSR are quite different from the customers' perspective, they are similar with respect to modeling requirements, so we analyze them together. Some options will target the same customers, so we take steps to avoid double-counting and overstating of participation.

In general, demand response options are controllable or dispatchable programmatic options where customers agree to reduce, shift, or modify their load during a specific number of hours throughout the year. Table 5-87 presents each of the final DR options that are included in this study and briefly describe each option. Note that Behavioral DR is voluntary and not dispatchable.

Table 5-87 – DR Options by Market Segment

Program Option	Eligibility	Mechanism	Lifetime
Behavioral DR (BDR)	Residential	Voluntary DR reductions in response to behavioral messaging. Requires AMI technology.	1
Grid-Interactive Water Heater	Residential	Internet-enabled control of water heater equipment.	10
Direct Load Control (DLC) of Smart Thermostats	Residential, Commercial	Internet-enabled control of thermostat set points, can be coupled with any dynamic pricing rate.	10
DLC of Smart Appliances	Residential	DLC switch installed on customer's equipment.	8
DLC of EV Charging	Residential	Automated, level 2 EV chargers that postpone or curtail charging during peak hours.	10
Curtailment Agreements – Firm	Large Commercial, Large Industrial[25]	Customers enact their customized, mandatory curtailment plan. May use stand-by generation. Penalties apply for non-performance.	3
Curtailment Agreements – Non-Firm	Large Commercial, Large Industrial	Customers enact their customized, mandatory curtailment plan. May use stand-by generation. No penalties apply for non-performance.	3
Battery Energy Storage	Residential, Commercial	Peak shifting of loads using stored electrochemical energy.	10
Thermal Energy Storage	Commercial, Industrial	Peak shifting of primarily space cooling loads using stored ice or cold water.	5

Demand side rate options are not controllable or dispatchable by the utility but are considered a resource to be utilized for impactful demand reductions. Demand side rates do require significant utility resources to plan and implement a rate through the regulatory process, as well as certain infrastructure requirements for certain rates. Table 5-86 details the DSR options analyzed in this study.

Table 5-88 – DSR Options by Market Segment

Program Option	Eligibility	Mechanism	Lifetime
Time of use (TOU) Rates	All segments	Higher rate for the peak block of hours that occurs every day. Requires either on/off peak meters or AMI technology.	10
Critical Peak Pricing (CPP)	All segments	Much higher rate for the peak block of hours that occurs only on event days. Requires AMI technology.	10
Real-time Pricing (RTP)	Commercial, Industrial	Dynamic rate that fluctuates throughout the day based on hourly energy market prices. Requires AMI technology.	10

[25] As discussed in the DR Market Characterization section of this report, the large commercial and industrial customers are not identified as individual segments. Instead, they are accounted for in the participation rates used for the curtailment options.

Detailed descriptions of each of the demand response program options and demand side rates can be found in the full analysis report.[26]

After the option list is developed, each option is characterized with respect to the achievable potential cases on a variety of different components, including participation rates, per customer impacts, and costs.

Participation Rates

Participation rate assumptions are defined as the percent of eligible customers who take part in a given option in a given year. Note that a customer is not considered eligible if they do not have the relevant equipment or are already participating in a mutually exclusive option. It is important to note that the percentage indicates the percentage of the eligible population that we assume will participate in each option. The eligible population reflects appliance saturation rates (e.g., the share of customers with electric water heating), large commercial and industrial segmentation for relevant programs, and the option hierarchy, described in the next section. The participation rates were sourced from recent evaluations and reports on currently implemented programs and rates, then adjusted to reflect implementation in the Liberty-Empire service territory.

In general, new DR and DSR options need time to ramp up and reach a steady state. During ramp up, customer education, marketing and recruitment take place, as well as the physical implementation and installation of any hardware, software, telemetry, or other equipment required. For Liberty-Empire, AEG assumed the different types of options ramp up over three to seven years, typical of industry experience.

DLC and rate-based options have participation ramp ups following an "S-shaped" diffusion curve over a five-year timeframe. This ramp was adjusted for the TOU option to reflect the target participation of the Liberty-Empire 2022 pilot. Curtailment Agreements are typically third-party-

[26] See Appendix 5A.

delivered over shorter contract periods. For curtailment and behavioral options, participation ramps up linearly over a three-year timeframe.

Per-customer Impact Assumptions

The potential demand savings are calculated by multiplying the per-customer load reduction at system peak by the total number of participating customers. The per customer impacts are presented as percentages or deemed kW values which reflect the total load reduction during an event. The impacts are each benchmarked to programs operating in the industry today, specifically those within Missouri and similar regions.

Table 5-89 – DR and DSR Per-customer Impact Assumptions

Customer Class	Option	Peak Season	Unit	Per Unit Reduction	
				RAP	MAP
Residential	Battery Energy Storage	Summer Peak	kW @meter	2.00	2.00
Residential	Battery Energy Storage	Winter Peak	kW @meter	2.00	2.00
Residential	Behavioral	Summer Peak	% of Peak	2.30%	1.73%
Residential	Behavioral	Winter Peak	% of Peak	2.30%	1.73%
Residential	Critical Peak Pricing Rates	Summer Peak	% of Peak	10.75%	11.13%
Residential	Critical Peak Pricing Rates	Winter Peak	% of Peak	5.38%	5.56%
Residential	DLC Smart Thermostats - Heating	Winter Peak	kW @meter	1.63	1.63
Residential	DLC Smart Thermostats - Cooling	Summer Peak	kW @meter	1.21	1.21
Residential	DLC Smart Appliances	Summer Peak	kW @meter	0.14	0.14
Residential	DLC Smart Appliances	Winter Peak	kW @meter	0.14	0.14
Residential	DLC Electric Vehicle Charging	Summer Peak	kW @meter	0.80	0.80
Residential	DLC Electric Vehicle Charging	Winter Peak	kW @meter	0.80	0.80
Residential	Grid-Interactive Water Heater	Summer Peak	kW @meter	0.54	0.54
Residential	Grid-Interactive Water Heater	Winter Peak	kW @meter	0.54	0.54
Residential	Time-of-Use	Summer Peak	% of Peak	13.10%	6.55%
Residential	Time-of-Use	Winter Peak	% of Peak	5.53%	2.77%
Commercial	Battery Energy Storage	Summer Peak	kW @meter	2.00	2.00
Commercial	Battery Energy Storage	Winter Peak	kW @meter	2.00	2.00
Commercial	Critical Peak Pricing Rates	Summer Peak	% of Peak	13.00%	14.50%
Commercial	Critical Peak Pricing Rates	Winter Peak	% of Peak	6.50%	7.25%
Commercial	Curtailment - Firm	Summer Peak	% of Peak	21.00%	21.00%
Commercial	Curtailment - Firm	Winter Peak	% of Peak	21.00%	21.00%
Commercial	Curtailment - Non-Firm	Summer Peak	% of Peak	21.00%	21.00%
Commercial	Curtailment - Non-Firm	Winter Peak	% of Peak	21.00%	21.00%

Customer Class	Option	Peak Season	Unit	Per Unit Reduction	
Commercial	DLC Electric Vehicle Charging	Winter Peak	kW @meter	0.80	0.80
Commercial	DLC Smart Thermostats - Heating	Winter Peak	% of Peak	4.45%	4.45%
Commercial	DLC Smart Thermostats - Cooling	Summer Peak	kW @meter	3.52	3.52
Commercial	Real Time Pricing	Summer Peak	% of Peak	13.00%	14.50%
Commercial	Real Time Pricing	Winter Peak	% of Peak	6.50%	7.25%
Commercial	Thermal Energy Storage	Summer Peak	% of Peak	50.00%	50.00%
Commercial	Time-of-Use	Summer Peak	% of Peak	13.10%	6.55%
Commercial	Time-of-Use	Summer Peak	% of Peak	13.10%	3.28%
Industrial	Critical Peak Pricing Rates	Summer Peak	% of Peak	10.00%	10.00%
Industrial	Critical Peak Pricing Rates	Winter Peak	% of Peak	5.00%	5.00%
Industrial	Curtailment - Firm	Summer Peak	% of Peak	21.00%	21.00%
Industrial	Curtailment - Firm	Winter Peak	% of Peak	21.00%	21.00%
Industrial	Curtailment - Non-Firm	Summer Peak	% of Peak	21.00%	21.00%
Industrial	Curtailment - Non-Firm	Winter Peak	% of Peak	21.00%	21.00%
Industrial	Real Time Pricing	Summer Peak	% of Peak	10.00%	10.00%
Industrial	Real Time Pricing	Winter Peak	% of Peak	5.00%	5.00%
Industrial	Thermal Energy Storage	Summer Peak	% of Peak	50.00%	50.00%
Industrial	Time-of-Use	Summer Peak	% of Peak	13.10%	13.10%
Industrial	Time-of-Use	Winter Peak	% of Peak	5.53%	1.55%

Cost Assumptions

Option costs include fixed and variable cost elements: development costs, annual administration costs, marketing and recruitment costs, equipment purchase and installation costs, annual O&M costs, and participant incentives. These assumptions are based on actual AEG program implementation experience and experience in developing program costs for other similar studies.

Table 5-90 – DR and DSR Option Cost Assumptions

Option	Cost Type	Unit	RAP Cost ($)	MAP Cost ($)
Battery Energy Storage	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$50	$60
	Cost of Equip + Install	$/tech	$660	$660
	Per kW Annual Incentive	$/kW @meter/year	$400	$400
Behavioral	Option Development Cost	$/option	$100,000	$100,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$21	$21
	Annual O&M Cost	$/participant/year	$4	$4
Critical Peak Pricing	Option Development Cost	$/option	$100,000	$100,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$74	$89
DLC Smart Thermostats - Heating	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$50	$55
	Per Participant Annual Incentive	$/participant/year	$13	$13
DLC Smart Thermostats - Cooling	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$62	$68
	Per Participant Annual Incentive	$/participant/year	$19	$19
DLC Smart Appliances	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$50	$60
	Cost of Equip + Install	$/tech	$300	$300
	Per Participant Annual Incentive	$/participant/year	$13	$13
DLC Electric Vehicle Charging	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$90	$100
	Annual O&M Cost	$/participant/year	$11	$11
	Cost of Equip + Install	$/tech	$2,000	$2,000

Option	Cost Type	Unit	RAP Cost ($)	MAP Cost ($)
	Per Participant Annual Incentive	$/participant/year	$100	$100
Grid-Interactive Water Heater	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$125	$150
	Cost of Equip + Install	$/tech	$325	$325
	Per Participant Annual Incentive	$/participant/year	$25	$25
Time-of-Use	Option Development Cost	$/option	$100,000	$100,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$74	$22
Curtailment - Firm, Non-Firm	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per kW Annual Incentive	$/kW @meter/year	$28	$28
Real Time Pricing	Option Development Cost	$/option	$100,000	$100,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$74	$89
Thermal Energy Storage	Option Development Cost	$/option	$75,000	$75,000
	Annual Option Administration Cost	$/year	$75,000	$75,000
	Per Customer Annual Marketing/Recruitment Cost	$/new participant/year	$50	$60
	Cost of Equip + Install	$/tech	$2,000	$2,000
	Per kW Annual Incentive	$/kW @meter/year	$875	$875

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.

Avoided Demand Cost

Liberty-Empire's avoided demand cost projections are based on a combination of sources that aim to develop a reasonable benchmark for the value of capacity. Because the SPP market does not have a formal capacity market and because Liberty-Empire's own supply-demand balance dynamics will evolve over time, it is necessary to consider a combination of fundamental SPP market drivers and utility-specific cost drivers in developing the estimate. The following section presents the rationale and drivers behind Liberty-Empire's avoided demand cost projections for three distinct periods.

Years 2022-2026: For the forecast period in which Liberty-Empire has an adequate reserve margin, the avoided cost of capacity is based on the net avoidable "going-forward" costs (fixed operations and maintenance costs and annual new capital expenditures, less projected energy margins) of the marginal plant in Liberty-Empire's existing generation portfolio. The marginal plant in Liberty-Empire's existing generation portfolio was determined by analyzing each existing plant's most recent budgeted fixed O&M costs and new capex less the projected energy margins that each plant was projected to earn in the SPP power market under Liberty-Empire's Base Case market conditions, producing the "net going-forward cost" of each plant. Based on a comparison of the net going-forward costs at each plant, Liberty-Empire determined that Iatan 1 has the

highest going-forward costs on average for the period and is thus the marginal retirement candidate in the portfolio. Therefore, the plant's going-forward costs are representative of the costs needed for Liberty-Empire to avoid a capacity deficit.

Years 2027-2028: For the period in which it was uncertain whether or not Liberty-Empire would have an adequate reserve margin because it was dependent on the retirement date of Energy Center 1 and 2, Liberty-Empire took an average of Iatan 1's net avoidable going-forward cost and the fundamentally-derived CRA SPP capacity price forecast. The rationale for this approach is that while Liberty-Empire is currently long capacity, this situation is dependent on maintaining all capacity resources in the existing fleet. While Liberty-Empire may have significant going-forward Iatan 1 costs during this time period, Liberty-Empire could, in theory, retire Iatan 1 and find a bilateral capacity opportunity in the market. Therefore, the 2027-2028 avoided demand cost splits the difference between the CRA SPP capacity price and the Iatan 1 going-forward cost.

Years 2029+: In the years in which it is certain that Liberty-Empire would require new additional generation capacity, the avoided demand cost projection is based on a transition to the projected cost of new entry ("CONE," which includes capital costs and ongoing fixed operations and maintenance costs) in SPP, net of expected energy margins in the SPP market. CRA's fundamentals-based SPP power market forecast projects a need for new capacity in the late 2020s and early 2030s as reserve margins decline due to growing SPP load, regional plant retirements, and declining ELCC. The cost of the new entrant in this time period is set by a blend of gas CC, gas CT, and battery storage, based on the rationale that the marginal capacity type is currently uncertain but is most likely to be one of these technology types. The value of capacity grows in the broader SPP market over this period due to larger "missing money" resulting from declining storage ELCC and lower energy margins as renewables push prices down.

The avoided demand cost projection used by Liberty-Empire in the 2022 IRP is shown in Figure 5-32 in 2020 dollars per kW-year.

Figure 5-32 – Avoided Capacity Price (2020$/kW-year)

****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.

Liberty-Empire engaged CRA to develop its avoided energy costs based on a fundamental market analysis of the Southwest Power Pool ("SPP") market. Since Liberty-Empire is a member of SPP and part of the SPP Integrated Marketplace ("SPP IM"), Liberty-Empire utilized market prices as the avoided energy cost. CRA developed a forward view of the SPP South electricity market for purposes of the 2022 IRP, incorporating an expectation for "Base Gas" and "Base Carbon" prices. The development of the gas and carbon price input assumptions is described further in Volume 4. The power price forecast uses a combination of public data and proprietary forecasts to develop input assumptions for the key supply and demand drivers of power market outcomes. Supply includes a bottom-up analysis of generation resources, including parameters for fuel type, operations (capacity, heat rates, planned outages, and forced outages), emissions costs, and expectations for the amount of additions (and retirements) over time. Demand includes the demand for electricity by zone at an annual, monthly, and hourly level. Figure 5-33 illustrates

Liberty-Empire's assumptions for the avoided energy costs ($/MWh) for the Base Case. These prices represent the all-hours SPP South Hub power price forecast in 2020 dollars per MWh.

Figure 5-33 – Avoided Energy Costs (Base Carbon / Base Gas) (2020$/MWh)

****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.

Projections of the price associated with CO_2 emissions (in real 2020 $/ton and nominal $/ton) for the Base case and the Low case (i.e. zero CO_2 price) are shown in Figure 5-34. Additional information on the development of these prices can be found in Technical Volume 4.

Figure 5-34 – Projections of Price for CO2 ($/ton) for the Low and Base Avoided Probable Environmental Cost Scenarios

****Confidential in Its Entirety****

CRA analyzed the SPP power market implications associated with the Low CO2 case within the Base Gas market scenario. Figure 5-35 illustrates Liberty-Empire's assumptions for the avoided energy costs ($/MWh) for the Base Gas scenario with and without a carbon price. These prices represent the all-hours SPP South price forecast in 2020 dollars per MWh.

Figure 5-35 – Liberty-Empire's Assumptions for the Avoided Energy Costs ($/MWh) for the Low Avoided Probable Environmental Cost Scenario

****Confidential in its entirety**[36]**

(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 Table 5-91.

Table 5-91 – Total Resource Cost Test Program Costs

Sector	Bundle	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$853,484	$874,735	$980,295	$1,013,876	$1,176,516	$1,206,532	$1,235,658	$1,264,330	$1,292,788	$1,319,311	$1,346,591	$1,364,046	$1,382,714	$1,396,980	$1,412,346	$1,430,079	$1,377,199	$1,392,268	$1,408,670	$1,375,349	$1,402,856
Residential	Retail Lighting	$471,209	$578,259	$373,848	$102,139	$8,474	$8,011	$8,354	$8,657	$8,925	$9,166	$9,384	$13,412	$9,769	$9,942	$10,105	$10,260	$10,408	$9,274	$8,622	$8,315	$8,482
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$28,439	$28,805	$29,171	$29,536	$29,900	$30,263	$30,626	$30,987	$31,348	$31,707	$32,066	$32,820	$33,476
Residential	Whole Home Efficiency	$1,121,390	$1,594,776	$1,749,994	$1,780,225	$1,871,049	$1,908,607	$1,949,127	$1,986,650	$2,024,081	$2,065,290	$2,102,325	$2,134,535	$2,165,029	$2,193,732	$2,223,397	$2,254,718	$2,250,460	$2,259,130	$2,288,648	$2,302,751	$2,348,806
Residential	Residential Behavioral	$29,792	$30,359	$30,930	$31,505	$32,083	$1,395	$482	$490	$500	$511	$522	$534	$545	$557	$568	$580	$592	$604	$617	$637	$0
Residential	**Subtotal**	**$2,475,875**	**$3,078,128**	**$3,135,068**	**$2,927,746**	**$3,088,122**	**$3,124,544**	**$3,193,622**	**$3,260,126**	**$3,354,733**	**$3,423,083**	**$3,487,994**	**$3,542,063**	**$3,587,958**	**$3,631,475**	**$3,677,042**	**$3,726,625**	**$3,670,007**	**$3,692,984**	**$3,738,623**	**$3,719,872**	**$3,793,620**
Commercial	Commercial Prescriptive	$1,346,265	$1,520,685	$1,609,439	$1,888,157	$1,928,765	$1,980,517	$2,040,690	$2,085,109	$2,115,451	$2,074,250	$2,033,614	$2,023,797	$2,014,042	$2,005,802	$1,992,066	$1,359,162	$1,187,835	$1,009,289	$917,550	$886,791	$904,527
Commercial	Commercial Custom	$173,846	$179,876	$185,319	$216,257	$220,641	$224,562	$228,059	$231,167	$233,918	$236,340	$238,460	$240,304	$241,893	$243,249	$237,403	$231,819	$227,732	$224,446	$221,833	$222,167	$226,611
Commercial	SBDI	$258,170	$281,388	$297,209	$352,568	$369,010	$382,266	$393,656	$403,191	$411,577	$405,890	$400,520	$396,830	$393,941	$391,932	$390,568	$247,877	$237,041	$201,445	$177,752	$167,284	$170,629
Commercial	Midstream Food Service	$14,949	$16,802	$18,512	$19,698	$20,675	$21,417	$21,978	$22,529	$22,863	$20,221	$18,686	$17,933	$2,851	$1,088	$2,169	$1,642	$1,159	$790	$532	$296	$302
Commercial	SEM	$40,147	$40,061	$39,966	$39,861	$39,748	$39,627	$39,498	$39,361	$39,217	$39,066	$38,908	$38,743	$38,573	$38,396	$38,214	$38,026	$37,834	$37,636	$37,434	$37,678	$38,432
Commercial	Retrocommissioning	$31,557	$34,091	$34,848	$35,607	$36,369	$37,134	$37,902	$38,672	$39,445	$42,799	$46,136	$47,704	$57,017	$63,749	$66,949	$88,217	$101,778	$108,278	$155,128	$180,902	$184,520
Commercial	**Subtotal**	**$1,864,934**	**$2,072,903**	**$2,185,292**	**$2,552,150**	**$2,615,207**	**$2,685,523**	**$2,761,783**	**$2,820,030**	**$2,862,470**	**$2,818,566**	**$2,776,325**	**$2,765,313**	**$2,748,317**	**$2,744,217**	**$2,727,369**	**$1,966,744**	**$1,793,379**	**$1,581,885**	**$1,510,228**	**$1,495,118**	**$1,525,021**
Portfolio	**EE Programs**																					
Residential	Critical Peak Pricing (Res)	$0	$280,909	$256,508	$228,822	$193,930	$203,822	$6,115	$6,115	$10,755	$10,439	$10,092	$9,800	$9,541	$9,309	$9,118	$8,946	$8,759	$8,578	$8,527	$10,060	$10,270
Residential	DLC Smart Thermostat	$0	$138,472	$174,694	$212,038	$284,178	$290,290	$330,710	$371,941	$26,510	$26,162	$25,754	$25,431	$25,160	$24,929	$24,765	$24,630	$24,467	$24,309	$24,381	$15,477	$15,854
Residential	Time of Use Rate (Res)	$304,370	$299,406	$290,164	$276,274	$251,217	$6,759	$6,759	$6,759	$12,264	$11,889	$11,478	$11,131	$10,824	$10,549	$10,322	$10,118	$9,897	$9,682	$9,621	$11,439	$11,689
Commercial	Critical Peak Pricing (Non Res)	$0	$63,750	$62,608	$60,816	$58,979	$57,232	$3,709	$3,709	$3,709	$3,709	$4,852	$4,835	$4,819	$4,802	$4,787	$4,769	$4,752	$4,740	$4,722	$4,718	$4,709
Commercial	Real Time Pricing	$0	$31,953	$30,402	$28,685	$27,009	$25,413	$12,329	$12,329	$12,329	$12,329	$12,657	$12,652	$12,648	$12,643	$12,639	$12,634	$12,629	$12,625	$12,620	$12,619	$12,616
Commercial	Time of Use Rate (Non Res)	$17,834	$30,222	$30,340	$36,602	$36,595	$36,637	$52,062	$51,932	$53,335	$22,494	$6,926	$6,906	$6,887	$6,867	$6,849	$6,828	$6,808	$6,793	$6,772	$6,767	$6,757
Portfolio	**Subtotal DR Programs**	**322,204**	**844,712**	**844,715**	**843,236**	**851,909**	**620,153**	**411,683**	**452,785**	**118,901**	**87,022**	**71,761**	**70,754**	**69,879**	**69,099**	**68,479**	**67,924**	**67,312**	**66,727**	**66,643**	**61,080**	**61,896**
Portfolio	**All Programs**	**5,015,462**	**5,995,744**	**6,165,074**	**6,323,131**	**6,555,238**	**6,430,220**	**6,367,088**	**6,532,941**	**6,336,105**	**6,328,672**	**6,336,080**	**6,378,130**	**6,406,153**	**6,444,790**	**6,472,890**	**5,761,293**	**5,530,699**	**5,341,596**	**5,315,494**	**5,276,071**	**5,380,536**

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

Table 5-91 above details the Total Resource Cost Test Program Costs.

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 bundle utility cost test costs are shown in Table 5-92 below. This includes incentives and non-incentives.

Table 5-92 – Utility Cost Test Costs

Sector	Bundle	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$582,834	$597,346	$669,427	$692,359	$803,422	$823,919	$843,809	$863,388	$882,822	$900,933	$919,562	$931,482	$944,230	$953,973	$964,466	$976,575	$940,465	$950,756	$961,956	$939,202	$957,986
Residential	Retail Lighting	$327,673	$402,111	$260,209	$71,049	$5,885	$5,559	$5,797	$6,007	$6,193	$6,360	$6,512	$8,308	$6,779	$6,899	$7,012	$7,120	$7,222	$6,435	$5,983	$5,770	$5,886
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$23,189	$23,488	$23,786	$24,083	$24,380	$24,676	$24,972	$25,267	$25,561	$25,854	$26,147	$26,761	$27,296
Residential	Whole Home Efficiency	$918,677	$1,260,428	$1,373,697	$1,397,200	$1,464,196	$1,492,964	$1,523,858	$1,552,593	$1,581,259	$1,612,632	$1,641,004	$1,665,906	$1,689,570	$1,711,944	$1,735,003	$1,759,248	$1,757,940	$1,765,907	$1,788,842	$1,802,626	$1,838,679
Residential	Residential Behavioral	$29,792	$30,359	$30,930	$31,505	$32,083	$1,395	$482	$490	$500	$511	$522	$534	$545	$557	$568	$580	$592	$604	$617	$637	$0
Residential	**Subtotal**	**$1,858,976**	**$2,290,244**	**$2,334,263**	**$2,192,113**	**$2,305,586**	**$2,323,837**	**$2,373,946**	**$2,422,478**	**$2,493,963**	**$2,543,925**	**$2,591,386**	**$2,631,314**	**$2,665,505**	**$2,698,049**	**$2,732,022**	**$2,768,790**	**$2,731,780**	**$2,749,556**	**$2,783,544**	**$2,774,997**	**$2,829,847**
Commercial	Commercial Prescriptive	$911,633	$1,029,771	$1,089,885	$1,278,650	$1,306,156	$1,341,197	$1,381,960	$1,412,051	$1,432,606	$1,404,700	$1,377,176	$1,370,528	$1,363,921	$1,358,341	$1,349,038	$920,334	$804,285	$683,339	$621,195	$600,356	$612,363
Commercial	Commercial Custom	$102,224	$106,574	$110,508	$132,716	$135,900	$138,759	$141,318	$143,602	$145,634	$147,435	$149,023	$150,416	$151,631	$152,682	$148,575	$144,688	$141,859	$139,606	$137,839	$137,930	$140,688
Commercial	SBDI	$193,223	$211,151	$223,599	$262,759	$275,025	$284,891	$293,306	$300,310	$306,413	$302,795	$299,320	$296,934	$295,046	$293,721	$292,806	$195,157	$187,711	$160,224	$142,118	$134,159	$136,842
Commercial	Midstream Food Service	$11,206	$12,586	$13,842	$14,724	$15,447	$15,997	$16,373	$16,752	$16,986	$15,047	$13,922	$13,408	$2,341	$1,054	$1,862	$1,470	$1,109	$831	$635	$208	$212
Commercial	SEM	$28,273	$28,212	$28,145	$28,071	$27,992	$27,906	$27,815	$27,719	$27,618	$27,511	$27,400	$27,284	$27,164	$27,040	$26,911	$26,779	$26,643	$26,504	$26,362	$26,534	$27,064
Commercial	Retrocommissioning	$21,739	$23,485	$24,006	$24,529	$25,054	$25,581	$26,110	$26,641	$27,173	$29,484	$31,782	$32,863	$39,277	$43,915	$46,119	$60,770	$70,111	$74,589	$106,861	$124,016	$127,108
Commercial	**Subtotal**	**$1,268,298**	**$1,411,779**	**$1,489,986**	**$1,741,450**	**$1,785,574**	**$1,834,331**	**$1,886,882**	**$1,927,074**	**$1,956,430**	**$1,926,971**	**$1,898,623**	**$1,891,432**	**$1,879,381**	**$1,876,753**	**$1,865,312**	**$1,349,199**	**$1,231,719**	**$1,085,092**	**$1,035,010**	**$1,023,802**	**$1,044,278**
Portfolio	**EE Programs**																					
Residential	Critical Peak Pricing (Res)	$0	$318,106	$293,705	$266,019	$231,127	$241,019	$43,312	$43,312	$47,952	$47,636	$47,289	$46,997	$46,738	$46,506	$46,315	$46,143	$45,956	$45,775	$45,724	$47,257	$47,467
Residential	DLC Smart Thermostat	$0	$243,695	$327,183	$422,417	$572,968	$659,244	$791,335	$935,981	$595,742	$600,488	$605,060	$609,624	$614,165	$618,679	$623,215	$627,743	$632,195	$636,608	$641,272	$634,379	$636,873
Residential	Time of Use Rate (Res)	$345,486	$340,522	$331,281	$317,390	$292,334	$47,876	$47,876	$47,876	$53,380	$53,006	$52,595	$52,247	$51,941	$51,665	$51,438	$51,235	$51,013	$50,798	$50,738	$52,556	$52,806
Commercial	Critical Peak Pricing (Non Res)	$0	$96,051	$94,908	$93,116	$91,280	$89,532	$36,010	$36,010	$36,010	$36,010	$36,010	$37,153	$37,135	$37,119	$37,103	$37,087	$37,070	$37,053	$37,041	$37,023	$37,019	$37,010
Commercial	Real Time Pricing	$0	$96,036	$94,485	$92,769	$91,093	$89,496	$76,413	$76,413	$76,413	$76,413	$76,413	$76,741	$76,736	$76,731	$76,727	$76,722	$76,717	$76,712	$76,709	$76,704	$76,703	$76,700
Commercial	Time of Use Rate (Non Res)	$51,718	$64,106	$64,223	$70,485	$70,479	$70,521	$85,945	$85,815	$87,218	$56,378	$40,810	$40,789	$40,770	$40,751	$40,732	$40,711	$40,692	$40,677	$40,656	$40,651	$40,640
Portfolio	**Subtotal DR Programs**	**397,204**	**1,158,516**	**1,205,785**	**1,262,196**	**1,349,280**	**1,197,688**	**1,080,890**	**1,225,406**	**896,715**	**869,930**	**859,648**	**863,529**	**867,465**	**871,431**	**875,510**	**879,618**	**883,622**	**887,608**	**892,116**	**888,563**	**891,496**
Portfolio	**All Programs**	**3,876,926**	**5,348,235**	**5,534,679**	**5,716,977**	**5,986,126**	**5,893,084**	**5,877,531**	**6,134,095**	**5,883,460**	**5,876,551**	**5,886,265**	**5,926,544**	**5,955,227**	**5,992,497**	**6,021,770**	**5,499,009**	**5,333,475**	**5,196,123**	**5,183,379**	**5,157,740**	**5,243,825**

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 does 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 program utility cost test was modified to include an estimated utility incentive of 10% of the total budget, presented in Table 5-93 and Table 5-94 below. The utility incentive was applied at the portfolio level, therefore, only affecting the portfolio level ratio.

Table 5-93 – Utility Cost Test Costs Modified with Utility Incentive

Sector	Bundle	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs	Modified UCT Costs
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Portfolio	All Programs	3,489,234	4,811,770	4,979,570	5,143,638	5,385,872	5,302,134	5,288,136	5,519,044	5,293,472	5,287,254	5,295,997	5,332,248	5,358,063	5,391,606	5,417,951	4,947,466	4,798,486	4,674,869	4,663,399	4,640,324	4,717,800

Table 5-94 – Utility Cost Test Ratios Modified with Utility Incentive

Sector	Bundle	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive	Modified UCT Ratio w/ Utility Incentive
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Portfolio	All Programs	2.92	2.44	2.46	2.29	2.26	2.42	2.60	2.67	2.97	3.05	3.15	3.25	3.36	3.47	3.62	3.78	3.93	4.11	4.27	4.40	4.50

(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.

(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.

Table 5-95 – Total Resource Cost Test Program Costs

Sector	Bundle	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs	TRC Costs
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$853,484	$874,735	$980,295	$1,013,876	$1,176,516	$1,206,532	$1,235,658	$1,264,330	$1,292,788	$1,319,311	$1,346,591	$1,364,046	$1,382,714	$1,396,980	$1,412,346	$1,430,079	$1,377,199	$1,392,268	$1,408,670	$1,375,349	$1,402,856
Residential	Retail Lighting	$471,209	$578,259	$373,848	$102,139	$8,474	$8,011	$8,354	$8,657	$8,925	$9,166	$9,384	$13,412	$9,769	$9,942	$10,105	$10,260	$10,408	$9,274	$8,622	$8,315	$8,482
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$0	$28,439	$28,805	$29,171	$29,536	$29,900	$30,263	$30,626	$30,987	$31,348	$31,707	$32,066	$32,820	$33,476
Residential	Whole Home Efficiency	$1,121,390	$1,594,776	$1,749,994	$1,780,225	$1,871,049	$1,908,607	$1,949,127	$1,986,650	$2,024,081	$2,065,290	$2,102,325	$2,134,535	$2,165,029	$2,193,732	$2,223,397	$2,254,718	$2,250,460	$2,259,130	$2,288,648	$2,302,751	$2,348,806
Residential	Residential Behavioral	$29,792	$30,359	$30,930	$31,505	$32,083	$1,395	$482	$490	$500	$511	$522	$534	$545	$557	$568	$580	$592	$604	$617	$637	$0
Residential	**Subtotal**	**$2,475,875**	**$3,078,128**	**$3,135,068**	**$2,927,746**	**$3,088,122**	**$3,124,544**	**$3,193,622**	**$3,260,126**	**$3,354,733**	**$3,423,083**	**$3,487,994**	**$3,542,063**	**$3,587,958**	**$3,631,475**	**$3,677,042**	**$3,726,625**	**$3,670,007**	**$3,692,984**	**$3,738,623**	**$3,719,872**	**$3,793,620**
Commercial	Commercial Prescriptive	$1,346,265	$1,520,685	$1,609,439	$1,888,157	$1,928,765	$1,980,517	$2,040,690	$2,085,109	$2,115,451	$2,074,250	$2,033,614	$2,023,797	$2,014,042	$2,005,802	$1,992,066	$1,359,162	$1,187,835	$1,009,289	$917,550	$886,791	$904,527
Commercial	Commercial Custom	$173,846	$179,876	$185,319	$216,257	$220,641	$224,562	$228,059	$231,167	$233,918	$236,340	$238,460	$240,304	$241,893	$243,249	$237,403	$231,819	$227,732	$224,446	$221,833	$222,167	$226,611
Commercial	SBDI	$258,170	$281,388	$297,209	$352,568	$369,010	$382,266	$393,656	$403,191	$411,577	$405,890	$400,520	$396,830	$393,941	$391,932	$390,568	$247,877	$237,041	$201,445	$177,752	$167,284	$170,629
Commercial	Midstream Food Service	$14,949	$16,802	$18,512	$19,698	$20,675	$21,417	$21,978	$22,529	$22,863	$20,221	$18,686	$17,933	$2,851	$1,088	$2,169	$1,642	$1,159	$790	$532	$296	$302
Commercial	SEM	$40,147	$40,061	$39,966	$39,861	$39,748	$39,627	$39,498	$39,361	$39,217	$39,066	$38,908	$38,743	$38,573	$38,396	$38,214	$38,026	$37,834	$37,636	$37,434	$37,678	$38,432
Commercial	Retrocommissioning	$31,557	$34,091	$34,848	$35,607	$36,369	$37,134	$37,902	$38,672	$39,445	$42,799	$46,136	$47,704	$57,017	$63,749	$66,949	$88,217	$101,778	$108,278	$155,128	$180,902	$184,520
Commercial	**Subtotal**	**$1,864,934**	**$2,072,903**	**$2,185,292**	**$2,552,150**	**$2,615,207**	**$2,685,523**	**$2,761,783**	**$2,820,030**	**$2,862,470**	**$2,818,566**	**$2,776,325**	**$2,765,313**	**$2,748,317**	**$2,744,217**	**$2,727,369**	**$1,966,744**	**$1,793,379**	**$1,581,885**	**$1,510,228**	**$1,495,118**	**$1,525,021**
Portfolio	**EE Programs**																					
Residential	Critical Peak Pricing (Res)	$0	$280,909	$256,508	$228,822	$193,930	$203,822	$6,115	$6,115	$10,755	$10,439	$10,092	$9,800	$9,541	$9,309	$9,118	$8,946	$8,759	$8,578	$8,527	$10,060	$10,270
Residential	DLC Smart Thermostat	$0	$138,472	$174,694	$212,038	$284,178	$290,290	$330,710	$371,941	$26,510	$26,162	$25,754	$25,431	$25,160	$24,929	$24,765	$24,630	$24,467	$24,309	$24,381	$15,477	$15,854
Residential	Time of Use Rate (Res)	$304,370	$299,406	$290,164	$276,274	$251,217	$6,759	$6,759	$6,759	$12,264	$11,889	$11,478	$11,131	$10,824	$10,549	$10,322	$10,118	$9,897	$9,682	$9,621	$11,439	$11,689
Commercial	Critical Peak Pricing (Non Res)	$0	$63,750	$62,608	$60,816	$58,979	$57,232	$3,709	$3,709	$3,709	$3,709	$4,852	$4,835	$4,819	$4,802	$4,787	$4,769	$4,752	$4,740	$4,722	$4,718	$4,709
Commercial	Real Time Pricing	$0	$31,953	$30,402	$28,685	$27,009	$25,413	$12,329	$12,329	$12,329	$12,329	$12,657	$12,652	$12,648	$12,643	$12,639	$12,634	$12,629	$12,625	$12,620	$12,619	$12,616
Commercial	Time of Use Rate (Non Res)	$17,834	$30,222	$30,340	$36,602	$36,595	$36,637	$52,062	$51,932	$53,335	$22,494	$6,926	$6,906	$6,887	$6,867	$6,849	$6,828	$6,808	$6,793	$6,772	$6,767	$6,757
Portfolio	**Subtotal DR Programs**	**322,204**	**844,712**	**844,715**	**843,236**	**851,909**	**620,153**	**411,683**	**452,785**	**118,901**	**87,022**	**71,761**	**70,754**	**69,879**	**69,099**	**68,479**	**67,924**	**67,312**	**66,727**	**66,643**	**61,080**	**61,896**
Portfolio	**All Programs**	**5,015,462**	**5,995,744**	**6,165,074**	**6,323,131**	**6,555,238**	**6,430,220**	**6,367,088**	**6,532,941**	**6,336,105**	**6,328,672**	**6,336,080**	**6,378,130**	**6,406,153**	**6,444,790**	**6,472,890**	**5,761,293**	**5,530,699**	**5,341,596**	**5,315,494**	**5,276,071**	**5,380,536**

Table 5-96 – Total Resource Cost Test Program Benefits

Sector	Bundle	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Sector_Sector	Bundle_Bundle	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits	TRC Benefits
Residential	Residential Prescriptive	$2,067,434	$2,202,702	$2,451,857	$2,648,756	$2,899,751	$3,085,879	$3,270,459	$3,458,685	$3,646,436	$3,826,002	$4,024,677	$4,216,071	$4,410,376	$4,608,163	$4,816,066	$5,023,454	$5,056,987	$5,255,790	$5,449,659	$5,572,191	$5,803,054
Residential	Retail Lighting	$2,839,800	$3,571,927	$3,263,411	$799,654	$40,669	$23,974	$25,827	$27,608	$34,564	$36,544	$38,484	$54,236	$42,409	$44,363	$46,316	$48,275	$50,238	$45,931	$43,799	$43,253	$45,045
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$35,934	$37,314	$38,692	$40,163	$41,578	$43,103	$44,589	$46,126	$47,683	$49,378	$51,122	$53,408	$55,622
Residential	Whole Home Efficiency	$2,454,523	$2,955,494	$3,239,428	$3,396,777	$3,581,725	$3,780,272	$3,941,799	$4,156,338	$4,369,225	$4,577,381	$4,804,865	$5,038,039	$5,272,315	$5,514,596	$5,768,719	$6,017,928	$6,189,769	$6,399,507	$6,637,175	$6,867,595	$7,150,267
Residential	Residential Behavioral	$41,231	$38,478	$40,120	$41,683	$51,080	$2,353	$843	$904	$964	$974	$1,004	$1,053	$1,093	$1,132	$1,216	$1,281	$1,329	$1,413	$1,528	$1,607	$1,673
Residential	**Subtotal**	**$7,402,989**	**$8,768,601**	**$8,994,816**	**$6,886,869**	**$6,523,225**	**$6,842,477**	**$7,238,927**	**$7,643,535**	**$8,087,122**	**$8,478,215**	**$8,907,722**	**$9,349,563**	**$9,767,770**	**$10,211,358**	**$10,676,907**	**$11,137,063**	**$11,346,006**	**$11,752,019**	**$12,183,283**	**$12,538,054**	**$13,055,662**
Commercial	Commercial Prescriptive	$3,047,118	$3,262,053	$3,108,864	$3,724,118	$3,889,136	$3,889,590	$4,153,957	$4,371,344	$4,654,580	$4,707,050	$4,726,807	$4,817,104	$5,030,516	$5,219,683	$5,349,126	$3,917,556	$3,658,905	$3,300,239	$3,115,276	$3,086,984	$3,208,984
Commercial	Commercial Custom	$329,513	$352,219	$379,136	$427,861	$458,535	$483,518	$508,007	$532,101	$555,685	$579,291	$603,048	$627,411	$651,358	$675,442	$683,276	$680,589	$687,374	$696,271	$706,395	$683,377	$711,581
Commercial	SBDI	$401,769	$400,807	$342,587	$370,577	$407,333	$429,066	$454,801	$478,970	$519,313	$530,767	$522,286	$529,842	$534,728	$544,532	$555,375	$334,117	$322,973	$277,965	$247,780	$236,528	$245,360
Commercial	Midstream Food Service	$23,284	$27,177	$31,293	$35,072	$38,786	$41,682	$44,195	$46,762	$49,036	$44,817	$42,815	$42,579	$7,211	$3,020	$6,113	$4,845	$3,667	$2,717	$2,050	$726	$756
Commercial	SEM	$36,035	$34,878	$38,036	$41,924	$46,441	$48,515	$50,367	$51,971	$53,118	$54,366	$55,657	$57,233	$58,716	$60,321	$61,703	$63,038	$64,672	$66,562	$68,294	$70,305	$73,236
Commercial	Retrocommissioning	$403,649	$418,537	$444,764	$474,561	$506,623	$524,778	$541,943	$558,409	$573,394	$592,769	$611,229	$627,970	$657,780	$684,558	$704,609	$758,713	$801,305	$833,173	$949,750	$1,029,825	$1,072,734
Commercial	**Subtotal**	**$4,241,367**	**$4,495,671**	**$4,344,680**	**$5,074,113**	**$5,346,854**	**$5,417,149**	**$5,753,270**	**$6,039,556**	**$6,405,125**	**$6,509,060**	**$6,561,842**	**$6,702,137**	**$6,940,309**	**$7,187,557**	**$7,360,203**	**$5,758,858**	**$5,538,896**	**$5,176,927**	**$5,089,546**	**$5,107,746**	**$5,312,652**
Portfolio	**EE Programs**																					
Residential	Critical Peak Pricing (Res)	$0	$27,273	$56,396	$84,794	$118,208	$159,246	$161,387	$171,738	$190,388	$181,302	$186,938	$194,488	$201,120	$204,936	$233,872	$251,030	$265,112	$293,636	$331,642	$345,746	$354,364
Residential	DLC Smart Thermostat	$0	$40,152	$98,728	$175,342	$303,334	$458,756	$629,435	$884,881	$984,540	$941,922	$974,412	$1,016,515	$1,053,651	$1,076,429	$1,229,115	$1,321,275	$1,397,327	$1,548,916	$1,750,787	$1,820,689	$1,866,071
Residential	Time of Use Rate (Res)	$51,135	$96,941	$151,190	$206,006	$292,878	$308,613	$311,819	$323,546	$349,820	$343,675	$353,332	$368,381	$380,884	$390,938	$430,162	$455,974	$476,143	$514,983	$567,837	$590,458	$605,175
Commercial	Critical Peak Pricing (Non Res)	$0	$18,768	$40,269	$62,802	$91,850	$125,813	$129,340	$140,779	$152,262	$143,654	$148,188	$154,114	$159,371	$162,381	$185,351	$199,288	$210,428	$233,070	$263,227	$273,980	$280,762
Commercial	Real Time Pricing	$0	$9,897	$20,048	$29,870	$44,461	$57,548	$58,981	$62,582	$65,999	$64,259	$66,093	$68,883	$71,221	$73,100	$80,426	$85,387	$89,138	$96,389	$106,256	$110,309	$113,039
Commercial	Time of Use Rate (Non Res)	$774	$2,312	$4,064	$6,345	$9,914	$13,484	$18,419	$24,678	$31,574	$32,498	$33,271	$34,522	$35,515	$36,279	$39,738	$41,904	$43,558	$46,904	$51,446	$53,159	$54,275
Portfolio	**Subtotal DR Programs**	**51,909**	**195,343**	**370,695**	**565,160**	**860,645**	**1,123,460**	**1,309,382**	**1,608,204**	**1,774,584**	**1,707,310**	**1,762,234**	**1,836,904**	**1,901,762**	**1,944,063**	**2,198,663**	**2,354,857**	**2,481,705**	**2,733,898**	**3,071,195**	**3,194,340**	**3,273,687**
Portfolio	**All Programs**	**11,696,265**	**13,459,614**	**13,710,192**	**12,526,141**	**12,730,724**	**13,383,087**	**14,301,580**	**15,291,295**	**16,266,831**	**16,694,585**	**17,231,797**	**17,888,604**	**18,609,841**	**19,342,977**	**20,235,773**	**19,250,778**	**19,366,607**	**19,662,844**	**20,344,024**	**20,840,140**	**21,642,001**

Table 5-97 – Total Resource Cost Test Benefit-Cost Ratio

Sector	Bundle	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio	TRC Ratio
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	2.42	2.52	2.50	2.61	2.46	2.56	2.65	2.74	2.82	2.90	2.99	3.09	3.19	3.30	3.41	3.51	3.67	3.77	3.87	4.05	4.14
Residential	Retail Lighting	6.03	6.18	8.73	7.83	4.80	2.99	3.09	3.19	3.87	3.99	4.10	4.04	4.34	4.46	4.58	4.71	4.83	4.95	5.08	5.20	5.31
Residential	Appliance Recycling	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.26	1.30	1.33	1.36	1.39	1.42	1.46	1.49	1.52	1.56	1.59	1.63	1.66
Residential	Whole Home Efficiency	2.19	1.85	1.85	1.91	1.89	1.95	2.02	2.09	2.16	2.22	2.29	2.36	2.44	2.51	2.59	2.67	2.75	2.83	2.90	2.98	3.04
Residential	Residential Behavioral	1.38	1.27	1.30	1.32	1.59	1.69	1.75	1.85	1.93	1.91	1.92	1.97	2.01	2.03	2.14	2.21	2.24	2.34	2.48	2.52	n/a
Residential	**Subtotal**	**2.68**	**2.35**	**2.41**	**2.02**	**1.90**	**2.14**	**2.36**	**2.48**	**2.82**	**2.86**	**2.95**	**3.05**	**3.14**	**3.23**	**3.38**	**3.49**	**3.63**	**3.78**	**3.92**	**4.07**	**4.14**
Commercial	Commercial Prescriptive	2.26	2.15	1.93	1.97	2.02	1.96	2.04	2.10	2.20	2.27	2.32	2.38	2.50	2.60	2.69	2.88	3.08	3.27	3.40	3.48	3.55
Commercial	Commercial Custom	1.90	1.96	2.05	1.98	2.08	2.15	2.23	2.30	2.38	2.45	2.53	2.61	2.69	2.78	2.88	2.94	3.02	3.10	3.18	3.08	3.14
Commercial	SBDI	1.56	1.42	1.15	1.05	1.10	1.12	1.16	1.19	1.26	1.31	1.30	1.34	1.36	1.39	1.42	1.35	1.36	1.38	1.39	1.41	1.44
Commercial	Midstream Food Service	1.56	1.62	1.69	1.78	1.88	1.95	2.01	2.08	2.14	2.22	2.29	2.37	2.53	2.77	2.82	2.95	3.17	3.44	3.86	2.45	2.51
Commercial	SEM	0.90	0.87	0.95	1.05	1.17	1.22	1.28	1.32	1.35	1.39	1.43	1.48	1.52	1.57	1.61	1.66	1.71	1.77	1.82	1.87	1.91
Commercial	Retrocommissioning	12.79	12.28	12.76	13.33	13.93	14.13	14.30	14.44	14.54	13.85	13.25	13.16	11.54	10.74	10.52	8.60	7.87	7.69	6.12	5.69	5.81
Commercial	**Subtotal**	**2.29**	**2.07**	**1.90**	**1.89**	**1.96**	**1.95**	**2.06**	**2.12**	**2.22**	**2.32**	**2.39**	**2.46**	**2.53**	**2.59**	**2.67**	**2.96**	**3.18**	**3.46**	**3.65**	**3.73**	**3.80**
Portfolio	**EE Programs**	**2.33**	**2.08**	**2.06**	**1.83**	**1.80**	**1.93**	**2.08**	**2.16**	**2.37**	**2.44**	**2.51**	**2.59**	**2.68**	**2.77**	**2.89**	**3.08**	**3.23**	**3.39**	**3.52**	**3.64**	**3.70**
Residential	Critical Peak Pricing (Res)	n/a	0.10	0.22	0.37	0.61	0.78	26.39	28.09	17.70	17.37	18.52	19.85	21.08	22.01	25.65	28.06	30.27	34.23	38.89	34.37	34.50
Residential	DLC Smart Thermostat	n/a	0.29	0.57	0.83	1.07	1.58	1.90	2.38	37.14	36.00	37.84	39.97	41.88	43.18	49.63	53.64	57.11	63.72	71.81	117.64	117.70
Residential	Time of Use Rate (Res)	0.17	0.32	0.52	0.75	1.17	45.66	46.13	47.87	28.52	28.91	30.78	33.10	35.19	37.06	41.67	45.07	48.11	53.19	59.02	51.62	51.77
Commercial	Critical Peak Pricing (Non Res)	n/a	0.34	0.75	1.21	1.83	2.58	40.96	44.64	48.32	45.58	35.92	37.46	38.84	39.68	45.41	48.95	51.83	57.52	65.16	67.84	69.61
Commercial	Real Time Pricing	n/a	0.36	0.77	1.22	1.93	2.65	5.61	5.96	6.29	6.13	6.13	6.39	6.61	6.78	7.46	7.91	8.26	8.92	9.84	10.20	10.45
Commercial	Time of Use Rate (Non Res)	0.04	0.08	0.13	0.17	0.27	0.37	0.35	0.48	0.59	1.44	4.80	5.00	5.16	5.28	5.80	6.14	6.40	6.90	7.60	7.86	8.03
Portfolio	**Subtotal DR Programs**	**0.16**	**0.23**	**0.44**	**0.67**	**1.01**	**1.81**	**3.18**	**3.55**	**14.92**	**19.62**	**24.56**	**25.96**	**27.22**	**28.13**	**32.11**	**34.67**	**36.87**	**40.97**	**46.08**	**52.30**	**52.89**
Portfolio	**All Programs**	**2.33**	**2.24**	**2.22**	**1.98**	**1.94**	**2.08**	**2.25**	**2.34**	**2.57**	**2.64**	**2.72**	**2.80**	**2.90**	**3.00**	**3.13**	**3.34**	**3.50**	**3.68**	**3.83**	**3.95**	**4.02**

Table 5-98 – Utility Cost Test Program Costs

Sector	Bundle	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs	UCT Costs
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$582,834	$597,346	$669,427	$692,359	$803,422	$823,919	$843,809	$863,388	$882,822	$900,933	$919,562	$931,482	$944,230	$953,973	$964,466	$976,575	$940,465	$950,756	$961,956	$939,202	$957,986
Residential	Retail Lighting	$327,673	$402,111	$260,209	$71,049	$5,885	$5,559	$5,797	$6,007	$6,193	$6,360	$6,512	$9,308	$6,779	$6,899	$7,012	$7,120	$7,222	$6,435	$5,983	$5,770	$5,886
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$23,189	$23,488	$23,786	$24,083	$24,380	$24,676	$24,972	$25,267	$25,561	$25,854	$26,147	$26,761	$27,296
Residential	Whole Home Efficiency	$918,677	$1,260,428	$1,373,697	$1,397,200	$1,464,196	$1,492,964	$1,523,858	$1,552,593	$1,581,259	$1,612,632	$1,641,004	$1,665,906	$1,689,570	$1,711,944	$1,735,003	$1,759,248	$1,757,940	$1,765,907	$1,788,842	$1,802,626	$1,838,679
Residential	Residential Behavioral	$29,792	$30,359	$30,930	$31,505	$32,083	$1,395	$482	$490	$500	$511	$522	$534	$545	$557	$568	$580	$592	$604	$617	$637	$0
Residential	**Subtotal**	**$1,858,976**	**$2,290,244**	**$2,334,263**	**$2,192,113**	**$2,305,586**	**$2,323,837**	**$2,373,946**	**$2,422,478**	**$2,493,963**	**$2,543,925**	**$2,591,386**	**$2,631,314**	**$2,665,505**	**$2,698,049**	**$2,732,022**	**$2,768,790**	**$2,731,780**	**$2,749,556**	**$2,783,544**	**$2,774,997**	**$2,829,847**
Commercial	Commercial Prescriptive	$911,633	$1,029,771	$1,089,885	$1,278,650	$1,306,156	$1,341,197	$1,381,960	$1,412,051	$1,432,606	$1,404,700	$1,377,176	$1,370,528	$1,363,921	$1,358,341	$1,349,038	$920,334	$804,285	$683,339	$621,195	$600,356	$612,363
Commercial	Commercial Custom	$102,224	$106,574	$110,508	$132,716	$135,900	$138,759	$141,318	$143,602	$145,634	$147,435	$149,023	$150,416	$151,631	$152,682	$148,575	$144,688	$141,859	$139,606	$137,839	$137,930	$140,688
Commercial	SBDI	$193,223	$211,151	$223,599	$262,759	$275,025	$284,891	$293,306	$300,310	$306,413	$302,795	$299,320	$296,934	$295,046	$293,721	$292,806	$195,157	$187,711	$160,224	$142,118	$134,159	$136,842
Commercial	Midstream Food Service	$11,206	$12,586	$13,842	$14,724	$15,447	$15,997	$16,373	$16,752	$16,986	$15,047	$13,922	$13,408	$2,341	$1,054	$1,862	$1,470	$1,109	$831	$635	$208	$212
Commercial	SEM	$28,273	$28,212	$28,145	$28,071	$27,992	$27,906	$27,815	$27,719	$27,618	$27,511	$27,400	$27,284	$27,164	$27,040	$26,911	$26,779	$26,643	$26,504	$26,362	$26,534	$27,064
Commercial	Retrocommissioning	$21,739	$23,485	$24,006	$24,529	$25,054	$25,581	$26,110	$26,641	$27,173	$29,484	$31,782	$32,863	$39,277	$43,915	$46,119	$60,770	$70,111	$74,589	$106,861	$124,616	$127,108
Commercial	**Subtotal**	**$1,268,298**	**$1,411,779**	**$1,489,986**	**$1,741,450**	**$1,785,574**	**$1,834,331**	**$1,886,882**	**$1,927,074**	**$1,956,430**	**$1,926,971**	**$1,898,623**	**$1,891,432**	**$1,879,381**	**$1,876,753**	**$1,865,312**	**$1,349,199**	**$1,231,719**	**$1,085,092**	**$1,035,010**	**$1,023,802**	**$1,044,278**
Portfolio	**EE Programs**																					
Residential	Critical Peak Pricing (Res)	$0	$318,106	$293,705	$266,019	$231,127	$241,019	$43,312	$43,312	$47,952	$47,636	$47,289	$46,997	$46,738	$46,506	$46,315	$46,143	$45,956	$45,775	$45,724	$47,257	$47,467
Residential	DLC Smart Thermostat	$0	$243,695	$327,183	$422,417	$572,968	$659,244	$791,335	$935,981	$595,742	$600,488	$605,060	$609,624	$614,165	$618,679	$623,215	$627,743	$632,195	$636,608	$641,272	$634,379	$636,873
Residential	Time of Use Rate (Res)	$345,486	$340,522	$331,281	$317,390	$292,334	$47,876	$47,876	$47,876	$53,380	$53,006	$52,595	$52,247	$51,941	$51,665	$51,438	$51,235	$51,013	$50,798	$50,738	$52,556	$52,806
Commercial	Critical Peak Pricing (Non Res)	$0	$96,051	$94,908	$93,116	$91,280	$89,532	$36,010	$36,010	$36,010	$36,010	$37,153	$37,135	$37,119	$37,103	$37,087	$37,070	$37,053	$37,041	$37,023	$37,019	$37,010
Commercial	Real Time Pricing	$0	$96,036	$94,485	$92,769	$91,093	$89,496	$76,413	$76,413	$76,413	$76,413	$76,741	$76,736	$76,731	$76,727	$76,722	$76,717	$76,712	$76,709	$76,704	$76,703	$76,700
Commercial	Time of Use Rate (Non Res)	$51,718	$64,106	$64,223	$70,485	$70,479	$70,521	$85,945	$85,815	$87,218	$56,378	$40,810	$40,789	$40,770	$40,751	$40,732	$40,711	$40,692	$40,677	$40,656	$40,651	$40,640
Portfolio	**Subtotal DR Programs**	**397,204**	**1,158,516**	**1,205,785**	**1,262,196**	**1,349,280**	**1,197,688**	**1,080,890**	**1,225,406**	**896,715**	**869,930**	**859,648**	**863,529**	**867,465**	**871,431**	**875,510**	**879,618**	**883,622**	**887,608**	**892,116**	**888,563**	**891,496**
Portfolio	**All Programs**	**3,876,926**	**5,348,235**	**5,534,679**	**5,716,977**	**5,986,126**	**5,893,084**	**5,877,531**	**6,134,095**	**5,883,460**	**5,876,551**	**5,886,265**	**5,926,544**	**5,955,227**	**5,992,497**	**6,021,770**	**5,499,009**	**5,333,475**	**5,196,123**	**5,183,379**	**5,157,740**	**5,243,825**

Table 5-99 – Utility Cost Test Program Benefits

Sector	Bundle	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits	UCT Benefits
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	$2,067,434	$2,202,702	$2,451,857	$2,648,756	$2,899,751	$3,085,879	$3,270,459	$3,458,685	$3,646,436	$3,826,002	$4,024,677	$4,216,071	$4,410,376	$4,608,163	$4,816,066	$5,023,454	$5,056,987	$5,255,790	$5,449,659	$5,572,191	$5,803,054
Residential	Retail Lighting	$1,555,492	$2,489,140	$2,354,113	$593,063	$36,487	$23,974	$25,827	$27,608	$34,564	$36,544	$38,484	$51,673	$42,409	$44,363	$46,316	$48,275	$50,238	$45,931	$43,799	$43,253	$45,045
Residential	Appliance Recycling	$0	$0	$0	$0	$0	$0	$0	$0	$35,934	$37,314	$38,692	$40,163	$41,578	$43,103	$44,589	$46,126	$47,683	$49,378	$51,122	$53,408	$55,622
Residential	Whole Home Efficiency	$2,324,929	$2,819,680	$3,111,390	$3,288,094	$3,457,457	$3,657,840	$3,868,419	$4,082,012	$4,293,956	$4,501,173	$4,727,720	$4,959,961	$5,193,307	$5,434,661	$5,687,860	$5,936,147	$6,107,070	$6,315,892	$6,552,649	$6,781,118	$7,062,060
Residential	Residential Behavioral	$41,231	$38,478	$40,120	$41,683	$51,080	$2,353	$843	$904	$964	$974	$1,004	$1,053	$1,093	$1,132	$1,216	$1,281	$1,329	$1,413	$1,528	$1,607	$1,673
Residential	**Subtotal**	**$6,389,086**	**$7,550,000**	**$7,957,479**	**$6,571,596**	**$6,444,775**	**$6,770,045**	**$7,165,547**	**$7,569,209**	**$8,011,854**	**$8,402,007**	**$8,830,577**	**$9,268,922**	**$9,688,762**	**$10,131,422**	**$10,596,047**	**$11,055,283**	**$11,263,307**	**$11,668,404**	**$12,098,757**	**$12,451,577**	**$12,967,455**
Commercial	Commercial Prescriptive	$2,642,243	$2,851,420	$2,751,802	$3,346,819	$3,489,378	$3,507,462	$3,761,746	$3,970,916	$4,251,010	$4,307,027	$4,331,266	$4,421,958	$4,591,453	$4,750,535	$4,859,955	$3,506,847	$3,279,110	$2,976,332	$2,824,391	$2,811,441	$2,927,930
Commercial	Commercial Custom	$323,930	$346,645	$373,573	$422,311	$452,999	$477,997	$502,502	$526,613	$550,215	$573,841	$597,617	$622,001	$645,971	$670,078	$677,935	$675,272	$682,082	$691,005	$701,156	$678,102	$706,201
Commercial	SBDI	$325,813	$326,911	$278,317	$308,503	$341,482	$362,375	$386,195	$408,810	$446,956	$457,575	$450,459	$458,056	$463,554	$473,418	$484,330	$273,322	$263,008	$225,827	$200,527	$191,370	$199,299
Commercial	Midstream Food Service	$23,284	$27,177	$31,293	$35,072	$38,786	$41,682	$44,195	$46,762	$49,036	$44,817	$42,815	$42,579	$7,211	$3,020	$6,113	$4,845	$3,667	$2,717	$2,050	$726	$756
Commercial	SEM	$36,035	$34,878	$38,036	$41,924	$46,441	$48,515	$50,367	$51,971	$53,118	$54,366	$55,657	$57,233	$58,716	$60,321	$61,703	$63,038	$64,672	$66,562	$68,294	$70,305	$73,236
Commercial	Retrocommissioning	$403,649	$418,537	$444,764	$474,561	$506,623	$524,778	$541,943	$558,409	$573,394	$592,769	$611,229	$627,970	$657,780	$684,558	$704,609	$758,713	$801,305	$833,173	$949,750	$1,029,825	$1,072,734
Commercial	**Subtotal**	**$3,754,953**	**$4,005,567**	**$3,917,786**	**$4,629,189**	**$4,875,708**	**$4,962,809**	**$5,286,948**	**$5,563,482**	**$5,923,729**	**$6,030,394**	**$6,089,043**	**$6,229,796**	**$6,424,684**	**$6,641,931**	**$6,794,645**	**$5,282,037**	**$5,093,844**	**$4,795,616**	**$4,746,169**	**$4,781,770**	**$4,980,156**
Portfolio	**EE Programs**																					
Residential	Critical Peak Pricing (Res)	$0	$27,273	$56,396	$84,794	$118,208	$159,246	$161,387	$171,738	$190,388	$181,302	$186,938	$194,488	$201,120	$204,936	$233,872	$251,030	$265,112	$293,636	$331,642	$345,746	$354,364
Residential	DLC Smart Thermostat	$0	$40,152	$98,728	$175,342	$303,334	$458,756	$629,435	$884,881	$984,540	$941,922	$974,412	$1,016,515	$1,053,651	$1,076,429	$1,229,115	$1,321,275	$1,397,327	$1,548,916	$1,750,787	$1,820,689	$1,866,071
Residential	Time of Use Rate (Res)	$51,135	$96,941	$151,190	$206,006	$292,878	$308,613	$311,819	$323,546	$349,820	$343,675	$353,332	$368,381	$380,884	$390,938	$430,162	$455,974	$476,143	$514,983	$567,837	$590,458	$605,175
Commercial	Critical Peak Pricing (Non Res)	$0	$18,768	$40,269	$62,802	$91,850	$125,813	$129,340	$140,779	$152,262	$143,654	$148,188	$154,114	$159,371	$162,381	$185,351	$199,288	$210,428	$233,070	$263,227	$273,980	$280,762
Commercial	Real Time Pricing	$0	$9,897	$20,048	$29,870	$44,461	$57,548	$58,981	$62,582	$65,999	$64,259	$66,093	$68,883	$71,221	$73,100	$80,426	$85,387	$89,138	$96,389	$106,256	$110,309	$113,039
Commercial	Time of Use Rate (Non Res)	$774	$2,312	$4,064	$6,345	$9,914	$13,484	$18,419	$24,678	$31,574	$32,498	$33,271	$34,522	$35,515	$36,279	$39,738	$41,904	$43,558	$46,904	$51,446	$53,159	$54,275
Portfolio	**Subtotal DR Programs**	**51,909**	**195,343**	**370,695**	**565,160**	**860,645**	**1,123,460**	**1,309,382**	**1,608,204**	**1,774,584**	**1,707,310**	**1,762,234**	**1,836,904**	**1,901,762**	**1,944,063**	**2,198,663**	**2,354,857**	**2,481,705**	**2,733,898**	**3,071,195**	**3,194,340**	**3,273,687**
Portfolio	**All Programs**	**10,195,948**	**11,750,910**	**12,245,960**	**11,765,945**	**12,181,129**	**12,856,315**	**13,761,877**	**14,740,895**	**15,710,167**	**16,139,711**	**16,681,855**	**17,335,622**	**18,015,208**	**18,717,416**	**19,589,356**	**18,692,177**	**18,838,857**	**19,197,919**	**19,916,121**	**20,427,686**	**21,221,299**

Table 5-100 – Utility Cost Test Benefit-Cost Ratio

Sector	Bundle	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio	UCT Ratio
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	3.55	3.69	3.66	3.83	3.61	3.75	3.88	4.01	4.13	4.25	4.38	4.53	4.67	4.83	4.99	5.14	5.38	5.53	5.67	5.93	6.06
Residential	Retail Lighting	5.97	6.19	9.05	8.35	6.20	4.31	4.46	4.60	5.58	5.75	5.91	5.55	6.26	6.43	6.61	6.78	6.96	7.14	7.32	7.50	7.65
Residential	Appliance Recycling	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.55	1.59	1.63	1.67	1.71	1.75	1.79	1.83	1.87	1.91	1.96	2.00	2.04
Residential	Whole Home Efficiency	2.53	2.24	2.26	2.35	2.36	2.45	2.54	2.63	2.72	2.79	2.88	2.98	3.07	3.17	3.28	3.37	3.47	3.58	3.66	3.76	3.84
Residential	Residential Behavioral	1.38	1.27	1.30	1.32	1.59	1.69	1.75	1.85	1.93	1.91	1.92	1.97	2.01	2.03	2.14	2.21	2.24	2.34	2.48	2.52	n/a
Residential	**Subtotal**	**2.92**	**2.42**	**2.51**	**2.20**	**2.10**	**2.35**	**2.54**	**2.59**	**2.99**	**3.04**	**3.14**	**3.25**	**3.35**	**3.46**	**3.62**	**3.74**	**3.87**	**4.03**	**4.19**	**4.33**	**4.43**
Commercial	Commercial Prescriptive	2.90	2.77	2.52	2.62	2.67	2.62	2.72	2.81	2.97	3.07	3.15	3.23	3.37	3.50	3.60	3.81	4.08	4.36	4.55	4.68	4.78
Commercial	Commercial Custom	3.17	3.25	3.38	3.18	3.33	3.44	3.56	3.67	3.78	3.89	4.01	4.14	4.26	4.39	4.56	4.67	4.81	4.95	5.09	4.92	5.02
Commercial	SBDI	1.69	1.55	1.24	1.17	1.24	1.27	1.32	1.36	1.46	1.51	1.50	1.54	1.57	1.61	1.65	1.40	1.40	1.41	1.41	1.43	1.46
Commercial	Midstream Food Service	2.08	2.16	2.26	2.38	2.51	2.61	2.70	2.79	2.89	2.98	3.08	3.18	3.08	2.87	3.28	3.30	3.31	3.27	3.23	3.50	3.57
Commercial	SEM	1.27	1.24	1.35	1.49	1.66	1.74	1.81	1.87	1.92	1.98	2.03	2.10	2.16	2.23	2.29	2.35	2.43	2.51	2.59	2.65	2.71
Commercial	Retrocommissioning	18.57	17.82	18.53	19.35	20.22	20.51	20.76	20.96	21.10	20.11	19.23	19.11	16.75	15.59	15.28	12.49	11.43	11.17	8.89	8.26	8.44
Commercial	**Subtotal**	**2.82**	**2.37**	**2.21**	**2.26**	**2.35**	**2.35**	**2.50**	**2.59**	**2.72**	**2.85**	**2.94**	**3.02**	**3.11**	**3.20**	**3.29**	**3.45**	**3.63**	**3.87**	**4.04**	**4.11**	**4.20**
Portfolio	**EE Programs**	**2.63**	**2.19**	**2.20**	**2.05**	**2.03**	**2.18**	**2.33**	**2.39**	**2.66**	**2.73**	**2.82**	**2.91**	**3.01**	**3.11**	**3.24**	**3.38**	**3.52**	**3.68**	**3.82**	**3.94**	**4.03**
Residential	Critical Peak Pricing (Res)	n/a	0.09	0.19	0.32	0.51	0.66	3.73	3.97	3.97	3.81	3.95	4.14	4.30	4.41	5.05	5.44	5.77	6.41	7.25	7.32	7.47
Residential	DLC Smart Thermostat	n/a	0.16	0.30	0.42	0.53	0.70	0.80	0.95	1.65	1.57	1.61	1.67	1.72	1.74	1.97	2.10	2.21	2.43	2.73	2.87	2.93
Residential	Time of Use Rate (Res)	0.15	0.28	0.46	0.65	1.00	6.45	6.51	6.76	6.55	6.48	6.72	7.05	7.33	7.57	8.36	8.90	9.33	10.14	11.19	11.23	11.46
Commercial	Critical Peak Pricing (Non Res)	n/a	0.22	0.47	0.75	1.11	1.55	3.66	3.99	4.32	4.07	4.09	4.25	4.39	4.47	5.10	5.48	5.79	6.41	7.24	7.53	7.71
Commercial	Real Time Pricing	n/a	0.11	0.22	0.34	0.51	0.67	0.79	0.84	0.89	0.87	0.89	0.92	0.95	0.98	1.08	1.14	1.19	1.29	1.42	1.47	1.51
Commercial	Time of Use Rate (Non Res)	0.01	0.04	0.06	0.09	0.14	0.19	0.21	0.29	0.36	0.58	0.82	0.85	0.87	0.89	0.98	1.03	1.07	1.15	1.27	1.31	1.34
Portfolio	**Subtotal DR Programs**	**0.13**	**0.17**	**0.31**	**0.45**	**0.64**	**0.94**	**1.21**	**1.31**	**1.98**	**1.96**	**2.05**	**2.13**	**2.19**	**2.23**	**2.51**	**2.68**	**2.81**	**3.08**	**3.44**	**3.59**	**3.67**
Portfolio	**All Programs**	**2.63**	**2.20**	**2.21**	**2.06**	**2.03**	**2.18**	**2.34**	**2.40**	**2.67**	**2.75**	**2.83**	**2.93**	**3.03**	**3.12**	**3.25**	**3.40**	**3.53**	**3.69**	**3.84**	**3.96**	**4.05**

(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 5-101 – Participant Cost Test Benefit-Cost Ratio

Sector	Bundle	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio	PCT Ratio
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	2.01	2.02	1.97	1.99	1.89	1.90	1.90	1.91	1.91	1.92	1.92	1.92	1.92	1.93	1.93	1.93	1.95	1.95	1.95	1.96	1.96
Residential	Retail Lighting	6.76	6.81	9.16	8.11	4.65	2.86	2.88	2.90	3.34	3.36	3.37	3.44	3.41	3.43	3.44	3.45	3.46	3.47	3.48	3.49	3.49
Residential	Appliance Recycling	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.42	2.43	2.44	2.44	2.45	2.45	2.45	2.46	2.46	2.46	2.47	2.47	2.47
Residential	Whole Home Efficiency	2.29	1.94	1.88	1.87	1.79	1.79	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.81	1.80	1.81	1.81
Residential	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	n/a	n/a
Residential	**Subtotal**	**3.13**	**3.04**	**2.96**	**2.32**	**2.06**	**2.08**	**2.12**	**2.16**	**2.17**	**2.16**	**2.16**	**2.16**	**2.16**	**2.16**	**2.16**	**2.16**	**2.17**	**2.17**	**2.17**	**2.18**	**2.17**
Commercial	Commercial Prescriptive	2.33	2.20	2.00	1.96	1.96	1.88	1.90	1.90	1.93	1.95	1.95	1.95	1.98	2.00	2.01	2.07	2.11	2.15	2.17	2.17	2.17
Commercial	Commercial Custom	1.56	1.59	1.63	1.64	1.68	1.71	1.73	1.75	1.76	1.78	1.80	1.81	1.82	1.84	1.84	1.83	1.82	1.82	1.82	1.71	1.71
Commercial	SBDI	2.04	1.89	1.64	1.53	1.56	1.55	1.56	1.56	1.60	1.61	1.59	1.60	1.59	1.60	1.60	1.61	1.61	1.62	1.62	1.62	1.62
Commercial	Midstream Food Service	1.87	1.89	1.91	1.95	1.99	2.01	2.01	2.02	2.03	2.04	2.05	2.07	2.23	2.56	2.37	2.47	2.65	2.94	3.42	1.82	1.82
Commercial	SEM	1.08	1.05	1.08	1.12	1.17	1.18	1.19	1.19	1.20	1.20	1.21	1.21	1.22	1.22	1.22	1.22	1.22	1.22	1.23	1.23	1.23
Commercial	Retrocommissioning	12.58	11.82	11.98	12.20	12.43	12.32	12.18	12.02	11.84	11.00	10.25	9.95	8.43	7.60	7.25	5.64	4.95	4.68	3.44	3.05	3.05
Commercial	**Subtotal**	**2.58**	**2.49**	**2.28**	**2.21**	**2.23**	**2.16**	**2.17**	**2.18**	**2.20**	**2.23**	**2.23**	**2.24**	**2.25**	**2.26**	**2.26**	**2.49**	**2.61**	**2.74**	**2.84**	**2.86**	**2.85**
Portfolio	**EE Programs**	**2.79**	**2.74**	**2.61**	**2.20**	**2.07**	**2.06**	**2.08**	**2.11**	**2.12**	**2.13**	**2.13**	**2.13**	**2.14**	**2.15**	**2.15**	**2.19**	**2.21**	**2.23**	**2.22**	**2.21**	**2.21**
Residential	Critical Peak Pricing (Res)	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	n/a	n/a
Residential	DLC Smart Thermostat	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	n/a	n/a
Residential	Time of Use Rate (Res)	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	n/a	n/a
Commercial	Critical Peak Pricing (Non Res)	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	n/a	n/a
Commercial	Real Time Pricing	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	n/a	n/a
Commercial	Time of Use Rate (Non Res)	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	n/a	n/a
Portfolio	**Subtotal DR Programs**	**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**	**n/a**	**n/a**
Portfolio	**All Programs**	**2.79**	**2.73**	**2.60**	**2.20**	**2.07**	**2.05**	**2.08**	**2.10**	**2.12**	**2.12**	**2.12**	**2.13**	**2.13**	**2.14**	**2.14**	**2.18**	**2.20**	**2.22**	**2.21**	**2.20**	**2.20**

Table 5-102 – Ratepayer Impact Cost Test Benefit-Cost Ratio

Sector	Bundle	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio	RIM Ratio
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	0.93	0.96	0.97	1.00	0.98	1.01	1.05	1.08	1.11	1.14	1.18	1.21	1.25	1.29	1.34	1.38	1.43	1.47	1.51	1.57	1.61
Residential	Retail Lighting	0.95	0.98	1.11	1.10	1.05	0.93	0.95	0.98	1.08	1.10	1.13	1.11	1.19	1.22	1.25	1.28	1.31	1.34	1.37	1.40	1.43
Residential	Appliance Recycling	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.59	0.61	0.62	0.63	0.65	0.66	0.68	0.69	0.71	0.72	0.74	0.75	0.77
Residential	Whole Home Efficiency	0.85	0.79	0.80	0.83	0.84	0.87	0.90	0.93	0.96	0.99	1.02	1.05	1.09	1.12	1.16	1.19	1.23	1.27	1.30	1.33	1.36
Residential	Residential Behavioral	0.77	0.75	0.78	0.80	0.88	0.92	0.95	1.00	1.05	1.03	1.05	1.07	1.09	1.11	1.17	1.21	1.24	1.30	1.38	1.40	3.24
Residential	**Subtotal**	**0.87**	**0.82**	**0.86**	**0.85**	**0.86**	**0.92**	**0.98**	**1.02**	**1.10**	**1.12**	**1.15**	**1.19**	**1.23**	**1.26**	**1.32**	**1.37**	**1.42**	**1.47**	**1.53**	**1.59**	**1.62**
Commercial	Commercial Prescriptive	0.75	0.74	0.71	0.74	0.76	0.76	0.78	0.80	0.84	0.86	0.89	0.91	0.95	0.99	1.02	1.08	1.14	1.21	1.25	1.29	1.31
Commercial	Commercial Custom	0.94	0.96	0.98	0.94	0.97	1.00	1.03	1.05	1.08	1.11	1.14	1.17	1.20	1.23	1.28	1.31	1.35	1.38	1.42	1.43	1.46
Commercial	SBDI	0.55	0.52	0.45	0.43	0.45	0.46	0.48	0.49	0.52	0.54	0.54	0.56	0.57	0.58	0.60	0.55	0.56	0.56	0.57	0.58	0.59
Commercial	Midstream Food Service	0.62	0.64	0.67	0.70	0.72	0.75	0.77	0.79	0.82	0.84	0.87	0.89	0.92	0.96	1.00	1.03	1.06	1.11	1.16	0.99	1.01
Commercial	SEM	0.50	0.49	0.53	0.57	0.62	0.65	0.67	0.70	0.71	0.73	0.75	0.77	0.80	0.82	0.84	0.87	0.89	0.92	0.95	0.97	0.99
Commercial	Retrocommissioning	1.17	1.19	1.22	1.25	1.29	1.32	1.35	1.38	1.40	1.43	1.46	1.49	1.51	1.53	1.56	1.58	1.60	1.64	1.65	1.67	1.70
Commercial	**Subtotal**	**0.74**	**0.70**	**0.68**	**0.69**	**0.72**	**0.73**	**0.76**	**0.78**	**0.81**	**0.84**	**0.86**	**0.89**	**0.91**	**0.94**	**0.96**	**1.03**	**1.08**	**1.15**	**1.20**	**1.23**	**1.26**
Portfolio	**EE Programs**	**0.80**	**0.76**	**0.78**	**0.77**	**0.78**	**0.83**	**0.87**	**0.90**	**0.96**	**0.98**	**1.01**	**1.04**	**1.08**	**1.12**	**1.16**	**1.24**	**1.30**	**1.36**	**1.42**	**1.47**	**1.50**
Residential	Critical Peak Pricing (Res)	n/a	0.09	0.19	0.32	0.51	0.65	3.55	3.78	3.80	3.64	3.78	3.95	4.11	4.20	4.81	5.18	5.49	6.11	6.90	6.96	7.11
Residential	DLC Smart Thermostat	n/a	0.16	0.30	0.41	0.52	0.68	0.78	0.92	1.60	1.51	1.55	1.61	1.65	1.68	1.90	2.03	2.13	2.34	2.63	2.76	2.82
Residential	Time of Use Rate (Res)	0.14	0.26	0.40	0.55	0.77	2.25	2.30	2.43	2.51	2.44	2.51	2.58	2.66	2.70	2.96	3.12	3.26	3.52	3.83	3.91	3.99
Commercial	Critical Peak Pricing (Non Res)	n/a	0.22	0.47	0.74	1.10	1.53	3.54	3.86	4.18	3.94	3.96	4.11	4.25	4.33	4.94	5.30	5.60	6.19	6.99	7.27	7.44
Commercial	Real Time Pricing	n/a	0.11	0.21	0.31	0.45	0.58	0.67	0.71	0.75	0.73	0.75	0.77	0.80	0.82	0.90	0.95	0.99	1.07	1.17	1.21	1.24
Commercial	Time of Use Rate (Non Res)	0.01	0.04	0.06	0.09	0.14	0.19	0.21	0.29	0.36	0.58	0.82	0.85	0.87	0.89	0.98	1.03	1.07	1.15	1.27	1.31	1.34
Portfolio	**Subtotal DR Programs**	**0.12**	**0.16**	**0.29**	**0.42**	**0.59**	**0.85**	**1.09**	**1.19**	**1.73**	**1.71**	**1.78**	**1.84**	**1.90**	**1.93**	**2.17**	**2.31**	**2.42**	**2.66**	**2.96**	**3.09**	**3.15**
Portfolio	**All Programs**	**0.80**	**0.76**	**0.78**	**0.77**	**0.78**	**0.83**	**0.87**	**0.90**	**0.96**	**0.98**	**1.01**	**1.04**	**1.08**	**1.12**	**1.16**	**1.24**	**1.30**	**1.36**	**1.42**	**1.47**	**1.50**

Table 5-103 – Societal Cost Test Benefit-Cost Ratio

Sector	Bundle	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio	SCT Ratio
Sector	Bundle	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Residential	Residential Prescriptive	2.42	2.52	2.50	2.61	2.46	2.56	2.65	2.74	2.82	2.90	2.99	3.09	3.19	3.30	3.41	3.51	3.67	3.77	3.87	4.05	4.14
Residential	Retail Lighting	6.03	6.18	8.73	7.83	4.80	2.99	3.09	3.19	3.87	3.99	4.10	4.04	4.34	4.46	4.58	4.71	4.83	4.95	5.08	5.20	5.31
Residential	Appliance Recycling	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.26	1.30	1.33	1.36	1.39	1.42	1.46	1.49	1.52	1.56	1.59	1.63	1.66
Residential	Whole Home Efficiency	2.19	1.85	1.85	1.91	1.89	1.95	2.02	2.09	2.16	2.22	2.29	2.36	2.44	2.51	2.59	2.67	2.75	2.83	2.90	2.98	3.04
Residential	Residential Behavioral	1.38	1.27	1.30	1.32	1.59	1.69	1.75	1.85	1.93	1.91	1.92	1.97	2.01	2.03	2.14	2.21	2.24	2.34	2.48	2.52	n/a
Residential	**Subtotal**	**2.68**	**2.35**	**2.41**	**2.02**	**1.90**	**2.14**	**2.36**	**2.48**	**2.82**	**2.86**	**2.95**	**3.05**	**3.14**	**3.23**	**3.38**	**3.49**	**3.63**	**3.78**	**3.92**	**4.07**	**4.14**
Commercial	Commercial Prescriptive	2.26	2.15	1.93	1.97	2.02	1.96	2.04	2.10	2.20	2.27	2.32	2.38	2.50	2.60	2.69	2.88	3.08	3.27	3.40	3.48	3.55
Commercial	Commercial Custom	1.90	1.96	2.05	1.98	2.08	2.15	2.23	2.30	2.38	2.45	2.53	2.61	2.69	2.78	2.88	2.94	3.02	3.10	3.18	3.08	3.14
Commercial	SBDI	1.56	1.42	1.15	1.05	1.10	1.12	1.16	1.19	1.26	1.31	1.30	1.34	1.36	1.39	1.42	1.35	1.36	1.38	1.39	1.41	1.44
Commercial	Midstream Food Service	1.56	1.62	1.69	1.78	1.88	1.95	2.01	2.08	2.14	2.22	2.29	2.37	2.53	2.77	2.82	2.95	3.17	3.44	3.86	2.45	2.51
Commercial	SEM	0.90	0.87	0.95	1.05	1.17	1.22	1.28	1.32	1.35	1.39	1.43	1.48	1.52	1.57	1.61	1.66	1.71	1.77	1.82	1.87	1.91
Commercial	Retrocommissioning	12.79	12.28	12.76	13.33	13.93	14.13	14.30	14.44	14.54	13.85	13.25	13.16	11.54	10.74	10.52	8.60	7.87	7.69	6.12	5.69	5.81
Commercial	**Subtotal**	**2.29**	**2.07**	**1.90**	**1.89**	**1.96**	**1.95**	**2.06**	**2.12**	**2.22**	**2.32**	**2.39**	**2.46**	**2.53**	**2.59**	**2.67**	**2.96**	**3.18**	**3.46**	**3.65**	**3.73**	**3.80**
Portfolio	**EE Programs**	**2.33**	**2.08**	**2.06**	**1.83**	**1.80**	**1.93**	**2.08**	**2.16**	**2.37**	**2.44**	**2.51**	**2.59**	**2.68**	**2.77**	**2.89**	**3.08**	**3.23**	**3.39**	**3.52**	**3.64**	**3.70**
Residential	Critical Peak Pricing (Res)	n/a	0.10	0.22	0.37	0.61	0.78	26.39	28.09	17.70	17.37	18.52	19.85	21.08	22.01	25.65	28.06	30.27	34.23	38.89	34.37	34.50
Residential	DLC Smart Thermostat	n/a	0.29	0.57	0.83	1.07	1.58	1.90	2.38	37.14	36.00	37.84	39.97	41.88	43.18	49.63	53.64	57.11	63.72	71.81	117.64	117.70
Residential	Time of Use Rate (Res)	0.17	0.32	0.52	0.75	1.17	45.66	46.13	47.87	28.52	28.91	30.78	33.10	35.19	37.06	41.67	45.07	48.11	53.19	59.02	51.62	51.77
Commercial	Critical Peak Pricing (Non Res)	n/a	0.34	0.75	1.21	1.83	2.58	40.96	44.64	48.32	45.58	35.92	37.46	38.84	39.68	45.41	48.95	51.83	57.52	65.16	67.84	69.61
Commercial	Real Time Pricing	n/a	0.36	0.77	1.22	1.93	2.65	5.61	5.96	6.29	6.13	6.13	6.39	6.61	6.78	7.46	7.91	8.26	8.92	9.84	10.20	10.45
Commercial	Time of Use Rate (Non Res)	0.04	0.08	0.13	0.17	0.27	0.37	0.35	0.48	0.59	1.44	4.80	5.00	5.16	5.28	5.80	6.14	6.40	6.90	7.60	7.86	8.03
Portfolio	**Subtotal DR Programs**	**0.16**	**0.23**	**0.44**	**0.67**	**1.01**	**1.81**	**3.18**	**3.55**	**14.92**	**19.62**	**24.56**	**25.96**	**27.22**	**28.13**	**32.11**	**34.67**	**36.87**	**40.97**	**46.08**	**52.30**	**52.89**
Portfolio	**All Programs**	**2.33**	**2.08**	**2.06**	**1.83**	**1.79**	**1.92**	**2.07**	**2.16**	**2.37**	**2.43**	**2.51**	**2.59**	**2.68**	**2.77**	**2.88**	**3.07**	**3.22**	**3.38**	**3.51**	**3.63**	**3.69**

(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.

Liberty-Empire engaged AEG to conduct a Demand-Side Management Potential Study and assist with demand-side program design in Liberty-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 TRC test 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.

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

- **Participant Cost Test** ("PCT") quantifies the benefits and costs to the customer due to program participation.
- **Ratepayer Impact Measure Cost Test** ("RIM") measures what happens to a customer's rates due to changes in utility revenues and operating costs.

- **Utility Cost Test** ("UCT") 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.
    - Modified Utility Cost Test – similar to the above definition but includes the costs of a projected utility incentive.
- **Societal Cost Test** ("SCT") measures the effects of a program on society as a whole.

The cost-effectiveness analysis was performed using Liberty-Empire-specific data. The input data gathered for the model is listed in Table 5-104.

Table 5-104 – 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)
Discount Rate (%)	kW/Participant Saved (Net and Gross)
Inflation Rate (%)	Number of Participants
Line Losses (%)	

Measures that were cost-effective within LoadMAP are included in the economic and achievable potential. The DSM Potential Study MAP and RAP was exported into the DSM bundle 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[37] 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**. The Realistic Achievable Potential ("RAP") candidates from the DSM Potential Study that Liberty-Empire proposes to pass to the integration phase. This portfolio reflects expected program participation given barriers to customer acceptance

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

and non-ideal implementation conditions. These measures are delivered under less than ideal market conditions.

- **MAP Portfolio**. The Maximum Achievable Potential ("MAP") candidates from the DSM Potential Study that Liberty-Empire proposes passing into the integration phase. This portfolio reflects expected program participation given favorable 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.
- **RAP- Portfolio**. Alternative demand-side portfolio designed to represent one-quarter of the RAP portfolio participation.
- **RAP+ Portfolio**. Alternative demand-side portfolio designed to represent the midpoint between the RAP and MAP portfolios.
- **RAP with TOU Opt-Out Portfolio.** Alternative demand-side portfolio designed to represent the RAP portfolio with the Time of Use Opt-Out demand response program included instead of the Time of Use Opt-in program.

Liberty-Empire provided several different commodity cost scenarios, each described in Section 5. For the purposes of this Demand Side Management analysis, the base avoided energy cost scenario and the "base + carbon" scenario, which incorporated a cost for avoided CO_2 emissions, were used to screen measures. The energy efficiency portfolios described above were screened using the base scenario. The RAP Portfolio was also screened utilizing the "base + carbon" scenario.

All bundles were designed with cost effectiveness measures. Measures were bundled based on the end-use, sector and implementation strategy. Incentive costs and non-incentive costs were assigned to bundles. Options were rescreened at the after measure bundling and cost assignment. Cost effectiveness at the option level was balanced with implementation

concerns[27.] Finally, the bundles were placed into three levels of first year $/kWh (low, medium, and high), and DR/DSR bundle.

The measure lifetime, gross energy and demand savings per unit and incremental cost per unit, as well as measure input source documentation are detailed Appendix 5B. Several sources of data were used to characterize the energy efficiency measures. AEG used recent studies performed for the Midwest, AEG data (e.g., DEEM database), and national and well-vetted regional data sources.

[27] Strategic Energy Management falls just below a 1.0 TRC in the first three of the projection. To balance cost effectiveness and implementation concerns, the program was left within the portfolio to allow for time to ramp up.

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 20 CSR 4240-22.060(3).

Potential demand-side programs and demand-side rate pilot programs that passed the total resource cost test (i.e. 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 five 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 20 CSR 4240-22.060. 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 MAP and RAP were exported into the DSM bundle 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[42] 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**. The Realistic Achievable Potential ("RAP") candidates from the DSM Potential Study that Liberty-Empire proposes to pass 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.
- **MAP Portfolio**. The Maximum Achievable Potential ("MAP") candidates from the DSM Potential Study that Liberty-Empire proposes passing into the integration phase. This

[42] Notices
del is consistent with the California Standard Practice Manual.

portfolio reflects expected program participation given favorable 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.

- **RAP- Portfolio**. Alternative demand-side portfolio designed to represent one-quarter of the RAP portfolio participation.
- **RAP+ Portfolio**. Alternative demand-side portfolio designed to represent the midpoint between the RAP and MAP portfolios.
- **RAP with TOU Opt-Out Portfolio.** Alternative demand-side portfolio designed to represent the RAP portfolio with the Time of Use Opt-Out demand response program included instead of the Time of Use Opt-in program.

Liberty-Empire provided several different commodity cost scenarios, each described in Section 5. For the purposes of this Demand Side Management analysis, the "base carbon" scenario, which incorporated a cost for avoided CO_2 emissions, was used to screen measures. The energy efficiency portfolios described above and the RAP Portfolio were also screened using the base carbon scenario.

(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 assumption and descriptions for each demand-side candidate resource option is provided in the appendices located in Appendix 5B. Additionally, impacts for energy and demand are included in Table 5-50 through Table 5-53 for RAP by bundle option and Table 5-105 through Table 5-109 for aggregated results by bundle scenario.

(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 five 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 five 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 five program scenarios with varying participation levels and incentives to account for potential uncertainty.

- **RAP Portfolio**. The Realistic Achievable Potential ("RAP") candidates from the DSM Potential Study that Liberty-Empire proposes to pass 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.
- **MAP Portfolio**. The Maximum Achievable Potential ("MAP") candidates from the DSM Potential Study that Liberty-Empire proposes passing into the integration phase. This portfolio reflects expected program participation given favorable 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.
- **RAP- Portfolio**. Alternative demand-side portfolio designed to represent one-quarter of the RAP portfolio participation.

- **RAP+ Portfolio**. Alternative demand-side portfolio designed to represent the midpoint between the RAP and MAP portfolios.
- **RAP with TOU Opt-Out Portfolio.** Alternative demand-side portfolio designed to represent the RAP portfolio with the Time of Use Opt-Out demand response program included instead of the Time of Use Opt-in program.

Liberty-Empire provided several different commodity cost scenarios, each described in Section 5. For the purposes of this Demand Side Management analysis, the "base carbon" scenario, which incorporated a cost for avoided CO_2 emissions, was used to screen measures. The energy efficiency portfolios described above and the RAP Portfolio were also screened using the base carbon scenario.

Table 5-105 – Comparison of Incremental Participation by Scenario

Incremental Participation	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
RAP-	143,788	171,159	166,104	90,499	75,179	72,373	76,715	81,443	83,260	84,038	84,247	84,950	85,014	85,479	85,659	84,034	83,720	81,698	80,844	80,154	80,855
RAP	191,718	228,212	221,472	120,665	100,075	96,332	102,107	108,410	110,835	111,873	112,153	113,090	113,161	113,771	114,005	111,845	111,431	108,739	107,596	106,672	107,602
RAP+	250,143	303,512	301,801	182,840	167,161	161,824	165,402	169,147	171,332	172,232	172,405	173,119	173,202	173,674	173,718	170,881	170,292	167,191	165,890	164,492	165,677
MAP	308,568	378,811	382,129	245,014	234,246	227,316	228,697	229,884	231,829	232,590	232,657	233,148	233,244	233,577	233,431	229,917	229,152	225,643	224,184	222,311	223,751
RAP + TOU Opt-Out	213,065	270,144	282,999	200,296	195,362	186,934	187,090	187,001	189,082	190,171	190,691	191,849	192,125	192,925	193,336	191,341	191,079	188,528	187,520	186,890	188,124

Table 5-106 – Comparison of Net MWh Savings by Scenario

Net MWh	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
RAP-	15,416	17,332	16,948	15,097	14,741	14,133	14,581	14,789	15,101	15,129	15,095	15,149	15,324	15,493	15,584	14,486	14,216	13,993	14,243	14,373	14,613
RAP	20,555	23,109	22,597	20,129	19,034	18,217	18,648	18,922	19,335	19,372	19,325	19,394	19,568	19,753	19,851	18,364	17,989	17,694	17,919	18,026	18,324
RAP+	26,774	30,809	30,937	28,513	27,540	26,195	26,563	26,354	26,705	26,628	26,456	26,410	26,515	26,619	26,616	24,706	24,235	23,883	24,149	24,100	24,438
MAP	32,472	37,530	37,927	35,275	34,335	32,809	33,468	33,189	33,463	33,259	32,953	32,780	32,807	32,823	32,710	30,385	29,811	29,396	29,699	29,480	29,851
RAP + TOU Opt-Out	22,497	26,952	28,286	27,572	27,920	26,828	27,088	26,982	27,390	27,451	27,438	27,542	27,754	27,975	28,108	26,669	26,329	26,067	26,325	26,476	26,805

Table 5-107 – Comparison of Net Coincidence MW Savings by Scenario

Net MW	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
RAP-	4.48	7.33	9.93	12.57	15.56	17.78	19.57	21.54	21.70	21.84	21.97	22.12	22.27	22.43	22.58	22.52	22.60	22.70	22.88	23.06	23.22
RAP	5.98	9.66	13.02	16.44	20.27	23.13	25.52	28.16	28.38	28.57	28.75	28.94	29.14	29.35	29.54	29.45	29.56	29.69	29.90	30.13	30.33
RAP+	9.14	15.58	21.51	27.37	33.52	36.90	39.33	41.94	42.18	42.40	42.59	42.80	43.02	43.25	43.46	43.33	43.45	43.60	43.86	44.09	44.35
MAP	11.56	20.10	28.10	36.06	44.42	48.86	51.86	55.06	55.34	55.59	55.80	56.03	56.28	56.53	56.76	56.62	56.76	56.94	57.25	57.48	57.79
RAP + TOU Opt-Out	8.85	15.35	21.44	27.44	33.66	36.11	38.01	40.08	40.29	40.52	40.75	41.00	41.25	41.51	41.76	41.74	41.90	42.07	42.34	42.63	42.88

Table 5-108 – Comparison of Incentives by Scenario

Total Incentives	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
RAP-	$789,034	$1,070,580	$1,126,130	$1,188,472	$1,283,275	$1,352,995	$1,433,869	$1,514,220	$1,539,281	$1,545,386	$1,551,247	$1,561,881	$1,570,000	$1,579,733	$1,587,289	$1,458,010	$1,418,489	$1,385,776	$1,385,055	$1,380,710	$1,400,022
RAP	$2,177,680	$2,804,340	$2,931,746	$3,072,450	$3,258,100	$3,405,199	$3,567,889	$3,731,788	$3,797,495	$3,812,891	$3,827,556	$3,852,585	$3,870,013	$3,893,228	$3,911,608	$3,563,719	$3,456,010	$3,365,620	$3,354,589	$3,340,009	$3,392,048
RAP+	$3,860,339	$4,786,765	$4,943,669	$5,114,807	$5,339,629	$5,487,115	$5,714,896	$5,905,660	$5,974,971	$5,957,179	$5,938,251	$5,936,604	$5,927,271	$5,926,745	$5,916,861	$5,242,526	$5,038,020	$4,883,893	$4,867,485	$4,788,350	$4,867,127
MAP	$6,105,510	$7,409,728	$7,585,795	$7,778,339	$8,023,137	$8,215,424	$8,519,110	$8,721,803	$8,779,762	$8,705,365	$8,629,596	$8,579,213	$8,521,798	$8,477,617	$8,418,453	$7,319,669	$6,993,326	$6,761,182	$6,739,787	$6,562,481	$6,674,522
RAP + TOU Opt-Out	$2,177,680	$2,804,340	$2,931,746	$3,071,215	$3,248,286	$3,395,372	$3,566,560	$3,730,454	$3,796,153	$3,811,684	$3,826,424	$3,851,457	$3,869,646	$3,892,945	$3,911,256	$3,563,400	$3,455,720	$3,365,356	$3,354,343	$3,340,002	$3,392,042

Table 5-109 – Comparison of Total Utility Administrative Costs by Scenario

Administration Costs	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
RAP-	$958,241	$1,646,762	$1,671,541	$1,688,934	$1,735,829	$1,352,799	$1,142,135	$1,206,675	$858,181	$827,559	$814,895	$820,051	$824,013	$828,805	$832,327	$766,583	$744,505	$726,696	$727,495	$719,800	$732,919
RAP	$1,699,246	$2,560,314	$2,619,352	$2,660,946	$2,744,444	$2,504,304	$2,326,060	$2,418,726	$2,102,384	$2,080,078	$2,075,127	$2,090,378	$2,101,633	$2,115,688	$2,126,581	$1,951,708	$1,893,884	$1,846,922	$1,845,209	$1,834,150	$1,868,195
RAP+	$3,071,603	$4,381,684	$4,458,515	$4,488,871	$4,573,979	$4,001,898	$3,718,565	$3,827,840	$3,415,543	$3,391,018	$3,374,789	$3,374,375	$3,370,119	$3,369,776	$3,363,500	$3,020,152	$2,904,755	$2,819,891	$2,814,382	$2,761,631	$2,814,847
MAP	$4,628,770	$6,469,755	$6,554,941	$6,565,987	$6,631,156	$5,875,223	$5,471,902	$5,590,135	$5,050,904	$5,012,622	$4,971,912	$4,941,866	$4,908,904	$4,881,569	$4,844,821	$4,280,502	$4,093,529	$3,960,706	$3,949,342	$3,834,984	$3,909,600
RAP + TOU Opt-Out	$2,135,382	$2,975,264	$3,020,364	$3,034,125	$3,075,027	$2,470,896	$2,276,809	$2,369,656	$2,054,847	$2,066,389	$2,078,451	$2,093,597	$2,105,145	$2,119,165	$2,129,967	$1,955,059	$1,897,196	$1,850,201	$1,848,499	$1,840,105	$1,875,008

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 20 CSR 4240-22.070(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.

Liberty-Empire has designated approximately 5% of its portfolio budget for Evaluation, Measurement and Verification ("EM&V") activities. To cost-effectively evaluate Liberty-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 Liberty-Empire's energy efficiency program portfolio.

Project Initiation Meetings

The evaluation contractor will meet with Liberty-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 Liberty-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 Liberty-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 Liberty-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 Liberty-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 Liberty-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 Liberty-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 Liberty-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 Liberty-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 Liberty-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 Liberty-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 Liberty-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.

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