NP

VOLUME 5

DEMAND-SIDE RESOURCE ANALYSIS

THE EMPIRE DISTRICT ELECTRIC COMPANY

4 CSR 240-22.050

CASE NO. EO-2013-0547

JULY 2013

SERVICES YOU COUNT ON

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22.0.050 DEMAND-SIDE RESOURCE ANALYSIS

DEMAND-SIDE RESOURCE ANALYSIS

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

SECTION 1 POTENTIAL DEMAND-SIDE RESOURCES

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

1.1 Describe and Document Selections

(A) To provide broad coverage of—

1.1.1 Market Segments Coverage

1. Appropriate market segments within each major class;

Empire engaged Applied Energy Group (AEG) to conduct a Demand-Side Management (DSM) Potential Study in Empire's Missouri service territory.

Empire commissioned an Energy Management Survey in 2008 to assist in efforts to develop effective energy efficiency programs and promote energy efficiency among residential customers. A total of 1,960 residential customers within Empire's Missouri, Arkansas, Kansas, and Oklahoma service territory completed the four-page questionnaires. The survey included

questions on general household characteristics, heating and cooling equipment, appliances, water usage, and energy management.

Empire commissioned a 2010 Commercial and Industrial Baseline Study to develop a profile of commercial and industrial (C&I) customers, including end-use breakdown and other equipment statistics (e.g. unit sizes, ages, types), that would be used to assess the potential improvements that could be made through measures or equipment replacement that would reduce energy consumption.

AEG utilized the 2008 Energy Management Survey, 2010 Commercial and Industrial Baseline Study, and U.S. Energy Information Administration (EIA) Residential Energy Consumption Surveys to identify the residential, commercial and industrial market segments as described in *Tables 5-1, 5-2,* and *5-3*, respectively.

	2010 GWh
Single Family	1,658
Multi-Family	225
Mobile Home	164

Table 5-1 - Residential Market Segments

	2010 GWh
Grocery	113
Health	195
Hotel	115
Misc.	94
Office	368
Pastoral	48
Restaurant	97
Retail	223
School	196
Other	115
Warehouse	73

Table 5-2 - Commercial Market Segments

	2010 GWh
Food Processing	735
Paper, Plastics and Furniture	133
Petroleum & Chemical	499
Machinery, Equipment, & Parts	131
Water Pumping	0.5

Table 5-3 - Industrial Market Segments

1.1.2 Decision-Maker Coverage

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

Empire meets regularly with an Advisory Group to review Empire's proposed demand side management programs, discuss opportunities for energy efficiency, and receive feedback. The Advisory Group includes, but is not limited to, the Missouri Department of Natural Resources (MDNR); Missouri Public Service Commission (MPSC); Missouri Department of Economic Development (MDED); Missouri Attorney General; Finnegan, Conrad and Peterson L.C.; and Johnson Consulting Group.

1.1.3 Major End Uses Coverage

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.;

AEG analyzed potential demand-side resources for all major end uses. The major end uses considered include:

1. Residential sector: lighting, space cooling, space heating, ventilation, water heating, refrigerators, freezers, cooking, clothes washers, clothes dryers, television, personal computers, furnace fans, plug loads, and other uses.

2. Commercial sector: space heat, space cooling, ventilation, water heat, refrigeration, lighting, office equipment, cooking equipment, and other uses.

3. Industrial sector: machine drives, space heat, space cooling, ventilation, lighting, process heating, and other uses.

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;

AEG developed the DSM programs listed below and describe in *Figures 5-1* through *5-11*:

- Residential Products Program
- Residential Appliance Recycling
- Residential High Efficiency HVAC
- Residential Whole House Efficiency
- Residential Low Income Weatherization
- Low Income New Homes
- School Energy Education
- Small Business Lighting
- C&I Energy Efficiency Rebate
- Building Operator Certification
- Interruptible Service Rider

<table>
<tr><td>Program</td><td>Residential Products Program</td></tr>
<tr><td>Description</td><td>The program's primary objective is to secure energy savings by incentivizing the purchase of ENERGY STAR® qualified lighting and appliances. Instant rebates will be applied to CFLs and LEDs at the point-of-purchase, varying depending upon the type of lighting, manufacturer and the associated retail cost. Mail-in rebates will be available to customers that purchase efficient appliances, including:
– ENERGY STAR Indoor and Outdoor Fixtures
– Efficient Nightlight
– ENERGY STAR Dehumidifier
– ENERGY STAR Refrigerator
– ENERGY STAR 2-Speed Pool Pump
Empire will engage a third-party contractor to implement the program. The contractor will:
– Establish relationships with lighting manufacturers and retailers throughout the Empire service territory.
– Process incentives.
– Track program data.
– Provide in-store promotional materials and retail sales staff training.
– Market the mail-in rebate program.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Help residential customers reduce their electricity bills.
– Educate residential customers about the benefits of efficient lighting and appliances.
– Develop partnerships with retailers to market the program.
– Demonstrate persistent energy savings.
– Encourage energy-saving behavior and awareness through the Empire lighting program.</td></tr>
<tr><td>Target Market</td><td>Residential customers</td></tr>
<tr><td>Marketing Strategy</td><td>Empire will work with the implementation contractor to market the program. The program may be marketed through bill inserts, newspaper advertisements, and partnerships with participating retailers.</td></tr>
<tr><td>Eligible Measures and Incentives</td><td>
<table>
<tr><td>CFL</td><td>$1.25</td></tr>
<tr><td>LED</td><td>$10</td></tr>
<tr><td>ENERGY STAR Indoor Fixture</td><td>$15</td></tr>
<tr><td>ENERGY STAR Exterior Fixture</td><td>$10</td></tr>
<tr><td>Efficient Nightlight</td><td>$2.50</td></tr>
<tr><td>ENERGY STAR Dehumidifier</td><td>$20</td></tr>
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<tr><td>ENERGY STAR 2-Speed Pool Pump</td><td>$150</td></tr>
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Estimated Participation

	2013	2014	2015
CFL	250,000	250,000	250,000
LED	500	750	1,000
ENERGY STAR Indoor Fixture	200	300	400
ENERGY STAR Exterior Fixture	200	275	350
Efficient Nightlight	70	80	90
ENERGY STAR Dehumidifier	125	150	175
ENERGY STAR Refrigerator	250	300	350
ENERGY STAR 2-Speed Pool Pump	50	60	70

Estimated Savings

	Net MWh Savings			Net Coincident kW Savings		
	2013	2014	2015	2013	2014	2015
CFL	8,212	8,212	5,201	727	727	460
LED	23	34	28	2.0	3.0	2.5
ENERGY STAR Indoor Fixture	19	29	39	1.7	2.6	3.4
ENERGY STAR Exterior Fixture	21	29	36	0.1	0.1	0.1
Efficient Nightlight	2	2	2	-	-	-
ENERGY STAR Dehumidifier	17	21	24	4.0	4.8	5.6
ENERGY STAR Refrigerator	23	27	31	3.5	4.2	4.8
ENERGY STAR 2-Speed Pool Pump	34	41	47	20	24	28

Estimated Budget

2013	2014	2015
$906,092	$917,837	$929,581

Cost Effectiveness

	TRC	Participant	Utility	Ratepayer Impact	Societal
2013	1.34	12.42	1.58	0.28	1.47
2014	1.48	12.16	1.76	0.31	1.62
2015	1.14	9.05	1.27	0.31	1.23

Figure 5-1 - Residential Products Program

<table>
<tr><td>Program</td><td>Appliance Recycling Program</td></tr>
<tr><td>Description</td><td>The program encourages residential customers to remove inefficient refrigerators and freezers from the electric system and dispose of them in an environmentally safe and responsible manner.
The program will provide an incentive to customers that turn-in their old, inefficient refrigerator(s) or freezer(s). Customers are limited to 2 rebates per program year. The refrigerator or freezer must be in working condition, between 10 and 30 cubic feet in size and at least five years of age. The refrigerators and freezers will be picked-up at no cost to the customer.
Empire will select a third-party implementation contractor that specializes in appliance recycling and has access to a recycling facility. The implementation contractor will handle scheduling, appliance pickup, recycling and disposal, and incentive processing.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Promote appliance recycling.
– Educate customers about the benefits of recycling their inefficient appliances.
– Reduce household and small commercial energy consumption.
– Influence consumer behavior by encouraging residential customers to avoid replacing their second refrigerator or freezer after it is recycled.</td></tr>
<tr><td>Target Market</td><td>Residential customers disposing of primary or secondary inefficient refrigerators or freezers.</td></tr>
<tr><td>Marketing Strategy</td><td>Empire will work with the implementation contractor to develop innovative and creative marketing strategies and materials. The program may be marketed through bill inserts, newspaper advertisements, community events, billboards, media and advertising in community newsletters.</td></tr>
<tr><td>Eligible Measures and Incentives</td><td>
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<tr><td>Refrigerator Recycle</td><td>382</td><td>477</td><td>573</td><td>68</td><td>86</td><td>103</td></tr>
<tr><td>Freezer Recycle</td><td>52</td><td>70</td><td>87</td><td>8</td><td>10</td><td>13</td></tr>
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Figure 5-2 - Residential Appliance Recycling Program

<table>
<tr><td>Program</td><td>Residential High-Efficiency HVAC Program</td></tr>
<tr><td>Description</td><td>The program objective is to encourage contractors to use energy efficiency as a marketing tool, stocking and selling more efficient HVAC units and moving the market toward greater efficiency.

Residential customers will be eligible to receive financial incentives for:
– Early retirement of heat pump systems in operable condition and at least 5 years of age.
– Purchase and installation of efficient central air conditioners, heat pumps, furnace fan motors, bathroom exhaust fans and programmable thermostats.

An implementation contractor will engage local HVAC contractors to participate and market the program, process rebates, provide program tracking and provide quality assurance/quality control.

Participating HVAC contractors must provide evidence of Air Conditioning Contractors of America (ACCA) Manual J training, the industry standard residential load calculation method. Empire offers free one-day training sessions on ACCA Manual J and Manual D at least twice a year in multiple cities across Empire’s Missouri service territory.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Educate customers about the benefits of installing high efficiency HVAC equipment.
– Develop partnerships with contractors to bring efficient systems to market.
– Help customers reduce their electricity bills.
– Build consumer confidence in the reliability of savings estimates through an educated and highly trained contract services team.</td></tr>
<tr><td>Target Market</td><td>Residential customers, including owners of rental properties and new construction, as well as HVAC contractors.</td></tr>
<tr><td>Marketing Strategy</td><td>The implementation contractor will develop partnerships with HVAC contractors through education and training seminars, presentations at Chamber of Commerce meetings, and other informational events. Additional marketing activities will include newspaper advertisements, email blasts and bill messaging.</td></tr>
<tr><td>Eligible Measures and Incentives</td><td>
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<tr><td>CAC SEER 15</td><td>$400</td></tr>
<tr><td>CAC SEER 16</td><td>$450</td></tr>
<tr><td>CAC SEER 17</td><td>$500</td></tr>
<tr><td>Heat Pump SEER 15</td><td>$400</td></tr>
<tr><td>Heat Pump SEER 16</td><td>$450</td></tr>
<tr><td>Heat Pump SEER 17</td><td>$500</td></tr>
<tr><td>Early Retirement HP SEER 16</td><td>$600</td></tr>
<tr><td>Early Retirement HP SEER 17</td><td>$700</td></tr>
<tr><td>Furnace Fan Motor</td><td>$40</td></tr>
<tr><td>HE Bathroom Exhaust Fan</td><td>$20</td></tr>
<tr><td>Programmable Thermostat</td><td>$15</td></tr>
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Program — **Residential High-Efficiency HVAC Program**

Estimated Participation

	2013	2014	2015
CAC SEER 15	300	350	400
CAC SEER 16	250	300	375
CAC SEER 17	50	60	70
Heat Pump SEER 15	80	90	100
Heat Pump SEER 16	50	75	100
Heat Pump SEER 17	25	30	35
Early Retirement HP SEER 16	10	10	10
Early Retirement HP SEER 17	5	5	5
Furnace Fan Motor	380	425	470
HE Bathroom Exhaust Fan	80	100	120
Programmable Thermostat	400	470	560

Estimated Savings

	Net MWh Savings			Net Coincident kW Savings		
	2013	2014	2015	2013	2014	2015
CAC SEER 15	149	173	198	134	156	179
CAC SEER 16	160	192	240	123	148	185
CAC SEER 17	38	46	54	32	39	45
Heat Pump SEER 15	129	145	92	75	84	57
Heat Pump SEER 16	88	132	107	47	70	57
Heat Pump SEER 17	49	59	45	24	29	21
Early Retirement HP SEER 16	37	37	37	20	20	20
Early Retirement HP SEER 17	19	19	19	10	10	10
Furnace Fan Motor	233	260	286	185	206	227
HE Bathroom Exhaust Fan	6	8	9	0.7	0.9	1.1
Programmable Thermostat	128	153	182	81	95	113

Estimated Budget

2013	2014	2015
$561,960	$669,848	$795,926

Cost Effectiveness

	TRC	Participant	Utility	Ratepayer Impact	Societal
2013	1.28	2.70	1.91	0.62	1.34
2014	1.38	2.68	2.05	0.67	1.43
2015	1.40	2.59	1.96	0.71	1.45

Figure 5-3 - Residential High-Efficiency HVAC Program

<table>
<tr><td>Program</td><td>Residential Whole House Efficiency Program</td></tr>
<tr><td>Description</td><td>The purpose of the program is to encourage whole-house improvements to existing homes by enhancing home energy audits and promoting comprehensive retrofit services.

The program will consist of 2 Tiers:

Tier 1: Direct Install. A home energy audit will identify potential efficiency improvements. The program will offer the audit and installation of measures at no cost to the customer. Measures included in the program: air sealing, faucet aerators, low-flow showerhead, water heater temperature setback, advanced power strip, water heater tank wrap, hot water pipe insulation and CFLs.

Tier 2: Insulation. Customers that have completed Tier 1 are eligible for incentives for the purchase and installation of attic insulation.

Empire will engage a contractor to implement the program. The contractor will
– Engage customers and schedule appointments
– Hire staff/engage local contractors to conduct audits and measure installations
– Process rebates
– Program tracking and quality assurance</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Demonstrate persistent energy savings.
– Encourage energy saving behavior and whole house improvements.
– Help residential customers reduce their electricity bills.</td></tr>
<tr><td>Target Market</td><td>Residential customers that own or rent a residence.</td></tr>
<tr><td>Marketing Strategy</td><td>The program will be marketed through direct outreach to customers, bill inserts, newspaper advertisements and email blasts as well as community events.</td></tr>
<tr><td>Eligible Measures and Incentives</td><td>Tier 1 will be provided at no cost to the customer.
Tier 2 incentive will be $300</td></tr>
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<tr><td>Tier 1</td><td>1,000</td><td>1,000</td><td>1,000</td></tr>
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<tr><td>Tier 1</td><td>1,171</td><td>1,171</td><td>1,123</td><td>276</td><td>276</td><td>272</td></tr>
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Figure 5-4 - Residential Whole House Efficiency Program

<table>
<tr><td>Program</td><td>Low Income Weatherization Program</td></tr>
<tr><td>Description</td><td>The program reduces energy costs for eligible low income homeowners and renters through increased home efficiency, at no cost to the participant. Home efficiency is improved through the installation of energy saving measures, such as insulation, caulking, weather stripping and heating system repair or replacement. The program supplements the federal Low Income Weatherization Assistance Program.

Empire customers work with one of the Missouri Weatherization Agencies to participate:

– Economic Security Corporation of Southwest Area
– Ozarks Area Community Action Corporation
– West Central Missouri Community Action Agency

The Missouri Weatherization Agencies offer cost-effective implementation, which allows most of the program budget to go directly to the purchase and installation of efficient equipment.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Demonstrate persistent energy savings.
– Encourage energy saving behavior.
– Help residential customers reduce their electricity bills.</td></tr>
<tr><td>Target Market</td><td>Low-income residential homeowners and renters.</td></tr>
<tr><td>Marketing Strategy</td><td>The Missouri Weatherization Agencies have primary responsibility for promoting the program. Empire will supplement statewide marketing efforts, promoting the program through community events and organizations, including schools, churches and nonprofit organizations within the service territory.</td></tr>
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<tr><td>2015</td><td>0.93</td><td>1.81</td><td>2.25</td><td>0.60</td><td>0.97</td></tr>
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Figure 5-5 - Low income Weatherization Program

<table>
<tr><td>Program</td><td>Low Income New Homes Program</td></tr>
<tr><td>Description</td><td>Empire works with local non-profit organizations to encourage efficient, affordable new housing for low income customers. Financial incentives, not to exceed $1,100 per home, are available for the following measures:
– Building Insulation, full incremental cost above the baseline.
– Exterior wall insulation with an R value ≥ 19.
– Attic insulation with an R value ≥ 38.
– Floor insulation with an R value ≥ 19.
– Central Air Conditioning, full incremental cost up to $400 for a SEER ≥.
– Heat Pump, full incremental cost up to $400. The incentive may not exceed the incentive for a similarly rated central air conditioning unit.
– Refrigerator, up to $200 for an ENERGY STAR refrigerator.
– Lighting, up to $100 for the installation of ENERGY STAR rated lighting fixtures.

Organizations notify Empire of their intent to participate in the program. Upon acceptance, Empire holds the maximum available financing per home for up to six months, with payment occurring upon receipt and review of paid invoices.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Demonstrate persistent energy savings.
– Encourage energy saving behavior.
– Help residential customers reduce their electricity bills.</td></tr>
<tr><td>Target Market</td><td>Local non-profit organizations building efficient, affordable new housing for low income customers.</td></tr>
<tr><td>Marketing Strategy</td><td>Empire promotes the program directly to local non-profit organizations that work with low income housing.</td></tr>
<tr><td>Incentives</td><td>$1,200 per home</td></tr>
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Figure 5-6 - Low Income New Homes Program

<table>
<tr><td>Program</td><td>School Energy Education Program</td></tr>
<tr><td>Description</td><td>The program offers a set of classroom activities and a kit of low-cost energy and water efficiency products to 6th grade students within the Empire service territory. The program helps build awareness of energy conservation among children and can impact customers at all income levels. Teachers will receive education materials including lesson plans, program videos, classroom posters and supplemental activities.

Each student receives an Energy Education Kit, which includes:
– CFLs and Nightlight
– Natural Resources Fact Chart
– Digital Water / Air Thermometer
– FilterTone® Alarm
– Showerhead
– Toilet Leak Detector Tablets
– Flow Rate Test Bag
– Mini Tape Measure

Empire will engage a third-party implementation contractor to recruit and train teachers, track participation, and provide support to students and teachers.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Educate students about the benefits of efficiency and the opportunities to reduce energy consumption.
– Increase awareness of and participation in other Empire energy efficiency programs.
– Long-term energy savings through enhanced education and awareness of energy efficiency among students and parents.</td></tr>
<tr><td>Target Market</td><td>School administrators (including teachers), 6th grade students and parents.</td></tr>
<tr><td>Marketing Strategy</td><td>The program will be marketed to schools officials including teachers, principals and school District personnel. Information on the benefits of this program will be explained teachers or principals prior to handing out the energy kits. Teachers and principals will also receive information on how to present these kits to students.</td></tr>
<tr><td>Incentives</td><td>Educational materials and Energy Education Kits are provided at no cost.</td></tr>
<tr><td>Estimated Participation</td><td>
<table>
<tr><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>750</td><td>750</td><td>750</td></tr>
</table>
</td></tr>
<tr><td>Estimated Savings</td><td>
<table>
<tr><th colspan="3">Net MWh Savings</th><th colspan="3">Net Coincident kW Savings</th></tr>
<tr><th>2013</th><th>2014</th><th>2015</th><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>292</td><td>292</td><td>292</td><td>61</td><td>61</td><td>61</td></tr>
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</td></tr>
<tr><td>Estimated Budget</td><td>
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<tr><td>Cost Effectiveness</td><td>
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<tr><th></th><th>TRC</th><th>Participant</th><th>Utility</th><th>Ratepayer Impact</th><th>Societal</th></tr>
<tr><td>2013</td><td>1.13</td><td>n/a</td><td>1.13</td><td>0.28</td><td>1.23</td></tr>
<tr><td>2014</td><td>1.28</td><td>n/a</td><td>1.28</td><td>0.31</td><td>1.38</td></tr>
<tr><td>2015</td><td>1.44</td><td>n/a</td><td>1.44</td><td>0.35</td><td>1.55</td></tr>
</table>
</td></tr>
</table>

Figure 5-7 - School Energy Education Program

<table>
<tr><td>Program</td><td>Small Business Lighting Program</td></tr>
<tr><td>Description</td><td>The program targets non-residential customers with an average electric demand of less than 250 kW per year. The program offers customers a free lighting energy audit that includes information on potential energy savings and anticipated payback as well as incentives that cover up to 70 percent of the equipment and installation costs. Eligible measures include permanent interior lighting fixtures and ballasts, such as T5 lamps, LED exit signs, pulse-start metal halides and occupancy sensors.

Empire will select an implementation contractor that will provide the lighting audit and information on lighting incentives. Incentives will be assigned directly to the contractor, so that the value of utility incentives is reduced directly from the sale price of the project. The contractor will be responsible for:

– Marketing and promotional activities
– Screening eligible measures
– Selecting and managing lighting contractors
– Tracking program results</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Effectively installing efficient equipment through the program.
– Educating commercial customers about the benefits of new energy efficient lighting technologies.
– Helping commercial customers reduce their electricity bills.
– Building consumer confidence in the reliability of savings estimates through an educated sales force and a highly tailored program approach.</td></tr>
<tr><td>Target Market</td><td>Small business customers with demand less than 250 kW per year.</td></tr>
<tr><td>Marketing Strategy</td><td>The implementation contractor will contact business owners, operators, property owners and tenants as well as participate in trade association and business organization events.</td></tr>
<tr><td>Incentives</td><td>Incentives will cover up to 70 percent of the equipment and installation costs.</td></tr>
<tr><td>Estimated Participation</td><td>
<table>
<tr><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>300</td><td>300</td><td>300</td></tr>
</table>
</td></tr>
<tr><td>Estimated Savings</td><td>
<table>
<tr><th colspan="3">Net MWh Savings</th><th colspan="3">Net Coincident kW Savings</th></tr>
<tr><th>2013</th><th>2014</th><th>2015</th><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>2,598</td><td>2,598</td><td>2,244</td><td>450</td><td>450</td><td>381</td></tr>
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<tr><td>Estimated Budget</td><td>
<table>
<tr><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>$1,558,118</td><td>$1,558,118</td><td>$1,439,233</td></tr>
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<tr><th></th><th>TRC</th><th>Participant</th><th>Utility</th><th>Ratepayer Impact</th><th>Societal</th></tr>
<tr><td>2013</td><td>1.05</td><td>8.41</td><td>0.90</td><td>0.33</td><td>1.13</td></tr>
<tr><td>2014</td><td>1.13</td><td>8.41</td><td>0.97</td><td>0.35</td><td>1.21</td></tr>
<tr><td>2015</td><td>1.14</td><td>7.48</td><td>0.97</td><td>0.36</td><td>1.22</td></tr>
</table>
</td></tr>
</table>

Figure 5-8 - Small Business Lighting Program

<table>
<tr><td>Program</td><td>Commercial and Industrial Energy Efficiency Rebate Program</td></tr>
<tr><td>Description</td><td>The program provides incentives to lower the cost of purchasing energy efficient equipment for commercial and industrial facilities. The program consists of prescriptive and custom rebates.

Prescriptive. Pre-qualified prescriptive rebates are available for new construction and retrofits. The rebated measures, including lighting, HVAC equipment, motors and variable frequency drives, are proven technologies that are readily available with known performance characteristics.

Custom. Equipment that does not qualify for a prescriptive rebate will be eligible for a custom rebate. Applications must be pre-approved by Empire before equipment is purchased and installed to ensure they produce a Societal Benefit-Cost Test of 1.05 or higher and have an incremental payback greater than two years.

Incentives are the lesser of the following:
– A buy-down to a two year payback;
– 50 percent of the incremental cost; or
– 50 percent of lifecycle avoided demand and energy costs.

A $20,000 incentive cap is imposed per facility per program year. However, if funds are still available in the last three months of the program year, the cap may be exceeded. Multiple rebate applications for different measures may be submitted.

All C&I customers are eligible to participate in this program. The same customer can participate in more than one measure in the same year, e.g., retrofit a lighting system and upgrade to a more efficient HVAC system.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Educate customers about the benefits of installing high efficiency equipment.
– Demonstrate persistent energy savings.
– Effectively install efficient equipment and systems through the Empire Program.
– Help commercial and industrial customers reduce their electricity bills.</td></tr>
<tr><td>Target Market</td><td>Commercial and industrial customers</td></tr>
<tr><td>Marketing Strategy</td><td>The program will be marketed through partnerships with Empire trade allies as well as newspaper advertisements, email blasts or targeted mailings to customers and contractors, bill inserts, and advertising in HVAC trade publications.</td></tr>
<tr><td>Eligible Measures and Incentives</td><td>Custom rebates will be calculated for all measures that are not listed under the Prescriptive Rebate program and meet the eligibility requirements above. The listed values are assumed for benefit-cost purposes. In practice, each rebate value and savings will be unique. Rebate values are calculated as either 50 percent of the incremental cost of the project or $0.30 per kWh savings, whichever is lower.</td></tr>
<tr><td>Estimated Participation</td><td>
<table>
<tr><th></th><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>C&I Custom</td><td>30</td><td>40</td><td>50</td></tr>
<tr><td>C&I Prescriptive</td><td>120</td><td>130</td><td>150</td></tr>
</table>
</td></tr>
</table>

Program: Commercial and Industrial Energy Efficiency Rebate Program

Estimated Savings

	Net MWh Savings			Net Coincident kW Savings		
	2013	2014	2015	2013	2014	2015
C&I Custom	672	896	1,121	116	155	194
C&I Prescriptive	2,410	2,636	2,917	411	455	499

Estimated Budget

	2013	2014	2015
C&I Custom	$44,352	$59,136	$73,920
C&I Prescriptive	$231,007	$255,017	$296,251

Cost Effectiveness

C&I Prescriptive

	TRC	Participant	Utility	Ratepayer Impact	Societal
2013	4.69	10.98	8.18	0.48	5.03
2014	5.05	10.98	8.80	0.52	5.39
2015	5.39	10.98	9.40	0.55	5.75

C&I Custom

	TRC	Participant	Utility	Ratepayer Impact	Societal
2013	2.86	7.11	4.94	0.45	3.07
2014	3.07	7.04	5.30	0.49	3.28
2015	3.19	6.84	5.51	0.52	3.41

Figure 5-9 - Commercial and Industrial Energy Efficiency Rebate Program

<table>
<tr><td>Program</td><td>Building Operator Certification Program</td></tr>
<tr><td>Description</td><td>The program is a training and certification program that educates facility managers and operators in the energy efficiency of their equipment and processes. The training includes approximately 80 hours of classroom and project work in building systems operation and maintenance. Each course in the series is completed in a one-day training session, except BOC 103 – HVAC Systems and Controls, a two-day course.

Empire offers incentives for Level 1 training, topics HVAC Systems and Controls, Efficient Lighting Fundamentals, Facility Electrical Systems, and Indoor Air Quality. To become certified, participants must pass an exam at the end of each day of training and complete assigned projects. Rebates of $575, half of the training tuition, are provided to Empire participants that complete the certification process.

The program is administered by the Missouri Energy Center in partnership with the Midwest Energy Efficiency Alliance (MEEA). The program is targeted towards customers with facilities that employ full-time building operators.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Educate building operators about the benefits of efficiency.
– Reduce commercial and industrial customer electricity bills.</td></tr>
<tr><td>Target Market</td><td>Commercial and industrial building managers</td></tr>
<tr><td>Marketing Strategy</td><td>Empire will continue to work with Missouri Energy Center and MEEA to promote and market the certification program. Marketing activities include targeted mailing to building operators and presentations at Chamber of Commerce meetings and trade conferences.</td></tr>
<tr><td>Estimated Participation</td><td>
<table>
<tr><th>2013</th><th>2014</th><th>2015</th></tr>
<tr><td>30</td><td>45</td><td>60</td></tr>
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</td></tr>
<tr><td>Estimated Savings</td><td>
<table>
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<tr><td>262</td><td>393</td><td>524</td><td>102</td><td>153</td><td>204</td></tr>
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<tr><td>Estimated Budget</td><td>
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<tr><td>$22,641</td><td>$33,961</td><td>$45,281</td></tr>
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<tr><td>Cost Effectiveness</td><td>
<table>
<tr><th></th><th>TRC</th><th>Participant</th><th>Utility</th><th>Ratepayer Impact</th><th>Societal</th></tr>
<tr><td>2013</td><td>1.39</td><td>4.04</td><td>2.44</td><td>0.36</td><td>1.49</td></tr>
<tr><td>2014</td><td>1.61</td><td>4.04</td><td>2.84</td><td>0.42</td><td>1.72</td></tr>
<tr><td>2015</td><td>1.87</td><td>4.04</td><td>3.29</td><td>0.48</td><td>1.98</td></tr>
</table>
</td></tr>
</table>

Figure 5-10 - Building Operator Certification Program

<table>
<tr><td>Program</td><td>Interruptible Service Rider Program</td></tr>
<tr><td>Description</td><td>The program is a load-shedding strategy to be used where system peak demand exceeds available capacity or extreme energy prices are expected. The program is designed to reduce customer load during peak periods, upon request by Empire. The rider is available to commercial and industrial customers with a minimum monthly billing demand of 200 kW and an anticipated minimum load curtailment capability of 200 kW. The program year runs from June 1 through May 31

Customers voluntarily enter into a contract for a term of one to five years for no greater than 50 MW annually. The contract is automatically renewed for the term of equal length unless termination notice is given by the customer or Empire. The customer rate for service interruption varies according to the length of the contract. Curtailments are limited to ten per year, with a maximum interruption of eight hours per curtailment event.</td></tr>
<tr><td>Program Goals</td><td>Program goals include:
– Educate non-residential customers about the benefits of reducing load during peak periods.
– Reduce commercial and industrial customer electricity bills.</td></tr>
<tr><td>Target Market</td><td>Commercial and industrial customers with a minimum monthly billing demand of 200 kW.</td></tr>
<tr><td>Marketing Strategy</td><td>Empire markets this program through partnerships with contractors and distributors of energy efficient systems and equipment. Other marketing includes newspaper advertisements, targeted mailings to customers and contractors, bill inserts and advertising in HVAC trade publications.</td></tr>
<tr><td>Incentives</td><td>Estimated $3,000 per participant</td></tr>
<tr><td>Estimated Details</td><td>
<table>
<tr><th>Participation</th><th>Net MWh Savings</th><th>Net kW Savings</th><th>Budget</th></tr>
<tr><td>5</td><td>81</td><td>2,738</td><td>$17,640</td></tr>
</table>
</td></tr>
<tr><td>Cost Effectiveness</td><td>
<table>
<tr><th></th><th>TRC</th><th>Participant</th><th>Utility</th><th>Ratepayer Impact</th><th>Societal</th></tr>
<tr><td>2013</td><td>20.79</td><td>n/a</td><td>3.11</td><td>2.03</td><td>20.90</td></tr>
<tr><td>2014</td><td>26.41</td><td>n/a</td><td>3.95</td><td>2.58</td><td>26.52</td></tr>
<tr><td>2015</td><td>31.99</td><td>n/a</td><td>4.79</td><td>3.12</td><td>32.10</td></tr>
</table>
</td></tr>
</table>

Figure 5-11 - Interruptible Service Rider Program

1.3 Demand-Side Rates

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

There are four common types of demand-side rates:

1. Time-of-Use: Customers pay a higher price during the designated peak period and lower prices during the off-peak. The designated peak and off-peak periods are typically defined by the season, day and time of day. For example a peak period may be defined as 4 pm to 7 pm non-holiday weekdays.

2. Critical Peak Price: Customers pay higher peak period prices during the few days a year when wholesale prices are the highest and pay a discounted off-peak price for the remainder of the year.

3. Peak Time Rebate: Customers are paid for load reductions during a peak period. There is no rate discount during non-event hours.

4. 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 1 MW of load) face hour-ahead prices.

AEG considered each of these demand-side rates in addition to a direct load control pilot for each major class, including residential, small C&I and large C&I.

Demand and energy reduction impacts result from a combination of the potential demand-side rate and the programmable thermostat. A residential programmable thermostat will achieve 0.35 kW savings and 382 kWh savings for a central air conditioner system and 1,101 kWh savings for a heat pump system. A non-residential programmable thermostat will achieve 0.59 kW savings and 442 kWh savings for a central air conditioner system and 815 kWh savings for a heat pump system. Programmable thermostats have a lifetime of 10 years. The C&I Interruptible Service Rider achieves 15,000 kWh savings.

Measure Category	Non-Coincident Peak kW
Residential Direct Load Control	1.352
Residential Peak Time Rebate	1.352
Residential Critical Peak Pricing	1.592
C&I Interruptible Service Rider	500
Small C&I Direct Load Control	1.987
Small C&I Critical Peak Pricing	2.387

Table 5-4 - Demand-Side Rate Energy and Demand Impacts per Unit

The demand-side rates were screened for cost-effectiveness as stand-alone pilot programs by the type of central cooling system (either central air conditioner or heat pump). Pilot programs were bundled into the residential and non-residential portfolios to assess overall impacts.

AEG gathered the end-use measure data from multiple sources, including:

1. Cheryl Hindes. (November 8, 2012). BGE's Smart Energy Pricing Pilot. Presentation to the PLMA Panel.
2. Freeman, Sullivan & Co. (2011). 2010 California Statewide Non-Residential Critical Peak Pricing Evaluation. Prepared for SDGE.
3. Rick Voytas. (2006). AmerenUE Critical Peak Pricing Pilot.
4. ENERGY STAR. Qualified Product Savings Calculator.
5. New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs (October 15, 2010).
6. State of Illinois. (2012). Energy Efficiency Technical Reference Manual.

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 considered and assessed nine scenarios for the demand-side programs and demand-side rates.

1. Base CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the Base CO_2 avoided cost (assuming no carbon cost).

2. Moderate CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the Moderate CO_2 avoided cost (assuming carbon allowances in 2021).

3. High CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the High CO_2 avoided cost (assuming carbon allowances in 2015).

4. RAP+. A portfolio designed to represent one-third of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

5. RAP++. A portfolio designed to represent two-thirds of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

6. Moderate Portfolio. A portfolio designed to achieve 1 percent incremental energy and demand savings by 2015.

7. Aggressive Portfolio. A portfolio designed to achieve 2 percent incremental energy and demand savings by 2020.

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

9. Missouri Energy Efficiency Investment Act of 2009 (MEEIA) Portfolio. A portfolio designed to achieve the MEEIA energy and demand savings goals, as outlined in 4 CSR 240-20.094.

1.5 Effects of Improved Technologies

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

1.5.1 Reduce or Manager Energy Use

1. Reduce or manage energy use; or

AEG considered and assessed improved technologies as they were projected to become cost-effective over the 20-year planning horizon as a potential demand-side resource to reduce or manage customer energy use.

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

1.5.2 Improve Delivery of Programs or Rates

AEG considered and assessed program delivery over the 20-year planning horizon, including direct install programs, conventional programs, and pilots.

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.

AEG reviewed potential studies, technical reference manuals, and demand-side management program evaluations as well as ENERGY STAR, the Consortium for Energy Efficiency and regional and national sources.

Empire commissioned an Energy Management Survey in 2008 to assist in efforts to develop effective energy efficiency programs and promote energy efficiency among residential customers. A total of 1,960 residential customers within Empire's Missouri, Arkansas, Kansas and Oklahoma service territory completed the four-page questionnaires. The survey included questions on general household characteristics, heating and cooling equipment, appliances, water usage, and energy management.

Empire commissioned a 2010 Commercial and Industrial Baseline Study to develop a profile of C&I customers, including end-use breakdown and other equipment statistics (e.g. unit sizes, ages, types), that would be used to assess the potential improvements that could be made through measures or equipment replacement that would reduce energy consumption.

AEG reviewed multiple potential studies, including:

1. Global Energy Partners. (2010). AmerenUE Demand Side Management (DSM) Market Potential Study.

2. KEMA. (2011). Missouri Statewide DSM Market Potential Study. Prepared for the Missouri Public Service Commission.

3. Midwest Energy Efficiency Alliance. (2006). Midwest Residential Market Assessment and DSM Potential Study.

4. Global Energy Partners. (2010). Energy Efficiency Potential Study for Consolidated Edison Company of New York, Inc.

5. Summit Blue Consulting. (2008). Energy Efficiency Potential Study for the State of Kansas. Submitted to the Kansas Energy Council.

AEG reviewed technical reference manuals and DSM program evaluations, including, but not limited to:

1. Frontier Associates, LLC (2010). Arkansas Comprehensive Programs Deemed Savings. Prepared by Nexant.

2. Connecticut Energy Efficiency Fund. Connecticut Program Savings Documentation for 2012 Program Year.

3. State of Illinois. (2012). Energy Efficiency Technical Reference Manual.

4. Kansas City Power & Light (2009). Evaluation of Kansas City Power and Light's Building Operator Certificate Program. Prepared by Opinion Dynamics Corporation.

5. Mass Save (2010). Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures. 2011 Program Year.

6. Michigan Public Service Commission (2013). Michigan Energy Measures Database. Prepared by Morgan Marketing Partners.

7. National Renewable Energy Laboratory. (February 2012). Residential, Commercial, and Utility-Scale Photovoltaic (PV) System Prices in the United States: Current Drivers and Cost-Reduction Opportunities.

8. NMR Group, Inc. (2011). Massachusetts Appliance Turn-In Program Impact Evaluation.

9. Public Utilities Commission of Ohio (2010). State of Ohio Energy Efficiency Technical Reference Manual. Prepared by Vermont Energy Investment Corporation.

10. Baltimore Gas & Electric. (November 8, 2012). BGE's Smart Energy Pricing Pilot. Cheryl Hindes PLMA Panel Presentation.

11. Freeman, Sullivan & Co. (2011). 2010 California Statewide Non-Residential Critical Peak Pricing Evaluation. Prepared for Sand Diego Gas & Electric.

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:

Process Overview

Empire engaged AEG to conduct a DSM Potential Study in Empire's Missouri service territory. AEG developed the potential demand-side programs to deliver cost-effective energy efficiency to each market segment.

The potential study examined several different types of energy efficiency potential, as defined in 4 CSR 240-3.164:

1. Technical Potential. Feasible energy and demand savings using all efficient technologies and design practices, unconstrained by budgets, cost-effectiveness or customer preferences.

2. Economic Potential. Feasible energy and demand savings using all cost-effective measures, unconstrained by budgets or customer preferences.

3. Achievable Potential. Savings resulting from expected program participation and ideal implementation conditions.

    a. Maximum Achievable Potential. Hypothetical upper-boundary of achievable demand-side energy and demand savings potential, presuming ideal conditions not typically observed.

    b. Realistic Achievable Potential. Realistic energy and demand savings a utility can expect to achieve through its demand-side programs from expected program participation and realistic implementation conditions.

The study involved carrying out a number of basic analytical steps to produce estimates of energy efficiency potentials (shown in *Figure 5-12*).

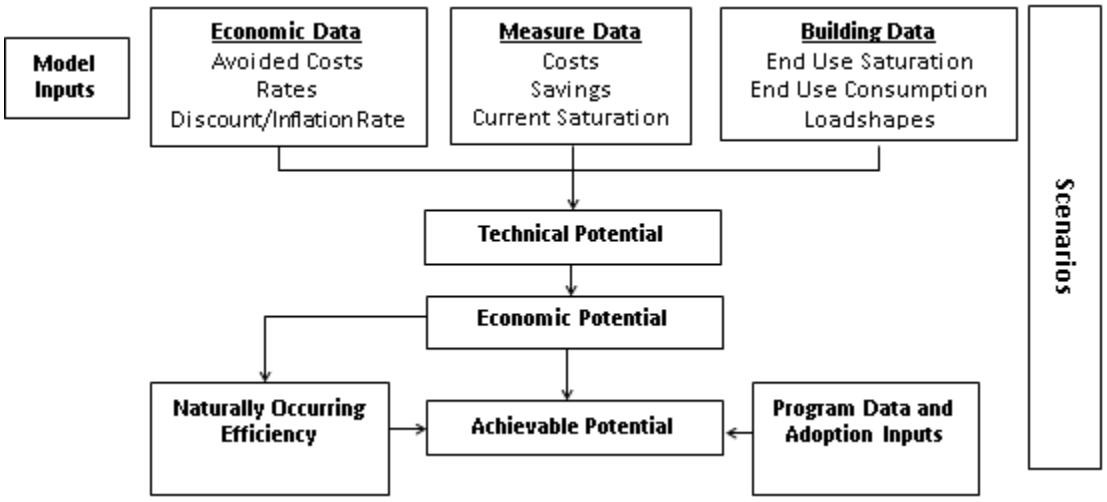


Figure 5-12 - Conceptual Overview of Potential Study Process

The key analytical steps taken include:

1. Step 1: Baseline Forecast: The baseline forecast provides detailed energy and demand use for the current marketplace of standard-efficiency technology. The forecast serves as a reference, from which the alternative high-efficiency technology and equipment will be compared.

   AEG developed information on building characteristics, including building type and energy consumption by end use.

   a. Empire provided the annual energy and peak demand forecast by sector.

   b. The residential building characteristic data was gleaned from the Empire Electric 2008 Energy Management Survey.

   c. Commercial and industrial building characteristic data were gleaned from Empire's 2010 Commercial Baseline Study.

2. Step 2: Estimate Technical and Economic Potential: The technical and economic potential were estimated utilizing a top-down approach. Annual technical and economic factors were gleaned from a 2010 Market Potential

Study for Ameren Missouri.[1] These factors were then applied to the Empire baseline forecast by sector.

3. Step 3: Estimate Achievable Program Potential: The maximum and realistic achievable potential energy and demand savings were estimated utilizing cost-effectiveness screening and portfolio scenarios. As required by 4 CSR 240-22.050, Empire must achieve all cost-effective demand-side savings.

AEG identified a comprehensive list of end-use measures for each market segment from the 2008 Energy Management Survey, 2010 Commercial and Industrial Baseline Study, technical reference manuals, and input from Empire's Advisory Group. AEG considered and assessed improved technologies that may be reasonably anticipated to occur during the planning horizon.

AEG gathered Empire's economic and technical data for the energy efficiency measures identified. Energy efficient measure energy and demand impacts were calculated using generally-accepted engineering algorithms based on a set of reasonable assumptions.

The cost-effectiveness analysis was performed using Empire-specific data. The software used to perform the benefit-cost screening has been adapted from Minnesota Office of Energy Security "BenCost" software and is consistent with the California Standard Practice Manual.

Energy efficiency measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income weatherization and low-income new homes programs, the programs were designed to be cost-effective. AEG bundled measures based on the end-use, sector, and implementation.

[1] Global Energy Partners, LLC. (2010). AmerenUE Demand Side Management Market Potential Study. Volume 3: Analysis of Energy-Efficiency Potential.

Residential Energy Management Survey

Empire commissioned an Energy Management Survey in 2008 to assist in efforts to develop effective energy efficiency programs and promote energy efficiency among residential customers. The survey was designed, administered, and analyzed by Opinion Research Specialists, LLC of Springfield, Missouri.

A random sample of 6,000 residential customers, segmented by population and energy usage, within Empire's Missouri, Arkansas, Kansas and Oklahoma service territory received four-page questionnaires and cover letters. The survey included questions on general household characteristics, heating and cooling equipment, appliances, water usage, and energy management. Survey participants were given approximately three weeks to complete the survey. A total of 1,960 questionnaires were completed and returned, for an overall response rate of 39 percent. Nine hundred and twenty-three (923) surveys were returned by the post office as undeliverable (15 percent). Overall survey results, based on the 1,960 completed questionnaires, have a margin of error of approximately ±2 percent at the 95 percent confidence interval.

A comparison of the 2008 Energy Management Survey sample to the 2010 U.S. Census demonstrates that there has not been a significant change in residential demographics and a new residential baseline study is unnecessary at this time.

Residential Demographic Comparison

AEG compared the 2008 Energy Management Survey sample to the 2010 U.S. Census to determine if there has been a significant change in Empire's residential demographics to necessitate additional primary data collection for an updated residential baseline study. The

2010 U.S. Census residential demographic data were gleaned from the American Community Survey 5-Year Estimates (2006 to 2010),[2] specifically:

- DP04: Selected Housing Characteristics; and
- S2501: Occupancy Characteristics.

The 2010 U.S. Census demographic data represents the Missouri, Arkansas, Kansas and Oklahoma counties within Empire's service territory. A second comparison was conducted utilizing 2009 U.S. EIA demographic data representing six states in the Midwest, including Missouri, Kansas, Nebraska, Arkansas, Louisiana and Oklahoma.[3]

Table 5-5 below presents the comparison of the 2008 Energy Management Survey, 2010 U.S. Census and 2009 U.S. EIA demographic data. The demographic data was analyzed and presented as minimum, average and maximum.[4] In all but three categories, the U.S. Census results are well within the range of the Energy Management Survey's results and are close to the average. For five categories, the Census results are within the margin of error of the Energy Management Survey. Although the U.S. EIA data covers a much larger geographic area, the results are also comparable to the U.S. Census and the Energy Management Survey. Given differences in sampling, coverage area, and data collection, the Energy Management Survey, the U.S. Census and the U.S. EIA data are comparable.

A comparison of the 2008 Energy Management Survey sample to the 2010 U.S. Census demonstrates that there has not been a significant change in residential demographics. A new baseline survey is not justified based on changes in demographics within Empire's service territory. Additionally, the saturation of major appliances and HVAC equipment are unlikely to have changed significantly in the time between 2008 and 2011 due to the low turnover rates of these types of equipment. Therefore, a new residential baseline study is unnecessary at this time.

[2] U.S. Census Bureau. American FactFinder. http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t
[3] U.S. EIA. 2009 Residential Energy Consumption Survey. www.eia.gov/consumption/residential/data/2009/#undefined
[4] The Energy Management Survey categorized data by low, medium and high electric consumption.

	2008 Energy Management			2010 U.S. Census	2009 U.S. EIA
	Min	Average	Max		
Residence <10 Years Old	19%	20%	25%	17%	17%
Residence 10-19 Years Old	18%	23%	24%	21%	14%
Residence 20-39 Years Old	24%	26%	34%	32%	33%
Residence 40+ Years Old	39%	31%	17%	30%	36%
1 Person Household	41%	24%	11%	26%	28%
2 Person Household	39%	42%	44%	37%	35%
3+ Person Household	20%	34%	45%	37%	37%
Single-Family Home	77%	81%	90%	75%	78%
Apartment	1%	3%	11%	9%	13%
Mobile Home	7%	8%	8%	11%	4%
Condo/Townhouse/Duplex	1%	8%	5%	5%	6%

Table 5-5 - Comparison of the 2008 Energy Management Survey, 2010 U.S. Census, and 2009 U.S. EIA Demographic Data

2008 Energy Management Survey Results

Empire customers primarily heat their homes with natural gas (43 percent) or electricity (41 percent). The majority of respondents use a central forced air furnace (64 percent) as their home's main heating system, followed by a heat pump (19 percent), fireplace or stove (7 percent) and space heater (6 percent). The largest group of residents (25 percent) indicated that their home heating system equipment was six to ten years old, followed by greater than 15 years (23 percent) and three to five years (22 percent). In terms of home heating systems, heat pumps tend to be relatively new while fireplaces/stoves tend to be relatively old.

System Type	<3 Years	3-5 Years	6-10 Years	11-15 Years	>15 Years
Total Heating System	14%	22%	25%	16%	23%
Central Forced Air	12%	22%	26%	18%	22%
Heat Pump	20%	27%	26%	14%	13%
Fireplace/Stove	15%	17%	17%	11%	40%
Room or Space Heater	24%	18%	11%	10%	37%

Table 5-6 - Heating Equipment Age

Sixty-eight (68) percent of Empire customers cool their home with a central air conditioner while 15 percent use a heat pump, 14 percent use a window air conditioning unit and 2percent do not cool their homes. The majority of respondents (28 percent) indicated that their home's

cooling system was six to ten years old. Window air conditioning units tend to be relatively new while central air conditioning units tend to be relatively old.

System Type	<3 Years	3-5 Years	6-10 Years	11-15 Years	>15 Years
Total Cooling System	16%	25%	28%	17%	14%
Central Air Conditioner	13%	24%	28%	19%	16%
Heat Pump	21%	26%	27%	12%	14%
Window Unit	27%	29%	26%	9%	9%

Table 5-7 - Cooling Equipment Age

A majority of respondents seldom (31 percent), if ever (22 percent), have their heating or cooling systems checked by a licensed service company. Twenty-three percent (23 percent) had the systems inspected at least once a year. The majority of homes (67 percent) are equipped with manually adjusted thermostats while 28 percent have programmable thermostats. Normal daytime temperature thermostat settings in summer and winter are shown in *Figure 5-13* below.

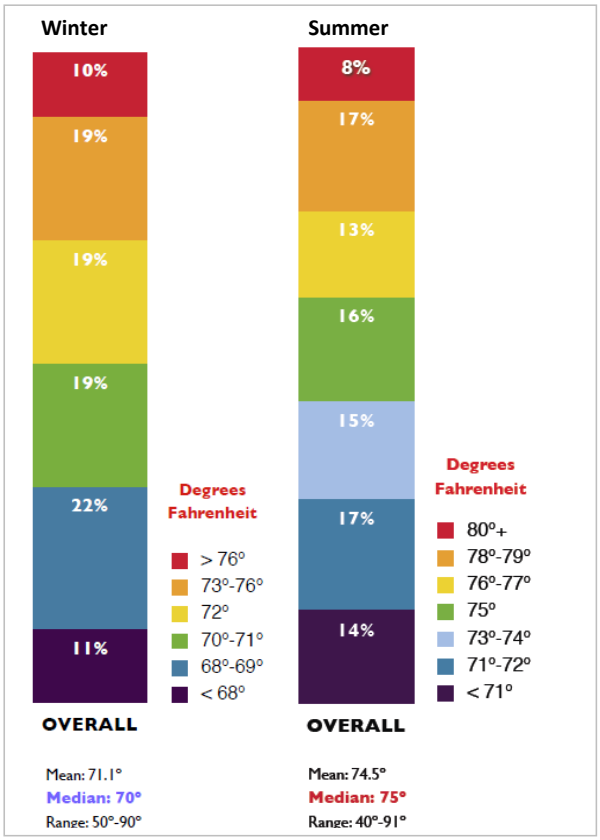


Figure 5-13 Normal Daytime Temperature Thermostat Settings

Electricity is the primary water heating fuel (56 percent), followed by natural gas (37 percent) and propane (7 percent). The majority of residents (30 percent) indicated that their hot water heater was between six and ten years old, followed by three to five years (28 percent) and less than three years (19 percent).

System Type	<3 Years	3-5 Years	6-10 Years	11-15 Years	>15 Years
Total Water Heating	19%	28%	30%	14%	9%
Electricity	20%	30%	28%	14%	8%
Natural Gas	17%	25%	34%	13%	11%
Propane	18%	29%	29%	14%	10%

Table 5-8 - Hot Water Heater age by Type of Water Heating Fuel

Approximately 20 to 25 percent of customers plan to replace their refrigerator (26 percent), hot water heater (24 percent), cooling (20 percent) or heating (18 percent) equipment in the next couple of years. More than 90 percent of respondents have at least one refrigerator, microwave, clothes washer or electric clothes dryer. Approximately 70 percent to 90 percent have an electric range or dishwasher.

Appliance	Number of Appliances		
	0	1	2+
Refrigerator	0%	76%	24%
Detached Freezer	43%	50%	7%
Microwave	3%	92%	5%
Clothes Washer	4%	94%	2%
Electric Clothes Dryer	10%	88%	2%
Electric Range	22%	76%	2%
Dishwasher	25%	74%	1%
Dehumidifier	87%	12%	1%
Gas/Propane Range	77%	22%	1%
Gas/Propane Dryer	93%	6%	1%
Sauna/Hot Tub	93%	6%	1%

Table 5-9 - Appliances per Household

Nearly 95 percent of respondents have at least one VCR/DVD player, 70 percent a tube-type television and 65 percent a stereo. Most respondents have at least one cell phone (87 percent), cordless phone (79 percent), personal computer (75 percent) or printer (70 percent).

Appliance	Number of Appliances		
	0	1	2+
Tube-Type TV	22%	29%	49%
VCR/DVD Player	7%	45%	48%
Stereo	34%	51%	15%
Video Game Console	66%	22%	12%
LCD TV	67%	22%	11%
DVR	67%	27%	6%
Home Theater	82%	16%	2%
Plasma TV	86%	12%	2%

Table 5-10 - Entertainment Devices per Household

Device	Number of Communication Devices		
	0	1	2+
Cell Phone	13%	34%	53%
Cordless Phone	21%	38%	41%
Personal Computer	25%	52%	23%
Printer	30%	57%	13%
iPod/MP3 Player	71%	17%	12%
Organizer (PDA)	91%	7%	2%
Fax Machine	78%	7%	2%

Table 5-11 - Communication Devices per Household

Within the last five years, approximately 30 percent of respondents have caulked their windows and door frames, sealed other air leaks or weather-stripped doors and windows.

Installation Type	
Caulking Windows and Door Frames	32%
Sealing Other Leaks	29%
Weather Strip Doors and Windows	29%
Storm Doors	24%
Double or Triple-Paned Windows	22%
Ceiling/Attic Insulation	22%
Exterior Wall Insulation	15%
Storm Windows	13%
Floor Insulation	7%
Foundation Insulation/Wrap	3%

Table 5-12 - Installation of Weatherization/Insulation Measures over the Past 5 Years

Customers were likely to utilize an Empire rebate or incentive for lighting (47 percent), not window air conditioners (11 percent). If offered, 46 percent of customers would be likely to have an on-site residential energy audit, 38 percent would access energy efficiency information online, 34 percent would use a low interest loan for energy-efficient upgrades or appliances, and 28 percent would self-administer an internet-based energy audit. Approximately 30 percent of respondents would allow Empire to automatically cycle their central air conditioner on and off in 15-minute intervals during peak usage days in the summer.

Rebate/Incentive Type	
Lighting	47%
Heating/Cooling Duct Cleaning	46%
Residential Energy Audit (On-Site)	46%
Central A/C Service Tune-Ups	44%
Weatherization Materials	44%
Refrigerators	43%
Energy Efficiency Information Online	38%
Washing Machines	37%
Water Heater Insulation Blankets	37%
Programmable Thermostats	34%
Low Interest Loans	34%
Central Air Conditioners	33%
Insulation Upgrade Incentives	33%
Residential Energy Audit (Online)	28%
Heat Pumps	18%
Window Air Conditioner	11%

Table 5-13 - Likelihood of Customer Utilizing a Rebate/Incentive by Measure

Commercial and Industrial Baseline Study

The purpose of the 2010 Commercial and Industrial Baseline Study was to develop a profile of C&I customers, including end-use breakdown and other equipment statistics (e.g. unit sizes, ages, types), that would be used to assess the potential improvements that could be made through measures or equipment replacement that would reduce energy consumption.

Based on analysis of the full account list of C&I customers (approximately 25,000), the sample was designed to segment the population by business type and usage stratum to recognize the two principal variables that affect usage components for facilities.[5] Approximately 150 sites were identified and 120 sites were successfully surveyed by auditors. Results were then weighted to account for the population and usage contributions of each business type and usage stratum.

The results of the 120 sample audits were compiled and reviewed. In about 20 percent of the cases, samples were re-assigned to different groups to reflect their actual business usage and a Public Assembly segment (mainly religious facilities) was extracted from the Miscellaneous group due to their specialized usage pattern. Annual energy consumption by business type and for total commercial sector, including the large accounts excluded from the sample, was compiled.

For several end uses, sample audit data was analyzed to determine existing characteristics, including:

- Lighting
- Cooling
- Ventilation
- Other end uses

Commercial Baseline Survey Results

Empire's commercial sector is comprised of primarily offices (22 percent), retail (14 percent), schools (12 percent) and health facilities (12 percent) as shown in *Figure 5-14*. Other building types include hotels, grocery, restaurant, warehouse and pastoral.

[5] Two techniques were utilized to most efficiently segment the population into energy usage strata, based on annual kWh, the Dalenius & Hodges technique and the Neyman Allocation technique.

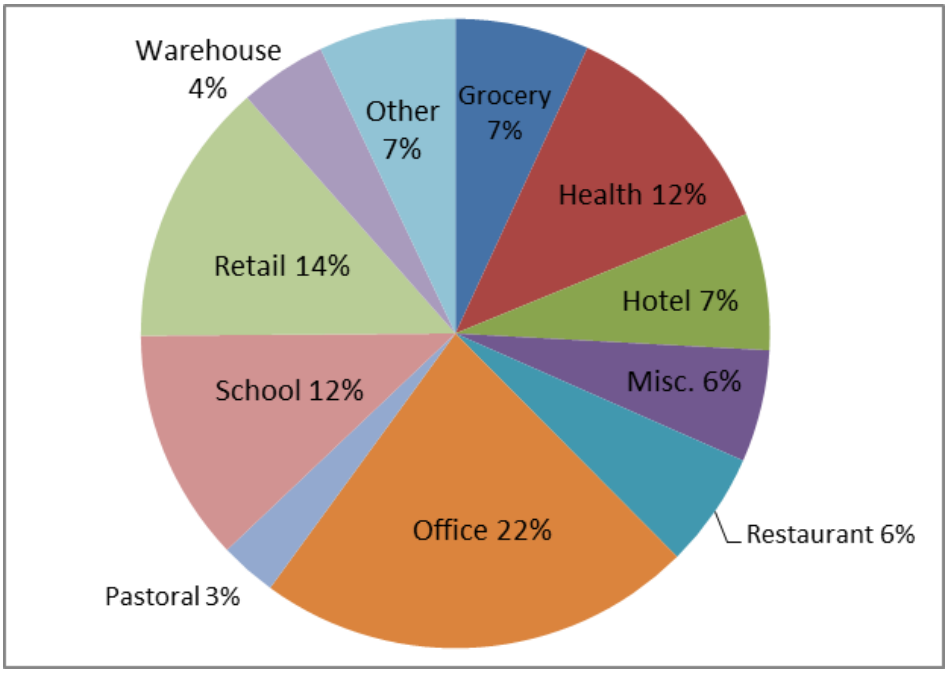


Figure 5-14 - Commercial Building Types

Empire commercial customers primarily use electricity for interior lighting (26 percent), space heating and cooling (13 percent each), and refrigeration (11 percent) as shown in *Figure 5-15*.

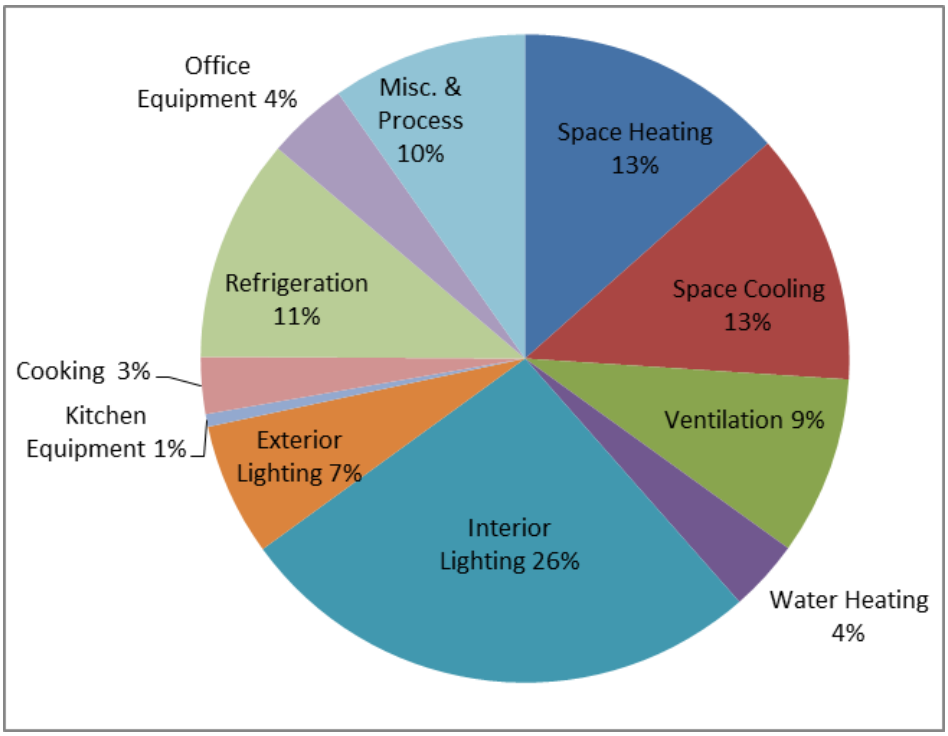


Figure 5-15 - Total Commercial Electricity by End Use

Industrial Baseline Survey Results

Empire's industrial sector is comprised of primarily food processing facilities (49 percent), petroleum, petrochemical and chemical operations (33 percent), paper, plastics and furniture operations (9 percent) and machinery, equipment and parts manufacturing (9 percent) as shown in *Figure 5-16*.

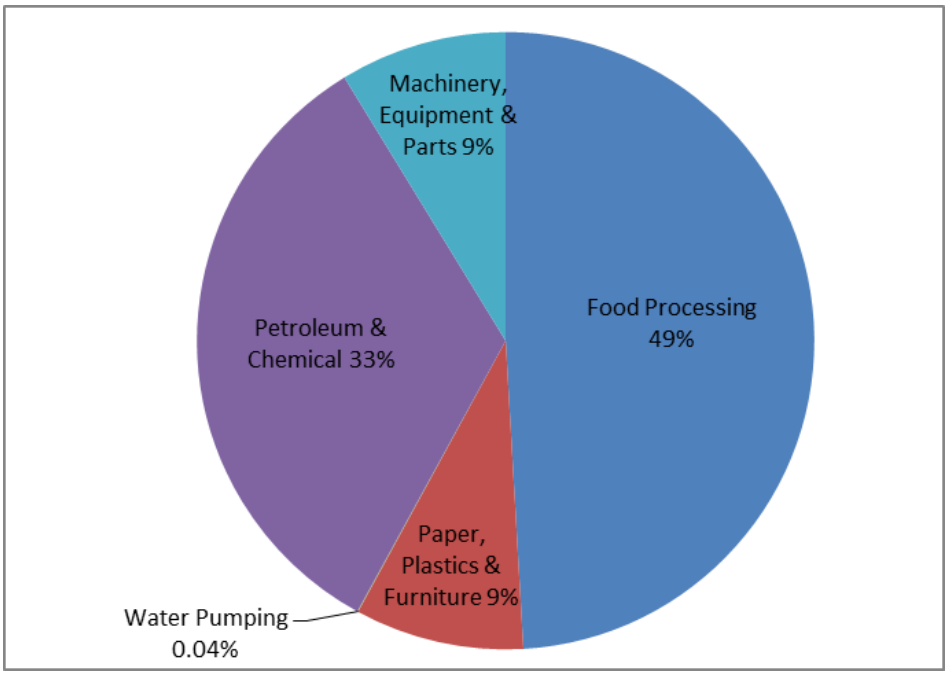


Figure 5-16 - Industrial Facility Type

Industrial facilities primarily consume electricity for machine drives (60 percent) and process cooling and refrigeration (16 percent) as shown in *Figure 5-17*.

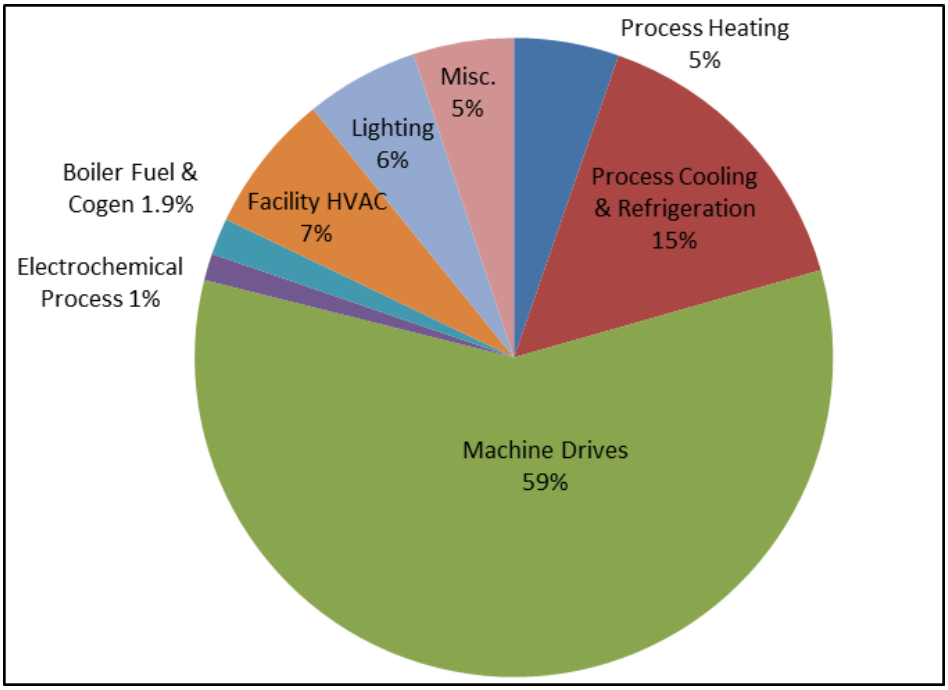


Figure 5-17 - End-Use Electricity Consumption, Industrial Facilities

Baseline Forecast

The baseline forecast provides detailed energy and demand use for the current marketplace of standard-efficiency technology, taking into account naturally occurring market effects as well as changes to building codes and appliance standards. The baseline forecast serves as a reference, from which the alternative high-efficiency technology and equipment will be compared.

Empire forecasted electric energy consumption, electric demand and consumers by sector within the Missouri service territory through 2032. Forecasted energy and demand consumption by residential, commercial, and industrial sector as presented in *Figures 5-18* and *5-19* with data shown in *Table 5-14*.

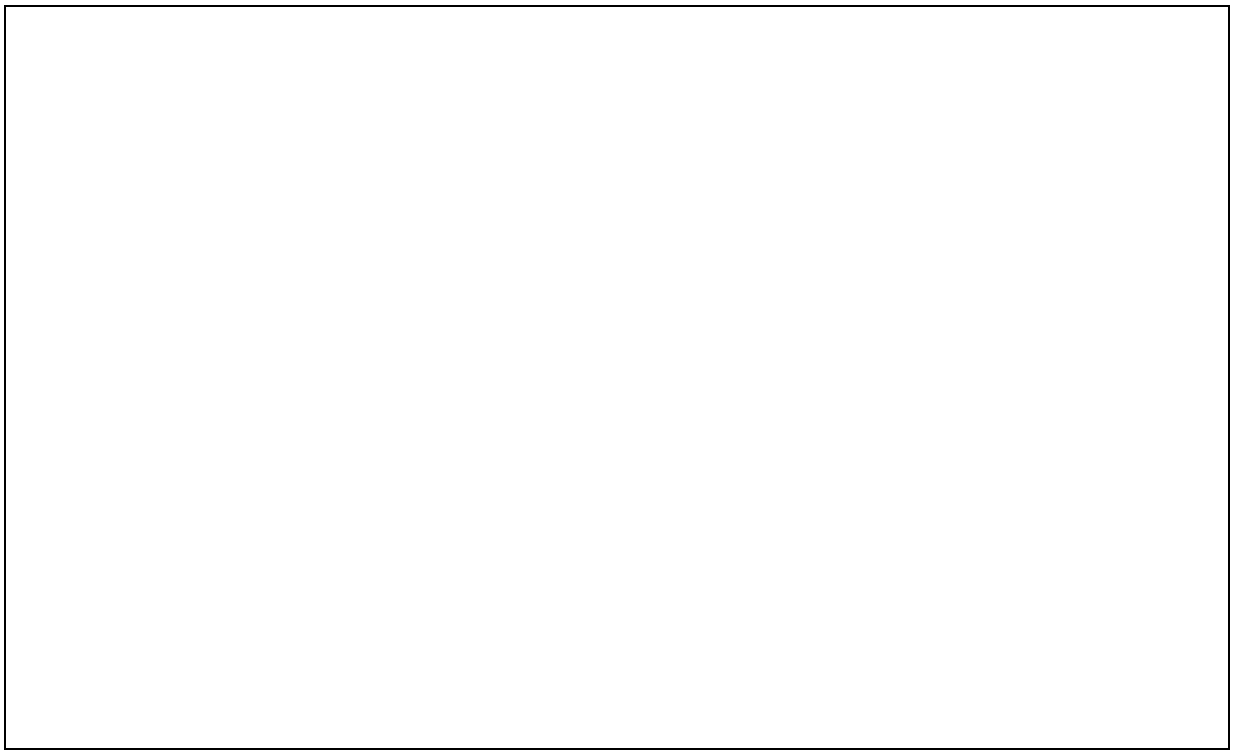


Figure 5-18 - Baseline Energy Forecast by Sector, GWh
Highly Confidential in its Entirety

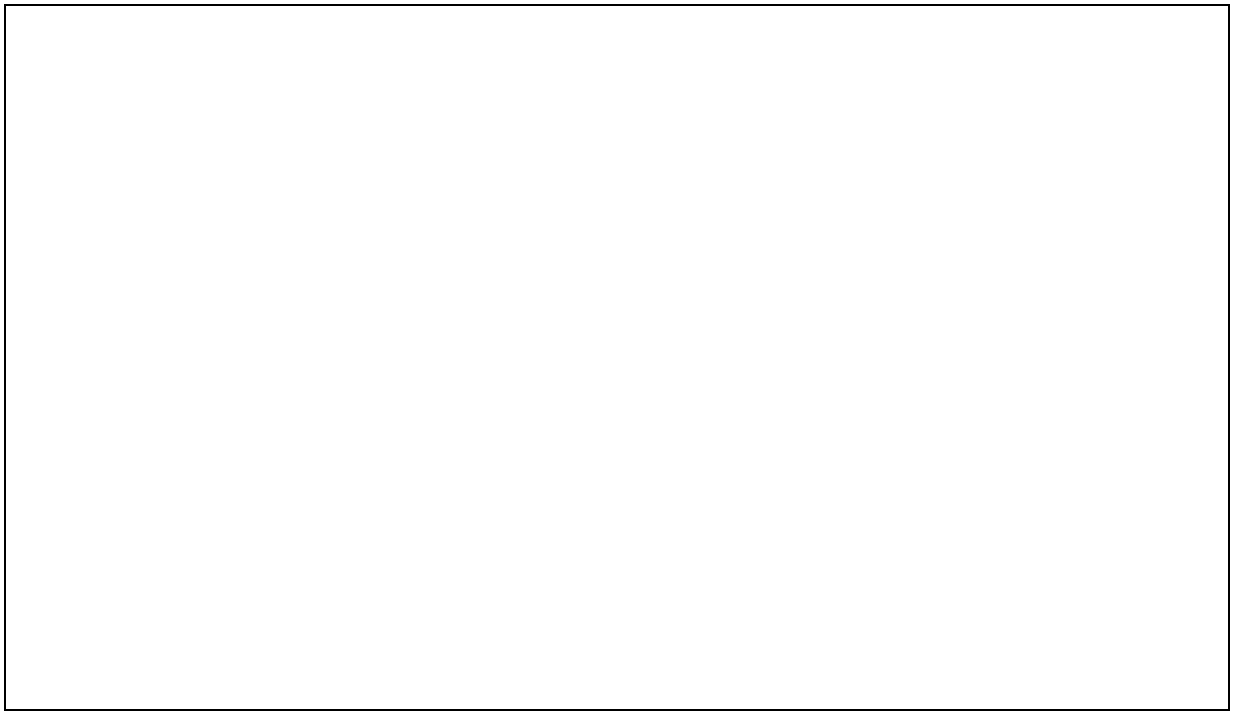


Figure 5-19 - Baseline Peak Demand Forecast by Sector, MW
Highly Confidential in its Entirety

Table 5-14 - Baseline Forecast by Sector

Highly Confidential in its Entirety

Residential Sector

In 2010, Empire provided 2,047 GWh of electricity to 141,493 residential customers. Therefore, the average residential customer consumed 14,447 kWh per year. The 2008 Energy Management Survey residential building types were applied to Empire's forecasted residential electric energy consumption, electric demand and consumers within the Missouri service territory through 2032. Empire's residential sector is comprised of primarily single family homes (83 percent), followed by multi-family homes (9 percent) and mobile homes (8 percent).

	2010	2015	2020	2025	2030
Single Family Home	1,658	1,534	1,596	1,678	1,778
Multi-Family Home	225	208	217	228	241
Mobile Home	164	152	158	166	176

Table 5-15 - Residential Baseline Electricity Consumption by Building Type, GWh

Electricity consumption by end use was estimated based on 2005 and 2009 U.S. EIA Residential Energy Consumption Surveys. [6] West North Central regional end use consumption was adjusted based on Missouri households. Residential electricity consumption is primarily for appliances and lighting (54 percent), followed by cooling (19 percent), refrigerator (12 percent), water heating (9 percent) and space heating (6 percent) as shown in *Figure 5-20*.

[6] EIA. 2005 Residential Energy Consumption Survey. www.eia.gov/consumption/residential/data/2005/#Home2; EIA. 2009 Residential Energy Consumption Survey. www.eia.gov/consumption/residential/data/2009/#undefined

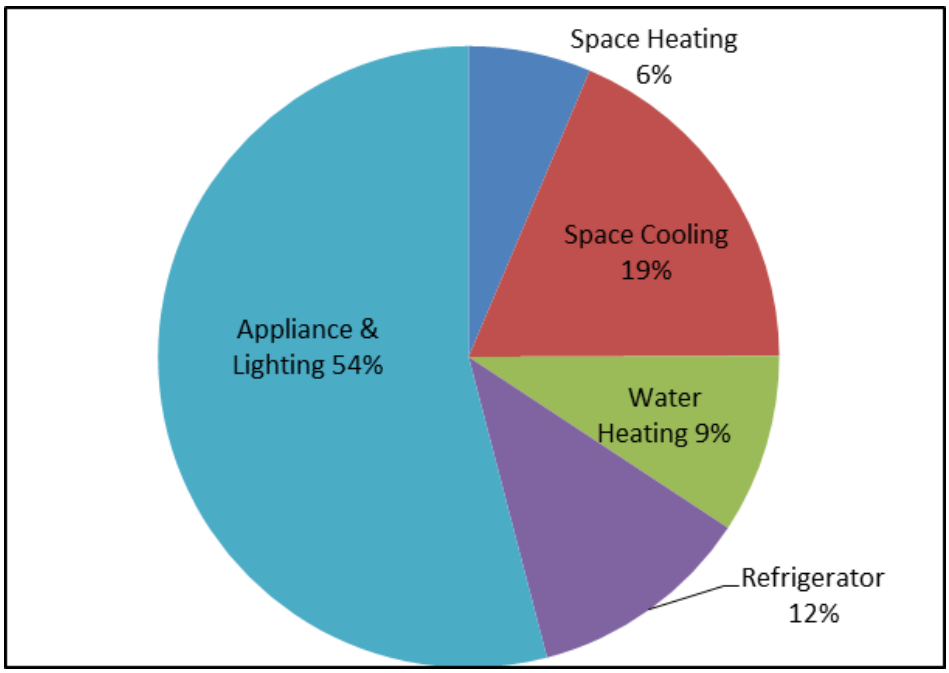


Figure 5-20 - Residential Electricity Consumption by End Use

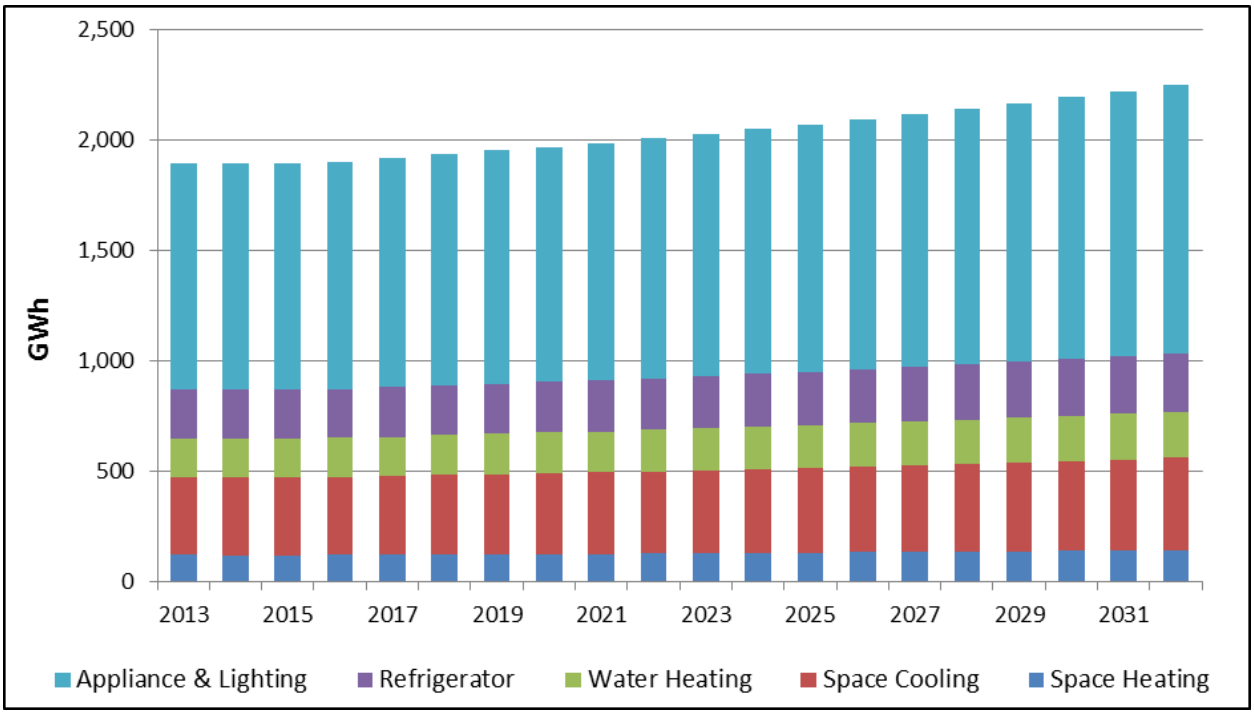


Figure 5-21 - Residential Baseline Electricity Consumption by End Use, GWh

Commercial Sector

In 2010, Empire provided 1,637 GWh of electricity to 24,505 commercial customers. Therefore, the average commercial customer consumed 66,798 kWh per year. The 2010 Commercial and Industrial Baseline Study building types and end uses were applied to Empire's forecasted commercial electric energy consumption, electric demand and consumers within the Missouri service territory through 2032. Based on the baseline study findings, the commercial sector is comprised of primarily offices (22 percent), retail (14 percent), schools (12 percent) and health facilities (12 percent). Other building types include hotel, grocery, restaurant, warehouse and pastoral.

	2010	2015	2020	2025	2030
Grocery	113	113	121	130	139
Health	195	195	209	223	240
Hotel	115	115	124	132	142
Misc.	94	94	101	108	116
Office	368	367	394	422	454
Pastoral	48	48	51	55	59
Restaurant	97	97	104	111	120
Retail	223	222	238	255	275
School	196	195	210	224	241
Other	115	115	124	132	142
Warehouse	73	73	78	84	90

Table 5-16 - Commercial Baseline Electricity Consumption by End Use, GWh

Commercial customers primarily use electricity for interior lighting (26 percent), space heating and cooling (13 percent each), and refrigeration (11 percent). Additional uses of electricity include ventilation, exterior lighting, water heating, office equipment, cooking, kitchen equipment and miscellaneous and processes.

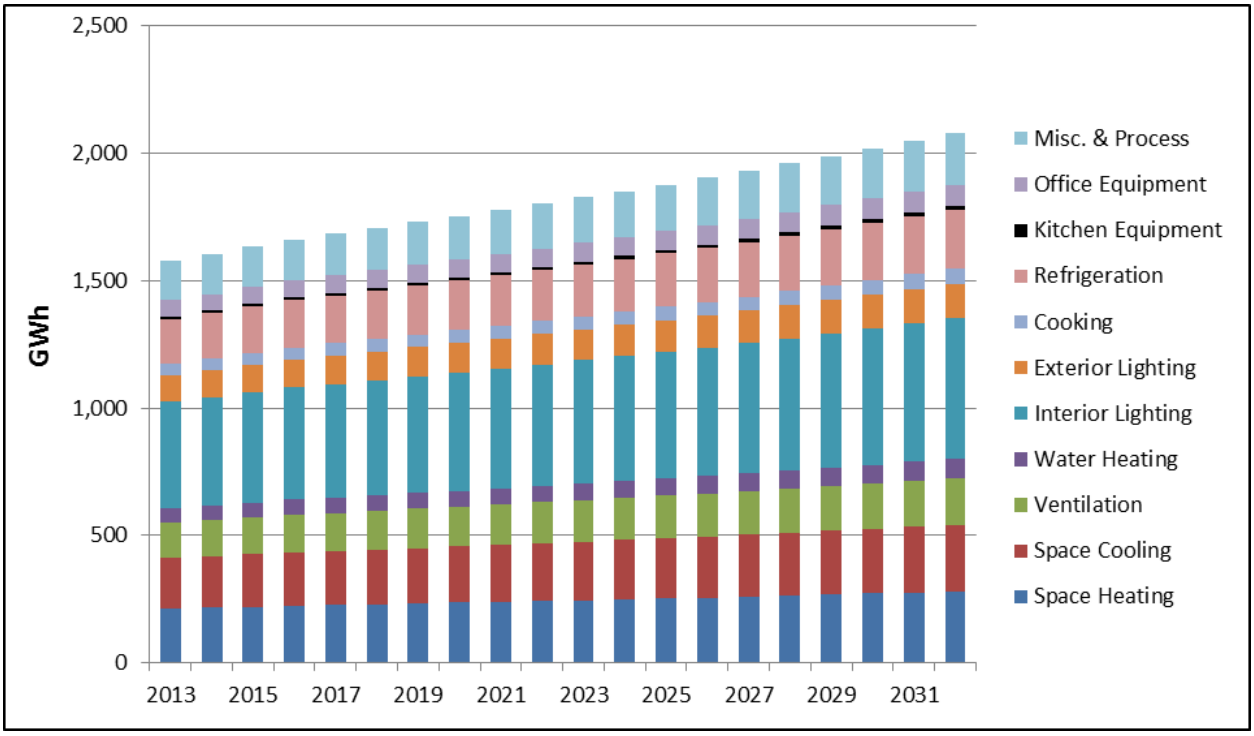


Figure 5-22 - Commercial Baseline Electricity Consumption by Building Type, GWh

Industrial Sector

In 2010, Empire provided 1,498 GWh of electricity to 2,399 industrial customers. Therefore, the average industrial customer consumed 624,697 kWh per year.

The 2010 Commercial and Industrial Baseline Study building types and end uses were applied to Empire's forecasted industrial electric energy consumption, electric demand and consumers within the Missouri service territory through 2032. Based on the baseline study findings, the industrial sector is comprised of primarily food processing facilities (49 percent), petroleum and chemical operations (33 percent), paper, plastics and furniture operations (9 percent) and machinery, equipment and parts manufacturing (9 percent).

	2010	2015	2020	2025	2030
Food Processing	735	740	747	752	756
Paper, Plastics, and Furniture	133	134	135	136	137
Petroleum & Chemical	499	502	507	510	513
Machinery, Equipment, & Parts	131	132	133	134	135
Water Pumping	0.5	0.5	0.5	0.5	0.6

Table 5-17 - Industrial Baseline Electricity Consumption by End Use, GWh

Industrial customers primarily use electricity for machine drives (60 percent), process cooling and refrigeration (16 percent), facility HVAC and lighting (6 percent each), and process heating (5 percent).

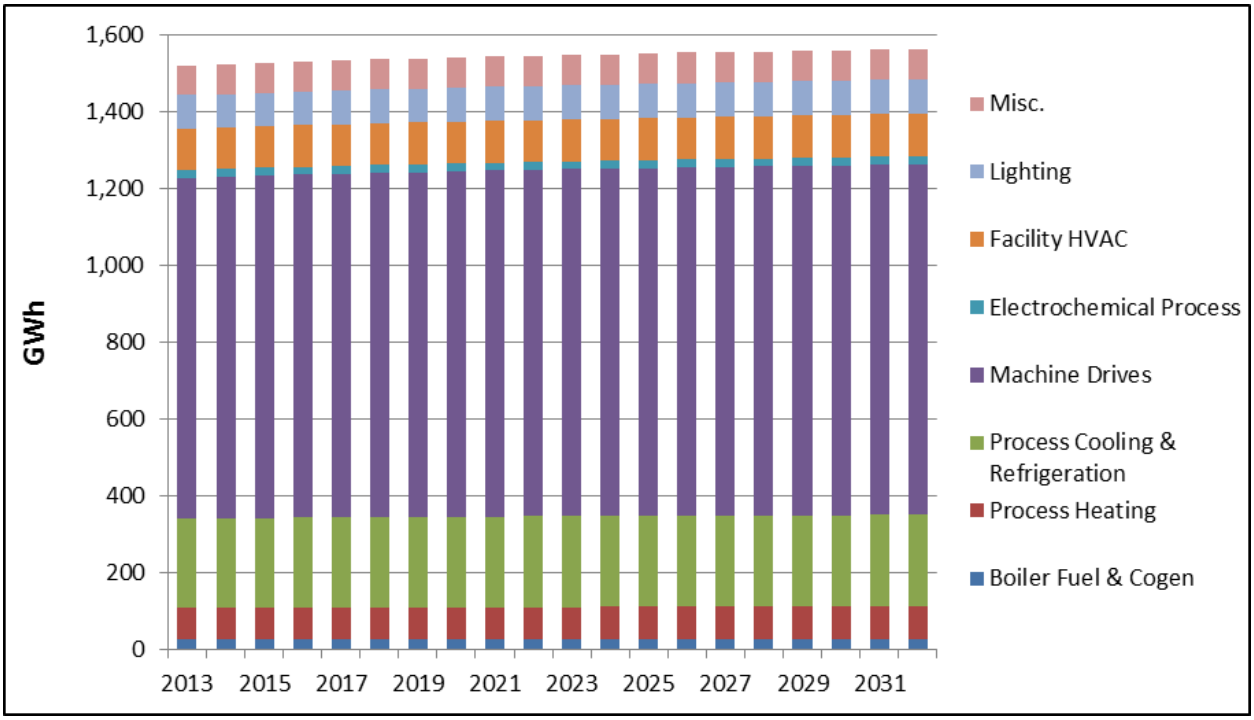


Figure 5-23 - Industrial Baseline by Facility Type, GWh

Technical and Economic Potential

In 2010, Empire's total electricity consumption was 5,182 GWh. If the current marketplace of standard-efficiency technology remains, total electricity consumption is expected to increase to 5,874 GWh in 2032.

1. Technical Potential. Feasible energy and demand savings using all efficient technologies and design practices, unconstrained by budgets, cost-effectiveness or customer preferences.

2. Economic Potential. Feasible energy and demand savings using all cost-effective measures, unconstrained by budgets or customer preferences.

The technical and economic potential were estimated utilizing a top-down approach. Annual technical and economic factors were gleaned from a 2010 Market Potential Study for Ameren Missouri.[7] These factors were then applied to the EDE baseline forecast by sector. The technical and economic potential factors gleaned from the Ameren Missouri study are presented in the following two tables.

	2010	2015	2020	2025	2030
Energy (% of Baseline)					
Residential	12%	32%	37%	39%	39%
Commercial	10%	26%	31%	33%	33%
Industrial	3%	9%	11%	11%	11%
Demand (% of Baseline)					
Residential	14%	45%	53%	58%	58%
Commercial	14%	35%	42%	45%	44%
Industrial	1%	3%	3%	3%	3%

Table 5-18 - Technical Potential Factors by Sector

[7] Global Energy Partners, LLC. (2010). AmerenUE Demand Side Management Market Potential Study. Volume 3: Analysis of Energy-Efficiency Potential.

	2010	2015	2020	2025	2030
Energy (% of Baseline)					
Residential	6%	12%	14%	19%	21%
Commercial	6%	14%	17%	18%	18%
Industrial	3%	7%	8%	8%	9%
Demand (% of Baseline)					
Residential	8%	20%	23%	27%	28%
Commercial	8%	20%	24%	26%	25%
Industrial	1%	2%	2%	2%	3%

Table 5-19 - Economic Potential Factors by Sector

1. Energy Savings: In 2030, technical potential is estimated at 1,697 GWh, **_____**, and economic potential is estimated at 957 GWh, **_____.**

2. Peak Demand Savings: In 2030, technical potential is estimated at 602 MW, **_____**, and economic potential is estimated at 320 MW, ** _____.**

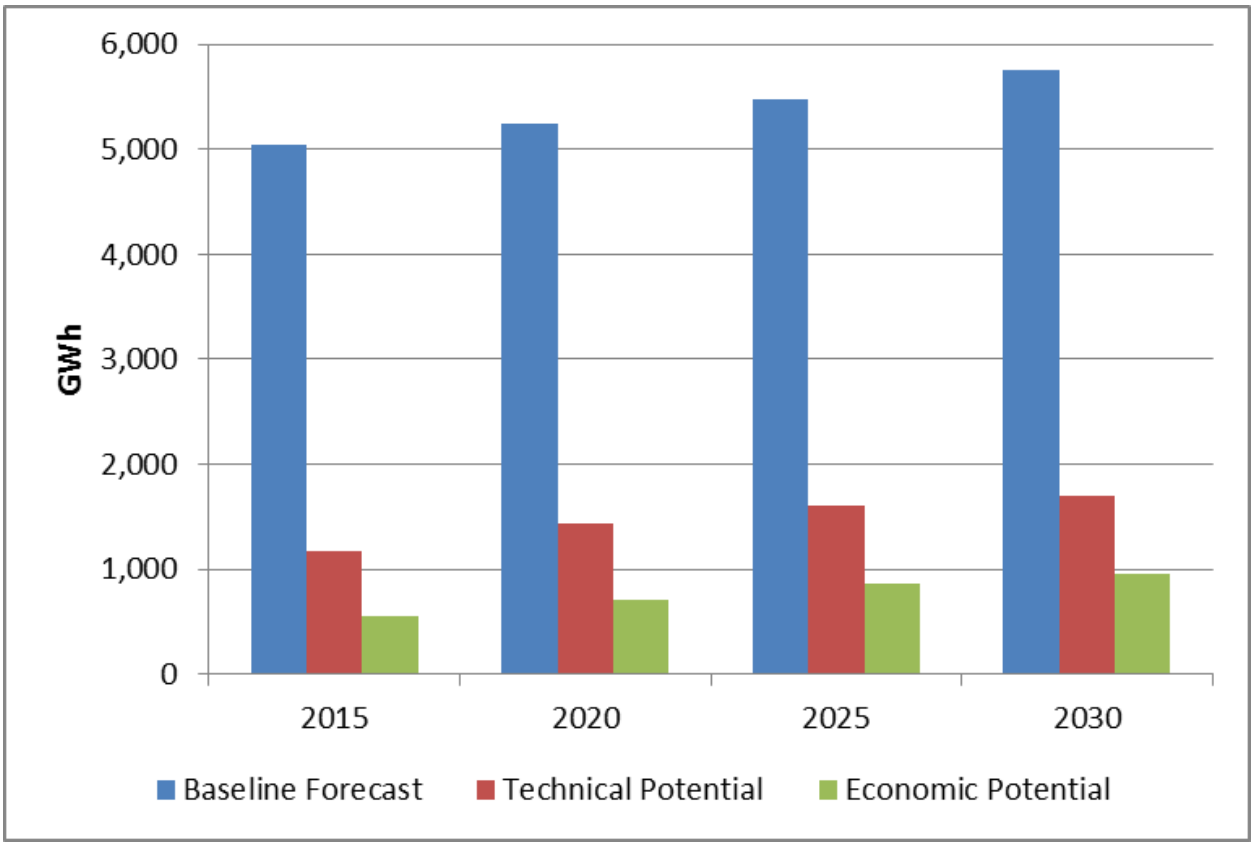


Figure 5-24 - Technical and Economic Potential, GWh

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Energy (GWh)																				
Residential	452	525	598	620	644	669	696	723	739	756	774	793	814	823	833	843	852	862	873	885
Commerical	309	366	426	451	473	497	521	549	562	575	588	602	616	624	633	643	653	658	668	678
Industrial	104	122	142	147	151	156	161	166	168	169	171	173	175	175	175	175	175	176	176	176
Total	**864**	**1013**	**1167**	**1217**	**1269**	**1322**	**1378**	**1438**	**1469**	**1501**	**1534**	**1568**	**1604**	**1622**	**1641**	**1661**	**1680**	**1697**	**1717**	**1738**
Peak Demand (MW)																				
Residential	187	216	243	257	269	282	294	299	311	321	332	343	350	348	356	361	367	372	372	372
Commerical	93	112	130	136	142	148	155	165	168	173	177	182	188	1901	191	192	195	197	199	201
Industrial	3	3	4	4	4	5	5	5	5	5	5	5	6	6	5	5	6	6	6	6
Total	**283**	**332**	**378**	**398**	**416**	**435**	**454**	**469**	**485**	**499**	**514**	**530**	**544**	**543**	**552**	**559**	**567**	**574**	**577**	**579**

Table 5-20 - Technical Potential by Sector

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Energy (GWh)																				
Residential	180	203	223	234	245	257	270	282	304	327	351	375	398	408	419	431	442	459	471	484
Commerical	172	202	232	246	259	273	287	305	313	321	329	337	344	348	353	359	364	368	373	378
Industrial	78	92	107	110	114	117	120	122	123	125	127	129	127	127	127	128	128	131	131	131
Total	**430**	**497**	**563**	**590**	**618**	**647**	**677**	**709**	**740**	**773**	**806**	**841**	**868**	**884**	**900**	**917**	**934**	**957**	**975**	**994**
Peak Demand (MW)																				
Residential	84	96	106	112	116	121	126	127	134	141	147	155	160	161	166	171	176	181	183	185
Commerical	54	64	74	77	81	85	89	94	96	98	100	102	107	108	108	108	110	111	113	114
Industrial	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total	**140**	**163**	**183**	**192**	**201**	**209**	**218**	**225**	**234**	**243**	**251**	**261**	**270**	**272**	**278**	**284**	**290**	**296**	**300**	**304**

Table 5-21 - Economic Potential by Sector

Residential Sector

The residential sector accounts for the largest share of technical and economic potential within Empire's Missouri service territory.

1. Energy Savings. In 2030, technical potential is estimated at 862 GWh, **_____**, and economic potential is estimated at 459 GWh, **_____.**

2. Peak Demand Savings. In 2030, technical potential is estimated at 372 MW, **_____**, and economic potential is estimated at 181 MW, **_____.**

	2015	2020	2025	2030
Energy (GWh)				
_____	**____**	**____**	**____**	**____**
Technical Potential	598	723	814	862
Economic Potential	223	282	398	459
Peak Demand (MW)				
_____	**____**	**____**	**____**	**____**
Technical Potential	243	299	350	372
Economic Potential	106	127	160	181

Table 5-22 - Residential Technical and Economic Potential

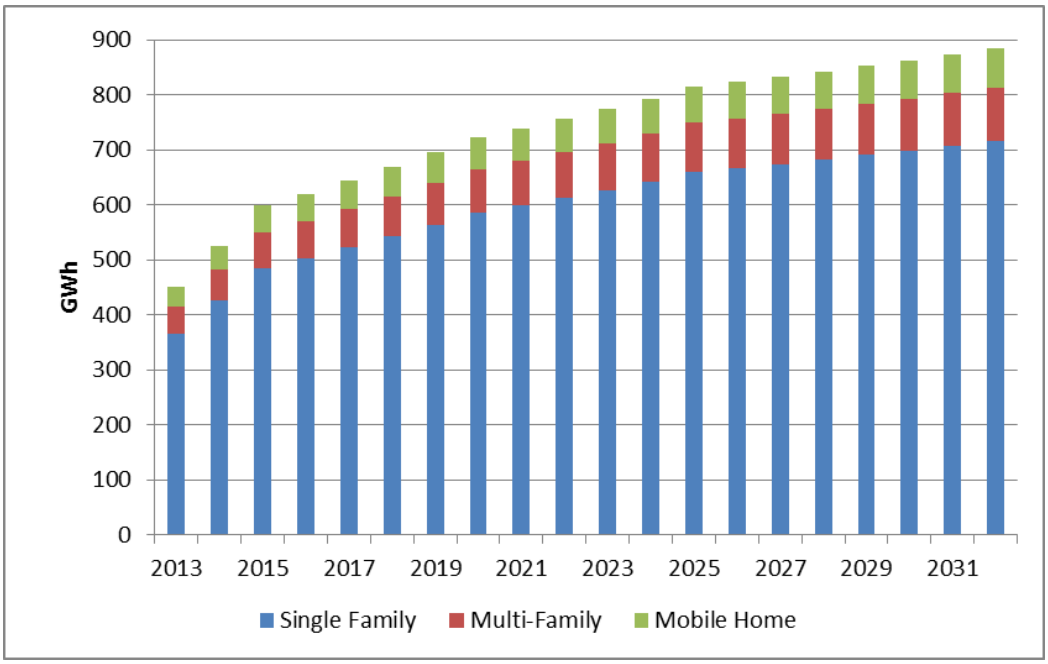


Figure 5-25 - Residential Technical Potential by Building Type, GWh

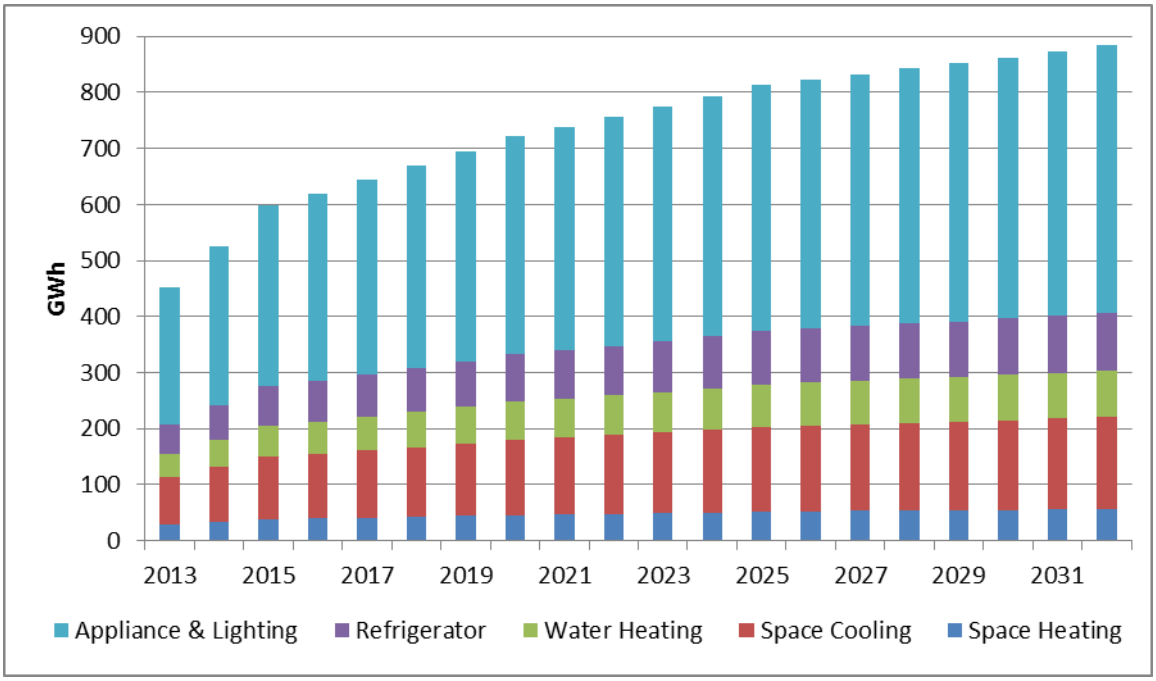


Figure 5-26 - Residential Technical Potential by End Use, GWh

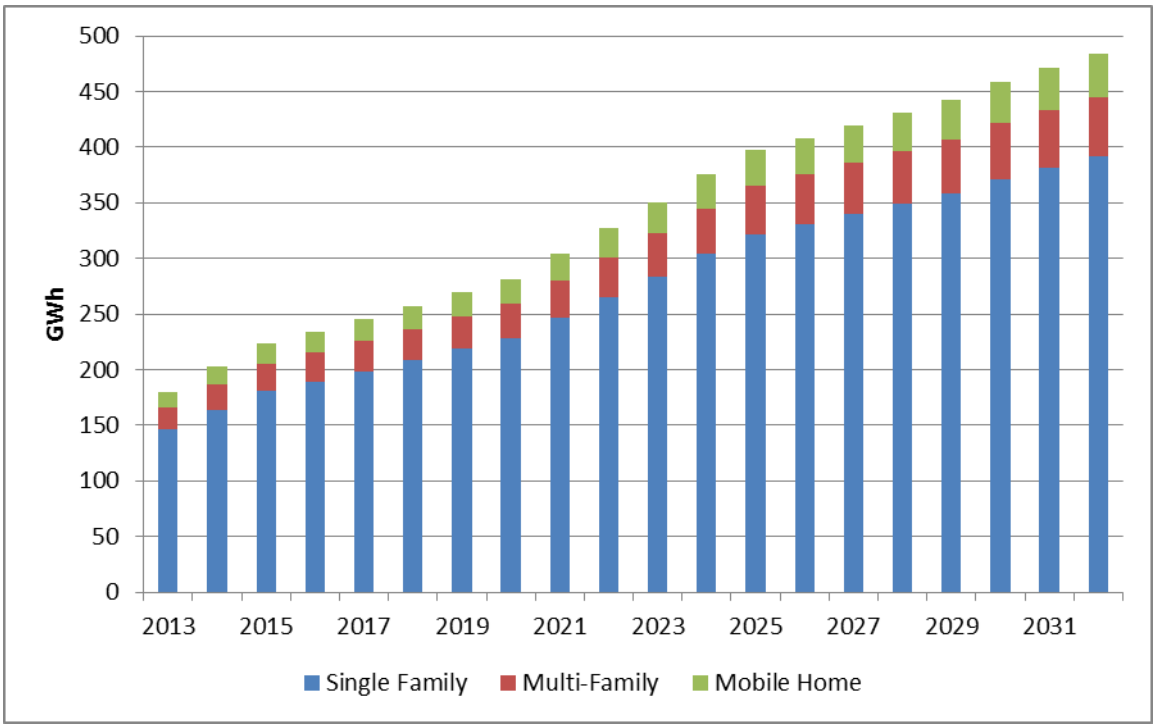


Figure 5-27 - Residential Economic Potential by Building Type, GWh

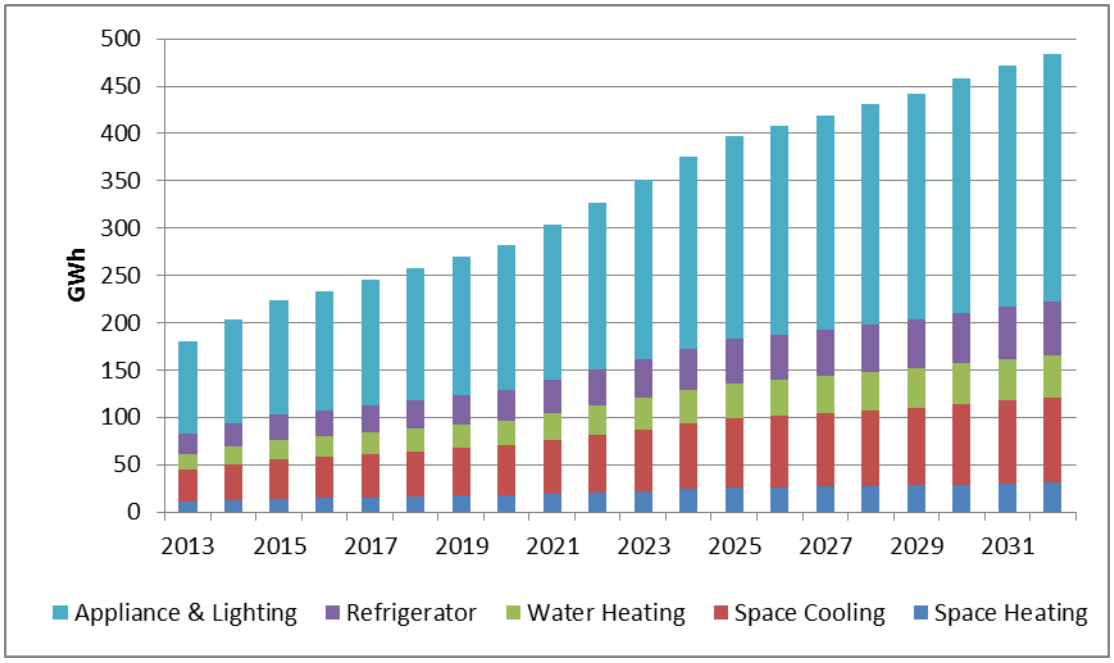


Figure 5-28 - Residential Economic Potential by End Use, GWh

Commercial Sector

1. Energy Savings. In 2030, technical potential is estimated at 658 GWh, **_____**, and economic potential is estimated at 368 GWh, **_____.**

2. Peak Demand Savings. In 2030, technical potential is estimated at 197 MW, **_____**, and economic potential is estimated at 111 MW, **_____.**

	2015	2020	2025	2030
Energy (GWh)				
_____	**____**	**____**	**____**	**____**
Technical Potential	426	549	616	658
Economic Potential	232	305	344	368
Peak Demand (MW)				
_____	**____**	**____**	**____**	**____**
Technical Potential	130	165	188	197
Economic Potential	74	94	107	111

Table 5-23 - Commercial Technical and Economic Potential

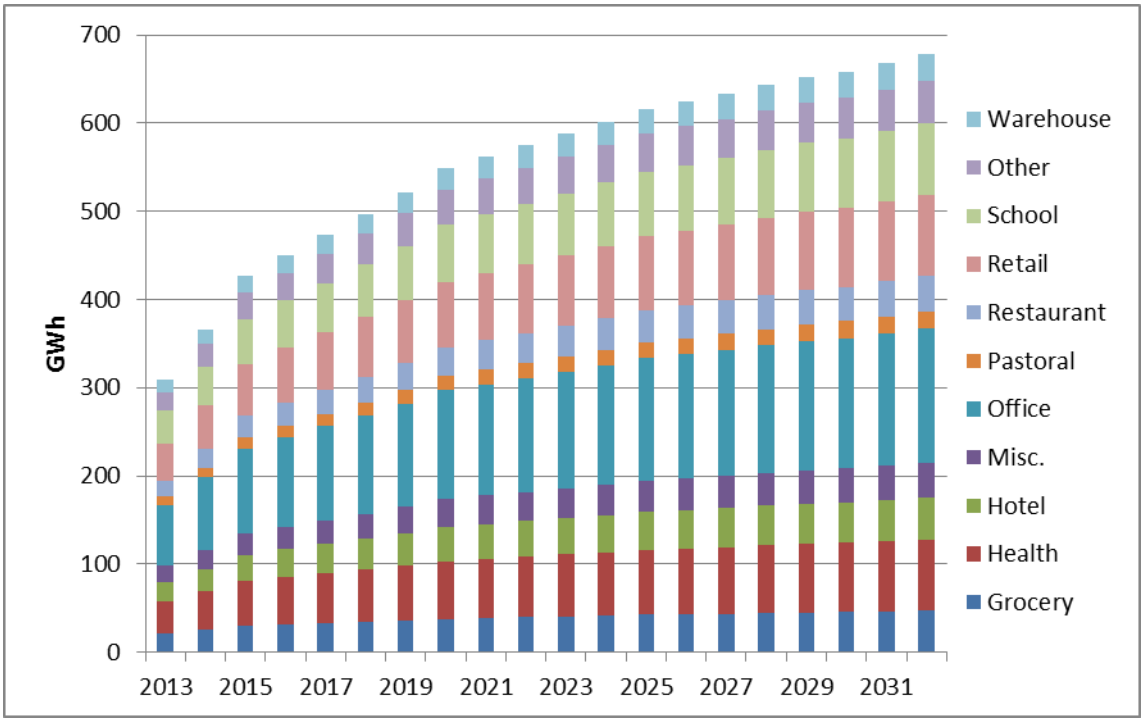


Figure 5-29 - Commercial Technical Potential by Building Type, GWh

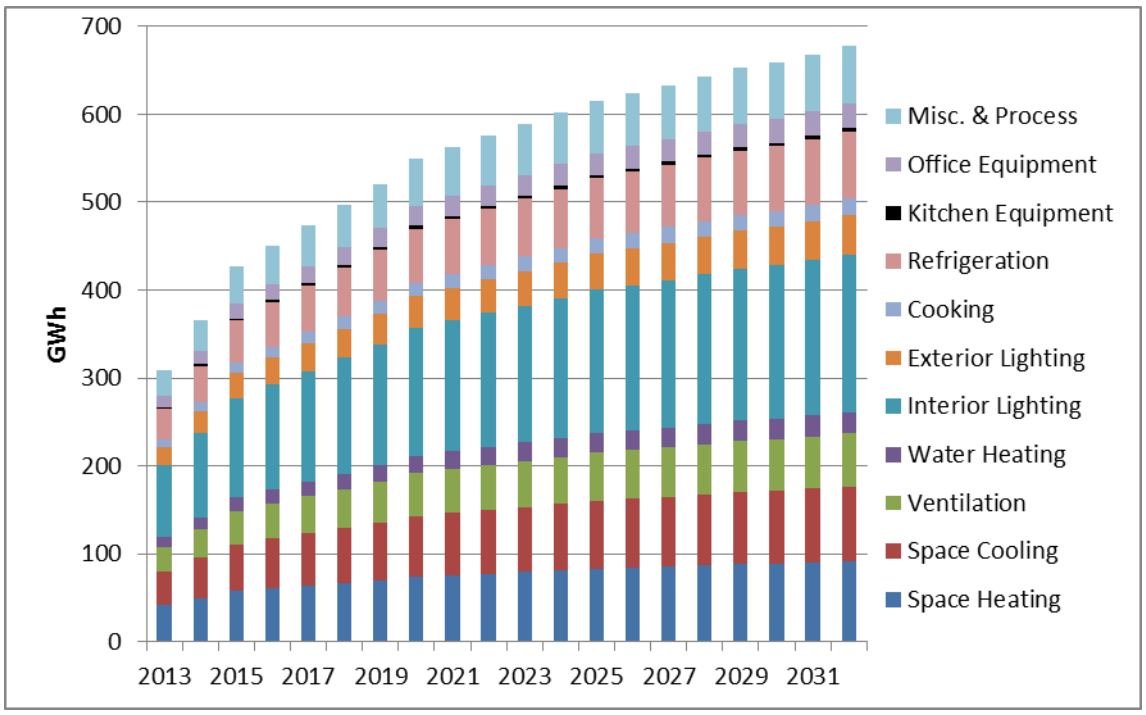


Figure 5-30 - Commercial Technical Potential by End Use, GWh

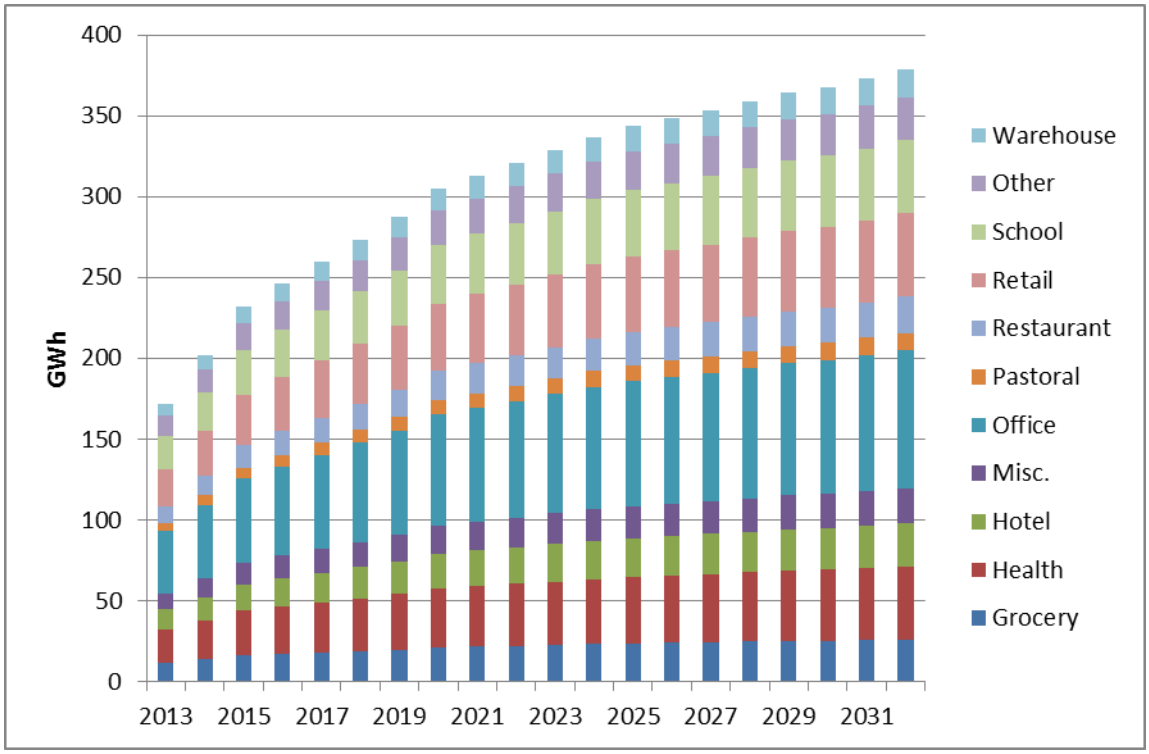


Figure 5-31 - Commercial Economic Potential by Building Type, GWh

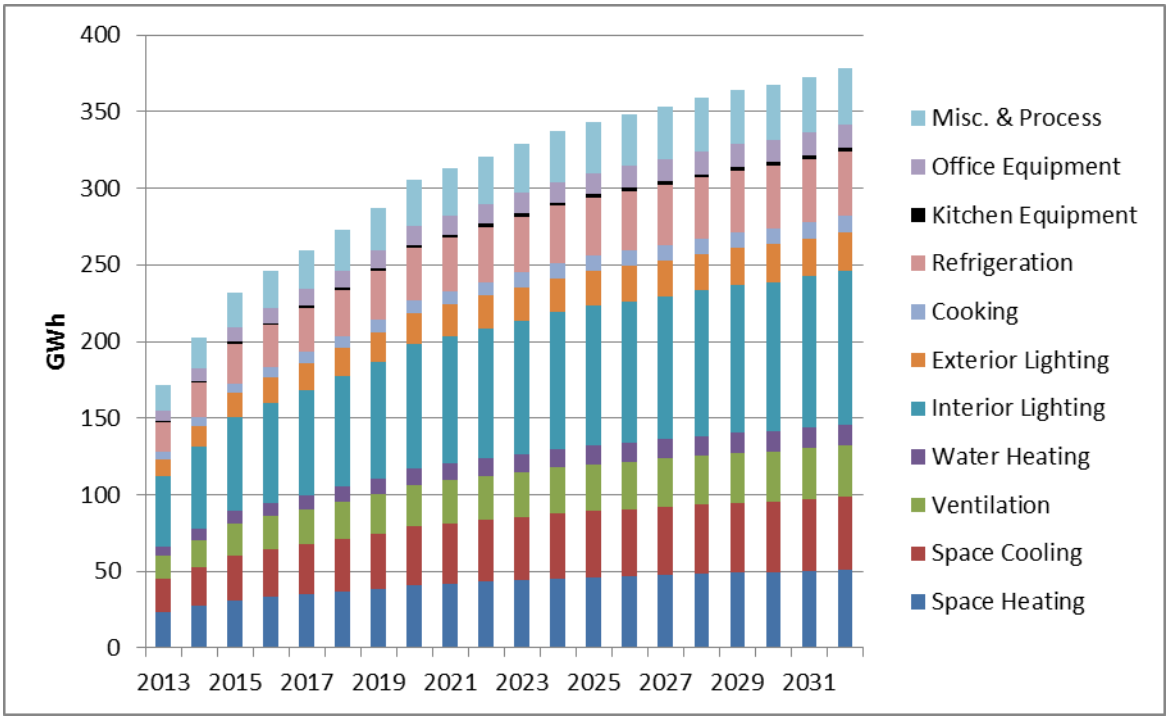


Figure 5-32 - Commercial Economic Potential by End Use, GWh

Industrial Sector

1. Energy Savings: In 2030, technical potential is estimated at 176 GWh, **_____ _____**, and economic potential is estimated at 131 GWh, **_____.**

2. Peak Demand Savings: In 2030, technical potential is estimated at 6 MW, **___ _____**, and economic potential is estimated at 4 MW, **_____ .**

	2015	2020	2025	2030
Energy (GWh)				
_____	**__**	**__**	**__**	**__**
Technical Potential	142	166	175	176
Economic Potential	107	122	127	131
Peak Demand (MW)				
_____	**__**	**__**	**__**	**__**
Technical Potential	4	5	6	6
Economic Potential	3	4	4	4

Table 5-24 - Industrial Technical and Economic Potential

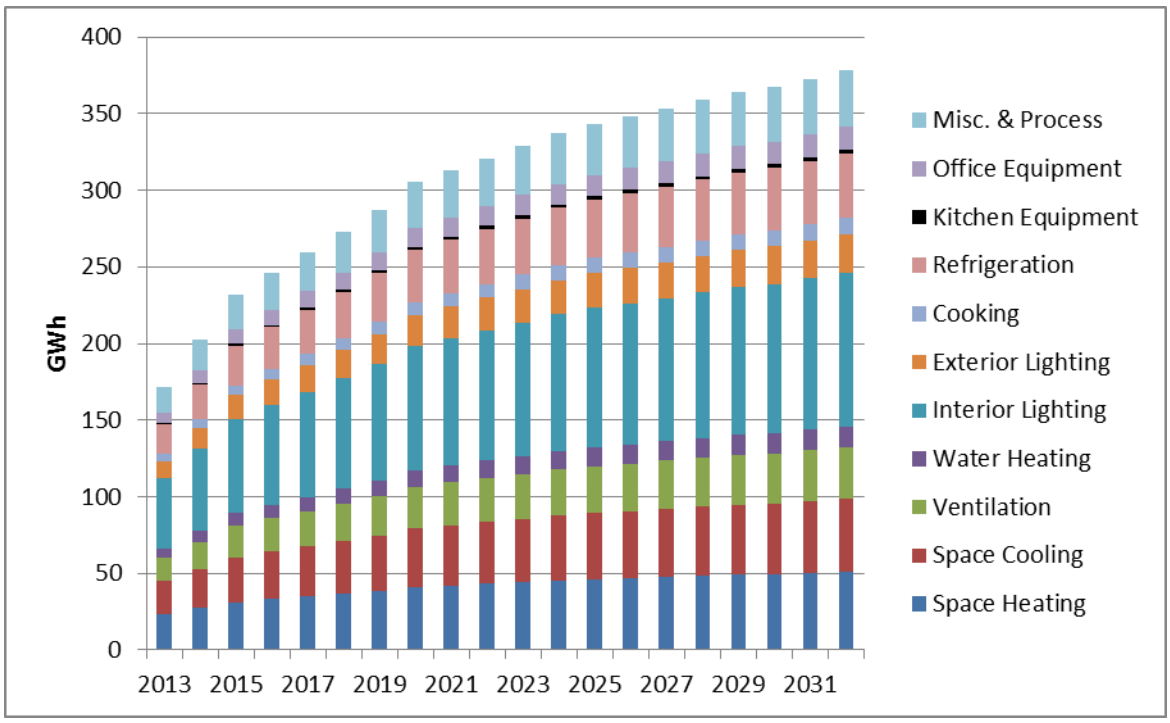


Figure 5-33 - Industrial Technical Potential by Building Type, GWh

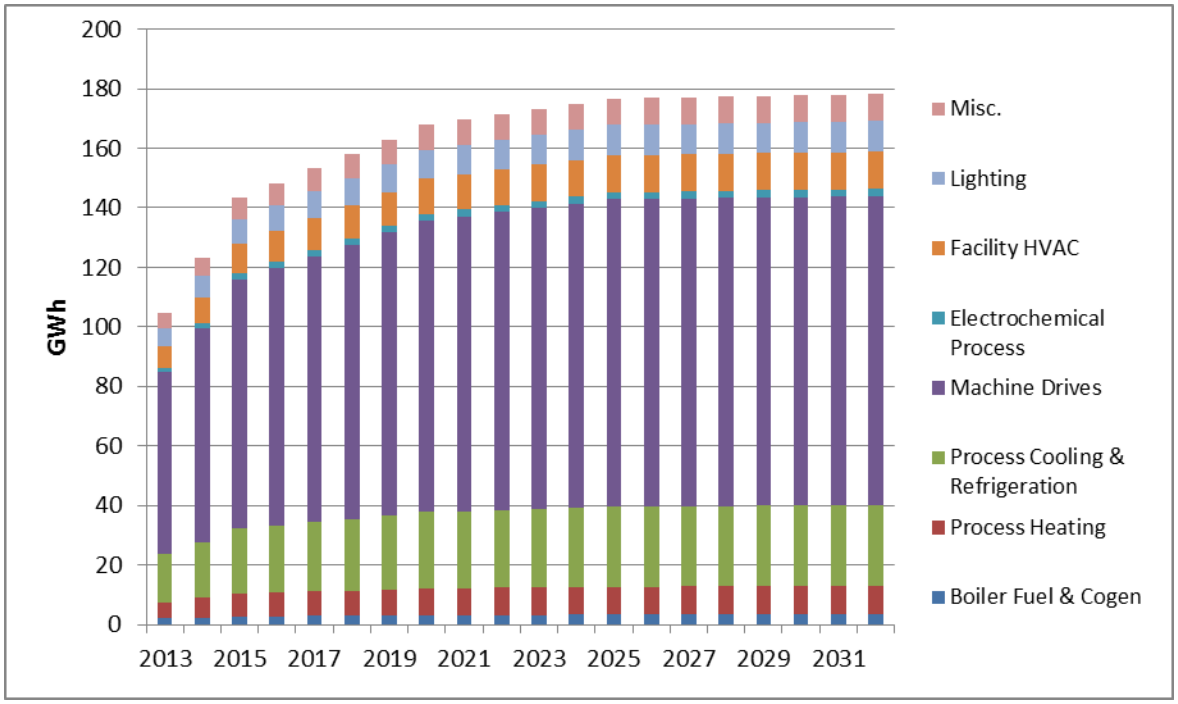


Figure 5-34 - Industrial Technical Potential by End Use, GWh

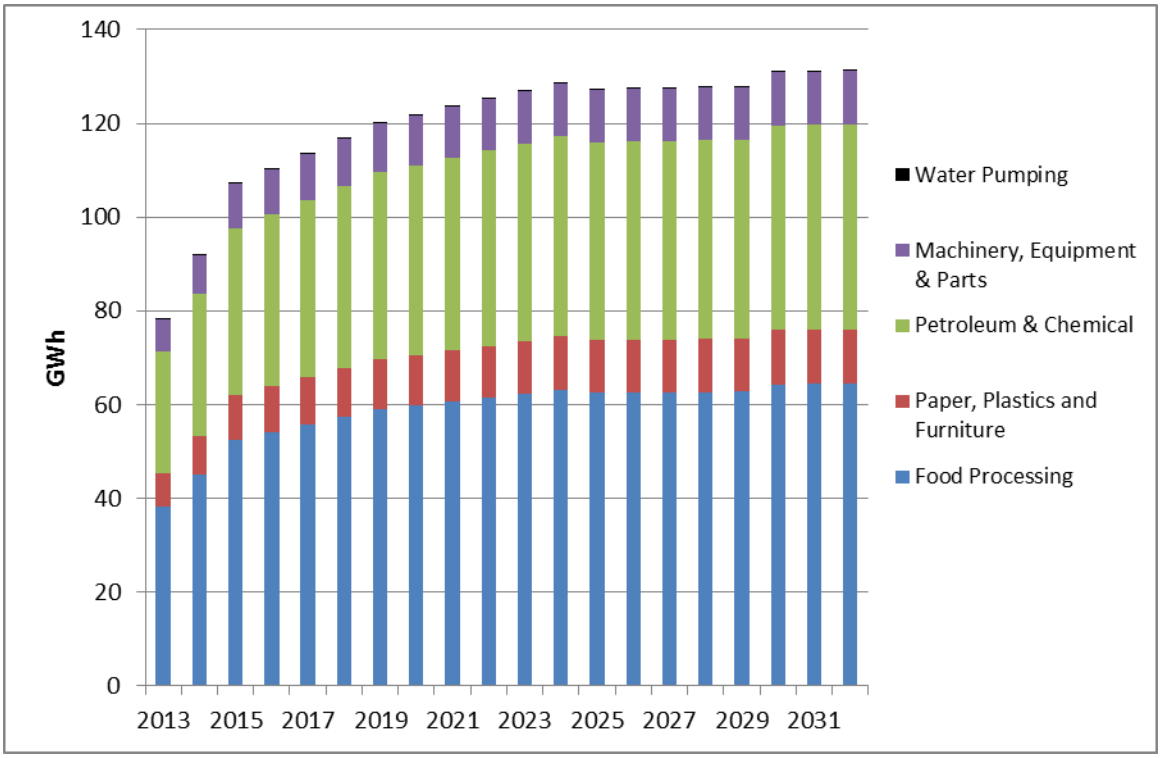


Figure 5-35 - Industrial Economic Potential by Building Type, GWh

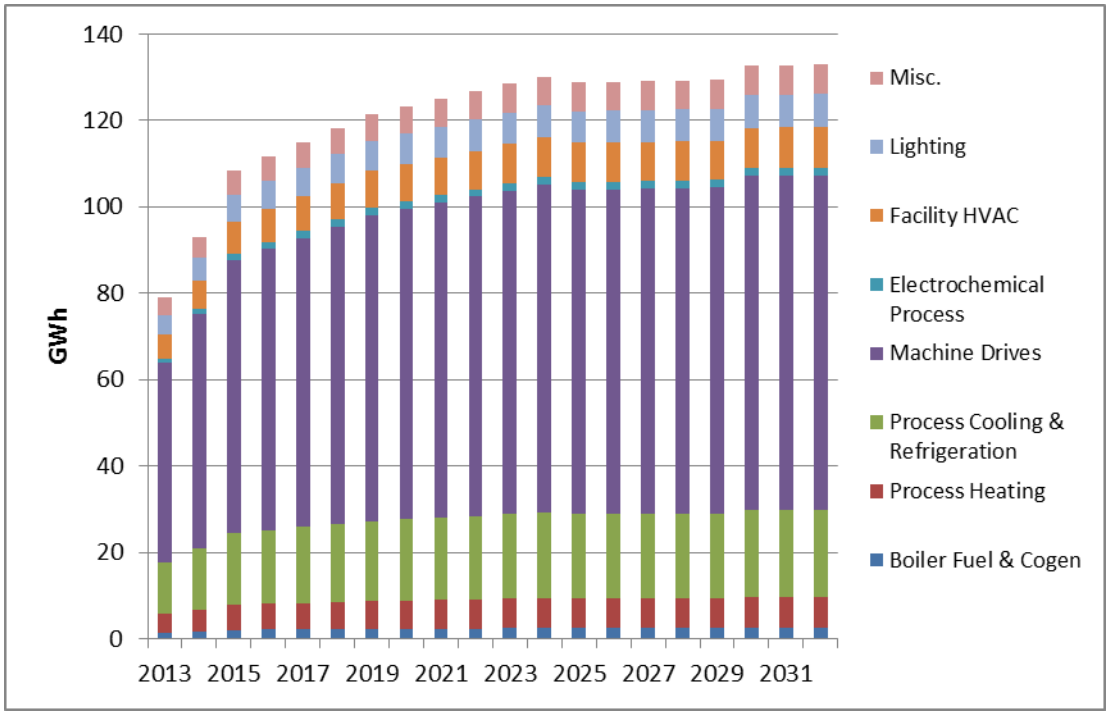


Figure 5-36 - Industrial Economic Potential by End Use, GWh

Energy Efficiency Achievable Potential

Achievable potential refers to the savings resulting from expected program participation and ideal implementation conditions.

1. Maximum Achievable Potential provides a hypothetical upper-boundary of achievable demand-side energy and demand savings potential, presuming ideal conditions not typically observed.

2. Realistic Achievable Potential provides realistic energy and demand savings a utility can expect to achieve through its demand-side programs from expected program participation and realistic implementation conditions.

The maximum and realistic achievable potential energy and demand savings were estimated utilizing cost-effectiveness screening and portfolio scenarios. As required by 4 CSR 240-22.050, Empire must achieve all cost-effective demand-side savings. A comprehensive list of energy efficiency measures was developed and screened for cost-effectiveness (i.e. a TRC benefit-cost ratio of at least 1.0). The list of measures, as well as energy and demand impacts, were developed using a variety of sources, including Empire's historic demand-side management (DSM) programs, the 2008 Residential Management Survey and the 2010 Commercial and Industrial Baseline study as well as ENERGY STAR, the Consortium for Energy Efficiency and regional and national sources. The list of measures screened for cost-effectiveness is shown in the tables below.

End-Use Category	Baseline Measure	End-Use Measure
Lighting	Incandescent	CFL
Lighting	Incandescent	LED
Lighting	Incandescent	ENERGY STAR Indoor Fixture
Lighting	Incandescent	ENERGY STAR Exterior Fixture
Lighting	Incandescent	Efficient Nightlight
Appliances	Standard Dehumidifier	ENERGY STAR Dehumidifier
Appliances	Standard Clothes Washer	ENERGY STAR Clothes Washer
Appliances	Standard Refrigerator	ENERGY STAR Refrigerator
Appliances	Standard Dishwasher	ENERGY STAR Dishwasher
Appliances	Standard Room Air Conditioner	ENERGY STAR Room Air Conditioner
Appliances	Single Speed Pool Pump	ENERGY STAR 2-Speed Pool Pump
Appliances	Single Speed Pool Pump	ENERGY STAR Variable Speed Pool Pump
Appliances	Single-Pane Window	ENERGY STAR Window
Appliances	Old Refrigerator	Refrigerator Recycle
Appliances	Old Freezer	Freezer Recycle
Appliances	Old Room Air Conditioner	Room Air Conditioner Recycle
Electronic	Standard Power Strip	Advanced Power Strip
Electronic	Standard Desktop Computer	ENERGY STAR Desktop Computer
Electronic	Standard Laptop Computer	ENERGY STAR Laptop Computer
Electronic	Standard Computer Monitor	ENERGY STAR Computer Monitor
Electronic	Standard Ink Jet Printer	ENERGY STAR Ink Jet Printer
Electronic	Standard Laser Color Printer	ENERGY STAR Laser Color Printer
Insulation/Shell	No Air Sealing	Air Sealing
Insulation/Shell	Attic Insulation, R=5	Attic Insulation
Insulation/Shell	Wall Insulation, R=5	Wall Insulation
Insulation/Shell	No Duct Insulation	Duct Insulation
Insulation/Shell	No Floor Insulation	Floor Insulation
Space Cooling	No Tune-Up	Central Air Conditioner Tune-Up
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 15
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 16
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 17
Space Cooling	Central Air Conditioner SEER 10	Early Retirement Central Air Conditioner SEER 16
Space Cooling	Central Air Conditioner SEER 10	Early Retirement Central Air Conditioner SEER 17
Space Heating	No Tune-Up	ASHP Tune-Up
Space Heating	Heat Pump SEER 13	Heat Pump SEER 15
Space Heating	Heat Pump SEER 13	Heat Pump SEER 16
Space Heating	Heat Pump SEER 13	Heat Pump SEER 17
Space Heating	Heat Pump SEER 10	Early Retirement HP SEER 16
Space Heating	Heat Pump SEER 10	Early Retirement HP SEER 17
Space Heating	Standard Ductless Mini-Split	Ductless Mini-Split SEER 21
Space Heating	Heat Pump SEER 13	Geothermal EER ≥17
Space Heating	Heat Pump SEER 13	Geothermal EER ≥21

End-Use Category	Baseline Measure	End-Use Measure
Space Cooling/Heating	No Programmable Thermostat	Programmable Thermostat
HVAC	No Faucet Aerator	Faucet Aerator
HVAC	No Low Flow Showerhead	Low Flow Showerhead
HVAC	Standard Electric Water Heater	Heat Pump Water Heater
HVAC	Standard Electric Water Heater	Solar Water Heater
HVAC	Thermostat Setting ≥ 120 degrees	Water Heater Temperature Setback
HVAC	No Water Heater Tank Wrap	Water Heater Tank Wrap
HVAC	No Hot Water Pipe Insulation	Hot Water Pipe Insulation
HVAC	Non-BPM Blower Motor	Furnace Fan Motor
HVAC	Standard Exhaust-Only Ventilation Fan	HE Bathroom Exhaust Fan
HVAC	No Whole House Fan	Whole House Fan

Table 5-25 - Residential Measures Screened

End-Use Category	Baseline Measure	End-Use Measure
Lighting	Standard T8 Fixture	T5 Fixture
Lighting	Standard T8 Fixture	High Performance T8
Lighting	Standard T8 Fixture	Low Wattage Fluorescent T8
Lighting	Metal Halide	High Bay Fluorescent Fixture T8
Lighting	Metal Halide	High Bay Fluorescent Fixture T5
Lighting	Incandescent	CFLs
Lighting	Incandescent	LED Lamp
Lighting	Incandescent Exit Sign	Exit Sign
Lighting	No Occupancy Sensors	Lighting Occupancy Sensors
HVAC	Standard Central Air Conditioner	Central Air Conditioner, SEER 14 (<65kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 11.5 (65 - 135 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 11.5 (135 - 240 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 10.3 (240 - 760 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 9.7 (>760 kBtuh)
HVAC	Standard Split Package Heat Pump	Split Package Heat Pump, SEER 14
HVAC	Standard Single System Heat Pump	Single System Heat Pump, SEER 14
HVAC	Standard Heat Pump	Heat Pump, EER 11.1 (65 < 135 kBtuh)
HVAC	Standard Heat Pump	Heat Pump, EER 10.7 (135 < 240 kBtuh)
HVAC	Standard Heat Pump	Heat Pump, EER 10.1 (>240 kBtuh)
HVAC	No Occupancy Sensors	Hotel Occupancy Sensors
HVAC	Standard Electric Water Heater	Electric Storage Water Heater
HVAC	Standard Electric Water Heater	Tankless Water Heater
HVAC	Standard Furnace, AFUE 90 percent	High Efficiency Furnace w/ ECM Motor
HVAC	Standard Chiller	Chiller
Motors	Shaded Pole Motor	Motor
Motors	Constant Speed Motor	VFD
Refrigeration	Standard Refrigerator	Solid Door Refrigerator
Refrigeration	Standard Refrigerator	Glass Door Refrigerator
Refrigeration	Standard Freezer	Solid Door Freezer
Refrigeration	Standard Freezer	Glass Door Freezer
Agriculture	Electric Open Waterer	Live Stock Waterer
Agriculture	Manual Engine Block Heater	Engine Block Timer
Agriculture	Multiple Non- HVLS Fans	High Volume Low Speed Fans
Agriculture	Standard Fan	High Speed Fans

Table 5-26 - C&I Measures Screened

AEG gathered Empire's economic data and technical data for the energy efficiency measures identified. Energy-efficient measure energy and demand impacts were calculated using generally accepted engineering algorithms based on a set of reasonable assumptions. Because of the diversity in equipment and energy consumption patterns across multiple building types and end-uses, there exists a variability in these savings estimates as they relate to program design and target markets, particularly at the planning stage of these programs.

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

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

1. Participant Cost Test quantifies the benefits and costs to the customer due to program participation.

2. Ratepayer Impact Measure (RIM) Cost Test measures what happens to a customer's rates due to changes in utility revenues and operating costs.

3. Utility Cost Test measures the net costs of a program as a resource option based on the costs incurred by the program administrator, excluding any net costs incurred by the participant.

4. Societal Cost Test measures the effects of a program on society as a whole.

The cost-effectiveness analysis was performed using Empire-specific data. The software used to perform the benefit-cost screening has been adapted from Minnesota Office of Energy Security "BenCost" software and is consistent with the California Standard Practice Manual. The input data gathered for the model included:

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)	Project Life (Years)
Environmental Damage Cost ($/kWh)	kWh/Participant Saved (Net and Gross)
Discount Rate (percent)	kW/Participant Saved (Net and Gross)
Growth Rate (percent)	Number of Participants
Line Losses (percent)	
Load Shapes	

Table 5-27 - Cost-Effectiveness Model Inputs

Empire provided commodity costs for four scenarios:

1. Base CO_2 assumes no carbon cost.
2. Moderate CO_2 assumes carbon allowances in 2021.
3. High CO_2 assumes carbon allowances in 2015.
4. Weighted CO_2 is a weighted average of the three commodity cost scenarios, assuming 50 percent Base CO_2, 40 percent Moderate CO_2 and 10 percent High CO_2.

Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income weatherization and low-income new homes programs, the programs were designed to be cost-effective. Measures were bundled based on the end-use, sector and implementation.

Residential Energy Efficiency Programs	
Residential Products Program	– CFL Bulbs – LED Bulbs – ENERGY STAR Fixtures (Interior and Exterior) – Efficient Nightlight – ENERGY STAR Dehumidifier – ENERGY STAR Refrigerator – ENERGY STAR 2-Speed Pool Pump – ENERGY STAR Electronics (desktop computer, laptop, computer monitor, ink jet printer, laser color copier)
Appliance Recycling	Recycle inefficient refrigerator, freezer or room air conditioner.
High Efficiency HVAC	– Central Air Conditioners (SEER 15, 16 and 17) – Central Air Conditioner Early Retirement (SEER 16 and 17) – Air Source Heat Pump Tune-Up – Air Source Heat Pump (SEER 15, 16 and 17) – Air Source Heat Pump Early Retirement (SEER 16 and 17) – Geothermal (EER 21) – Furnace Fan Motor – High Efficiency Bathroom Exhaust Fan – Programmable Thermostat
Whole House Efficiency	The program has two components: 1) Direct Install. The customer receives a free audit as well as air sealing, faucet aerators, low flow showerhead, water heater temperature setback, advanced power strip, water heater tank wrap, hot water pipe insulation, and CFL bulbs. 2) Insulation. Customer incentives available for installing attic and wall insulation and ENERGY STAR Windows.
Low Income Weatherization	Supplements the federal Low Income Weatherization Assistance Program, reducing energy costs for eligible low income homeowners and renters through increased home efficiency.
Low Income New Homes	Customers receive up to $1,500 for qualifying efficiency improvements.
School Energy Education Program	Offers classroom activities and a kit of low-cost energy efficiency and water conservation products to 6th grade students within the Empire service territory.
Commercial Energy Efficiency Programs	
Small Business Lighting	Small commercial customers will receive incentives up to 70 percent of installed lighting equipment costs.
C&I Energy Efficiency Rebate	Customers receive up to $20,000 for prescriptive or custom equipment installed.
Building Operator Certificate	Incentive for building equipment and processes training and certification.

Table 5-28 - Energy Efficiency Portfolio

AEG considered several energy efficiency portfolios based on the cost-effective measures.

1. Planned Portfolio: The realistically achievable portfolio that Empire proposes implementing for program years 2013 through 2015. The Planned Portfolio was analyzed utilizing the Base CO_2, Moderate CO_2 and High CO_2 avoided costs.

2. RAP+: Alternative demand-side portfolio designed to represent one-third of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

3. RAP++: Alternative demand-side portfolio designed to represent two-thirds of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

4. Moderate Portfolio: Alternative demand-side portfolio designed to achieve 1 percent incremental energy and demand savings by 2015.

5. Aggressive Portfolio: Alternative demand-side portfolio designed to achieve 2 percent incremental energy and demand savings by 2020.

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

7. Missouri Energy Efficiency Investment Act of 2009 (MEEIA) Portfolio: Alternative demand-side portfolio designed to achieve the MEEIA energy and demand savings goals, as outlined in 4 CSR 240-20.094. The portfolio is considered the maximum achievable potential.

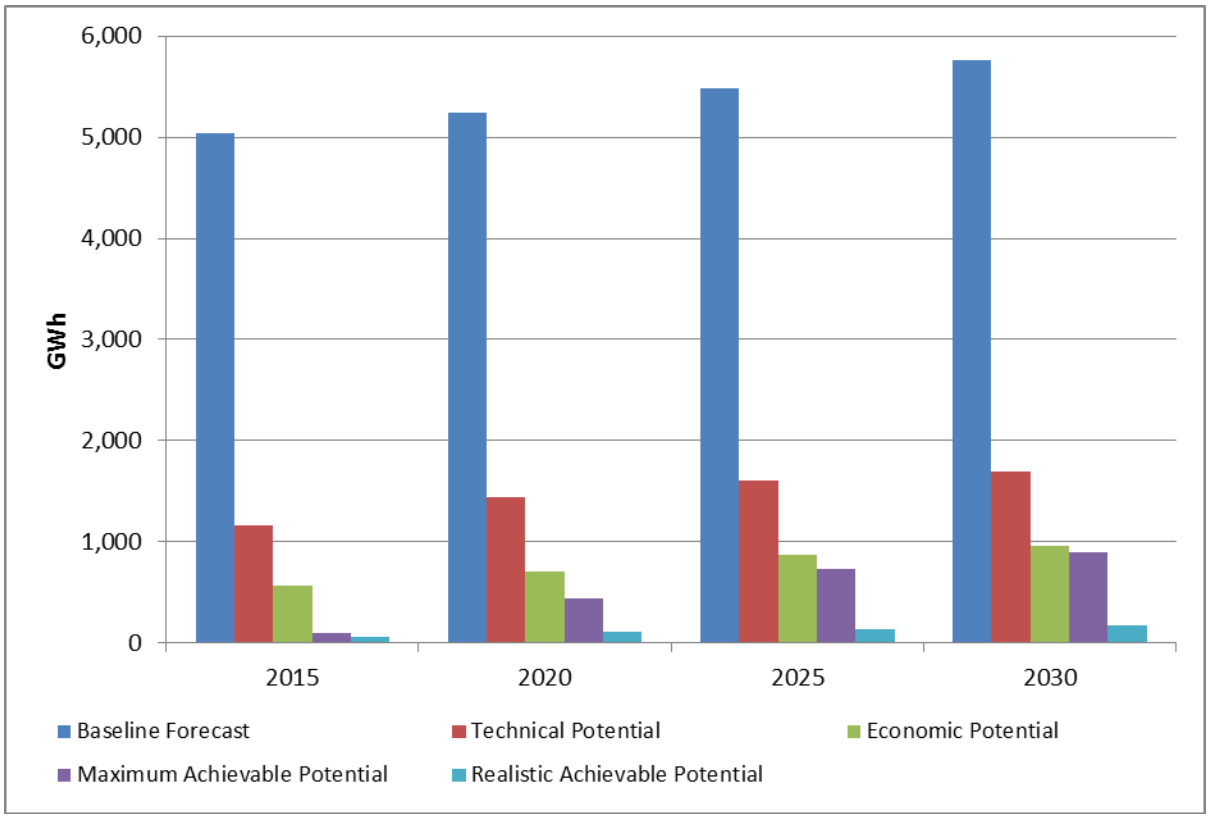


Figure 5-37 - Realistic and Maximum Achievable Potential, GWh

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Energy (GWh)																				
Residential	19	44	71	108	154	197	248	303	350	389	421	451	480	517	554	571	588	598	605	612
Non-Residential	6	16	34	53	72	95	117	139	164	187	210	232	255	278	303	306	305	293	28	268
Total	**25**	**60**	**105**	**160**	**226**	**291**	**365**	**443**	**513**	**576**	**631**	**684**	**735**	**795**	**856**	**877**	**893**	**891**	**886**	**880**
Peak Demand (MW)																				
Residential	4	10	19	31	45	60	77	93	108	123	136	148	160	172	184	190	195	198	200	200
Non-Residential	1	3	6	10	14	18	23	28	33	38	42	47	51	56	60	61	60	57	55	52
Total	**5**	**13**	**26**	**41**	**59**	**79**	**100**	**121**	**141**	**160**	**178**	**195**	**211**	**228**	**244**	**250**	**255**	**255**	**254**	**252**

Table 5-29 - Maximum Achievable Potential by Sector

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Energy (GWh)																				
Residential	13	26	36	46	56	58	59	64	64	64	63	62	61	65	70	72	75	78	79	81
Non-Residential	6	12	19	26	33	39	46	52	57	63	68	74	79	85	90	95	92	92	92	92
Total	**19**	**38**	**55**	**72**	**89**	**97**	**105**	**115**	**121**	**127**	**131**	**136**	**141**	**150**	**160**	**164**	**167**	**170**	**172**	**173**
Peak Demand (MW)																				
Residential	2	5	7	9	12	13	15	17	18	20	21	22	24	25	27	28	29	30	30	31
Non-Residential	2	3	5	7	9	11	13	14	16	17	19	20	22	23	24	25	25	25	25	25
Total	**4**	**8**	**12**	**16**	**21**	**24**	**27**	**31**	**34**	**37**	**39**	**42**	**45**	**48**	**51**	**53**	**54**	**55**	**55**	**56**

Table 5-30 - Realistic Achievable by Sector

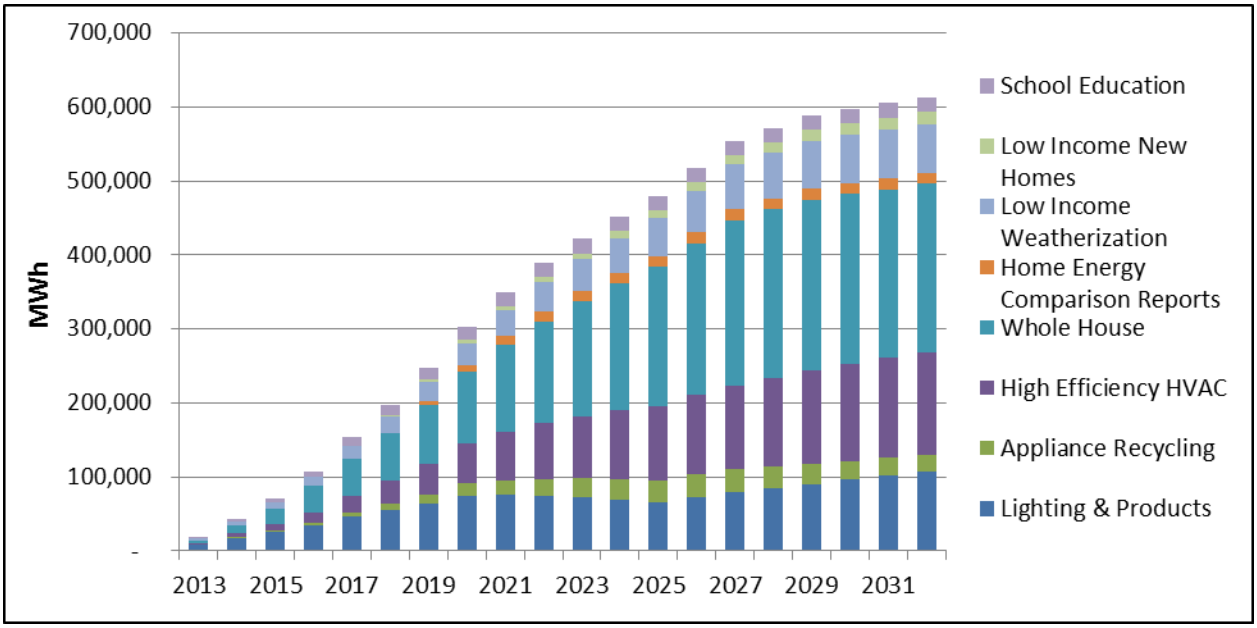


Figure 5-38 - Residential Maximum Achievable Potential by End Use, MWh

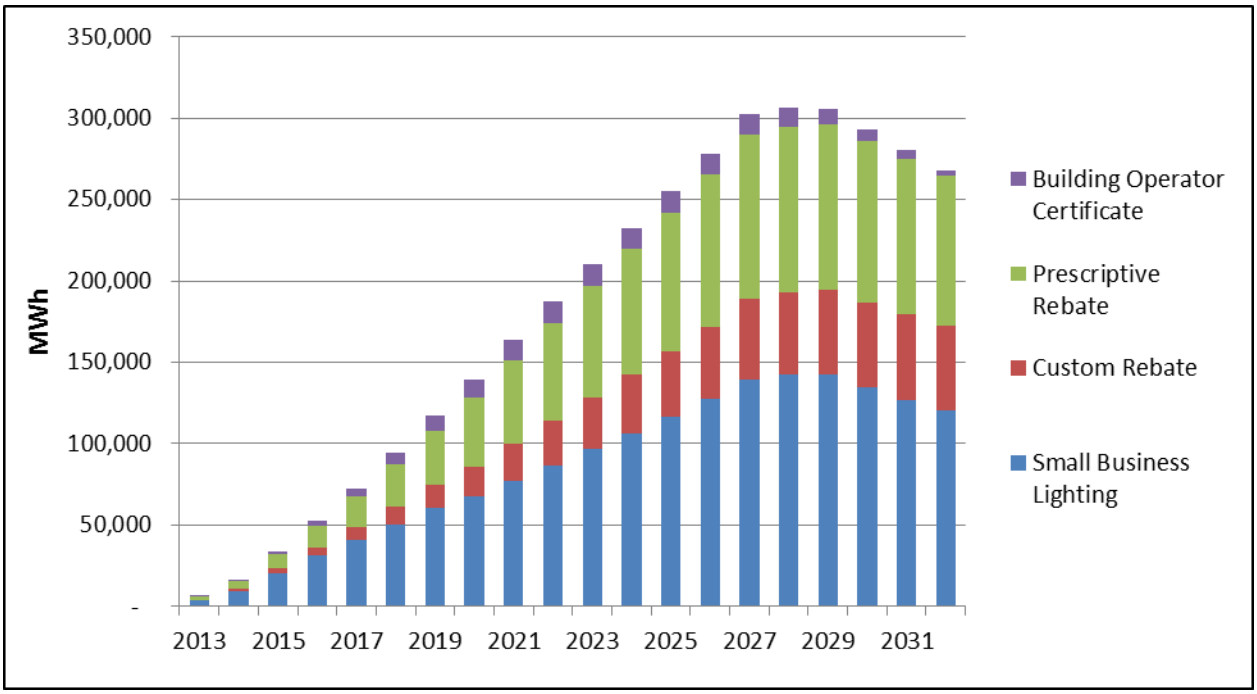


Figure 5-39 - Commercial and Industrial Maximum Achievable Potential by End Use, MWh

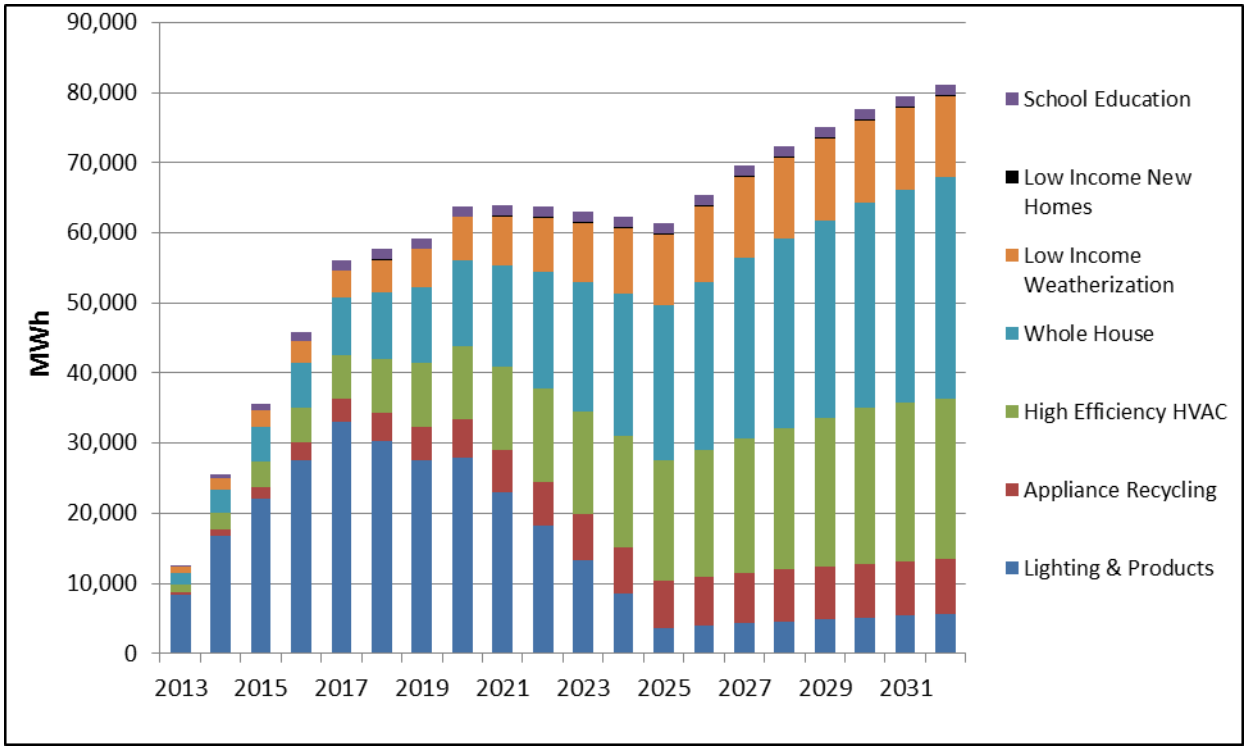


Figure 5-40 - Residential Realistic Achievable Potential by End Use, MWh

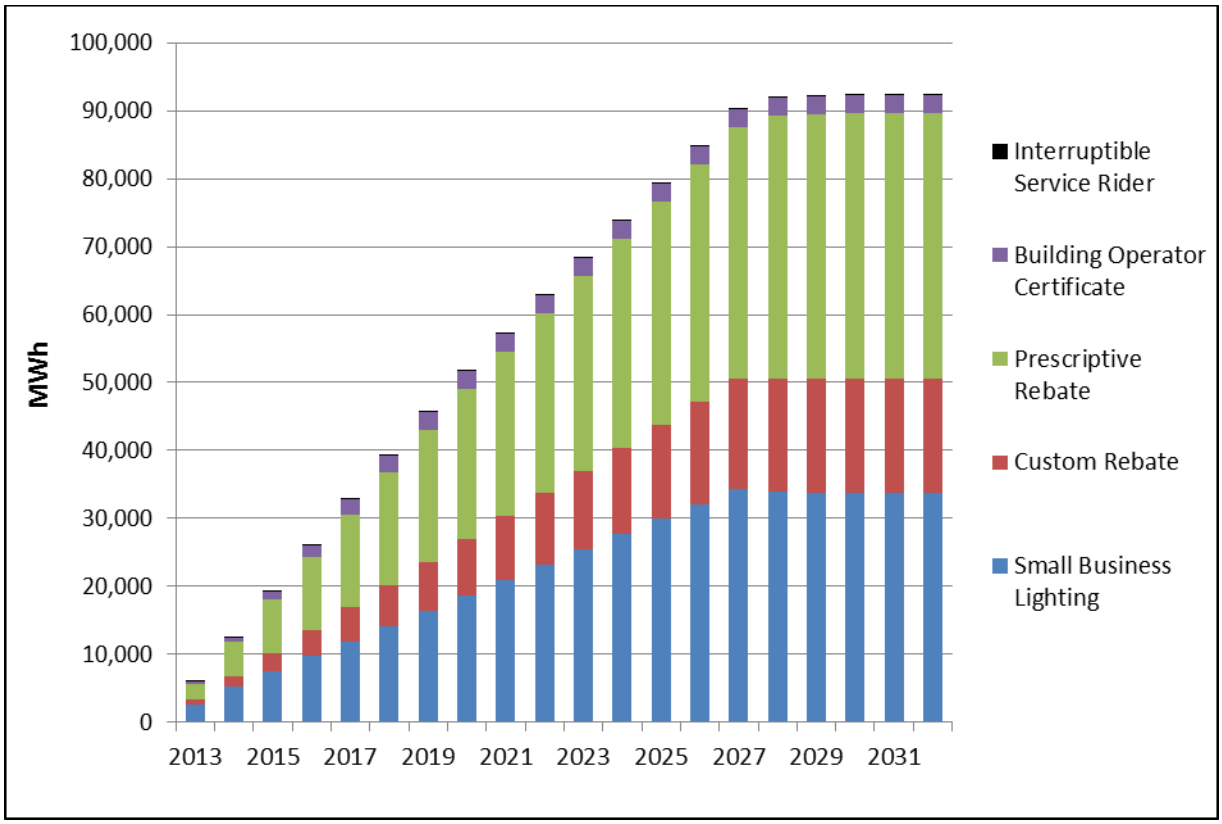


Figure 5-41 - Commercial and Industrial Realistic Achievable Potential by End Use, MWh

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 fulfill this requirement of the IRP rule, Empire analyzed the demand-side portfolios of six utilities. These utilities were chosen due to their proximity to Empire's service territory or by their similar size to Empire. However, from this proxy group there is no utility that is *exactly* comparable for this purpose. For example, Empire is smaller and more rural than other IOUs in Missouri, and has a different climate zone than utilities with similar size. Another factor is differences in demographics. With that being said, Empire reviewed the descriptions of demand-side portfolios from the websites of Ameren (Missouri), Otter Tail (North Dakota, South Dakota, Minnesota), Kansas City Power & Light (KCP&L) (Missouri), KCP&L Greater Missouri Operations (GMO) (Missouri), and Oklahoma Gas and Electric Company (OG&E) (Oklahoma, Arkansas), and Cleco Corporation (Louisiana).

Through this research, Empire discovered that the set of candidate DSM programs from this IRP does have many commonalities with those of the other utilities that were considered as shown in the table below.

Program	Customer Class	Utilities Participating	Empire
Air-Source Heat Pump	Residential	Otter Tail, Ameren (MO)	Yes
Geothermal Heat Pump	Residential	Otter Tail, Ameren (MO), OG&E	Yes
Central AC Replacement/Tuneup	Residential	Ameren (MO), KCP&L, GMO	Yes
Direct Load Control	Residential	Otter Tail	No
Water Heating	Residential	Otter Tail	No
Thermal Storage Systems	Residential	Otter Tail	No
AC Cycling	Residential	Otter Tail	No
On-Bill Financing	Residential	Otter Tail	No
Appliance Recycling	Residential	Otter Tail, Ameren (MO), KCP&L, GMO	Yes
CFL's/Lighting	Residential	Otter Tail, Ameren (MO),	Yes
Insulation Rebate	Residential	Otter Tail	Yes
Low-Income Weatherization (CAP)	Residential	Otter Tail, KCP&L, GMO, Cleco	Yes
Low-Income Weatherization (Independent)	Residential	Ameren (MO), OG&E	No
Room AC	Residential	Ameren (MO)	No
Energy Star® New Homes	Residential	Ameren (MO), OG&E	No
Free Audit	Residential	Ameren (MO)	No
Home Performance with Energy Star®	Residential	KCP&L, GMO	No
Home Appliances	Residential	KCP&L, GMO	Yes
Solar PV Installation	Residential	KCP&L, GMO	No
Programmable T-Stat	Residential	Ameren (MO), KCP&L, GMO	Yes
Free AC Tune-up/Duct Repair	Residential	OG&E	No
Energy-Efficient New Homes Discount	Residential	Cleco	No
School-based Energy Education	Residential	OG&E	Yes
Commercial Design Assistance	C&I	Otter Tail	No
Recommissioning & Retrocommissioning	C&I	Otter Tail, Ameren (MO)	No
EE Improvement Grants	C&I	Otter Tail	No
Refrigeration	C&I	Otter Tail, Ameren (MO), KCP&L, GMO	Yes
Plan Review Program	C&I	Otter Tail	No
Lighting Retrofit	C&I	Otter Tail, KCP&L, GMO	Yes
Lighting New Construction	C&I	Otter Tail, Ameren (MO), KCP&L	Yes
Motors	C&I	Otter Tail, Ameren (MO), KCP&L	Yes
Variable-speed Drives	C&I	Otter Tail, Ameren (MO), KCP&L	Yes
C&I HVAC	C&I	Ameren (MO), KCP&L, GMO	Yes
IT/Data Center Upgrades	C&I	Ameren (MO), GMO	Yes
C&I New Construction	C&I	Ameren (MO)	Yes
Building Operator Certification (BOC)	C&I	KCP&L, GMO	Yes
Demand Response	C&I	KCP&L	Yes
Peak Pricing Plan	C&I	OG&E	No
C&I Appliances	C&I	GMO	Yes

Table 5-31 - Survey of Comparable EE Portfolios

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;

AEG utilized the 2008 Energy Management Survey, 2010 Commercial and Industrial Baseline Study, and U.S. EIA Residential Energy Consumption Surveys to identify the residential, commercial and industrial market segments.

	2010 GWh
Single Family	1,658
Multi-Family	225
Mobile Home	164

Table 5-32 - Residential Market Segments

	2010 GWh
Grocery	113
Health	195
Hotel	115
Misc.	94
Office	368
Pastoral	48
Restaurant	97
Retail	223
School	196
Other	115
Warehouse	73

Table 5-33 - Commercial Market Segments

	2010 GWh
Food Processing	735
Paper, Plastics and Furniture	133
Petroleum & Chemical	499
Machinery, Equipment & Parts	131
Water Pumping	0.5

Table 5-34 - Industrial Market Segments

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 identified a comprehensive list of end-use measures for each market segment from the 2008 Energy Management Survey, 2010 Commercial and Industrial Baseline Study, technical reference manuals, and input from Empire's Advisory Group. AEG considered and assessed improved technologies that may be reasonably anticipated to occur during the planning horizon.

The major categories of residential end-use measures included:

- Lighting
- Appliances
- Appliance Recycling
- Electronics
- Insulation and Building Shell
- HVAC
- Space Heating
- Space Cooling
- Agricultural

End-Use Category	Baseline Measure	End-Use Measure
Lighting	Incandescent	CFL
Lighting	Incandescent	LED
Lighting	Incandescent	ENERGY STAR Indoor Fixture
Lighting	Incandescent	ENERGY STAR Exterior Fixture
Lighting	Incandescent	Efficient Nightlight
Appliances	Standard Dehumidifier	ENERGY STAR Dehumidifier
Appliances	Standard Clothes Washer	ENERGY STAR Clothes Washer
Appliances	Standard Refrigerator	ENERGY STAR Refrigerator
Appliances	Standard Dishwasher	ENERGY STAR Dishwasher
Appliances	Standard Room Air Conditioner	ENERGY STAR Room Air Conditioner
Appliances	Single Speed Pool Pump	ENERGY STAR 2-Speed Pool Pump
Appliances	Single Speed Pool Pump	ENERGY STAR Variable Speed Pool Pump
Appliances	Single-Pane Window	ENERGY STAR Window
Appliances	Old Refrigerator	Refrigerator Recycle
Appliances	Old Freezer	Freezer Recycle
Appliances	Old Room Air Conditioner	Room Air Conditioner Recycle
Electronic	Standard Power Strip	Advanced Power Strip
Electronic	Standard Desktop Computer	ENERGY STAR Desktop Computer
Electronic	Standard Laptop Computer	ENERGY STAR Laptop Computer
Electronic	Standard Computer Monitor	ENERGY STAR Computer Monitor
Electronic	Standard Ink Jet Printer	ENERGY STAR Ink Jet Printer
Electronic	Standard Laser Color Printer	ENERGY STAR Laser Color Printer
Insulation/Shell	No Air Sealing	Air Sealing
Insulation/Shell	Attic Insulation, R=5	Attic Insulation
Insulation/Shell	Wall Insulation, R=5	Wall Insulation
Insulation/Shell	No Duct Insulation	Duct Insulation
Insulation/Shell	No Floor Insulation	Floor Insulation
Space Cooling	No Tune-Up	Central Air Conditioner Tune-Up
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 15
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 16
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 17
Space Cooling	Central Air Conditioner SEER 10	Early Retirement Central Air Conditioner SEER 16
Space Cooling	Central Air Conditioner SEER 10	Early Retirement Central Air Conditioner SEER 17
Space Heating	No Tune-Up	ASHP Tune-Up
Space Heating	Heat Pump SEER 13	Heat Pump SEER 15
Space Heating	Heat Pump SEER 13	Heat Pump SEER 16
Space Heating	Heat Pump SEER 13	Heat Pump SEER 17
Space Heating	Heat Pump SEER 10	Early Retirement HP SEER 16
Space Heating	Heat Pump SEER 10	Early Retirement HP SEER 17
Space Heating	Standard Ductless Mini-Split	Ductless Mini-Split SEER 21
Space Heating	Heat Pump SEER 13	Geothermal EER ≥17
Space Heating	Heat Pump SEER 13	Geothermal EER ≥21

End-Use Category	Baseline Measure	End-Use Measure
Space Cooling/Heating	No Programmable Thermostat	Programmable Thermostat
HVAC	No Faucet Aerator	Faucet Aerator
HVAC	No Low Flow Showerhead	Low Flow Showerhead
HVAC	Standard Electric Water Heater	Heat Pump Water Heater
HVAC	Standard Electric Water Heater	Solar Water Heater
HVAC	Thermostat Setting ≥ 120 degrees	Water Heater Temperature Setback
HVAC	No Water Heater Tank Wrap	Water Heater Tank Wrap
HVAC	No Hot Water Pipe Insulation	Hot Water Pipe Insulation
HVAC	Non-BPM Blower Motor	Furnace Fan Motor
HVAC	Standard Exhaust-Only Ventilation Fan	HE Bathroom Exhaust Fan
HVAC	No Whole House Fan	Whole House Fan

Table 5-35 - Residential End-Use Measures

Residential Light Bulbs

The CFL and LED bulb savings are adjusted in 2015 to account for the U.S, Congress Energy Independence and Security Act (EISA) of 2007 to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for 'general service' light bulbs. The efficiency standards will be implemented in two phases, with higher efficiency requirements in each phase. From 2012 to 2014, new standard light bulbs will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. Phase 2 calls for a 60 percent reduction in light bulb energy use by 2020, or 45 lumens per watt.[8]

The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock. For example, while the first phase of the EISA legislation went into effect on January 1, 2012, customers will be able to purchase non-EISA mandated bulbs until stock runs out. AEG assumes that EISA legislated bulbs will be widely available and purchased in 2015. In 2015, CFL

[8] See Database of State Incentives for Renewables & Efficiency (DSIRE). *Federal Appliance Standards*. Available at: www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US04R&re=1&ee=1

bulb savings are adjusted to 29 kWh savings per unit and 0.026 kW savings per unit and LED bulb savings are adjusted to 39 kWh savings per unit and 0.036 kW savings per unit.

2013 to 2014 Savings per Unit:

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
CFL	46	0.042
LED	64	0.058

2015 Savings per Unit:

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
CFL	29	0.026
LED	39	0.036

A CFL bulb has a measure lifetime of 5 years and an incremental cost of $2 per bulb. An LED bulb has a measure lifetime of 27 years and an incremental cost of $25 per bulb.

Efficient nightlights utilize LED bulbs while a standard nightlight utilizes an incandescent bulb. An efficient nightlight has a measure lifetime of 8 years and an incremental cost of $5 per nightlight.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Efficient Nightlight	26	-

Residential ENERGY STAR Light Fixtures

An ENERGY STAR Indoor Fixture is wired for pin-based compact fluorescent lamps and is installed in an interior residential setting. The baseline measure is a standard incandescent

interior fixture. ENERGY STAR estimates that a 120 Watt incandescent fixture can be replaced with a 26 Watt compact fluorescent lamp. An ENERGY STAR Indoor Fixture has a measure life of 20 years and an incremental cost of $32 per fixture.

An ENERGY STAR Exterior Fixture is wired for pin-based compact fluorescent lamps and is installed in an exterior residential setting. The baseline measure is a standard incandescent exterior fixture. ENERGY STAR estimates that a 120 Watt incandescent fixture can be replaced with a 19 Watt compact fluorescent lamp. An ENERGY STAR Exterior Fixture has a measure life of 20 years and an incremental cost of $17 per fixture.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Indoor Fixture	90	0.082
ENERGY STAR Exterior Fixture	97	0.088

ENERGY STAR Clothes Washer

Clothes washer electric energy and demand savings are determined from three components, the clothes washer, the hot water source and the drying method. Therefore, clothes washers are analyzed under three scenarios:

- Electric hot water heater with no clothes dryer
- Electric hot water heater with an electric clothes dryer
- Natural gas hot water heater with an electric dryer

An updated ENERGY STAR Clothes Washer standard went into effect in February 2013, requiring a minimum of a 2.0 modified energy factor and a minimum of a 6.0 water factor. ENERGY STAR Clothes Washers have a measure life of 14 years and an incremental cost of $150 per clothes washer.

An updated federal Clothes Washer standard will be effective in 2015, thereby modifying the energy and demand savings associated with ENERGY STAR Clothes Washers.

Modified Energy Factor	2013 to 20114	2015
Federal Standard	1.26	1.29
Energy Star	2.60	2.60

In 2015, clothes washers with electric hot water and no dyer will achieve 149 kWh savings and 0.506 kW savings per unit. Clothes washers with electric hot water and an electric dryer will achieve 399 kWh savings and 1.353 kW savings per unit. Clothes washers with natural gas hot water and an electric dryer will achieve 274 kW savings and 0.930 kW savings per unit. As of 2015, the incremental cost for an ENERGY STAR Clothes Washer will be $450.

2013 to 2104 Savings per Unit:

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Electric Hot Water Heater, No Dryer	156	0.530
Electric Hot Water Heater, Electric Dryer	418	1.417
Natural Gas Hot Water Heater, Electric Dryer	287	0.974

2015 Savings per Unit:

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Electric Hot Water Heater, No Dryer	149	0.506
Electric Hot Water Heater, Electric Dryer	399	1.353
Natural Gas Hot Water Heater, Electric Dryer	274	0.930

ENERGY STAR Refrigerator

The ENERGY STAR Refrigerator energy and demand savings are estimated based on a 26 cubic foot top-freezer refrigerator.

Product Category	NAECA	ENERGY STAR
Refrigerators and Refrigerator-freezers with manual defrost	8.82 * Volume + 248.4	7.056 * Volume + 198.72
Refrigerator-Freezer--partial automatic defrost	8.82 * Volume + 248.4	7.056 * Volume + 198.72
Refrigerator-Freezers--automatic defrost with top-mounted freezer without through-the-door ice service and all-refrigerators--automatic defrost	9.80 * Volume + 276	7.84 * Volume + 220.8
Refrigerator-Freezers--automatic defrost with side-mounted freezer without through-the-door ice service	4.91 * Volume + 507.5	3.928 * Volume + 406
Refrigerator-Freezers--automatic defrost with bottom-mounted freezer without through-the-door ice service	4.60 * Volume + 459	3.68 * Volume + 367.2
Refrigerator-Freezers--automatic defrost with top-mounted freezer with through-the-door ice service	10.20 * Volume + 356	8.16 * Volume + 284.8
Refrigerator-Freezers--automatic defrost with side-mounted freezer with through-the-door ice service	10.10 * Volume + 406	8.08 * Volume + 24.8

Table 5-36 - Maximum Energy Usage per kWh per Year

An ENERGY STAR Refrigerator has a measure life of 17 years and an incremental cost of $30 per refrigerator.

Revised ENERGY STAR and federal Refrigerator standards will be effective in 2014. In 2014, the ENERGY STAR Refrigerator savings are adjusted to 103 kWh savings per unit and 0.016 kW savings per unit at an incremental cost of $60.

2013 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Refrigerator	106	0.016

2014 to 2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Refrigerator	103	0.016

ENERGY STAR Room Air Conditioner

An updated ENERGY STAR Room Air Conditioner standard will be effective in October 2013, increasing the energy efficiency ratio for a 10,000 Btu/h room air conditioner to 11.3 EER. In 2013, an ENERGY STAR Room Air Conditioner has an incremental cost of $50. An updated federal Room Air Conditioner standard will be effective in 2014, increasing the energy efficiency ratio for a 10,000 Btu/h room air conditioner to 10.9 EER.

In 2014, the ENERGY STAR Room Air Conditioner savings are adjusted to 38 kWh savings per unit and 0.032 kW savings per unit at an incremental cost of $200. Room air conditioners have a measure life of 12 years.

2013 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Room Air Conditioner	160	0.135

2014 to 2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Room Air Conditioner	38	0.032

ENERGY STAR Dehumidifier

The ENERGY STAR and federal Dehumidifier standards were updated in October 2012. A dehumidifier <75 pints per day must have an energy factor of at least 1.85 liters per kWh and a dehumidifier ≥75 pints per day must have an energy factor of at least 2.8 liters per kWh. An average dehumidifier capacity of 40 pints per day was assumed, based on the ENERGY STAR energy savings calculator. An ENERGY STAR Dehumidifier has a measure life of 12 years and an incremental cost of $45 per dehumidifier.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Dehumidifier	161	0.099

ENERGY STAR Dishwasher

The ENERGY STAR Dishwasher standard went into effect in 2012. An updated federal Dishwasher standard will be effective in 2013. A standard dishwasher must use no more than 295 kWh per year and 4.25 gallons of water per wash cycle. A compact dishwasher must use no more than 222 kWh per year and 3.5 gallons of water per wash cycle. The energy and demand saving are dependent upon the water heater source of energy. Therefore, ENERGY STAR Dishwashers are analyzed under two scenarios, electric hot water heater and natural gas hot water heater. An ENERGY STAR Dishwasher has a measure life of 10 years and an incremental cost of $50 per dishwasher.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Electric Hot Water Heater	12	0.056
Natural Gas Hot Water Heater	5	0.025

ENERGY STAR Pool Pump

An ENERGY STAR Pool Pump can run at different speeds and be programmed to match the pool operation with its appropriate pool pump speed. Two-speed pool pumps have the ability to operate at two speeds, high and low, while variable speed pool pumps have the ability to operate at more than two speeds. Effective February 2013, the ENERGY STAR Pool Pump standards require an energy factor of at least 3.8 for two-speed and variable speed pool pumps. The Consortium for Energy Efficiency has conducted extensive research on residential pool pump efficiency. The energy and demand savings are estimated based on Consortium for Energy Efficiency analysis regarding typical pool capacity, turnover rates per day and pool pump usage per day (by pool pump speed). An ENERGY STAR Pool Pump has a measure life of 10 years and an incremental cost of $300 per 2-speed pool pump and $1,000 per variable speed pool pump.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR 2-Speed Pool Pump	790	0.552
ENERGY STAR Variable Speed Pool Pump	673	0.730

ENERGY STAR Windows

The ENERGY STAR Window energy and demand savings are taken from the Arkansas Comprehensive Programs Deemed Savings, prepared by Nexant for Frontier Associates, LLC in 2010. The baseline measure is a single-pane window in a home with electric central air conditioning and natural gas heat. An ENERGY STAR Window has a measure life of 25 years and an incremental cost of $635 per square foot of window.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Window	804	0.649

Appliance Recycling

Program evaluations have found a range of energy savings associated with refrigerator recycling, ranging from 1,074 kWh per refrigerator to 1,946 kWh per refrigerator. The refrigerator and freezer recycling analysis utilized savings estimates from a 2011 impact evaluation of the Massachusetts Appliance Turn-In Program, conducted by the NMR Group. The refrigerator and freezer are assumed to have eight years of remaining life before the homeowner would need to replace the unit(s). The incremental cost is $93 per refrigerator or freezer removed from the residence.

	Gross kWh
KEMA-XENERGY (2004)[9]	1,946
ADM (2008)[10]	1,775
Cadmus (2010)[11]	PGE 1,220
	SCE 1,181
	SDGE 1,074
Cadmus (2009)[12]	1,447
NMR (2011)[13]	1,289

The room air conditioner recycling energy and demand savings assume that a 5,000 Btu/h room air conditioner with an energy efficiency ratio of 7.70 is removed from the residence. The room air conditioner is assumed to have four years of remaining life before the homeowner would need to replace the unit. The incremental cost is $49 per room air conditioner removed from the residence.

[9] KEMA-XENERGY (February 2004). Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program. Prepared for Southern California Edison.
[10] ADM Associates (April 2008). Evaluation Study of the 2004-05 Statewide Residential Appliance Recycling Program. Prepared for the California Public Utilities Commission.
[11] The Cadmus Group (February 2010). Residential Retrofit High Impact Measure Evaluation Report. Prepared for the California Public Utilities Commission Energy Division.
[12] The Cadmus Group (January 2009). Impact Evaluation of the 2007 Appliance Management Program and Low Income Weatherization Program. Prepared for National Grid.
[13] NMR Group (June 2011). Massachusetts Appliance Turn-In Program Impact Evaluation. Submitted to National Grid, NSTAR Electric, Cape Light Compact, Western Massachusetts Electric Company.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Refrigerator Recycle	1,289	0.226
Freezer Recycle	1,105	0.158
Room Air Conditioner Recycle	151	0.649

Advanced Power Strips

Advanced Power Strips are power strips with the ability to automatically disconnect power to specific measures plugged into the power strip. In a 2011 evaluation, Lockheed Martin and Energy Solutions identified seven major types of advanced power strips:[14]

1. Master Control have one master control outlet, four to six controlled outlets that automatically power down designated devices when the load is turned off by the user, and one or two uncontrolled outlets that are always on.

2. Load Sensing sense the drop in current that occurs when the control device enters a low-power mode. When the power draw drops below a certain threshold, power is disconnected from the controlled outlets on the plug strip.

3. Occupancy Sensing detect the presence or absence of a user, and automatically turn the attached equipment on and off accordingly.

4. Timer can turn equipment off based on a programmable timer.

5. Remote/Wireless Control enables consumers to disconnect power to all devices plugged into the strip by using a designated remote that is programmed into the power strip.

6. USB Interface or Toggle Control plug into the computer via a USB connection. When the computer is turned off, a signal from the USB port shuts down the flow of power to peripherals.

7. Informational have power meters and display screens that show the user the power of each device plugged into the outlets, voltage, power factors, and/or current.

[14] NYSERDA (2011). Advanced Power Strip Research Report. Prepared by Lockheed Martin and Energy Solutions.

Advanced power strips can be used for a multitude of measures. For the analysis, the energy and demand savings are associated with home entertainment measures, such as a television, DVD player, video game console, etc. The baseline measure is a standard power strip that is manually controlled. An advanced power strip has a measure life of 10 years and an incremental cost of $20 per power strip.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Advanced Power Strip	75	0.011

ENERGY STAR Electronics

An ENERGY STAR qualified computer will use between 30 percent and 65 percent less energy than a standard computer. The ENERGY STAR savings calculator estimates that a computer is being used 38 percent of the time, in sleep mode 5 percent of the time and turned off 58 percent of the time. An ENERGY STAR computer has a measure life of 4 years.

A monitor is being used 22 percent of the time, in sleep mode 5 percent of the time and turned off 73 percent of the time. An ENERGY STAR monitor has a measure life of 5 years.

The ENERGY STAR printer savings are estimated directly from the ENERGY STAR savings calculator. An ENERGY STAR printer has a measure life of 5 years.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Laptop Computer	24	0.003
ENERGY STAR Desktop Computer	77	0.009
ENERGY STAR Computer Monitor	14	0.002
ENERGY STAR Ink Jet Printer	5	0.091
ENERGY STAR Laser Color Printer	165	3.014

Residential Air Sealing and Insulation

ENERGY STAR considers sealing and insulating a residential home one of most cost-effective ways to improve energy efficiency and comfort. A homeowner can save an estimated 20 percent of heating and cooling costs. Thermal shell air leaks are identified and sealed to reduce infiltration levels. Air sealing has a measure life of 15 years and an incremental cost of $272. Insulation can be added and/or upgraded throughout the home, including the ceiling, walls, floors and ducts. These areas typically have little to no insulation. The analysis included the following assumptions:

1. Attic Insulation upgraded from a baseline R-value of 5 to an efficient R-value of 38.
2. Wall Insulation upgraded from a baseline R-value of 5 to an efficient R-value of 11.
3. Floor Insulation added to an un-insulated floor to an efficient R-value of 19.
4. Duct Insulation added to un-insulation duct work to an efficient R-Value of 8.

Attic, wall and floor insulation have a measure life of 25 years and incremental costs of $588 for an attic, $1,414 for wall insulation and $1,035 for floor insulation. Duct insulation has a measure life of 20 years and an incremental cost of $360.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Air Sealing	521	0.251
Attic Insulation	2,038	0.346
Wall Insulation	1,599	0.272
Duct Insulation	62	0.120
Floor Insulation	330	-

Faucet Aerators and Low Flow Showerheads

A low flow faucet aerator must be rated no more than 1.5 gallons per minute for bathrooms and no more than 2.2 gallons per minute for kitchens. A standard bathroom faucet aerator is rated at 2.25 gallons per minute and a standard kitchen faucet aerator is rated at 2.75 gallons per minute. A low flow faucet aerator has a measure lifetime of 9 years and an incremental cost of $8 per aerator.

A low flow showerhead must be rated at 2.0 gallons per minute or less. A standard showerhead typically is rated at 2.5 gallons per minute. A low flow showerhead has a measure life of 10 years and an incremental cost of $12 per showerhead.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Faucet Aerator - Kitchen	131	0.667
Faucet Aerator - Bathroom	56	0.283
Low Flow Showerhead	124	0.327

Residential Water Heaters

An ENERGY STAR Heat Pump Water Heater is purchased to replace a standard new electric water heater that meets the federal minimum efficiency standard. The ENERGY STAR Heat Pump Water Heater standard is effective in July 2013, requiring an energy factor of 2.0. The federal Heat Pump Water Heater energy factor requirement will be increasing from 0.86 to 0.95, effective April 2015. The incremental cost of an ENERGY STAR Heat Pump Water Heater is $700. In 2015, the ENERGY STAR Heat Pump Water Heater savings are adjusted to 1,477 kWh savings per unit and 0.583 kW savings per unit at an incremental cost of $1,000. An ENERGY STAR Heat Pump Water Heater has a measure life of 13 years.

2013 to 2014 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Heat Pump Water Heater	1,740	0.687

2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Heat Pump Water Heater	1,477	0.583

A Solar Water Heater is purchased to replace a standard new electric water heater that meets the federal minimum efficiency standard. The water heater utilizes solar energy to the heat the water. A Solar Water Heater has a measure lifetime of 15 years and an incremental cost of $4,500.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Solar Water Heater	1,623	0.293

Hot Water Heater Pipe Insulation

Hot water heater pipe insulation assumes that un-insulated hot water heater hot and cold pipes are insulated up to the first elbow. The water pipes act as an extension of the hot water tank up to the first elbow, therefore the insulation reduces standby loss. The savings assumed 6 feet of insulated hot water heater pipe and 3 feet of insulated cold water heater pipe. The baseline measure is a hot water heater without pipe insulation. Hot water heater pipe insulation has a measure life of 15 years and an incremental cost of $15.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Hot Water Pipe Insulation	122	0.014

Water Heater Temperature Setback

Water heater temperature setback lowers the thermostat setting on a hot water tank to 120 degrees. Under baseline conditions, the hot water tank thermostat is set higher than 120 degrees, typically 135 degrees. The water heater temperature setback has a measure life of 2 years and an incremental cost of $5.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Water Heater Temperature Setback	86	0.010

Water Heater Tank Wrap

Water heater tank wrap is insulation 'blanket' that is wrapped around an electric hot water tank to reduce standby loss. The insulation must be at least R-8. The baseline is a standard electric hot water tank without a water heater tank wrap. A water heater tank wrap has a measure life of 5 years and an incremental cost of $10.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Water Heater Tank Wrap	79	0.009

Furnace Fan Motor

A new furnace with a brushless permanent magnet blower motor is installed instead of a new furnace with a lower efficiency motor. Savings can be maximized with duct improvements and low pressure drop filters. The furnace fan motor savings are decreased if the homeowner runs

the motor more often than the lower efficiency motor would have been run. The baseline is a new furnace with a low efficiency motor. A furnace fan motor has a measure life of 20 years and an incremental cost of $97. The savings vary depending on whether the motor operates with a central air conditioner as well as the furnace.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Furnace Fan Motor (with CAC)	732	0.621
Furnace Fan Motor (w/o CAC)	644	0.547

High Efficiency Bathroom Exhaust Fan

A high efficiency bathroom exhaust fan provides more adequate ventilation. A new efficient exhaust-only ventilation fan will have an average fan efficacy of 8.3. The baseline unit is a standard exhaust-only fan with an average fan efficacy of 3.1. A high efficiency bathroom exhaust fan has a measure life of 19 years and an incremental cost of $44.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
High Efficiency Bathroom Exhaust Fan	89	0.010

Whole House Fan

The use of a whole house fan will offset existing central air conditioning loads. Whole house fans operate when the outside temperature is less than the inside temperature, and serve to cool the house by drawing cool air in through open windows and expelling warmer air through attic vents. The baseline is an existing home with central air conditioning and without a whole house fan. A whole house fan has a measure life of 15 years and an incremental cost of $2,254.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Whole House Fan	187	-

Residential Central Air Conditioner

Central Air Conditioner Tune-Ups measure refrigerant charge levels and airflow over the unit coil, correcting any problems found. The tune-up increases the operating efficiency of the unit, which can be diminished over time. The baseline is an existing central air conditioner that has not been serviced for at least three years. The central air conditioner tune-up has a measure life of 5 years and an incremental cost of $175.

The Central Air Conditioner relates to the replacement of an existing unit at the end of its useful life or the installation of a new system. A residential system is typically 36,000 Btu/hour. A standard central air conditioner unit has a 13 SEER and 11.09 EER, based on current federal standards. An efficient central air conditioner is more efficient than a standard unit. The analysis examined a 15 SEER, 16 SEER and 17 SEER that receives a quality installation (verification of proper charge and airflow). A central air conditioner has a measure life of 18 years and an incremental cost of $556 for a 15 SEER, $834 for a 16 SEER, and $1,111 for a 17 SEER.

The Early Retirement Central Air Conditioner relates to the early removal of an existing inefficient central air conditioner prior to the natural end of useful life and replacement with a qualifying efficient central air conditioner. A residential system is typically 36,000 Btu/hr. An existing central air conditioner unit is estimated to have a 10 SEER and 9.2 EER. The analysis examined a 16 SEER and 17 SEER that receives a quality installation (verification of proper charge and airflow). A central air conditioner has a measure life of 18 years and an estimated remaining useful life of 8 years. The cost of a new 16 SEER is $2,482 and a 17 SEER is $2,760. The cost is offset in year 8 by the $1,649 cost of a new 13 SEER unit.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Central Air Conditioner Tune-Up	212	0.196
Central Air Conditioner SEER 15	576	0.557
Central Air Conditioner SEER 16	744	0.615
Central Air Conditioner SEER 17	892	0.803
Early Retirement Central Air Conditioner SEER 16	1,723	1.282
Early Retirement Central Air Conditioner SEER 17	1,871	1.470

Residential Air Source Heat Pump

Air Source Heat Pump Tune-Ups measure refrigerant charge levels and airflow over the unit coil, correcting any problems found. The tune-up increases the operating efficiency of the unit, which can be diminished over time. The baseline is an existing air source heat pump that has not been serviced for at least three years. The air source heat pump tune-up has a measure life of 5 years and an incremental cost of $175.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Air Source Heat Pump Tune-Up	741	0.196

The Air Source Heat Pump relates to the replacement of an existing unit at the end of its useful life or the installation of a new system. A residential system is typically 36,000 Btu/hour. A standard air source heat pump unit has a 13 SEER and 7.7 HSPF, based on current federal standards. An efficient air source heat pump is more efficient than a standard unit. The analysis examined a 15 SEER, 8.5 HSPF and 16 SEER, 8.5 HSPF and 17 SEER, 8.6 HSPF that receives a quality installation (verification of proper charge and airflow). An air source heat pump has a measure life of 18 years and an incremental cost of $588 for a 15 SEER, $881 for a 16 SEER, and $1,175 for a 17 SEER.

An updated federal Air Source Heat Pump standard will be effective in January 2015. Therefore, in 2015 the Air Source Heat Pump savings will be adjusted to the following:

1. A SEER 15 unit will achieve 1,076 kWh savings per unit and 0.708 kW savings per unit at an incremental cost of $294.

2. A SEER 16 unit will achieve 1,243 kWh savings per unit and 0.708 kW savings per unit at an incremental cost of $588.

3. A SEER 17 unit will achieve 1,485 kWh savings per unit and 0.759 kW savings per unit at an incremental cost of $881.

2013 to 2014 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Heat Pump SEER 15	1,878	1.162
Heat Pump SEER 16	2,046	1.162
Heat Pump SEER 17	2,287	1.213

2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Heat Pump SEER 15	1,076	0.708
Heat Pump SEER 16	1,243	0.708
Heat Pump SEER 17	1,485	0.759

The Early Retirement Air Source Heat Pump relates to the early removal of an existing inefficient air source heat pump prior to the natural end of useful life and replacement with a qualifying efficient air source heat pump. A residential system is typically 36,000 Btu/hr. An existing air source heat pump unit is estimated to have a 10 SEER, 6.8 HSPF. The analysis examined a 16 SEER, 8.5 HSPF and 17 SEER, 8.6 HSPF that receives a quality installation (verification of proper charge and airflow). An air source heat pump has a measure life of 18 years and an estimated remaining useful life of 8 years. The cost of a new 16 SEER is $2,774 and a 17 SEER is $3,068. The cost is offset in year 8 by the $1,893 cost of a new 13 SEER unit.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Early Retirement HP SEER 16	4,260	2.553
Early Retirement HP SEER 17	4,502	2.600

Ductless Mini-Split Heat Pump

An updated federal Ductless Mini-Split Heat Pump standard will be effective in January 2015. Therefore, in 2015 a Ductless Mini-Split Heat Pump will achieve 419 kWh savings per unit and 0.329 kW savings per unit. A Ductless Mini-Split Heat Pump has a measure life of 18 years and an incremental cost of $704 per unit.

2013 to 2014 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Ductless Mini-Split SEER 21	557	0.480

2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Ductless Mini-Split SEER 21	419	0.329

Geothermal Heat Pump

Geothermal Heat Pumps use the constant temperature of the earth to heat and cool a residence. There are closed- and open-loop systems:

1. Closed-Loop System: Most circulate an antifreeze solution through a closed loop buried in the ground or submerged in water. A heat exchanger transfers heat between the refrigerant in the heat pump and the antifreeze solution in the closed loop. The loop can be in a horizontal, vertical, or pond/lake configuration.

2. Open-Loop System: A well or surface body water is used as the heat exchange fluid that circulates directly through the system. Once it has circulated through the system, the water returns to the ground through the well or surface discharge.

A residential system is typically 36,000 Btu/hr. Two system types were analyzed:

- Closed-loop water-to-air system with a 17.1 EER and 3.6 COP.
- Open-loop water-to-air system with a 21.1 EER and 4.1 COP.

The baseline is a standard air source heat pump with a 13 SEER, 7.7 HSPF. A geothermal heat pump has a measure life of 18 years and an incremental cost of $3,609.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Geothermal EER ≥17	4,315	0.596
Geothermal EER ≥21	5,489	0.847

Programmable Thermostat

A Programmable Thermostat has the capability to adjust temperature set-points according to a schedule without manual intervention. The baseline is a manual thermostat. A Programmable Thermostat has a measure life of 10 years and an incremental cost of $30 per thermostat.

The Programmable Thermostat savings is dependent upon the heating and/or cooling equipment that exists at the residence. The analysis screened six programmable thermostats:

- Central Air Conditioner SEER 15
- Central Air Conditioner SEER 16
- Central Air Conditioner SEER 17
- Air Source Heat Pump SEER 15

- Air Source Heat Pump SEER 16
- Air Source Heat Pump SEER 17

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Programmable Thermostat (CAC SEER 15)	254	0.255
Programmable Thermostat (CAC SEER 16)	239	0.249
Programmable Thermostat (CAC SEER 16)	225	0.231
Programmable Thermostat (Heat Pump SEER 15)	830	0.259
Programmable Thermostat (Heat Pump SEER 16)	814	0.259
Programmable Thermostat (Heat Pump SEER 17)	793	0.259

The major categories of commercial and industrial (C&I) end-use measures included:

- Lighting
- HVAC
- Refrigeration
- Motors
- Agriculture

End-Use Category	Baseline Measure	End-Use Measure
Lighting	Standard T8 Fixture	T5 Fixture
Lighting	Standard T8 Fixture	High Performance T8
Lighting	Standard T8 Fixture	Low Wattage Fluorescent T8
Lighting	Metal Halide	High Bay Fluorescent Fixture T8
Lighting	Metal Halide	High Bay Fluorescent Fixture T5
Lighting	Incandescent	CFLs
Lighting	Incandescent	LED Lamp
Lighting	Incandescent Exit Sign	Exit Sign
Lighting	No Occupancy Sensors	Lighting Occupancy Sensors
HVAC	Standard Central Air Conditioner	Central Air Conditioner, SEER 14 (<65kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 11.5 (65 - 135 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 11.5 (135 - 240 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 10.3 (240 - 760 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 9.7 (>760 kBtuh)
HVAC	Standard Split Package Heat Pump	Split Package Heat Pump, SEER 14
HVAC	Standard Single System Heat Pump	Single System Heat Pump, SEER 14
HVAC	Standard Heat Pump	Heat Pump, EER 11.1 (65 < 135 kBtuh)
HVAC	Standard Heat Pump	Heat Pump, EER 10.7 (135 < 240 kBtuh)
HVAC	Standard Heat Pump	Heat Pump, EER 10.1 (>240 kBtuh)
HVAC	No Occupancy Sensors	Hotel Occupancy Sensors
HVAC	Standard Electric Water Heater	Electric Storage Water Heater
HVAC	Standard Electric Water Heater	Tankless Water Heater
HVAC	Standard Furnace, AFUE 90 percent	High Efficiency Furnace w/ ECM Motor
HVAC	Standard Chiller	Chiller
Motors	Shaded Pole Motor	Motor
Motors	Constant Speed Motor	VFD
Refrigeration	Standard Refrigerator	Solid Door Refrigerator
Refrigeration	Standard Refrigerator	Glass Door Refrigerator
Refrigeration	Standard Freezer	Solid Door Freezer
Refrigeration	Standard Freezer	Glass Door Freezer
Agriculture	Electric Open Waterer	Live Stock Waterer
Agriculture	Manual Engine Block Heater	Engine Block Timer
Agriculture	Multiple Non- HVLS Fans	High Volume Low Speed Fans
Agriculture	Standard Fan	High Speed Fans

Table 5-37 - C&I End-Use Measures

Non-Residential Lighting

T5 lamps have higher lumens per watt than a standard T8 or an existing T8 or T12 system. The smaller lamp diameter allows for better optical systems, and more precise control of lighting. These characteristics result in light fixtures that produce equal or greater light than standard T8 or T12 fixtures, while using fewer watts.

1. A 4-lamp industrial T5 fixture consumes 128 Watts. A comparable standard 3-lamp T8 fixture consumes 178 Watts. A T5 fixture has a measure life of 15 years and an incremental cost of $30 per fixture.

2. A 4-lamp High Bay Fluorescent fixture T5 consumes 240 Watts. A comparable standard Metal Halide fixture consumes 455 Watts. A high bay fluorescent fixture has a measure life of 16 years and an incremental cost of $100 per fixture.

Efficient T8 lamps have higher lumens per watt than a standard T8.

1. A 3-Lamp High Performance T5 fixture consumes 58 Watts. A comparable standard T8 with electronic ballast consumes 88 Watts. A high performance T5 fixture has a measure life of 16 years and an incremental cost of $20 per fixture.

2. A Low-Wattage Fluorescent T8 fixture consumes 25 Watts. A comparable standard T8 consumes 28 Watts. A low-wattage fluorescent T8 fixture has a measure life of 7 years and an incremental cost of $2.

3. A 6-lamp High Bay Fluorescent T8 fixture consumes 206 Watts. A comparable standard Metal Halide fixture consumes 455 Watts. A high bay fluorescent T8 fixture has a measure life of 16 years and an incremental cost of $225.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
T5 Fixture	195	0.048
High Performance T8	117	0.029
Low Wattage Fluorescent T8	12	0.003
High Bay Fluorescent Fixture T8	1,259	0.310
High Bay Fluorescent Fixture T5	1,208	0.298

The CFL and LED bulb savings are adjusted in 2015 to account for the United States Congress passed the Energy Independence and Security Act (EISA) of 2007 to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for 'general service' light bulbs. The efficiency standards will be implemented in two phases, with higher efficiency requirements in each phase. From 2012 to 2014, new standard light bulbs will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. Phase 2 calls for a 60 percent reduction in light bulb energy use by 2020, or 45 lumens per watt.

The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock. For example, while the first phase of the EISA legislation went into effect on January 1, 2012, customers will be able to purchase non-EISA mandated bulbs until stock runs out. AEG assumes that EISA-legislated bulbs will be widely available and widely purchased in 2015. In 2015, CFL bulb savings are adjusted to 132 kWh savings per unit and 0.038 kW savings per unit and LED bulb savings are adjusted to 125 kWh savings per unit and 0.036 kW savings per unit.

A CFL bulb has a measure life of 2 years and an incremental cost of $2. An LED bulb has a measure life of 7 years and an incremental cost of $40.

2013 to 2014 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
CFLs	208	0.060
LED Lamp	201	0.058

2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
CFLs	132	0.038
LED Lamp	125	0.036

Single-Package and Split System Unitary Air Conditioners

Air conditioning systems are a major consumer of electricity and systems that exceed baseline efficiencies can save considerable amounts of energy. High Efficiency Air Conditioners includes single-package and split systems unitary air-, water-, and evaporatively-cooled air conditioning equipment. The efficient equipment must exceed the energy efficiency requirements of the International Energy Conservation Code (IECC) 2009.

The baseline equipment is a standard-efficiency air-, water, or evaporatively cooled air conditioner that meets the energy efficiency requirements of the International Energy Conservation Code (IECC) 2006.

UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
Air conditioners, Air cooled	< 65,000 Btu/h[d]	Split system	13.0 SEER	AHRI 210/240
		Single package	13.0 SEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	10.3 EER[c] (before Jan 1, 2010) 11.2 EER[c] (as of Jan 1, 2010)	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	9.7 EER[c] (before Jan 1, 2010) 11.0 EER[c] (as of Jan 1, 2010)	AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split system and single package	9.5 EER[c] 9.7 IPLV[c] (before Jan 1, 2010) 10.0 EER[c] 9.7 IPLV[g] (as of Jan 1, 2010)	
	≥ 760,000 Btu/h	Split system and single package	9.2 EER[c] 9.4 IPLV[c] (before Jan 1, 2010) 9.7 EER[c] 9.4 IPLV[c] (as of Jan 1, 2010)	
Through-the-wall, Air cooled	< 30,000 Btu/h[d]	Split system	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	AHRI 210/240
		Single package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Air conditioners, Water and evaporatively cooled	< 65,000 Btu/h	Split system and single package	12.1 EER	AHRI 210/240
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	11.5 EER[c]	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	11.0 EER[c]	AHRI 340/360
	≥ 240,000 Btu/h	Split system and single package	11.5 EER[c]	

For SI: 1 British thermal unit per hour = 0.2931 W.

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. IPLVs are only applicable to equipment with capacity modulation.

c. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

d. Single-phase air-cooled air conditioners < 65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA); SEER values are those set by NAECA.

Figure 5-42 - International Energy Conservation Code (IECC) 2009

High efficiency air conditioners have a measure lifetime of 15 years.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
SEER 14 (<65kBtuh)	270	0.330	$300
EER 11.5 (65 - 135 kBtuh)	996	1.216	$1,490
EER 11.5 (135 - 240 kBtuh)	3,172	3.873	$2,220
EER 10.3 (240 - 760 kBtuh)	2,009	2.453	$2,878
EER 9.7 (>760 kBtuh)	3,579	4.370	$6,395

Heat Pump Systems

Efficient heat pump systems are high-efficiency air cooled, water source, ground water source, or ground source heat pump systems that exceeds the energy efficiency requirements of the International Energy Conservation Code.

The baseline equipment is assumed to be a standard-efficiency air cooled, water source, ground water source, or ground source heat pump system that meets the energy efficiency requirements of the International Energy Conservation Code.

UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
Air cooled, (Cooling mode)	< 65,000 Btu/h[d]	Split system	13.0 SEER	AHRI 210/240
		Single package	13.0 SEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	10.1 EER[c] (before Jan 1, 2010) 11.0 EER[c] (as of Jan 1, 2010)	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	9.3 EER[c] (before Jan 1, 2010) 10.6 EER[c] (as of Jan 1, 2010)	AHRI 340/360
	≥ 240,000 Btu/h	Split system and single package	9.0 EER[c] 9.2 IPLV[c] (before Jan 1, 2010) 9.5 EER[c] 9.2 IPLV[c] (as of Jan 1, 2010)	
Through-the-Wall (Air cooled, cooling mode)	< 30,000 Btu/h[d]	Split system	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	AHRI 210/240
		Single package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Water Source (Cooling mode)	< 17,000 Btu/h	86°F entering water	11.2 EER	AHRI/ASHRAE 13256-1
	≥ 17,000 Btu/h and < 135,000 Btu/h	86°F entering water	12.0 EER	AHRIASHRAE 13256-1
Groundwater Source (Cooling mode)	< 135,000 Btu/h	59°F entering water	16.2 EER	AHRI/ASHRAE 13256-1
Ground source (Cooling mode)	< 135,000 Btu/h	77°F entering water	13.4 EER	AHRI/ASHRAE 13256-1
Air cooled (Heating mode)	< 65,000 Btu/h[d] (Cooling capacity)	Split system	7.7 HSPF	AHRI 210/240
		Single package	7.7 HSPF	
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb Outdoor air	3.2 COP (before Jan 1, 2010) 3.3 COP (as of Jan 1, 2010)	
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb Outdoor air	3.1 COP (before Jan 1, 2010) 3.2 COP (as of Jan 1, 2010)	AHRI 340/360

Figure 5-43 - International Energy Conservation Code (IECC) 2009

An efficient heat pump system has a measure life of 15 years.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
EER 11.1 (65 < 135 kBtuh)	745	0.098	$1,825
EER 10.7 (135 < 240 kBtuh)	530	0.647	$2,510
EER 10.1 (>240 kBtuh)	3,971	2.555	$3,250

Hotel Occupancy Sensors

Hotel occupancy sensors control packaged terminal air conditioner units with electric heat, heat pump units and/or fan coil units in hotels that operate all 12 months of the year.

The measure includes the installation of occupancy sensors, window/door switches for rooms that have operable window or patio doors, and an unoccupied thermostat set-mode of 65 degrees Fahrenheit in the heating mode and 78 degrees Fahrenheit in the cooling mode. The baseline measure assumes the equipment has no occupancy-based controls.

A hotel occupancy sensor has a measure life of 10 years and an incremental cost of $250.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Hotel Occupancy Sensors	438	0.090

Electric Storage Water Heater

Efficient electric storage water heaters are assumed to meet the following requirements:

- Energy factor greater than or equal to 0.95
- Minimum Thermal Efficiency of 0.98
- Less than 3 percent standby loss

- Equivalent storage capacity to the unit being replaced
- GAMA/AHRI efficiency rating certified

The baseline measure is an electric storage water heater with 50 or more gallon capacity and an input wattage between 12kW and 54kW.

An efficient electric storage water heater has a measure life of 5 years and an incremental cost of $1,050.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Electric Storage Water Heater	1,781	0.200

Tankless Water Heater

Tankless water heaters function similar to standard hot water heaters except they do not have a storage tank. The water is heated instantaneously as it passes through the heating element. Tankless water heaters achieve savings by eliminating the standby losses that occur in stand-alone or tank-type water heaters and by being more efficient than the baseline storage hot water heater.

A new electric-powered tankless hot water heater has an energy factor greater than or equal to 0.98. The baseline measure is an electric commercial-grade tanked water heater with 50 or more gallon storage capacity and an energy factor less than or equal to 0.9.

A tankless water heater has a measure life of 5 years and an incremental cost of $1,050.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Tankless Water Heater	2,992	0.340

High-Efficiency Furnace

High-efficiency furnaces achieve savings through the utilization of a sealed, super-insulated combustion chamber, more efficient burners, and multiple heat exchangers that remove a significant portion of the waste heat from the flue gasses. Furnaces equipped with ECM fan motors save additional electric energy.

A high-efficiency furnace must be a natural gas-fired furnace with a minimum Annual Fuel Utilization Efficiency rating of 92 percent and input rating of less than 225,000 Btu/hour with an ECM fan motor. The baseline measure is a furnace with an Annual Fuel Utilization Efficiency rating of 78 percent without an ECM fan motor.

A high-efficiency furnace with ECM motor has a measure life of 17 years and an incremental cost of $754.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
High Efficiency Furnace w/ ECM Motor	710	0.402

Electric Chiller

An efficient chiller exceeds the efficiency requirements of the 2009 International Energy Conservation Code. The chiller analyzed is 100 tons with 14 IPLV and 10 EER. The baseline measure meets the efficiency requirements of the2009 International Energy Conservation Code.

An efficient chiller has a measure life of 20 years and an incremental cost of $12,700.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Chiller	10,220	5.497

Motors

An efficient motor meets the minimum efficiency levels of NEMA premium efficiency motors. The baseline equipment assumes a standard motor. An efficient motor has a measure lifetime of 15 years and an incremental cost of $115.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Motor	430	0.154

Variable Frequency Drive

A variable frequency drive installed on an HVAC system pump or fan motor will modulate the speed of the motor when it is not needed to run at full load. Since the power of the motor is proportional to the cube of the speed, this will result in significant energy savings. A baseline measure is a constant volume motor.

A variable frequency drive has a measure life of 15 years and an incremental cost of $2,518.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
VFD	35,533	16.667

Commercial Refrigeration

ENERGY STAR-labeled commercial refrigerators and freezers are more energy efficient because they are designed with components such as ECM evaporator and condenser fan motors, hot gas anti-sweat heaters, or high-efficiency compressors, which will significantly reduce energy consumption.

The efficient equipment is a new vertical solid or glass door refrigerator or freezer or vertical chest freezer meeting the minimum ENERGY STAR efficiency level standards. The average volume is 24 cubic feet.

Volume	Refrigerator kWh	Freezer kWh
Solid Door		
0 < 15	0.089 * Volume + 1.411	0.250 * Volume + 1.250
15 ≤ 30	0.037 * Volume + 2.200	0.400 * Volume – 1.000
30 ≤ 50	0.056 * Volume + 1.635	0.163 * Volume + 6.125
50	0.060 * Volume + 1.416	0.158 * Volume + 6.333
Glass Door		
0 < 15	0.118 * Volume + 1.382	0.607 * Volume + 0.893
15 ≤ 30	0.140 * Volume + 1.050	0.733 * Volume – 1.000
30 ≤ 50	0.088 * Volume + 2.625	0.250 * Volume + 13.500
≥ 50	0.110 * Volume + 1.500	0.450 * Volume + 3.500

The baseline equipment is assumed to be an existing solid or glass door refrigerator or freezer meeting the minimum federal manufacturing standards as specified by the Energy Policy Act of 2005.

Type	kWh
Solid Door Refrigerator	0.10 * Volume + 2.04
Glass Door Refrigerator	0.12 * Volume + 3.34
Solid Door Freezer	0.40 * Volume + 1.38
Glass Door Freezer	0.75 * Volume + 4.10

An efficient non-residential refrigerator has a measure life of 12 years and an incremental cost of $164. An efficient non-residential freezer has a measure life of 12 years and an incremental cost of $166.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Solid Door Refrigerator	493	0.056
Glass Door Refrigerator	661	0.075
Solid Door Freezer	869	0.099
Glass Door Freezer	2,010	0.230

Engine Block Timer for Agricultural Equipment

An Engine Block Timer is a plug-in timer activated below a specific outdoor temperature to control an engine block heater in agricultural equipment. Engine block heaters are typically used during cold weather to pre-warm an engine prior to start, for convenience heaters are typically plugged in considerably longer than necessary to improve startup performance. A timer allows a user to preset the heater to come on for only the amount of time necessary to pre-warm the engine block, reducing unnecessary run time even if the baseline equipment has an engine block temperature sensor.

An efficient measure is an engine block heater operated by an outdoor plug-in timer that turns on the heater only when the outdoor temperature is below 25 degrees Fahrenheit.

The baseline measure is an engine block heater that is manually plugged in by the farmer to facilitate equipment startup at a later time.

An efficient engine block timer has a measure life of 3 years and an incremental cost of $10.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Engine Block Timer	664	-

High Volume Low Speed Fans

The 20 to 24 foot diameter horizontally mounted ceiling high volume low speed fans replaces multiple non-high volume low speed fans that have reached the end of useful life in agricultural applications. The high volume low speed fan must have a variable frequency drive. A high volume low speed fan has a measure life of 10 years and an incremental cost of $4,150.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
High Volume Low Speed Fans	6,577	2.408

High Speed Fans

High speed exhaust, ventilation and circulation fans equipped with a diffuser that meet the following minimum efficiency criteria:

Diameter of Fan (inches)	Exhaust & Ventilation Fans	Circulation Fans
24 through 35	14.0 cfm/W at 0.10 static pressure	12.5 lbf/kW
36 through 47	17.1 cfm/W at 0.10 static pressure	18.2 lbf/kW
48 through 71	20.3 cfm/W at 0.10 static pressure	23.0 lbf/kW

The baseline measure is an existing fan that reached the end of its useful life.

An efficient high speed fan has a measure life of 7 years and an incremental cost of $150.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
High Speed Fans	372	0.118

Live Stock Waterer

An efficient live-stock waterer is an electrically-heated, thermally-insulated waterer with minimum of 2 inches of insulation. A thermostat is required on a unit with a heating element greater than or equal to 250 watts. The baseline measure is an electric open waterer with sinking or floating water heaters that has reached the end of useful life.

The efficient live-stock waterer has a measure life of 10 years and an incremental cost of $788.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Live Stock Waterer	1,593	0.525

3.4 Advanced, Metering, and Distribution Assessment

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

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

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.

The marketing plan will include:

- The Smart Energy Solutions portal of Empire's website
- Direct customer outreach (via Empire and/or an implementation contractor)

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

The Missouri Weatherization Agencies have primary responsibility for promoting Low-Income Weatherization Program. Empire will supplement statewide marketing efforts, promoting the program through community events and organizations, including schools, churches and nonprofit organizations within the service territory. Empire will promote the Low-Income New Homes Program directly to local non-profit organizations that work with low-income housing.

3.6 State-Wide Marketing and Outreach Program Evaluation

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

Empire will cooperatively market programs jointly run with outside organizations, such as non-profit organizations and other Missouri electric and natural gas utilities. Empire is currently cooperatively marketing the Low-Income Weatherization, Low-Income New Homes, Building Operating Certificate and whole-home programs with partnering organizations.

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:

3.7.1 Stand-Alone Demand and Energy Reduction Impacts

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

The demand and energy reduction impacts of each end-use measure are presented in the tables below.

Residential Lighting

The CFL and LED bulb savings are adjusted in 2015 to account for the United States Congress passed the Energy Independence and Security Act (EISA) of 2007 to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for 'general service' light bulbs. The efficiency standards will be implemented in two phases, with higher efficiency requirements in each phase. From 2012 to 2014, standard light bulbs manufactured will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. Phase 2 calls for a 60 percent reduction in light bulb energy use by 2020, or 45 lumens per watt.[15]

The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock. For example, while the first phase of the EISA legislation went into effect on January 1, 2012, customers will be able to purchase non-EISA mandated bulbs until stock runs out. AEG assumes that EISA legislated bulbs will be widely available and widely purchased in 2015. In 2015, CFL bulb savings are adjusted to 29 kWh savings per unit and 0.026 kW savings per unit and LED bulb savings are adjusted to 39 kWh savings per unit and 0.036 kW savings per unit.

[15] See Database of State Incentives for Renewables & Efficiency (DSIRE). *Federal Appliance Standards*. Available at: www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US04R&re=1&ee=1

End-Use Measure	Measure Lifetime	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
CFL	5	46	0.042	$2
LED	27	64	0.058	$25
ENERGY STAR Indoor Fixture	20	90	0.082	$32
ENERGY STAR Exterior Fixture	20	97	0.088	$17
Efficient Nightlight	8	26	-	$5

Table 5-38 - Residential Lighting End-Use Measures

Residential Appliances and Electronics

The most recent ENERGY STAR Clothes Washer standard went into effect in February 2013. An updated federal Clothes Washer standard will be effective in 2015, thereby modifying the energy and demand savings associated with ENERGY STAR Clothes Washers. In 2015, clothes washers with electric hot water and no dryer will achieve 149 kWh savings and 0.506 kW savings per unit. Clothes washers with electric hot water and an electric dryer will achieve 399 kWh savings and 1.353 kW savings per unit. Clothes washers with natural gas hot water and an electric dryer will achieve 274 kW savings and 0.930 kW savings per unit. As of 2015, the incremental cost for an ENERGY STAR Clothes Washer will be $450.

An updated ENERGY STAR standard and federal standard for Refrigerators will be effective in 2014. In 2014, the ENERGY STAR Refrigerator savings are adjusted to 103 kWh savings per unit and 0.016 kW savings per unit at an incremental cost of $60.

An updated ENERGY STAR Room Air Conditioner standard will be effective in October 2013. An updated federal Room Air Conditioner standard will be effective in 2014. In 2014, the ENERGY STAR Room Air Conditioner savings are adjusted to 38 kWh savings per unit and 0.032 kW savings per unit at an incremental cost of $200.

End-Use Measure	Measure Lifetime	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
ENERGY STAR Dehumidifier	12	161	0.099	$45
ENERGY STAR Clothes Washer (Electric DHW, No Dryer)	14	156	0.530	$150
ENERGY STAR Clothes Washer (Electric DHW, Electric Dryer)	14	418	1.417	$150
ENERGY STAR Clothes Washer (Gas DHW, Electric Dryer)	14	287	0.974	$150
ENERGY STAR Refrigerator	17	106	0.016	$30
ENERGY STAR Dishwasher (Electric DHW)	10	12	0.056	$50
ENERGY STAR Dishwasher (Gas DHW)	10	5	0.025	$50
ENERGY STAR Room Air Conditioner	12	160	0.135	$50
ENERGY STAR 2-Speed Pool Pump	10	790	0.552	$300
ENERGY STAR Variable Speed Pool Pump	10	673	0.730	$1,000
ENERGY STAR Window	25	804	0.649	$1,334
Refrigerator Recycle	8	1,289	0.226	$93
Freezer Recycle	8	1,105	0.158	$93
Room Air Conditioner Recycle	4	151	0.649	$49
Advanced Power Strip	10	75	0.011	$20
ENERGY STAR Desktop Computer	4	77	0.009	$0
ENERGY STAR Laptop Computer	4	24	0.003	$0
ENERGY STAR Computer Monitor	5	14	0.002	$0
ENERGY STAR Ink Jet Printer	5	5	0.091	$0
ENERGY STAR Laser Color Printer	5	165	3.014	$0

Table 5-39 - Residential Appliance and Electronic End-Use Measures

Residential Insulation and HVAC

The ENERGY STAR Heat Pump Water Heater standard is effective in July 2013. An updated federal Heat Pump Water Heater standard will be effective in April 2015. In 2015, the ENERGY STAR Heat Pump Water Heater savings are adjusted to 1,477 kWh savings per unit and 0.583 kW savings per unit at an incremental cost of $1,000.

End-Use Measure	Measure Lifetime	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
Air Sealing	15	521	0.251	$272
Attic Insulation	25	2,038	0.346	$588
Wall Insulation	25	1,599	0.272	$1,414
Duct Insulation	20	62	0.120	$360
Floor Insulation	25	330	-	$1,035
Faucet Aerator - Kitchen	9	131	0.667	$8
Faucet Aerator - Bathroom	9	56	0.283	$8
Low Flow Showerhead	10	124	0.327	$12
Heat Pump Water Heater	13	1,740	0.687	$700
Solar Water Heater	15	1,623	0.293	$4,500
Water Heater Temperature Setback	2	86	0.010	$5
Water Heater Tank Wrap	5	79	0.009	$10
Hot Water Pipe Insulation	15	122	0.014	$15
Furnace Fan Motor (with CAC)	20	732	0.621	$97
Furnace Fan Motor (w/o CAC)	20	644	0.547	$97
HE Bathroom Exhaust Fan	19	89	0.010	$44
Whole House Fan	15	187	-	$2,254

Table 5-40 - Residential Insulation and HVAC End-Use Measures

Residential Space Cooling and Heating

An updated federal Air Source Heat Pump standard will be effective in January 2015. Therefore, in 2015 the Air Source Heat Pump savings will be adjusted to the following:

1. A SEER 15 unit will achieve 1,076 kWh savings per unit and 0.708 kW savings per unit at an incremental cost of $294.

2. A SEER 16 unit will achieve 1,243 kWh savings per unit and 0.708 kW savings per unit at an incremental cost of $588.

3. A SEER 17 unit will achieve 1,485 kWh savings per unit and 0.759 kW savings per unit at an incremental cost of $881.

An updated federal Ductless Mini-Split Heat Pump standard will be effective in January 2015. Therefore, in 2015 a Ductless Mini-Split Heat Pump will achieve 419 kWh savings per unit and 0.329 kW savings per unit at an incremental cost of $704.

End-Use Measure	Measure Lifetime	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
Central Air Conditioner Tune-Up	5	212	0.196	$175
Central Air Conditioner SEER 15	18	576	0.557	$556
Central Air Conditioner SEER 16	18	744	0.615	$834
Central Air Conditioner SEER 17	18	892	0.803	$1,111
Early Retirement Central Air Conditioner SEER 16	8	1,723	1.282	$2,482
Early Retirement Central Air Conditioner SEER 17	8	1,871	1.470	$2,760
ASHP Tune-Up	5	741	0.196	$175
Heat Pump SEER 15	18	1,878	1.162	$588
Heat Pump SEER 16	18	2,046	1.162	$881
Heat Pump SEER 17	18	2,287	1.213	$1,175
Early Retirement HP SEER 16	8	4,260	2.553	$2,774
Early Retirement HP SEER 17	8	4,502	2.600	$3,068
Ductless Mini-Split SEER 21	18	557	0.480	$704
Geothermal EER ≥17	18	4,315	0.596	$3,609
Geothermal EER ≥21	18	5,489	0.847	$3,609
Programmable Thermostat (CAC SEER 15)	10	254	0.255	$30
Programmable Thermostat (CAC SEER 16)	10	239	0.249	$30
Programmable Thermostat (CAC SEER 16)	10	225	0.231	$30
Programmable Thermostat (Heat Pump SEER 15)	10	830	0.259	$30
Programmable Thermostat (Heat Pump SEER 16)	10	814	0.259	$30
Programmable Thermostat (Heat Pump SEER 17)	10	793	0.259	$30

Table 5-41 - Residential Space Cooling and Heating End-Use Measures

C&I End-Use Measures

The CFL and LED bulb savings are adjusted in 2015 to account for the United States Congress passed the Energy Independence and Security Act (EISA) of 2007 to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for 'general service' light bulbs. The efficiency standards will be implemented in two phases, with higher efficiency requirements in each phase. From 2012 to 2014, standard light bulbs manufactured will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. Phase 2 calls for a 60 percent reduction in light bulb energy use by 2020, or 45 lumens per watt.

The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock. For example, while the first phase of the EISA legislation went into effect on January 1, 2012, customers will be able to purchase non-EISA mandated bulbs until stock runs out. AEG assumes that EISA legislated bulbs will be widely available and widely purchased in 2015. In 2015, CFL bulb savings are adjusted to 132 kWh savings per unit and 0.038 kW savings per unit and LED bulb savings are adjusted to 125 kWh savings per unit and 0.036 kW savings per unit.

End-Use Category	End-Use Measure	Measure Lifetime	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
Lighting	T5 Fixture	15	195	0.048	$30
Lighting	High Performance T8	16	117	0.029	$20
Lighting	Low Wattage Fluorescent T8	7	12	0.003	$2
Lighting	High Bay Fluorescent Fixture T8	16	1,259	0.310	$225
Lighting	High Bay Fluorescent Fixture T5	16	1,208	0.298	$100
Lighting	CFLs	2	208	0.060	$2
Lighting	LED Lamp	7	201	0.058	$40
Lighting	Exit Sign	15	171	0.038	$25
Lighting	Lighting Occupancy Sensors	8	863	0.192	$54
HVAC	Central A/C, SEER 14 (<65kBtuh)	15	270	0.330	$300
HVAC	Central A/C, EER 11.5 (65 - 135 kBtuh)	15	996	1.216	$1,490
HVAC	Central A/C, EER 11.5 (135 - 240 kBtuh)	15	3,172	3.873	$2,220
HVAC	Central A/C, EER 10.3 (240 - 760 kBtuh)	15	2,009	2.453	$2,878
HVAC	Central A/C, EER 9.7 (>760 kBtuh)	15	3,579	4.370	$6,395
HVAC	Split Package Heat Pump, SEER 14	15	725	0.330	$370
HVAC	Single System Heat Pump, SEER 14	15	451	0.330	$370
HVAC	Heat Pump, EER 11.1 (65 < 135 kBtuh)	15	745	0.098	$1,825
HVAC	Heat Pump, EER 10.7 (135 < 240 kBtuh)	15	530	0.647	$2,510
HVAC	Heat Pump, EER 10.1 (>240 kBtuh)	15	3,971	2.555	$3,250
HVAC	Hotel Occupancy Sensors	10	438	0.090	$250
HVAC	Electric Storage Water Heater	5	1,781	0.200	$1,050
HVAC	Tankless Water Heater	5	2,992	0.340	$1,050
HVAC	High Efficiency Furnace w/ ECM Motor	17	710	0.402	$754
HVAC	Chiller	20	10,220	5.497	$12,700
Motors	Motor	15	430	0.154	$115
Motors	VFD	15	35,533	16.667	$2,518
Refrigeration	Solid Door Refrigerator	12	493	0.056	$164
Refrigeration	Glass Door Refrigerator	12	661	0.075	$164
Refrigeration	Solid Door Freezer	12	869	0.099	$166
Refrigeration	Glass Door Freezer	12	2,010	0.230	$166
Agriculture	Live Stock Waterer	10	1,593	0.525	$788
Agriculture	Engine Block Timer	3	664	-	$10
Agriculture	High Volume Low Speed Fans	10	6,577	2.408	$4,150
Agriculture	High Speed Fans	7	372	0.118	$150

Table 5-42 - C&I End-Use Measures

3.7.2 Impact of Bundling End-Use Measures

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

End-use measures were screened for cost-effectiveness on a stand-alone and bundled basis. Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income weatherization and low-income new homes programs, the programs were designed to be cost-effective. Measures were bundled based on end-use and implementation. For example, space cooling and heating end-use measures benefit from being installed by an experienced HVAC contractor.

Residential Energy Efficiency Programs	
Residential Products Program	– CFL Bulbs – LED Bulbs – ENERGY STAR Fixtures (Interior and Exterior) – Efficient Nightlight – ENERGY STAR Dehumidifier – ENERGY STAR Refrigerator – ENERGY STAR 2-Speed Pool Pump – ENERGY STAR Electronics (desktop computer, laptop, computer monitor, ink jet printer, laser color copier)
Appliance Recycling	Recycle inefficient refrigerator, freezer or room air conditioner.
High Efficiency HVAC	– Central Air Conditioners (SEER 15, 16 and 17) – Central Air Conditioner Early Retirement (SEER 16 and 17) – Air Source Heat Pump Tune-Up – Air Source Heat Pump (SEER 15, 16 and 17) – Air Source Heat Pump Early Retirement (SEER 16 and 17) – Geothermal (EER 21) – Furnace Fan Motor – High Efficiency Bathroom Exhaust Fan – Programmable Thermostat
Whole House Efficiency	The program has two components: 3) Direct Install. The customer receives a free audit as well as air sealing, faucet aerators, low flow showerhead, water heater temperature setback, advanced power strip, water heater tank wrap, hot water pipe insulation, and CFL bulbs. 4) Insulation. Customer incentives available for installing attic and wall insulation and ENERGY STAR Windows.
Low Income Weatherization	Supplements the federal Low Income Weatherization Assistance Program, reducing energy costs for eligible low income homeowners and renters through increased home efficiency.
Low Income New Homes	Customers receive up to $1,500 for qualifying efficiency improvements.
School Energy Education Program	Offers classroom activities and a kit of low-cost energy efficiency and water conservation products to 6th grade students within the Empire service territory.
Commercial Energy Efficiency Programs	
Small Business Lighting	Small commercial customers will receive incentives up to 70 percent of installed lighting equipment costs.
C&I Energy Efficiency Rebate	Customers receive up to $20,000 for prescriptive or custom equipment installed.
Building Operator Certificate	Incentive for building equipment and processes training and certification.

Table 5-43 - Energy Efficiency Programs

3.7.3 Change in Participants and Installations

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

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Products Program	251,395	251,915	252,435	253,705	253,705	253,705	253,705	253,705	6,955	6,955	6,955	6,955	6,955	7,030	7,030	7,030	7,030	7,030	7,030	7,030
CFL	250,000	250,000	250,000	250,000	250,000	250,000	250,000	250,000												
LED	500	750	1,000	2,000	2,000	2,000	2,000	2,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
ENERGY STAR Indoor Fixture	200	300	400	500	500	500	500	500	600	600	600	600	600	600	600	600	600	600	600	600
ENERGY STAR Exterior Fixture	200	275	350	425	425	425	425	425	500	500	500	500	500	500	500	500	500	500	500	500
Efficient Nightlight	70	80	90	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
ENERGY STAR Dehumidifier	125	150	175	200	200	200	200	200	225	225	225	225	225	250	250	250	250	250	250	250
ENERGY STAR Refrigerator	250	300	350	400	400	400	400	400	450	450	450	450	450	500	500	500	500	500	500	500
ENERGY STAR 2-Speed Pool Pump	50	60	70	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
Residential Appliance Recycling	475	600	725	850	850	850	850	850	975	975	975	975	975	1,075	1,075	1,075	1,075	1,075	1,075	1,075
Refrigerator Recycle	400	500	600	700	700	700	700	700	800	800	800	800	800	900	900	900	900	900	900	900
Freezer Recycle	75	100	125	150	150	150	150	150	175	175	175	175	175	175	175	175	175	175	175	175
Residential High Efficiency HVAC	1,630	1,915	2,245	2,520	2,520	2,520	2,520	2,520	2,675	2,675	2,675	2,675	2,675	2,160	2,160	2,160	2,160	2,160	2,160	2,160
CAC SEER 15	300	350	400	450	450	450	450	450	450	450	450	450	450							
CAC SEER 16	250	300	375	450	450	450	450	450	500	500	500	500	500	600	600	600	600	600	600	600
CAC SEER 17	50	60	70	80	80	80	80	80	90	90	90	90	90	100	100	100	100	100	100	100
Heat Pump SEER 15	80	90	100	100	100	100	100	100	100	100	100	100	100							
Heat Pump SEER 16	50	75	100	100	100	100	100	100	100	100	100	100	100	150	150	150	150	150	150	150
Heat Pump SEER 17	25	30	35	40	40	40	40	40	40	40	40	40	40	50	50	50	50	50	50	50
Early Retirement HP SEER 16	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Early Retirement HP SEER 17	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Furnace Fan Motor (with CAC)	300	325	350	375	375	375	375	375	400	400	400	400	400	425	425	425	425	425	425	425
Furnace Fan Motor (w/o CAC)	80	100	120	140	140	140	140	140	160	160	160	160	160	180	180	180	180	180	180	180
HE Bathroom Exhaust Fan	80	100	120	140	140	140	140	140	160	160	160	160	160	180	180	180	180	180	180	180
Programmable Thermostat	400	470	560	630	630	630	630	630	660	660	660	660	660	460	460	460	460	460	460	460
Whole House	12,300	12,300	12,300	12,300	12,300	12,300	12,300	12,300	18,450	18,450	18,450	18,450	18,450	18,450	18,450	18,450	18,450	18,450	18,450	18,450
Audit	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Air Sealing	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Faucet Aerator - Kitchen	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Faucet Aerator - Bathroom	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Low Flow Showerhead	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Water Heater Temperature Setback	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Advanced Power Strip	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Water Heater Tank Wrap	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Hot Water Pipe Insulation	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
CFL	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Attic Insulation	300	300	300	300	300	300	300	300	450	450	450	450	450	450	450	450	450	450	450	450
Low Income Weatherization	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Low Income New Homes	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
School Kits	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Small Business Lighting	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200	13,200
C&I Custom Rebate	30	40	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
C&I Prescriptive	7,086	7,682	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869	8,869
T5 Fixture	600	650	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
High Performance T8	2,400	2,600	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Low Wattage Fluorescent T8	1,200	1,300	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
High Bay Fluorescent Fixture T8	600	650	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
High Bay Fluorescent Fixture T5	120	130	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
CFLs	120	130	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
LED Lamp	1,200	1,300	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Exit Sign	240	260	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
Lighting Occupancy Sensors	480	520	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
CAC <65kBtuh	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CAC 65 - 135 kBtuh	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CAC 135 - 240 kBtuh	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CAC 240 - 760 kBtuh	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Split Package Heat Pump	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Single System Heat Pump	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Motor	48	52	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
VFD	6	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Solid Door Refrigerator	12	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Glass Door Refrigerator	12	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Solid Door Freezer	12	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Glass Door Freezer	12	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Live Stock Waterer			8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Engine Block Timer	12	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
Building Operator Certificate	30	45	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Products Program	251,395	503,310	755,745	1,009,450	1,263,155	1,516,860	1,770,565	2,024,270	2,031,225	2,038,180	2,045,135	2,052,090	2,059,045	2,066,075	2,073,105	2,080,135	2,087,165	2,094,195	2,101,225	2,108,255
CFL	250,000	500,000	750,000	1,000,000	1,250,000	1,500,000	1,750,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
LED	500	1,250	2,250	4,250	6,250	8,250	10,250	12,250	17,250	22,250	27,250	32,250	37,250	42,250	47,250	52,250	57,250	62,250	67,250	72,250
ENERGY STAR Indoor Fixture	200	500	900	1,400	1,900	2,400	2,900	3,400	4,000	4,600	5,200	5,800	6,400	7,000	7,600	8,200	8,800	9,400	10,000	10,600
ENERGY STAR Exterior Fixture	200	475	825	1,250	1,675	2,100	2,525	2,950	3,450	3,950	4,450	4,950	5,450	5,950	6,450	6,950	7,450	7,950	8,450	8,950
Efficient Nightlight	70	150	240	340	440	540	640	740	840	940	1,040	1,140	1,240	1,340	1,440	1,540	1,640	1,740	1,840	1,940
ENERGY STAR Dehumidifier	125	275	450	650	850	1,050	1,250	1,450	1,675	1,900	2,125	2,350	2,575	2,825	3,075	3,325	3,575	3,825	4,075	4,325
ENERGY STAR Refrigerator	250	550	900	1,300	1,700	2,100	2,500	2,900	3,350	3,800	4,250	4,700	5,150	5,650	6,150	6,650	7,150	7,650	8,150	8,650
ENERGY STAR 2-Speed Pool Pump	50	110	180	260	340	420	500	580	660	740	820	900	980	1,060	1,140	1,220	1,300	1,380	1,460	1,540
Residential Appliance Recycling	475	1,075	1,800	2,650	3,500	4,350	5,200	6,050	7,025	8,000	8,975	9,950	10,925	12,000	13,075	14,150	15,225	16,300	17,375	18,450
Refrigerator Recycle	400	900	1,500	2,200	2,900	3,600	4,300	5,000	5,800	6,600	7,400	8,200	9,000	9,900	10,800	11,700	12,600	13,500	14,400	15,300
Freezer Recycle	75	175	300	450	600	750	900	1,050	1,225	1,400	1,575	1,750	1,925	2,100	2,275	2,450	2,625	2,800	2,975	3,150
Residential High Efficiency HVAC	1,630	3,545	5,790	8,310	10,830	13,350	15,870	18,390	21,065	23,740	26,415	29,090	31,765	33,925	36,085	38,245	40,405	42,565	44,725	46,885
CAC SEER 15	300	650	1,050	1,500	1,950	2,400	2,850	3,300	3,750	4,200	4,650	5,100	5,550	5,550	5,550	5,550	5,550	5,550	5,550	5,550
CAC SEER 16	250	550	925	1,375	1,825	2,275	2,725	3,175	3,675	4,175	4,675	5,175	5,675	6,275	6,875	7,475	8,075	8,675	9,275	9,875
CAC SEER 17	50	110	180	260	340	420	500	580	670	760	850	940	1,030	1,130	1,230	1,330	1,430	1,530	1,630	1,730
Heat Pump SEER 15	80	170	270	370	470	570	670	770	870	970	1,070	1,170	1,270	1,270	1,270	1,270	1,270	1,270	1,270	1,270
Heat Pump SEER 16	50	125	225	325	425	525	625	725	825	925	1,025	1,125	1,225	1,375	1,525	1,675	1,825	1,975	2,125	2,275
Heat Pump SEER 17	25	55	90	130	170	210	250	290	330	370	410	450	490	540	590	640	690	740	790	840
Early Retirement HP SEER 16	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
Early Retirement HP SEER 17	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Furnace Fan Motor (with CAC)	300	625	975	1,350	1,725	2,100	2,475	2,850	3,250	3,650	4,050	4,450	4,850	5,275	5,700	6,125	6,550	6,975	7,400	7,825
Furnace Fan Motor (w/o CAC)	80	180	300	440	580	720	860	1,000	1,160	1,320	1,480	1,640	1,800	1,980	2,160	2,340	2,520	2,700	2,880	3,060
HE Bathroom Exhaust Fan	80	180	300	440	580	720	860	1,000	1,160	1,320	1,480	1,640	1,800	1,980	2,160	2,340	2,520	2,700	2,880	3,060
Programmable Thermostat	400	870	1,430	2,060	2,690	3,320	3,950	4,580	5,240	5,900	6,560	7,220	7,880	8,340	8,800	9,260	9,720	10,180	10,640	11,100
Whole House	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Audit	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Air Sealing	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Faucet Aerator - Kitchen	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Faucet Aerator - Bathroom	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Low Flow Showerhead	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Water Heater Temperature Setback	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Advanced Power Strip	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Water Heater Tank Wrap	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Hot Water Pipe Insulation	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
CFL	4,000	8,000	12,000	16,000	20,000	24,000	28,000	32,000	38,000	44,000	50,000	56,000	62,000	68,000	74,000	80,000	86,000	92,000	98,000	104,000
Attic Insulation	300	600	900	1,200	1,500	1,800	2,100	2,400	2,850	3,300	3,750	4,200	4,650	5,100	5,550	6,000	6,450	6,900	7,350	7,800
Low Income Weatherization	350	700	1,050	1,400	1,750	2,100	2,450	2,800	3,150	3,500	3,850	4,200	4,550	4,900	5,250	5,600	5,950	6,300	6,650	7,000
Low Income New Homes	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
School Kits	750	1,500	2,250	3,000	3,750	4,500	5,250	6,000	6,750	7,500	8,250	9,000	9,750	10,500	11,250	12,000	12,750	13,500	14,250	15,000

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Small Business Lighting	13,200	26,400	39,600	52,800	66,000	79,200	92,400	105,600	118,800	132,000	145,200	158,400	171,600	184,800	198,000	211,200	224,400	237,600	250,800	264,000
C&I Custom Rebate	30	70	120	170	220	270	320	370	420	470	520	570	620	670	720	770	820	870	920	970
C&I Prescriptive	7,086	14,768	23,637	32,506	41,375	50,244	59,113	67,982	76,851	85,720	94,589	103,458	112,327	121,196	130,065	138,934	147,803	156,672	165,541	174,410
T5 Fixture	600	1,250	2,000	2,750	3,500	4,250	5,000	5,750	6,500	7,250	8,000	8,750	9,500	10,250	11,000	11,750	12,500	13,250	14,000	14,750
High Performance T8	2,400	5,000	8,000	11,000	14,000	17,000	20,000	23,000	26,000	29,000	32,000	35,000	38,000	41,000	44,000	47,000	50,000	53,000	56,000	59,000
Low Wattage Fluorescent T8	1,200	2,500	4,000	5,500	7,000	8,500	10,000	11,500	13,000	14,500	16,000	17,500	19,000	20,500	22,000	23,500	25,000	26,500	28,000	29,500
High Bay Fluorescent Fixture T8	600	1,250	2,000	2,750	3,500	4,250	5,000	5,750	6,500	7,250	8,000	8,750	9,500	10,250	11,000	11,750	12,500	13,250	14,000	14,750
High Bay Fluorescent Fixture T5	120	250	400	550	700	850	1,000	1,150	1,300	1,450	1,600	1,750	1,900	2,050	2,200	2,350	2,500	2,650	2,800	2,950
CFLs	120	250	400	550	700	850	1,000	1,150	1,300	1,450	1,600	1,750	1,900	2,050	2,200	2,350	2,500	2,650	2,800	2,950
LED Lamp	1,200	2,500	4,000	5,500	7,000	8,500	10,000	11,500	13,000	14,500	16,000	17,500	19,000	20,500	22,000	23,500	25,000	26,500	28,000	29,500
Exit Sign	240	500	800	1,100	1,400	1,700	2,000	2,300	2,600	2,900	3,200	3,500	3,800	4,100	4,400	4,700	5,000	5,300	5,600	5,900
Lighting Occupancy Sensors	480	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200	5,800	6,400	7,000	7,600	8,200	8,800	9,400	10,000	10,600	11,200	11,800
CAC <65kBtuh	2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59
CAC 65 - 135 kBtuh	2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59
CAC 135 - 240 kBtuh	2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59
CAC 240 - 760 kBtuh	2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59
Split Package Heat Pump	2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59
Single System Heat Pump	2	5	8	11	14	17	20	23	26	29	32	35	38	41	44	47	50	53	56	59
Motor	48	100	160	220	280	340	400	460	520	580	640	700	760	820	880	940	1,000	1,060	1,120	1,180
VFD	6	13	21	29	37	45	53	61	69	77	85	93	101	109	117	125	133	141	149	157
Solid Door Refrigerator	12	25	40	55	70	85	100	115	130	145	160	175	190	205	220	235	250	265	280	295
Glass Door Refrigerator	12	25	40	55	70	85	100	115	130	145	160	175	190	205	220	235	250	265	280	295
Solid Door Freezer	12	25	40	55	70	85	100	115	130	145	160	175	190	205	220	235	250	265	280	295
Glass Door Freezer	12	25	40	55	70	85	100	115	130	145	160	175	190	205	220	235	250	265	280	295
Live Stock Waterer	-	-	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144
Engine Block Timer	12	25	40	55	70	85	100	115	130	145	160	175	190	205	220	235	250	265	280	295

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	25,795	26,028	26,260	26,643	26,643	26,643	26,643	26,643	2,405	2,405	2,405	2,405	2,405	2,480	2,480	2,480	2,480	2,480	2,480	2,480
Residential Appliance Recycling	342	433	525	617	617	617	617	617	708	708	708	708	708	775	775	775	775	775	775	775
Residential High Efficiency HVAC	1,630	1,915	2,245	2,520	2,520	2,520	2,520	2,520	2,675	2,675	2,675	2,675	2,675	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Whole House	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Low Income Weatherization	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Low Income New Homes	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
School Kits	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Non-Residential																				
Small Business Lighting	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
C&I Custom Rebate	30	40	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
C&I Prescriptive	120	130	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Building Operator Certificate	30	45	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

Table 5-48 - Incremental Participation by Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	25,795	51,823	78,083	104,725	131,368	158,010	184,653	211,295	13,700	16,105	18,510	20,915	23,320	25,800	28,280	30,760	33,240	35,720	38,200	40,680
Residential Appliance Recycling	342	775	1,300	1,917	2,533	3,150	3,767	4,383	5,092	5,800	6,508	7,217	7,925	8,700	9,475	10,250	11,025	11,800	12,575	13,350
Residential High Efficiency HVAC	1,630	3,545	5,790	8,310	10,830	13,350	15,870	18,390	21,065	23,740	26,415	29,090	31,765	33,925	36,085	38,245	40,405	42,565	44,725	46,885
Whole House	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Low Income Weatherization	350	700	1,050	1,400	1,750	2,100	2,450	2,800	3,150	3,500	3,850	4,200	4,550	4,900	5,250	5,600	5,950	6,300	6,650	7,000
Low Income New Homes	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
School Kits	750	1,500	2,250	3,000	3,750	4,500	5,250	6,000	6,750	7,500	8,250	9,000	9,750	10,500	11,250	12,000	12,750	13,500	14,250	15,000
Non-Residential																				
Small Business Lighting	300	600	900	1,200	1,500	1,800	2,100	2,400	2,700	3,000	3,300	3,600	3,900	4,200	4,500	4,800	5,100	5,400	5,700	6,000
C&I Custom Rebate	30	70	120	170	220	270	320	370	420	470	520	570	620	670	720	770	820	870	920	970
C&I Prescriptive	120	250	400	550	700	850	1,000	1,150	1,300	1,450	1,600	1,750	1,900	2,050	2,200	2,350	2,500	2,650	2,800	2,950
Building Operator Certificate	30	75	135	195	255	315	375	435	495	555	615	675	735	795	855	915	975	1,035	1,095	1,155

Table 5-49 - Cumulative Participation by Program

3.7.4 Demand Reduction and Energy Savings

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.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	0.76	0.77	0.50	0.51	0.51	0.51	0.51	0.51	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Residential Appliance Recycling	0.08	0.10	0.12	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Residential High Efficiency HVAC	0.73	0.86	0.92	1.02	1.02	1.02	1.02	1.02	1.08	1.08	1.08	1.08	1.08	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Whole House	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Low Income Weatherization	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Low Income New Homes	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	0.00	0.00	0.00
School Kits	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Non-Residential																				
Small Business Lighting	0.45	0.45	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
C&I Custom Rebate	0.12	0.16	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
C&I Prescriptive	0.41	0.45	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Building Operator Certificate	0.10	0.15	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	0.76	1.52	2.03	2.54	3.06	2.84	2.63	2.68	2.29	1.89	1.47	1.05	0.62	0.65	0.68	0.70	0.73	0.75	0.78	0.80
Residential Appliance Recycling	0.08	0.17	0.29	0.42	0.56	0.69	0.83	0.96	1.04	1.10	1.14	1.16	1.18	1.22	1.25	1.29	1.31	1.32	1.34	1.36
Residential High Efficiency HVAC	0.73	1.59	2.51	3.53	4.55	5.58	6.58	7.58	8.64	9.69	10.67	11.63	12.57	13.32	14.06	14.80	15.54	16.28	16.57	16.76
Whole House	0.36	0.72	1.07	1.41	1.76	2.09	2.41	2.75	3.25	3.75	4.22	4.69	5.16	5.62	6.08	6.33	6.58	6.82	7.05	7.28
Low Income Weatherization	0.28	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.09	3.37	3.65	3.93	4.21	4.21	4.21	4.21	4.21	4.21
Low Income New Homes	0.00	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
School Kits	0.06	0.12	0.18	0.24	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Non-Residential																				
Small Business Lighting	0.45	0.90	1.28	1.66	2.04	2.42	2.80	3.18	3.56	3.94	4.32	4.70	5.09	5.47	5.85	5.78	5.71	5.71	5.71	5.71
C&I Custom Rebate	0.12	0.27	0.47	0.66	0.85	1.05	1.24	1.44	1.63	1.82	2.02	2.21	2.41	2.60	2.79	2.87	2.91	2.91	2.91	2.91
C&I Prescriptive	0.41	0.87	1.36	1.85	2.35	2.85	3.34	3.79	4.16	4.55	4.92	5.30	5.66	6.02	6.39	6.67	6.73	6.77	6.77	6.77
Building Operator Certificate	0.10	0.25	0.46	0.66	0.87	0.97	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	8,350	8,394	5,409	5,470	5,470	5,470	5,470	5,470	380	380	380	380	380	388	388	388	388	388	388	388
Residential Appliance Recycling	434	547	660	773	773	773	773	773	886	886	886	886	886	982	982	982	982	982	982	982
Residential High Efficiency HVAC	1,036	1,223	1,268	1,398	1,398	1,398	1,398	1,398	1,472	1,472	1,472	1,472	1,472	1,268	1,268	1,268	1,268	1,268	1,268	1,268
Whole House	1,696	1,696	1,648	1,648	1,648	1,648	1,648	1,648	2,471	2,471	2,471	2,471	2,471	2,471	2,471	2,471	2,471	2,471	2,471	2,471
Low Income Weatherization	771	771	771	771	771	771	771	771	771	771	771	771	771	771	771	771	771	771	771	771
Low Income New Homes	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
School Kits	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292	292
Non-Residential																				
Small Business Lighting	2,598	2,598	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244	2,244
C&I Custom Rebate	672	896	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121
C&I Prescriptive	2,410	2,636	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917	2,917
Building Operator Certificate	262	393	524	524	524	524	524	524	524	524	524	524	524	524	524	524	524	524	524	524

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

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	8,350	16,745	22,154	27,624	33,094	30,353	27,611	27,881	23,058	18,235	13,378	8,513	3,625	3,935	4,242	4,545	4,848	5,128	5,404	5,676
Residential Appliance Recycling	434	982	1,642	2,416	3,189	3,963	4,736	5,510	5,962	6,301	6,527	6,639	6,752	6,961	7,169	7,378	7,473	7,569	7,664	7,760
Residential High Efficiency HVAC	1,036	2,259	3,527	4,925	6,323	7,693	9,062	10,421	11,854	13,287	14,592	15,872	17,124	18,157	19,190	20,222	21,255	22,288	22,675	22,921
Whole House	1,696	3,392	4,965	6,538	8,112	9,486	10,860	12,282	14,529	16,614	18,478	20,342	22,206	23,995	25,783	27,020	28,256	29,412	30,476	31,539
Low Income Weatherization	771	1,542	2,313	3,084	3,856	4,627	5,398	6,169	6,940	7,711	8,482	9,253	10,024	10,795	11,567	11,567	11,567	11,567	11,567	11,567
Low Income New Homes	11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	165	165	165	165	165
School Kits	292	584	876	1,168	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460	1,460
Non-Residential																				
Small Business Lighting	2,598	5,196	7,441	9,685	11,929	14,174	16,418	18,662	20,907	23,151	25,395	27,640	29,884	32,129	34,373	34,019	33,665	33,665	33,665	33,665
C&I Custom Rebate	672	1,569	2,689	3,810	4,931	6,051	7,172	8,292	9,413	10,533	11,654	12,775	13,895	15,016	16,136	16,584	16,809	16,809	16,809	16,809
C&I Prescriptive	2,410	5,046	7,938	10,820	13,709	16,597	19,484	22,109	24,284	26,499	28,642	30,785	32,866	34,943	37,012	38,662	39,034	39,237	39,237	39,237
Building Operator Certificate	262	655	1,180	1,704	2,228	2,490	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622	2,622

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

3.7.5 Cost Estimates

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

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

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

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

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

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

The realistic achievable potential cost of incentives to customers to participate in the DSM Programs is shown in the tables below.

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

The realistic achievable potential cost to the customer and utility to implement the DSM Programs is shown in the tables below.

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

The realistic achievable potential utility's cost to administer the DSM Programs is shown in the tables below.

F. Other costs identified by the utility;

AEG did not identify other costs for the DSM Programs.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Products Program																				
CFL	$2	$2	$2	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
LED	$25	$25	$23	$22	$22	$21	$21	$21	$20	$20	$19	$19	$19	$18	$18	$17	$17	$17	$16	$16
ENERGY STAR Indoor Fixture	$32	$32	$32	$33	$34	$35	$36	$37	$38	$39	$40	$41	$42	$43	$44	$45	$46	$47	$48	$49
ENERGY STAR Exterior Fixture	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17
Efficient Nightlight	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
ENERGY STAR Dehumidifier	$45	$45	$45	$46	$47	$48	$49	$50	$51	$52	$53	$54	$55	$56	$57	$58	$59	$60	$61	$62
ENERGY STAR Refrigerator	$30	$30	$60	$61	$62	$63	$64	$65	$66	$67	$68	$69	$70	$71	$72	$73	$74	$75	$77	$79
ENERGY STAR 2-Speed Pool Pump	$300	$300	$300	$306	$312	$318	$324	$330	$337	$344	$351	$358	$365	$372	$379	$387	$395	$403	$411	$419
Residential Appliance Recycling																				
Refrigerator Recycle	$93	$93	$93	$91	$89	$87	$85	$83	$81	$79	$77	$75	$74	$73	$72	$71	$70	$69	$68	$67
Freezer Recycle	$93	$93	$93	$91	$89	$87	$85	$83	$81	$79	$77	$75	$74	$73	$72	$71	$70	$69	$68	$67
Residential High Efficiency HVAC																				
CAC SEER 15	$556	$556	$556	$567	$578	$590	$602	$614	$626	$639	$652	$665	$0	$0	$0	$0	$0	$0	$0	$0
CAC SEER 16	$834	$834	$834	$850	$867	$884	$902	$920	$938	$957	$976	$996	$664	$664	$664	$664	$664	$664	$664	$664
CAC SEER 17	$1,111	$1,111	$1,111	$1,134	$1,157	$1,180	$1,204	$1,228	$1,253	$1,278	$1,304	$1,330	$996	$996	$996	$996	$996	$996	$996	$996
Heat Pump SEER 15	$588	$588	$294	$300	$306	$312	$318	$324	$330	$337	$344	$351	$0	$0	$0	$0	$0	$0	$0	$0
Heat Pump SEER 16	$881	$881	$588	$599	$611	$623	$635	$648	$661	$674	$687	$701	$715	$729	$744	$759	$774	$789	$805	$821
Heat Pump SEER 17	$1,175	$1,175	$881	$899	$917	$935	$954	$973	$992	$1,012	$1,032	$1,053	$1,074	$1,095	$1,117	$1,139	$1,162	$1,185	$1,209	$1,233
Early Retirement HP SEER 16	$2,774	$2,774	$2,774	$2,829	$2,886	$2,944	$3,003	$3,063	$3,124	$3,186	$3,250	$3,315	$3,381	$3,449	$3,518	$3,588	$3,660	$3,733	$3,808	$3,884
Early Retirement HP SEER 17	$3,068	$3,068	$3,068	$3,129	$3,192	$3,256	$3,321	$3,387	$3,455	$3,524	$3,594	$3,666	$3,739	$3,814	$3,890	$3,968	$4,047	$4,128	$4,211	$4,295
Furnace Fan Motor	$97	$97	$97	$99	$101	$103	$105	$107	$109	$111	$113	$115	$117	$119	$121	$123	$125	$128	$131	$134
HE Bathroom Exhaust Fan	$44	$44	$44	$44	$45	$46	$47	$48	$49	$50	$51	$52	$53	$54	$55	$56	$57	$58	$59	$60
Programmable Thermostat	$30	$30	$30	$31	$32	$33	$34	$35	$36	$37	$38	$39	$40	$41	$42	$43	$44	$45	$46	$47
Whole House																				
Air Sealing	$272	$272	$272	$277	$283	$289	$295	$301	$307	$313	$319	$325	$332	$339	$346	$353	$360	$367	$374	$381
Faucet Aerator - Kitchen	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8
Faucet Aerator - Bathroom	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8
Low Flow Showerhead	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12
Water Heater Temperature Setback	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Advanced Power Strip	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Water Heater Tank Wrap	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Hot Water Pipe Insulation	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
CFL (4 bulbs)	$7.20	$7.20	$6.00	$5.88	$5.76	$5.64	$5.52	$5.40	$5.28	$5.16	$5.04	$4.92	$4.84	$4.76	$4.68	$4.60	$4.52	$4.44	$4.36	$4.28
Attic Insulation	$588	$588	$588	$600	$612	$624	$636	$649	$662	$675	$689	$703	$717	$731	$746	$761	$776	$792	$808	$824
Low Income Weatherization	$1,200	$1,200	$1,200	$1,224	$1,248	$1,273	$1,298	$1,324	$1,350	$1,377	$1,405	$1,433	$1,462	$1,491	$1,521	$1,551	$1,582	$1,614	$1,646	$1,679
Low Income New Homes	$2,750	$2,750	$2,750	$2,805	$2,861	$2,918	$2,976	$3,036	$3,097	$3,159	$3,222	$3,286	$3,352	$3,419	$3,487	$3,557	$3,628	$3,701	$3,775	$3,851

Table 5-54 - Residential Measure Incremental Costs

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Small Business Lighting	1,300	1,300	1,300	1,300	1,300	1,200	1,200	1,200	1,200	1,200	1,100	1,100	1,100	1,100	1,100	1,100	1,000	1,000	1,000	1,000
C&I Custom Rebate	2,200	2,200	2,200	2,200	2,200	2,200	2,100	2,100	2,100	2,100	2,000	2,000	2,000	2,000	2,000	1,900	1,900	1,900	1,900	1,900
C&I Prescriptive																				
T5 Fixture	$30	$30	$30	$29	$28	$27	$26	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
High Performance T8	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Low Wattage Fluorescent T8	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2
High Bay Fluorescent Fixture T8	$225	$225	$225	$221	$217	$213	$209	$205	$201	$197	$193	$189	$185	$181	$177	$173	$170	$167	$164	$161
High Bay Fluorescent Fixture T5	$100	$100	$100	$98	$96	$94	$92	$90	$88	$86	$84	$82	$80	$78	$76	$74	$73	$72	$71	$70
CFLs	$2	$2	$2	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
LED Lamp	$40	$40	$40	$39	$38	$37	$36	$35	$34	$33	$32	$31	$30	$29	$28	$27	$26	$25	$25	$25
Exit Sign	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Lighting Occupancy Sensors	$54	$54	$54	$53	$52	$51	$50	$49	$48	$47	$46	$45	$44	$43	$42	$41	$40	$39	$38	$37
CAC <65kBtuh	$300	$300	$300	$306	$312	$318	$324	$330	$337	$344	$351	$358	$365	$372	$379	$387	$395	$403	$411	$419
CAC 65 - 135 kBtuh	$1,490	$1,490	$1,490	$1,520	$1,550	$1,581	$1,613	$1,645	$1,678	$1,712	$1,746	$1,781	$1,817	$1,853	$1,890	$1,928	$1,967	$2,006	$2,046	$2,087
CAC 135 - 240 kBtuh	$2,220	$2,220	$2,220	$2,264	$2,309	$2,355	$2,402	$2,450	$2,499	$2,549	$2,600	$2,652	$2,705	$2,759	$2,814	$2,870	$2,927	$2,986	$3,046	$3,107
CAC 240 - 760 kBtuh	$2,878	$2,878	$2,878	$2,936	$2,995	$3,055	$3,116	$3,178	$3,242	$3,307	$3,373	$3,440	$3,509	$3,579	$3,651	$3,724	$3,798	$3,874	$3,951	$4,030
Split Package Heat Pump	$370	$370	$370	$377	$385	$393	$401	$409	$417	$425	$434	$443	$452	$461	$470	$479	$489	$499	$509	$519
Single System Heat Pump	$370	$370	$370	$377	$385	$393	$401	$409	$417	$425	$434	$443	$452	$461	$470	$479	$489	$499	$509	$519
Motor	$115	$115	$115	$117	$119	$121	$123	$125	$128	$131	$134	$137	$140	$143	$146	$149	$152	$155	$158	$161
VFD	$2,518	$2,518	$2,518	$2,568	$2,619	$2,671	$2,724	$2,778	$2,834	$2,891	$2,949	$3,008	$3,068	$3,129	$3,192	$3,256	$3,321	$3,387	$3,455	$3,524
Solid/Glass Door Refrigerator	$164	$164	$164	$167	$170	$173	$176	$180	$184	$188	$192	$196	$200	$204	$208	$212	$216	$220	$224	$228
Solid/Glass Door Freezer	$166	$166	$166	$169	$172	$175	$179	$183	$187	$191	$195	$199	$203	$207	$211	$215	$219	$223	$227	$232
Live Stock Waterer	$788	$788	$788	$803	$819	$835	$852	$869	$886	$904	$922	$940	$959	$978	$998	$1,018	$1,038	$1,059	$1,080	$1,102
Engine Block Timer	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Building Operator Certificate	$1,150	$1,150	$1,150	$1,173	$1,196	$1,220	$1,244	$1,269	$1,294	$1,320	$1,346	$1,373	$1,400	$1,428	$1,457	$1,486	$1,516	$1,546	$1,577	$1,609

Table 5-55 - Non-Residential Measure Incremental Costs

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Products Program																				
CFL	$1.25	$1.25	$1.25	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75	$0.75
LED	$10	$10	$10	$10	$10	$10	$10	$10	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8
ENERGY STAR Indoor Fixture	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$20	$20	$20	$20	$20	$20	$20
ENERGY STAR Exterior Fixture	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Efficient Nightlight	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50
ENERGY STAR Dehumidifier	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
ENERGY STAR Refrigerator	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30	$30
ENERGY STAR 2-Speed Pool Pump	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150
Residential Appliance Recycling	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35	$35
Residential High Efficiency HVAC																				
CAC SEER 15	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400								
CAC SEER 16	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$400	$400	$400	$400	$400	$400	$400	$400
CAC SEER 17	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$450	$450	$450	$450	$450	$450	$450	$450
Heat Pump SEER 15	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400	$400								
Heat Pump SEER 16	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$450	$400	$400	$400	$400	$400	$400	$400	$400
Heat Pump SEER 17	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$500	$450	$450	$450	$450	$450	$450	$450	$450
Early Retirement HP SEER 16	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600	$600
Early Retirement HP SEER 17	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700	$700
Furnace Fan Motor	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$50	$50	$50	$50	$50	$50	$50	$50
HE Bathroom Exhaust Fan	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Programmable Thermostat	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
Whole House	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$300	$350	$350	$350	$350	$350	$350	$350	$350
Low Income New Homes	$1,200	$1,200	$1,200	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500

Table 5-56 - Residential Incentives per Measure

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Small Business Lighting	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033	$2,033
C&I Custom Rebate	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,050	$1,050	$1,050	$1,050	$1,000	$1,000	$1,000	$1,000	$1,000	$950	$950	$950	$950	$950
C&I Prescriptive																				
T5 Fixture	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$40	$35	$35	$35	$35	$35	$35	$35	$35
High Performance T8	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9	$9
Low Wattage Fluorescent T8	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00
High Bay Fluorescent Fixture T8	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$100	$75	$75	$75	$75	$75	$75	$75	$75
High Bay Fluorescent Fixture T5	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$35	$35	$35	$35	$35	$35	$35	$35
CFLs	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$1.00	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50
LED Lamp	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$10	$10	$10	$10	$10	$10	$10	$10
Exit Sign	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Lighting Occupancy Sensors	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$20	$20	$20	$20	$20	$20	$20	$20
CAC <65kBtuh	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$150	$175	$175	$175	$175	$175	$175	$175	$175
CAC 65 - 135 kBtuh	$650	$650	$650	$650	$650	$650	$650	$700	$700	$700	$700	$700	$750	$750	$750	$750	$750	$750	$750	$750
CAC 135 - 240 kBtuh	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$1,200	$1,200	$1,200	$1,200	$1,200	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300	$1,300
CAC 240 - 760 kBtuh	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,375	$1,375	$1,375	$1,375	$1,375	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Split Package Heat Pump	$175	$175	$175	$175	$175	$175	$175	$200	$200	$200	$200	$200	$225	$225	$225	$225	$225	$225	$225	$225
Single System Heat Pump	$175	$175	$175	$175	$175	$175	$175	$200	$200	$200	$200	$200	$225	$225	$225	$225	$225	$225	$225	$225
Motor	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$50	$60	$60	$60	$60	$60	$60	$60	$60
VFD	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500	$1,500
Solid/Glass Door Refrigerator	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$100	$100	$100	$100	$100	$100	$100	$100
Solid/Glass Door Freezer	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$75	$100	$100	$100	$100	$100	$100	$100	$100
Live Stock Waterer	$400	$400	$400	$400	$400	$400	$400	$425	$425	$425	$425	$425	$450	$450	$450	$450	$450	$450	$450	$450
Engine Block Timer	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Building Operator Certificate	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575	$575

Table 5-57 - Non-Residential Incentives per Measure

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	$340,175	$348,450	$356,725	$247,500	$247,500	$247,500	$247,500	$247,500	$84,250	$84,250	$84,250	$84,250	$84,250	$89,250	$89,250	$89,250	$89,250	$89,250	$89,250	$89,250
Residential Appliance Recycling	$16,625	$21,000	$25,375	$29,750	$29,750	$29,750	$29,750	$29,750	$34,125	$34,125	$34,125	$34,125	$34,125	$37,625	$37,625	$37,625	$37,625	$37,625	$37,625	$37,625
Residential High Efficiency HVAC	$356,800	$425,300	$505,350	$569,850	$569,850	$569,850	$569,850	$569,850	$600,000	$600,000	$600,000	$600,000	$349,100	$417,750	$417,750	$417,750	$417,750	$417,750	$417,750	$417,750
Whole House	$550,000	$550,000	$550,000	$550,000	$560,000	$560,000	$570,000	$570,000	$870,000	$885,000	$885,000	$900,000	$922,500	$937,500	$952,500	$967,500	$967,500	$982,500	$997,500	$997,500
Low Income Weatherization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Low Income New Homes	$6,000	$6,000	$6,000	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500
School Kits	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Non-Residential																				
Small Business Lighting	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819
C&I Custom Rebate	$33,000	$44,000	$55,000	$110,000	$110,000	$110,000	$105,000	$105,000	$105,000	$105,000	$100,000	$100,000	$100,000	$100,000	$100,000	$95,000	$95,000	$95,000	$95,000	$95,000
C&I Prescriptive	$171,880	$189,745	$220,425	$220,425	$220,425	$220,425	$220,425	$221,525	$221,525	$221,525	$221,525	$221,525	$184,125	$184,125	$184,125	$184,125	$184,125	$184,125	$184,125	$184,125
Building Operator Certificate	$17,250	$25,875	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500

Table 5-58 - Total Incentives per Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	$565,917	$569,387	$572,856	$567,090	$567,090	$567,090	$567,090	$567,090	$34,978	$34,978	$34,978	$34,978	$34,978	$37,328	$37,328	$37,328	$37,328	$37,328	$37,328	$37,328
Residential Appliance Recycling	$77,040	$97,314	$117,588	$137,862	$137,862	$137,862	$137,862	$137,862	$158,135	$158,135	$158,135	$158,135	$158,135	$174,354	$174,354	$174,354	$174,354	$174,354	$174,354	$174,354
Residential High Efficiency HVAC	$205,160	$244,548	$290,576	$327,664	$327,664	$327,664	$327,664	$327,664	$345,000	$345,000	$345,000	$345,000	$200,733	$240,206	$240,206	$240,206	$240,206	$240,206	$240,206	$240,206
Whole House	$588,410	$588,410	$588,410	$588,410	$589,645	$589,645	$590,880	$590,880	$888,173	$890,025	$890,025	$891,878	$900,090	$901,943	$903,795	$905,648	$905,648	$907,500	$909,353	$909,353
Low Income Weatherization	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000
Low Income New Homes	$1,371	$1,371	$1,371	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714
School Kits	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211
Non-Residential																				
Small Business Lighting	$948,299	$948,299	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414
C&I Custom Rebate	$11,352	$15,136	$18,920	$37,840	$37,840	$37,840	$36,120	$36,120	$36,120	$36,120	$34,400	$34,400	$34,400	$34,400	$34,400	$32,680	$32,680	$32,680	$32,680	$32,680
C&I Prescriptive	$59,127	$65,272	$75,826	$75,826	$75,826	$75,826	$75,826	$76,205	$76,205	$76,205	$76,205	$76,205	$63,339	$63,339	$63,339	$63,339	$63,339	$63,339	$63,339	$63,339
Building Operator Certificate	$5,391	$8,086	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781

Table 5-59 - Total Utility Administrative Costs per Program

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.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	25,795	26,028	26,260	26,643	26,643	26,643	26,643	26,643	2,405	2,405	2,405	2,405	2,405	2,480	2,480	2,480	2,480	2,480	2,480	2,480
Residential Appliance Recycling	342	433	525	617	617	617	617	617	708	708	708	708	708	775	775	775	775	775	775	775
Residential High Efficiency HVAC	1,630	1,915	2,245	2,520	2,520	2,520	2,520	2,520	2,675	2,675	2,675	2,675	2,675	2,160	2,160	2,160	2,160	2,160	2,160	2,160
Whole House	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Low Income Weatherization	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Low Income New Homes	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
School Kits	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
Non-Residential																				
Small Business Lighting	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
C&I Custom Rebate	30	40	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
C&I Prescriptive	120	130	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Building Operator Certificate	30	45	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

Table 5-60 - Incremental Participation by Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	25,795	51,823	78,083	104,725	131,368	158,010	184,653	211,295	13,700	16,105	18,510	20,915	23,320	25,800	28,280	30,760	33,240	35,720	38,200	40,680
Residential Appliance Recycling	342	775	1,300	1,917	2,533	3,150	3,767	4,383	5,092	5,800	6,508	7,217	7,925	8,700	9,475	10,250	11,025	11,800	12,575	13,350
Residential High Efficiency HVAC	1,630	3,545	5,790	8,310	10,830	13,350	15,870	18,390	21,065	23,740	26,415	29,090	31,765	33,925	36,085	38,245	40,405	42,565	44,725	46,885
Whole House	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,500	11,000	12,500	14,000	15,500	17,000	18,500	20,000	21,500	23,000	24,500	26,000
Low Income Weatherization	350	700	1,050	1,400	1,750	2,100	2,450	2,800	3,150	3,500	3,850	4,200	4,550	4,900	5,250	5,600	5,950	6,300	6,650	7,000
Low Income New Homes	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
School Kits	750	1,500	2,250	3,000	3,750	4,500	5,250	6,000	6,750	7,500	8,250	9,000	9,750	10,500	11,250	12,000	12,750	13,500	14,250	15,000
Non-Residential																				
Small Business Lighting	300	600	900	1,200	1,500	1,800	2,100	2,400	2,700	3,000	3,300	3,600	3,900	4,200	4,500	4,800	5,100	5,400	5,700	6,000
C&I Custom Rebate	30	70	120	170	220	270	320	370	420	470	520	570	620	670	720	770	820	870	920	970
C&I Prescriptive	120	250	400	550	700	850	1,000	1,150	1,300	1,450	1,600	1,750	1,900	2,050	2,200	2,350	2,500	2,650	2,800	2,950
Building Operator Certificate	30	75	135	195	255	315	375	435	495	555	615	675	735	795	855	915	975	1,035	1,095	1,155

Table 5-61 - Cumulative Participation by Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	0.76	0.77	0.50	0.51	0.51	0.51	0.51	0.51	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Residential Appliance Recycling	0.08	0.10	0.12	0.14	0.14	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Residential High Efficiency HVAC	0.73	0.86	0.92	1.02	1.02	1.02	1.02	1.02	1.08	1.08	1.08	1.08	1.08	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Whole House	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
Low Income Weatherization	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Low Income New Homes	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	0.00	0.00	0.00
School Kits	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Non-Residential																				
Small Business Lighting	0.45	0.45	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
C&I Custom Rebate	0.12	0.16	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
C&I Prescriptive	0.41	0.45	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Building Operator Certificate	0.10	0.15	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20

Table 5-62 - Incremental Net Demand Reductions by Program (MW)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	0.76	1.52	2.03	2.54	3.06	2.84	2.63	2.68	2.29	1.89	1.47	1.05	0.62	0.65	0.68	0.70	0.73	0.75	0.78	0.80
Residential Appliance Recycling	0.08	0.17	0.29	0.42	0.56	0.69	0.83	0.96	1.04	1.10	1.14	1.16	1.18	1.22	1.25	1.29	1.31	1.32	1.34	1.36
Residential High Efficiency HVAC	0.73	1.59	2.51	3.53	4.55	5.58	6.58	7.58	8.64	9.69	10.67	11.63	12.57	13.32	14.06	14.80	15.54	16.28	16.57	16.76
Whole House	0.36	0.72	1.07	1.41	1.76	2.09	2.41	2.75	3.25	3.75	4.22	4.69	5.16	5.62	6.08	6.33	6.58	6.82	7.05	7.28
Low Income Weatherization	0.28	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.09	3.37	3.65	3.93	4.21	4.21	4.21	4.21	4.21	4.21
Low Income New Homes	0.00	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
School Kits	0.06	0.12	0.18	0.24	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Non-Residential																				
Small Business Lighting	0.45	0.90	1.28	1.66	2.04	2.42	2.80	3.18	3.56	3.94	4.32	4.70	5.09	5.47	5.85	5.78	5.71	5.71	5.71	5.71
C&I Custom Rebate	0.12	0.27	0.47	0.66	0.85	1.05	1.24	1.44	1.63	1.82	2.02	2.21	2.41	2.60	2.79	2.87	2.91	2.91	2.91	2.91
C&I Prescriptive	0.41	0.87	1.36	1.85	2.35	2.85	3.34	3.79	4.16	4.55	4.92	5.30	5.66	6.02	6.39	6.67	6.73	6.77	6.77	6.77
Building Operator Certificate	0.10	0.25	0.46	0.66	0.87	0.97	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02

Table 5-63 - Cumulative Net Demand Reductions by Program (MW)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	$340,175	$348,450	$356,725	$247,500	$247,500	$247,500	$247,500	$247,500	$84,250	$84,250	$84,250	$84,250	$84,250	$89,250	$89,250	$89,250	$89,250	$89,250	$89,250	$89,250
Residential Appliance Recycling	$16,625	$21,000	$25,375	$29,750	$29,750	$29,750	$29,750	$29,750	$34,125	$34,125	$34,125	$34,125	$34,125	$37,625	$37,625	$37,625	$37,625	$37,625	$37,625	$37,625
Residential High Efficiency HVAC	$356,800	$425,300	$505,350	$569,850	$569,850	$569,850	$569,850	$569,850	$600,000	$600,000	$600,000	$600,000	$349,100	$417,750	$417,750	$417,750	$417,750	$417,750	$417,750	$417,750
Whole House	$550,000	$550,000	$550,000	$550,000	$560,000	$560,000	$570,000	$570,000	$870,000	$885,000	$885,000	$900,000	$922,500	$937,500	$952,500	$967,500	$967,500	$982,500	$997,500	$997,500
Low Income Weatherization	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Low Income New Homes	$6,000	$6,000	$6,000	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500
School Kits	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Non-Residential																				
Small Business Lighting	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819	$609,819
C&I Custom Rebate	$33,000	$44,000	$55,000	$110,000	$110,000	$110,000	$105,000	$105,000	$105,000	$105,000	$100,000	$100,000	$100,000	$100,000	$100,000	$95,000	$95,000	$95,000	$95,000	$95,000
C&I Prescriptive	$171,880	$189,745	$220,425	$220,425	$220,425	$220,425	$220,425	$221,525	$221,525	$221,525	$221,525	$221,525	$184,125	$184,125	$184,125	$184,125	$184,125	$184,125	$184,125	$184,125
Building Operator Certificate	$17,250	$25,875	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500	$34,500

Table 5-64 - Total Incentives per Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Residential Products Program	$565,917	$569,387	$572,856	$567,090	$567,090	$567,090	$567,090	$567,090	$34,978	$34,978	$34,978	$34,978	$34,978	$37,328	$37,328	$37,328	$37,328	$37,328	$37,328	$37,328
Residential Appliance Recycling	$77,040	$97,314	$117,588	$137,862	$137,862	$137,862	$137,862	$137,862	$158,135	$158,135	$158,135	$158,135	$158,135	$174,354	$174,354	$174,354	$174,354	$174,354	$174,354	$174,354
Residential High Efficiency HVAC	$205,160	$244,548	$290,576	$327,664	$327,664	$327,664	$327,664	$327,664	$345,000	$345,000	$345,000	$345,000	$200,733	$240,206	$240,206	$240,206	$240,206	$240,206	$240,206	$240,206
Whole House	$588,410	$588,410	$588,410	$588,410	$589,645	$589,645	$590,880	$590,880	$888,173	$890,025	$890,025	$891,878	$900,090	$901,943	$903,795	$905,648	$905,648	$907,500	$909,353	$909,353
Low Income Weatherization	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000	$294,000
Low Income New Homes	$1,371	$1,371	$1,371	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714	$1,714
School Kits	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211	$47,211
Non-Residential																				
Small Business Lighting	$948,299	$948,299	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414	$829,414
C&I Custom Rebate	$11,352	$15,136	$18,920	$37,840	$37,840	$37,840	$36,120	$36,120	$36,120	$36,120	$34,400	$34,400	$34,400	$34,400	$34,400	$32,680	$32,680	$32,680	$32,680	$32,680
C&I Prescriptive	$59,127	$65,272	$75,826	$75,826	$75,826	$75,826	$75,826	$76,205	$76,205	$76,205	$76,205	$76,205	$63,339	$63,339	$63,339	$63,339	$63,339	$63,339	$63,339	$63,339
Building Operator Certificate	$5,391	$8,086	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781	$10,781

Table 5-65 - Total Utility Administrative Costs per Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Products Program																				
CFL	$2	$2	$2	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
LED	$25	$25	$23	$22	$22	$21	$21	$21	$20	$20	$19	$19	$19	$18	$18	$17	$17	$17	$16	$16
ENERGY STAR Indoor Fixture	$32	$32	$32	$33	$34	$35	$36	$37	$38	$39	$40	$41	$42	$43	$44	$45	$46	$47	$48	$49
ENERGY STAR Exterior Fixture	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17	$17
Efficient Nightlight	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
ENERGY STAR Dehumidifier	$45	$45	$45	$46	$47	$48	$49	$50	$51	$52	$53	$54	$55	$56	$57	$58	$59	$60	$61	$62
ENERGY STAR Refrigerator	$30	$30	$60	$61	$62	$63	$64	$65	$66	$67	$68	$69	$70	$71	$72	$73	$74	$75	$77	$79
ENERGY STAR 2-Speed Pool Pump	$300	$300	$300	$306	$312	$318	$324	$330	$337	$344	$351	$358	$365	$372	$379	$387	$395	$403	$411	$419
Residential Appliance Recycling																				
Refrigerator Recycle	$93	$93	$93	$91	$89	$87	$85	$83	$81	$79	$77	$75	$74	$73	$72	$71	$70	$69	$68	$67
Freezer Recycle	$93	$93	$93	$91	$89	$87	$85	$83	$81	$79	$77	$75	$74	$73	$72	$71	$70	$69	$68	$67
Residential High Efficiency HVAC																				
CAC SEER 15	$556	$556	$556	$567	$578	$590	$602	$614	$626	$639	$652	$665	$0	$0	$0	$0	$0	$0	$0	$0
CAC SEER 16	$834	$834	$834	$850	$867	$884	$902	$920	$938	$957	$976	$996	$664	$664	$664	$664	$664	$664	$664	$664
CAC SEER 17	$1,111	$1,111	$1,111	$1,134	$1,157	$1,180	$1,204	$1,228	$1,253	$1,278	$1,304	$1,330	$996	$996	$996	$996	$996	$996	$996	$996
Heat Pump SEER 15	$588	$588	$294	$300	$306	$312	$318	$324	$330	$337	$344	$351	$0	$0	$0	$0	$0	$0	$0	$0
Heat Pump SEER 16	$881	$881	$588	$599	$611	$623	$635	$648	$661	$674	$687	$701	$715	$729	$744	$759	$774	$789	$805	$821
Heat Pump SEER 17	$1,175	$1,175	$881	$899	$917	$935	$954	$973	$992	$1,012	$1,032	$1,053	$1,074	$1,095	$1,117	$1,139	$1,162	$1,185	$1,209	$1,233
Early Retirement HP SEER 16	$2,774	$2,774	$2,774	$2,829	$2,886	$2,944	$3,003	$3,063	$3,124	$3,186	$3,250	$3,315	$3,381	$3,449	$3,518	$3,588	$3,660	$3,733	$3,808	$3,884
Early Retirement HP SEER 17	$3,068	$3,068	$3,068	$3,129	$3,192	$3,256	$3,321	$3,387	$3,455	$3,524	$3,594	$3,666	$3,739	$3,814	$3,890	$3,968	$4,047	$4,128	$4,211	$4,295
Furnace Fan Motor	$97	$97	$97	$99	$101	$103	$105	$107	$109	$111	$113	$115	$117	$119	$121	$123	$125	$128	$131	$134
HE Bathroom Exhaust Fan	$44	$44	$44	$44	$45	$46	$47	$48	$49	$50	$51	$52	$53	$54	$55	$56	$57	$58	$59	$60
Programmable Thermostat	$30	$30	$30	$31	$32	$33	$34	$35	$36	$37	$38	$39	$40	$41	$42	$43	$44	$45	$46	$47
Whole House																				
Air Sealing	$272	$272	$272	$277	$283	$289	$295	$301	$307	$313	$319	$325	$332	$339	$346	$353	$360	$367	$374	$381
Faucet Aerator - Kitchen	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8
Faucet Aerator - Bathroom	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8	$8
Low Flow Showerhead	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12	$12
Water Heater Temperature Setback	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5	$5
Advanced Power Strip	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Water Heater Tank Wrap	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Hot Water Pipe Insulation	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
CFL (4 bulbs)	$7.20	$7.20	$6.00	$5.88	$5.76	$5.64	$5.52	$5.40	$5.28	$5.16	$5.04	$4.92	$4.84	$4.76	$4.68	$4.60	$4.52	$4.44	$4.36	$4.28
Attic Insulation	$588	$588	$588	$600	$612	$624	$636	$649	$662	$675	$689	$703	$717	$731	$746	$761	$776	$792	$808	$824
Low Income Weatherization	$1,200	$1,200	$1,200	$1,224	$1,248	$1,273	$1,298	$1,324	$1,350	$1,377	$1,405	$1,433	$1,462	$1,491	$1,521	$1,551	$1,582	$1,614	$1,646	$1,679
Low Income New Homes	$2,750	$2,750	$2,750	$2,805	$2,861	$2,918	$2,976	$3,036	$3,097	$3,159	$3,222	$3,286	$3,352	$3,419	$3,487	$3,557	$3,628	$3,701	$3,775	$3,851

Table 5-66 - Residential Measure Incremental Costs

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Small Business Lighting	1,300	1,300	1,300	1,300	1,300	1,200	1,200	1,200	1,200	1,200	1,100	1,100	1,100	1,100	1,100	1,100	1,000	1,000	1,000	1,000
C&I Custom Rebate	2,200	2,200	2,200	2,200	2,200	2,200	2,100	2,100	2,100	2,100	2,000	2,000	2,000	2,000	2,000	1,900	1,900	1,900	1,900	1,900
C&I Prescriptive																				
T5 Fixture	$30	$30	$30	$29	$28	$27	$26	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
High Performance T8	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20	$20
Low Wattage Fluorescent T8	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2	$2
High Bay Fluorescent Fixture T8	$225	$225	$225	$221	$217	$213	$209	$205	$201	$197	$193	$189	$185	$181	$177	$173	$170	$167	$164	$161
High Bay Fluorescent Fixture T5	$100	$100	$100	$98	$96	$94	$92	$90	$88	$86	$84	$82	$80	$78	$76	$74	$73	$72	$71	$70
CFLs	$2	$2	$2	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1	$1
LED Lamp	$40	$40	$40	$39	$38	$37	$36	$35	$34	$33	$32	$31	$30	$29	$28	$27	$26	$25	$25	$25
Exit Sign	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25	$25
Lighting Occupancy Sensors	$54	$54	$54	$53	$52	$51	$50	$49	$48	$47	$46	$45	$44	$43	$42	$41	$40	$39	$38	$37
CAC <65kBtuh	$300	$300	$300	$306	$312	$318	$324	$330	$337	$344	$351	$358	$365	$372	$379	$387	$395	$403	$411	$419
CAC 65 - 135 kBtuh	$1,490	$1,490	$1,490	$1,520	$1,550	$1,581	$1,613	$1,645	$1,678	$1,712	$1,746	$1,781	$1,817	$1,853	$1,890	$1,928	$1,967	$2,006	$2,046	$2,087
CAC 135 - 240 kBtuh	$2,220	$2,220	$2,220	$2,264	$2,309	$2,355	$2,402	$2,450	$2,499	$2,549	$2,600	$2,652	$2,705	$2,759	$2,814	$2,870	$2,927	$2,986	$3,046	$3,107
CAC 240 - 760 kBtuh	$2,878	$2,878	$2,878	$2,936	$2,995	$3,055	$3,116	$3,178	$3,242	$3,307	$3,373	$3,440	$3,509	$3,579	$3,651	$3,724	$3,798	$3,874	$3,951	$4,030
Split Package Heat Pump	$370	$370	$370	$377	$385	$393	$401	$409	$417	$425	$434	$443	$452	$461	$470	$479	$489	$499	$509	$519
Single System Heat Pump	$370	$370	$370	$377	$385	$393	$401	$409	$417	$425	$434	$443	$452	$461	$470	$479	$489	$499	$509	$519
Motor	$115	$115	$115	$117	$119	$121	$123	$125	$128	$131	$134	$137	$140	$143	$146	$149	$152	$155	$158	$161
VFD	$2,518	$2,518	$2,518	$2,568	$2,619	$2,671	$2,724	$2,778	$2,834	$2,891	$2,949	$3,008	$3,068	$3,129	$3,192	$3,256	$3,321	$3,387	$3,455	$3,524
Solid/Glass Door Refrigerator	$164	$164	$164	$167	$170	$173	$176	$180	$184	$188	$192	$196	$200	$204	$208	$212	$216	$220	$224	$228
Solid/Glass Door Freezer	$166	$166	$166	$169	$172	$175	$179	$183	$187	$191	$195	$199	$203	$207	$211	$215	$219	$223	$227	$232
Live Stock Waterer	$788	$788	$788	$803	$819	$835	$852	$869	$886	$904	$922	$940	$959	$978	$998	$1,018	$1,038	$1,059	$1,080	$1,102
Engine Block Timer	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Building Operator Certificate	$1,150	$1,150	$1,150	$1,173	$1,196	$1,220	$1,244	$1,269	$1,294	$1,320	$1,346	$1,373	$1,400	$1,428	$1,457	$1,486	$1,516	$1,546	$1,577	$1,609

Table 5-67 - Non-Residential Measure Incremental Costs

3.9 Sources and Quality of Information

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

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

Measure	Savings	Incremental Cost	Measure Life
CFL	ENERGY STAR/Illinois	Illinois	ENERGY STAR
LED	ENERGY STAR/Illinois	ENERGY STAR	ENERGY STAR
ENERGY STAR Indoor Fixture	ENERGY STAR/Illinois	ENERGY STAR	ENERGY STAR
ENERGY STAR Exterior Fixture	ENERGY STAR/Illinois	Illinois	ENERGY STAR
Efficient Nightlight	Penn	Michigan	Penn
ENERGY STAR Dehumidifier	ENERGY STAR/DOE	Illinois	ENERGY STAR
ENERGY STAR Clothes Washer	Illinois/ ENERGY STAR /DOE	ENERGY STAR	Illinois
ENERGY STAR Refrigerator	Illinois/ ENERGY STAR /DOE	Illinois/Estimate	New York
ENERGY STAR Dishwasher	ENERGY STAR /DOE	ENERGY STAR	Illinois
ENERGY STAR Room Air Conditioner	ENERGY STAR /DOE	ENERGY STAR/Michigan	Illinois
ENERGY STAR Pool Pumps	CEE Pool/ ENERGY STAR	NREL Pool	Ohio
ENERGY STAR Windows	Arkansas	Michigan	Arkansas
Refrigerator/Freezer Recycle	NMR	Michigan	Illinois
Room Air Conditioner Recycle	Arkansas/Ohio	Michigan	Illinois
Advanced Power Strip	NYSERDA	NYSERDA	NYSERDA
ENERGY STAR Computers	ENERGY STAR	ENERGY STAR	ENERGY STAR
ENERGY STAR Computer Monitor	ENERGY STAR	ENERGY STAR	ENERGY STAR
ENERGY STAR Ink Jet Printer	ENERGY STAR /NYSERDA	ENERGY STAR	ENERGY STAR
ENERGY STAR Laser Color Printer	ENERGY STAR /NYSERDA	ENERGY STAR	ENERGY STAR
Air Sealing	Illinois	PSC Colorado	Illinois
Attic Insulation	Illinois	PSC Colorado	Illinois
Wall Insulation	Illinois	PSC Colorado	Illinois
Duct Insulation	Arkansas	Michigan	Arkansas
Floor Insulation	Arkansas	Michigan	Arkansas
Faucet Aerators	Illinois	Illinois	Illinois
Low Flow Showerhead	Illinois	Illinois	Illinois
Central Air Conditioner Tune-Up	Illinois/ ENERGY STAR	Illinois	Mass
Central Air Conditioner Systems	New York/DOE/ENERGY STAR/Mass	Michigan	Illinois
ASHP Tune-Up	Illinois/ ENERGY STAR	Illinois	Mass
Heat Pump Systems	New York/DOE/ENERGY STAR/Mass	Michigan	Illinois
Ductless Mini-Split SEER 21	Mass/CT/DOE	Michigan	Mass
Geothermal	Illinois/ ENERGY STAR	Illinois/Ohio	Illinois
Heat Pump Water Heater	Illinois/Arkansas/DOE/ENERGY STAR	Michigan/Illinois	Illinois
Solar Water Heater	Penn	Michigan	Penn
Furnace Fan Motor	Illinois	Illinois	Illinois
Water Heater Temperature Setback	Illinois	Illinois	Illinois
HE Bathroom Exhaust Fan	Illinois	Illinois	Illinois
Water Heater Tank Wrap	Ohio	ACEEE	Ohio
Hot Water Pipe Insulation	Ohio/Arkansas	Ohio	Ohio
Whole House Fan	Penn	Michigan	Penn
Programmable Thermostat	New York/DOE/ ENERGY STAR /Mass	Illinois	Illinois

Table 5-68 - Residential End-Use Measure Documentation

Measure	Savings	Incremental Cost	Measure Life
T5 Fixture	Illinois	Illinois	Illinois
High Performance T8	Illinois	Illinois	Illinois
Low Wattage Fluorescent T8	Illinois	Illinois	Illinois
High Bay Fluorescent Fixture T8	Illinois	Illinois	Illinois
High Bay Fluorescent Fixture T5	Illinois	Illinois	Illinois
CFLs	Illinois	Illinois	Illinois
LED Lamp	Illinois	Illinois	Illinois
Exit Sign	PSC Colorado/Illinois	Michigan	Arkansas
Lighting Occupancy Sensors	Illinois	Illinois	Illinois
CAC <65kBtuh	Illinois/CEE	Michigan	Illinois
CAC 65 - 135 kBtuh	Illinois/CEE	Michigan	Illinois
CAC 135 - 240 kBtuh	Illinois/CEE	Michigan	Illinois
CAC 240 - 760 kBtuh	Illinois/CEE	Michigan	Illinois
CAC >760 kBtuh	Illinois/CEE	Michigan	Illinois
Split Package Heat Pump	Illinois/CEE	Michigan	Illinois
Single System Heat Pump	Illinois/CEE	Michigan	Illinois
Heat Pump 65 < 135 kBtuh	Illinois/CEE	Michigan	Illinois
Heat Pump 135 < 240 kBtuh	Illinois/CEE	Michigan	Illinois
Heat Pump >240 kBtuh	Illinois/CEE	Michigan	Illinois
Hotel Occupancy Sensors	Mass	Michigan	Mass
Electric Storage Water Heater	Illinois	Illinois	Illinois
Tankless Water Heater	Illinois	Illinois	Illinois
High Efficiency Furnace w/ ECM Motor	Illinois	Illinois	Illinois
Chiller	Arkansas/Michigan	Illinois	Illinois
Motor	Arkansas	Ohio	Ohio
VFD	Ohio	Ohio	Ohio
Solid Door Refrigerator	Illinois	Illinois	Illinois
Glass Door Refrigerator	Illinois	Illinois	Illinois
Solid Door Freezer	Illinois	Illinois	Illinois
Glass Door Freezer	Illinois	Illinois	Illinois
Live Stock Waterer	Illinois	Illinois	Illinois
Engine Block Timer	Illinois	Illinois	Illinois
High Volume Low Speed Fans	Illinois	Illinois	Illinois
High Speed Fans	Illinois	Illinois	Illinois

Table 5-69 - C&I End-Use Measure Documentation

AEG gathered the end-use measure data from multiple sources, including the sources below:

1. American Council for an Energy-Efficient Economy. Water Heating. http://aceee.org/consumer/water-heating

2. Connecticut Energy Efficiency Fund. Connecticut Program Savings Documentation for 2012 Program Year.

3. Consortium for Energy Efficiency (2011). Residential Swimming Pool Initiative (DRAFT); Consortium for Energy Efficiency (2012). Efficient Residential Swimming Pool Initiative (DRAFT).

4. Consortium for Energy Efficiency. High-Efficiency Commercial Air Conditioning and Heat Pump Initiative.

5. ENERGY STAR. Qualified Product Savings Calculator.

6. Frontier Associates, LLC (2010). Arkansas Comprehensive Programs Deemed Savings. Prepared by Nexant.

7. Mass Save (2010). Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures. 2011 Program Year.

8. Michigan Public Service Commission (2013). Michigan Energy Measures Database. Prepared by Morgan Marketing Partners.

9. NMR Group, Inc. (2011). Massachusetts Appliance Turn-In Program Impact Evaluation.

10. New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs (October 15, 2010).

11. NREL. Building America Retrofit Alliance. (2012). Measure Guideline: Replacing Single-Speed Pool Pumps with Variable Speed Pool Pumps for Energy Savings.

12. NYSERDA (2011). Advanced Power Strip Research Report. Prepared by Lockheed Martin and Energy Solutions.

13. Pennsylvania Utility Commission (June 2013). Technical Reference Manual. State of Pennyslvania Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards.

14. Public Service Company of Colorado. (2012). 2012/2013 Demand-Side Management Plan: Electric & Natural Gas. Docket No. 11A-631EG.

15. Public Utilities Commission of Ohio (2010). State of Ohio Energy Efficiency Technical Reference Manual. Prepared by Vermont Energy Investment Corporation.

16. State of Illinois. (2012). Energy Efficiency Technical Reference Manual.

17. U.S. Department of Energy. Building Technologies Program: Residential Products.

SECTION 4 DEVELOPMENT OF POTENTIAL DEMAND-SIDE RATES

(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 Review of Other Utilities' Demand-Side Rates

(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, including:

1. Cheryl Hindes. (November 8, 2012). BGE's Smart Energy Pricing Pilot. Presentation to the PLMA Panel.

2. Freeman, Sullivan & Co. (2011). 2010 California Statewide Non-Residential Critical Peak Pricing Evaluation. Prepared for SDGE.

3. Rick Voytas. (2006). AmerenUE Critical Peak Pricing Pilot.

4. Faruqui, A., et al. (2012). Dynamic Pricing of Electricity for Residential Customers: The Evidence from Michigan.

5. Faruqui, A., et al. (2012). Dynamic Pricing in a Moderate Climate: The Evidence from Connecticut.

6. Charles River Associates. (2005). Impact Evaluation of the California Statewide Pricing Pilot.

4.2 Identification of Demand-Side Rates

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

There are four common types of demand-side rates:

1. Time-of-Use: Customers pay a higher price during the designated peak period and lower prices during the off-peak. The designated peak and off-peak periods are typically defined by the season, day and time of day. For example, a peak period may be defined as 4 pm to 7 pm non-holiday weekdays.

2. Critical Peak Price: Customers pay higher peak period prices during the few days a year when wholesale prices are the highest and pay a discounted off-peak price for the remainder of the year.

3. Peak Time Rebate: Customers are paid for load reductions during a peak period. There is no rate discount during non-event hours.

4. 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.

AEG considered each of these demand-side rates in addition to a direct load control pilot for each major class, including residential, small C&I and large C&I.

Demand and energy reduction impacts result from a combination of the potential demand-side rate and the programmable thermostats. A residential programmable thermostat will achieve 0.35 kW savings and 382 kWh savings for a central air conditioner system and 1,101 kWh savings for a heat pump system. A non-residential programmable thermostat will achieve 0.59 kW savings and 442 kWh savings for a central air conditioner system and 815 kWh savings for a heat pump system. Programmable thermostats have a lifetime of 10 years. The C&I Interruptible Service Rider achieves 15,000 kWh savings.

Measure Category	Non-Coincident Peak kW
Residential Direct Load Control	1.352
Residential Peak Time Rebate	1.352
Residential Critical Peak Pricing	1.592
C&I Interruptible Service Rider	500
Small C&I Direct Load Control	1.987
Small C&I Critical Peak Pricing	2.387

Table 5-70 - Demand-Side Rate Energy and Demand Impacts per Unit

The demand-side rates were screened for cost-effectiveness as a stand-alone pilot program by the type of central cooling system (either central air conditioner or heat pump). Based on the Residential Appliance Saturation Survey, it was estimated that 70 percent of pilot participants would utilize a central air conditioner and 30 percent would utilize a heat pump. Pilot programs were bundled into the residential and non-residential portfolios to assess overall impacts. These stand-alone pilot programs were not found to be cost-effective until 2018 or later (i.e. a TRC benefit-cost ratio of at least 1.0).

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Program																				
Direct Load Control	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.00	1.04	1.07	1.10	1.14	1.18	1.22	1.26	1.30	1.34	1.39	1.44
Peak Time Rebate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.98	1.01	1.05	1.08	1.12	1.15	1.19	1.23	1.27	1.31	1.36	1.41	1.45
Critical Peak Pricing	n/a	n/a	n/a	n/a	n/a	n/a	0.98	1.02	1.05	1.08	1.12	1.16	1.19	1.23	1.27	1.31	1.36	1.40	1.45	1.50
Non-Residential Program																				
Interruptible Service Rider	11.71	14.87	18.03	29.21	40.57	51.71	62.93	64.60	66.33	68.08	69.84	71.58	73.43	75.28	77.17	79.15	81.09	83.11	85.26	87.40
Direct Load Control	n/a	n/a	n/a	n/a	n/a	1.08	1.16	1.20	1.24	1.28	1.32	1.36	1.40	1.44	1.49	1.54	1.58	1.64	1.69	1.75
Critical Peak Pricing	n/a	n/a	n/a	n/a	n/a	1.18	1.28	1.32	1.36	1.41	1.45	1.49	1.54	1.59	1.63	1.68	1.74	1.79	1.85	1.91

Table 5-71 - Demand-Side Rate Pilot Program TRC Benefit-Cost Ratio

4.3 Effects of Technological Advancement

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

Demand-side rates are most effective with the use of two-way communicating meters and programmable thermostats, allowing Empire to communicate with customers real-time. Two-way communicating meters, or smart meters, and programmable thermostats are not currently prevalent throughout Empire's territory making pilot programs more costly.

4.4 Assessment Input Data

(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:

4.4.1 Demand and Energy Reduction Impact

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

Demand and energy reduction impacts result from a combination of the potential demand-side rate and the programmable thermostats. A residential programmable thermostat will achieve 0.35 kW savings and 382 kWh savings for a central air conditioner system and 1,101 kWh savings for a heat pump system. A non-residential programmable thermostat will achieve 0.59 kW savings and 442 kWh savings for a central air conditioner system and 815 kWh savings for a heat pump system. Programmable thermostats have a lifetime of 10 years. The C&I Interruptible Service Rider achieves 15,000 kWh savings.

Measure Category	Non-Coincident Peak kW
Residential Direct Load Control	1.352
Residential Peak Time Rebate	1.352
Residential Critical Peak Pricing	1.592
C&I Interruptible Service Rider	500
Small C&I Direct Load Control	1.987
Small C&I Critical Peak Pricing	2.387

Table 5-72 - Demand-Side Rate Energy and Demand Impacts per Unit

4.4.2 Interaction of Multiple Demand-Side Rates

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 a stand-alone pilot program by the type of central cooling system (either central air conditioner or heat pump). Pilot programs were bundled into the residential and non-residential portfolios to assess overall impacts.

4.4.3 Interaction of Potential Demand-Side Rates and Programs

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

The interactions between potential demand-side rates and potential demand-side programs were assessed. The demand-side rate pilot programs were screened for cost-effectiveness as pilot programs bundled into the residential and non-residential portfolios.

4.4.4 Demand and Reduction Energy Savings

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 maximum achievable potential incremental and cumulative demand and energy savings due to the potential demand-side rate pilot programs can be found in the following tables.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	-	-	-	-	-	-	-	-	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924
Peak Time Rebate	-	-	-	-	-	-	-	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924
Critical Peak Pricing	-	-	-	-	-	-	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924	1,924
Non-Residential																				
Interruptible Service Rider	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81
Direct Load Control	-	-	-	-	-	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405
Critical Peak Pricing	-	-	-	-	-	405	405	405	405	405	405	405	405	405	405	405	405	405	405	405

Table 5-73 - Incremental Net Energy Savings (MWh)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	-	-	-	-	-	-	-	-	1,924	3,848	5,772	7,696	9,620	11,544	13,468	15,392	17,316	19,240	19,240	19,240
Peak Time Rebate	-	-	-	-	-	-	-	1,924	3,848	5,772	7,696	9,620	11,544	13,468	15,392	17,316	19,240	19,240	19,240	19,240
Critical Peak Pricing	-	-	-	-	-	-	1,924	3,848	5,772	7,696	9,620	11,544	13,468	15,392	17,316	19,240	19,240	19,240	19,240	19,240
Non-Residential																				
Interruptible Service Rider	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81	81
Direct Load Control	-	-	-	-	-	405	810	1,215	1,620	2,025	2,429	2,834	3,239	3,644	4,049	4,049	4,049	4,049	4,049	4,049
Critical Peak Pricing	-	-	-	-	-	405	810	1,215	1,620	2,025	2,429	2,834	3,239	3,644	4,049	4,049	4,049	4,049	4,049	4,049

Table 5-74 - Cumulative Lifetime Net Energy Savings (MWh)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	-	-	-	-	-	-	-	-	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Peak Time Rebate	-	-	-	-	-	-	-	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Critical Peak Pricing	-	-	-	-	-	-	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Non-Residential																				
Interruptible Service Rider	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Direct Load Control	-	-	-	-	-	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Critical Peak Pricing	-	-	-	-	-	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4

Table 5-75 - Incremental Net Coincident Demand Savings (MW)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	-	-	-	-	-	-	-	-	4.1	5.1	6.2	7.2	8.3	9.4	10.4	11.5	12.5	13.6	13.6	13.6
Peak Time Rebate	-	-	-	-	-	-	-	4.1	5.1	6.2	7.2	8.3	9.4	10.4	11.5	12.5	13.6	13.6	13.6	13.6
Critical Peak Pricing	-	-	-	-	-	-	4.8	5.8	6.9	8.0	9.0	10.1	11.1	12.2	13.3	14.3	14.3	14.3	14.3	14.3
Non-Residential																				
Interruptible Service Rider	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Direct Load Control	-	-	-	-	-	1.2	1.5	1.9	2.2	2.6	3.0	3.3	3.7	4.0	4.4	4.4	4.4	4.4	4.4	4.4
Critical Peak Pricing	-	-	-	-	-	1.4	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.2	4.6	4.6	4.6	4.6	4.6	4.6

Table 5-76 - Cumulative Lifetime Net Coincident Demand Savings (MW)

4.4.5 Cost of Demand-Side Rates

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 cost of incentives or financing to encourage participation in the potential demand-side rate pilot programs can be found in the table below. The incentives varied depending on the scenario analyzed, for example the realistic achievable potential scenario versus the maximum achievable potential scenario. The maximum achievable potential incentives by pilot program are shown in the table below.

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

AEG did not identify any costs to the customer for participating in a demand-side rate program. The maximum achievable potential cost to the utility of technology to implement the potential demand-side rate pilot programs can be found in the table below.

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

The maximum achievable potential utility's cost to administer the potential demand-side rate pilot programs can be found in the table below.

D. Other costs identified by the utility;

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

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

The maximum achievable potential incremental and cumulative participants, load impacts, utility costs and program participant costs can be found in in the tables below.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
Peak Time Rebate	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
Critical Peak Pricing	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15	$15
Non-Residential																				
Interruptible Service Rider	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Direct Load Control	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10
Critical Peak Pricing	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10	$10

Table 5-77 - Customer Incentive per Unit

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	$0	$0	$0	$0	$0	$0	$0	$0	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000
Peak Time Rebate	$0	$0	$0	$0	$0	$0	$0	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000
Critical Peak Pricing	$0	$0	$0	$0	$0	$0	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000	$45,000
Non-Residential																				
Interruptible Service Rider	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000
Direct Load Control	$0	$0	$0	$0	$0	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000
Critical Peak Pricing	$0	$0	$0	$0	$0	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000	$6,000

Table 5-78 - Total Customer Incentives by Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	$0	$0	$0	$0	$0	$0	$0	$0	$2,198,087	$2,198,087	$2,198,087	$2,198,087	$2,198,087	$2,198,087	$2,198,087	$2,198,087	$2,198,087	$2,198,087	$2,198,087	$2,198,087
Peak Time Rebate	$0	$0	$0	$0	$0	$0	$0	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820
Critical Peak Pricing	$0	$0	$0	$0	$0	$0	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820	$2,174,820
Non-Residential																				
Interruptible Service Rider	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688	$4,688
Direct Load Control	$0	$0	$0	$0	$0	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964	$480,964
Critical Peak Pricing	$0	$0	$0	$0	$0	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145	$457,145

Table 5-79 - Total Utility Administrative Costs

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control									3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Peak Time Rebate								3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Critical Peak Pricing							3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Non-Residential																				
Interruptible Service Rider	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Direct Load Control						600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Critical Peak Pricing						600	600	600	600	600	600	600	600	600	600	600	600	600	600	600

Table 5-80 - Incremental Participants by Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	-	-	-	-	-	-	-	-	3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000	27,000	30,000	33,000	36,000
Peak Time Rebate	-	-	-	-	-	-	-	3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000	27,000	30,000	33,000	36,000	39,000
Critical Peak Pricing	-	-	-	-	-	-	3,000	6,000	9,000	12,000	15,000	18,000	21,000	24,000	27,000	30,000	33,000	36,000	39,000	42,000
Non-Residential																				
Interruptible Service Rider	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Direct Load Control	-	-	-	-	-	600	1,200	1,800	2,400	3,000	3,600	4,200	4,800	5,400	6,000	6,600	7,200	7,800	8,400	9,000
Critical Peak Pricing	-	-	-	-	-	600	1,200	1,800	2,400	3,000	3,600	4,200	4,800	5,400	6,000	6,600	7,200	7,800	8,400	9,000

Table 5-81 - Cumulative Participants by Program

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	-	-	-	-	-	-	-	-	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Peak Time Rebate	-	-	-	-	-	-	-	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Critical Peak Pricing	-	-	-	-	-	-	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Non-Residential																				
Interruptible Service Rider	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Direct Load Control	-	-	-	-	-	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Critical Peak Pricing	-	-	-	-	-	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4

Table 5-82 - Incremental Net Coincident Demand Savings (MW)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential																				
Direct Load Control	-	-	-	-	-	-	-	-	4.1	5.1	6.2	7.2	8.3	9.4	10.4	11.5	12.5	13.6	13.6	13.6
Peak Time Rebate	-	-	-	-	-	-	-	4.1	5.1	6.2	7.2	8.3	9.4	10.4	11.5	12.5	13.6	13.6	13.6	13.6
Critical Peak Pricing	-	-	-	-	-	-	4.8	5.8	6.9	8.0	9.0	10.1	11.1	12.2	13.3	14.3	14.3	14.3	14.3	14.3
Non-Residential																				
Interruptible Service Rider	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Direct Load Control	-	-	-	-	-	1.2	1.5	1.9	2.2	2.6	3.0	3.3	3.7	4.0	4.4	4.4	4.4	4.4	4.4	4.4
Critical Peak Pricing	-	-	-	-	-	1.4	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.2	4.6	4.6	4.6	4.6	4.6	4.6

Table 5-83 - Cumulative Lifetime Net Coincident Demand Savings (MW)

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

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

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

The measure lifetime and gross energy and demand savings per unit are detailed above. AEG gathered the end-use measure data from multiple sources, including the sources below:

1. Cheryl Hindes. (November 8, 2012). BGE's Smart Energy Pricing Pilot. Presentation to the PLMA Panel.
2. Freeman, Sullivan & Co. (2011). 2010 California Statewide Non-Residential Critical Peak Pricing Evaluation. Prepared for SDGE.
3. Rick Voytas. (2006). AmerenUE Critical Peak Pricing Pilot.
4. ENERGY STAR. Qualified Product Savings Calculator.
5. New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs (October 15, 2010).
6. State of Illinois. (2012). Energy Efficiency Technical Reference Manual.

SECTION 5 POTENTIAL DEMAND-SIDE PROGRAM AND RATE 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.

The demand-side program cost-effectiveness evaluation design process began by developing a comprehensive list of energy measures and screening the measures for cost-effectiveness (i.e. a Total Resource Cost (TRC) benefit-cost ratio of at least 1.0).

The list of measures, as well as energy and demand impacts, were developed using a variety of sources, including Empire's historic DSM programs, the 2008 Residential Management Survey and the 2010 Commercial and Industrial Baseline study as well as ENERGY STAR, the Consortium for Energy Efficiency and regional and national sources. The list of measures screened for cost-effectiveness is shown in the tables below.

End-Use Category	Baseline Measure	End-Use Measure
Lighting	Incandescent	CFL
Lighting	Incandescent	LED
Lighting	Incandescent	ENERGY STAR Indoor Fixture
Lighting	Incandescent	ENERGY STAR Exterior Fixture
Lighting	Incandescent	Efficient Nightlight
Appliances	Standard Dehumidifier	ENERGY STAR Dehumidifier
Appliances	Standard Clothes Washer	ENERGY STAR Clothes Washer
Appliances	Standard Refrigerator	ENERGY STAR Refrigerator
Appliances	Standard Dishwasher	ENERGY STAR Dishwasher
Appliances	Standard Room Air Conditioner	ENERGY STAR Room Air Conditioner
Appliances	Single Speed Pool Pump	ENERGY STAR 2-Speed Pool Pump
Appliances	Single Speed Pool Pump	ENERGY STAR Variable Speed Pool Pump
Appliances	Single-Pane Window	ENERGY STAR Window
Appliances	Old Refrigerator	Refrigerator Recycle
Appliances	Old Freezer	Freezer Recycle
Appliances	Old Room Air Conditioner	Room Air Conditioner Recycle
Electronic	Standard Power Strip	Advanced Power Strip
Electronic	Standard Desktop Computer	ENERGY STAR Desktop Computer
Electronic	Standard Laptop Computer	ENERGY STAR Laptop Computer
Electronic	Standard Computer Monitor	ENERGY STAR Computer Monitor
Electronic	Standard Ink Jet Printer	ENERGY STAR Ink Jet Printer
Electronic	Standard Laser Color Printer	ENERGY STAR Laser Color Printer
Insulation/Shell	No Air Sealing	Air Sealing
Insulation/Shell	Attic Insulation, R=5	Attic Insulation
Insulation/Shell	Wall Insulation, R=5	Wall Insulation
Insulation/Shell	No Duct Insulation	Duct Insulation
Insulation/Shell	No Floor Insulation	Floor Insulation
Space Cooling	No Tune-Up	Central Air Conditioner Tune-Up
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 15
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 16
Space Cooling	Central Air Conditioner SEER 13	Central Air Conditioner SEER 17
Space Cooling	Central Air Conditioner SEER 10	Early Retirement Central Air Conditioner SEER 16
Space Cooling	Central Air Conditioner SEER 10	Early Retirement Central Air Conditioner SEER 17
Space Heating	No Tune-Up	ASHP Tune-Up
Space Heating	Heat Pump SEER 13	Heat Pump SEER 15
Space Heating	Heat Pump SEER 13	Heat Pump SEER 16
Space Heating	Heat Pump SEER 13	Heat Pump SEER 17
Space Heating	Heat Pump SEER 10	Early Retirement HP SEER 16
Space Heating	Heat Pump SEER 10	Early Retirement HP SEER 17
Space Heating	Standard Ductless Mini-Split	Ductless Mini-Split SEER 21
Space Heating	Heat Pump SEER 13	Geothermal EER ≥17
Space Heating	Heat Pump SEER 13	Geothermal EER ≥21
Space Cooling/Heating	No Programmable Thermostat	Programmable Thermostat
HVAC	No Faucet Aerator	Faucet Aerator
HVAC	No Low Flow Showerhead	Low Flow Showerhead
HVAC	Standard Electric Water Heater	Heat Pump Water Heater
HVAC	Standard Electric Water Heater	Solar Water Heater

End-Use Category	Baseline Measure	End-Use Measure
HVAC	Thermostat Setting ≥ 120 degrees	Water Heater Temperature Setback
HVAC	No Water Heater Tank Wrap	Water Heater Tank Wrap
HVAC	No Hot Water Pipe Insulation	Hot Water Pipe Insulation
HVAC	Non-BPM Blower Motor	Furnace Fan Motor
HVAC	Standard Exhaust-Only Ventilation Fan	HE Bathroom Exhaust Fan
HVAC	No Whole House Fan	Whole House Fan

Table 5-84 - Residential Measures Screened

End-Use Category	Baseline Measure	End-Use Measure
Lighting	Standard T8 Fixture	T5 Fixture
Lighting	Standard T8 Fixture	High Performance T8
Lighting	Standard T8 Fixture	Low Wattage Fluorescent T8
Lighting	Metal Halide	High Bay Fluorescent Fixture T8
Lighting	Metal Halide	High Bay Fluorescent Fixture T5
Lighting	Incandescent	CFLs
Lighting	Incandescent	LED Lamp
Lighting	Incandescent Exit Sign	Exit Sign
Lighting	No Occupancy Sensors	Lighting Occupancy Sensors
HVAC	Standard Central Air Conditioner	Central Air Conditioner, SEER 14 (<65kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 11.5 (65 - 135 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 11.5 (135 - 240 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 10.3 (240 - 760 kBtuh)
HVAC	Standard Central Air Conditioner	Central Air Conditioner, EER 9.7 (>760 kBtuh)
HVAC	Standard Split Package Heat Pump	Split Package Heat Pump, SEER 14
HVAC	Standard Single System Heat Pump	Single System Heat Pump, SEER 14
HVAC	Standard Heat Pump	Heat Pump, EER 11.1 (65 < 135 kBtuh)
HVAC	Standard Heat Pump	Heat Pump, EER 10.7 (135 < 240 kBtuh)
HVAC	Standard Heat Pump	Heat Pump, EER 10.1 (>240 kBtuh)
HVAC	No Occupancy Sensors	Hotel Occupancy Sensors
HVAC	Standard Electric Water Heater	Electric Storage Water Heater
HVAC	Standard Electric Water Heater	Tankless Water Heater
HVAC	Standard Furnace, AFUE 90 percent	High Efficiency Furnace w/ ECM Motor
HVAC	Standard Chiller	Chiller
Motors	Shaded Pole Motor	Motor
Motors	Constant Speed Motor	VFD
Refrigeration	Standard Refrigerator	Solid Door Refrigerator
Refrigeration	Standard Refrigerator	Glass Door Refrigerator
Refrigeration	Standard Freezer	Solid Door Freezer
Refrigeration	Standard Freezer	Glass Door Freezer
Agriculture	Electric Open Waterer	Live Stock Waterer
Agriculture	Manual Engine Block Heater	Engine Block Timer
Agriculture	Multiple Non- HVLS Fans	High Volume Low Speed Fans
Agriculture	Standard Fan	High Speed Fans

Table 5-85 - C&I Measures Screened

AEG gathered Empire's economic data and technical data for the energy efficiency measures identified. Energy and demand impacts for each energy efficiency measure 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 was the primary method of assessing the cost-effectiveness of energy-efficient measures and programs. The TRC test is a widely-accepted methodology that has been used across the United States for over twenty-five years. TRC measures the net costs and benefits of an energy efficiency program as a resource option based on the total costs of the program, including both the participant's and the utility's costs. This test represents the combination of the effects of a program on both participating and non-participating customers.

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

1. Participant Cost Test quantifies the benefits and costs to the customer due to program participation.

2. Ratepayer Impact Measure (RIM) Cost Test measures what happens to a customer's rates due to changes in utility revenues and operating costs.

3. Utility Cost Test measures the net costs of a program as a resource option based on the costs incurred by the program administrator, excluding any net costs incurred by the participant.

4. Societal Cost Test measures the effects of a program on society as a whole.

The cost-effectiveness analysis was performed using Empire-specific data. The software used to perform the benefit-cost screening has been adapted from Minnesota Office of Energy Security "BenCost" software and is consistent with the California Standard Practice Manual. The input data gathered for the model included:

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)	Project Life (Years)
Environmental Damage Cost ($/kWh)	kWh/Participant Saved (Net and Gross)
Discount Rate (percent)	kW/Participant Saved (Net and Gross)
Growth Rate (percent)	Number of Participants
Line Losses (percent)	
Load Shapes	

Table 5-86 - Cost-Effectiveness Model Inputs

Empire provided commodity costs for four scenarios:

1. Base CO_2 assumes no carbon cost.
2. Moderate CO_2 assumes carbon allowances in 2021.
3. High CO_2 assumes carbon allowances in 2015.
4. Weighted CO_2 is a weighted average of the three commodity cost scenarios, assuming 50 percent Base CO_2, 40 percent Moderate CO_2 and 10 percent High CO_2.

Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income weatherization and low-income new homes programs, the programs were designed to be cost-effective. Measures were bundled based on the end-use, sector and implementation.

Residential Energy Efficiency Programs	
Residential Products Program	– CFL Bulbs – LED Bulbs – ENERGY STAR Fixtures (Interior and Exterior) – Efficient Nightlight – ENERGY STAR Dehumidifier – ENERGY STAR Refrigerator – ENERGY STAR 2-Speed Pool Pump – ENERGY STAR Electronics (desktop computer, laptop, computer monitor, ink jet printer, laser color copier)
Appliance Recycling	Recycle inefficient refrigerator, freezer or room air conditioner.
High Efficiency HVAC	– Central Air Conditioners (SEER 15, 16 and 17) – Central Air Conditioner Early Retirement (SEER 16 and 17) – Air Source Heat Pump Tune-Up – Air Source Heat Pump (SEER 15, 16 and 17) – Air Source Heat Pump Early Retirement (SEER 16 and 17) – Geothermal (EER 21) – Furnace Fan Motor – High Efficiency Bathroom Exhaust Fan – Programmable Thermostat
Whole House Efficiency	The program has two components: 5) Direct Install. The customer receives a free audit as well as air sealing, faucet aerators, low flow showerhead, water heater temperature setback, advanced power strip, water heater tank wrap, hot water pipe insulation, and CFL bulbs. 6) Insulation. Customer incentives available for installing attic and wall insulation and ENERGY STAR Windows.
Low Income Weatherization	Supplements the federal Low Income Weatherization Assistance Program, reducing energy costs for eligible low income homeowners and renters through increased home efficiency.
Low Income New Homes	Customers receive up to $1,500 for qualifying efficiency improvements.
School Energy Education Program	Offers classroom activities and a kit of low-cost energy efficiency and water conservation products to 6th grade students within the Empire service territory.
Commercial Energy Efficiency Programs	
Small Business Lighting	Small commercial customers will receive incentives up to 70 percent of installed lighting equipment costs.
C&I Energy Efficiency Rebate	Customers receive up to $20,000 for prescriptive or custom equipment installed.
Building Operator Certificate	Incentive for building equipment and processes training and certification.

Table 5-87 - Energy Efficiency Portfolio

AEG considered several energy efficiency portfolios based on the cost-effective measures.

1. Planned Portfolio. The realistically achievable portfolio that Empire proposes implementing for program years 2013 through 2015. The Planned Portfolio was analyzed utilizing the Base CO_2, Moderate CO_2 and High CO_2 avoided costs.

2. RAP+. Alternative demand-side portfolio designed to represent one-third of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

3. RAP++. Alternative demand-side portfolio designed to represent two-thirds of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

4. Moderate Portfolio. Alternative demand-side portfolio designed to achieve 1 percent incremental energy and demand savings by 2015.

5. Aggressive Portfolio. Alternative demand-side portfolio designed to achieve 2 percent incremental energy and demand savings by 2020.

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

7. Missouri Energy Efficiency Investment Act of 2009 (MEEIA) Portfolio. Alternative demand-side portfolio designed to achieve the MEEIA energy and demand savings goals, as outlined in 4 CSR 240-20.094. The portfolio is considered the maximum achievable potential.

5.1 Demand-Side Program and Rate Benefits

(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.

5.1.1 Avoided Demand Cost

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

Empire developed its avoided demand costs with input from its IRP Stakeholder Advisory Group. The Avoided Demand Cost is comprised of values for generation, transmission, and distribution. With input from the Stakeholder Group, Empire began with $10/kW as the avoided generation cost, and increased that to $20/kW by 2015 and then trended this to the levelized carrying cost of an installed simple-cycle combustion turbine by 2019. In 2020 and beyond, Empire continued to use the levelized carrying cost of a simple-cycle combustion turbine escalated at the rate of inflation. For the transmission cost component of the avoided demand cost, Empire used the levelized carrying cost of the estimated transmission cost to interconnect a simple-cycle combustion turbine. After reviewing the avoided distribution costs used in the compliance filings of other utilities, internal discussions and discussions with its IRP Advisory Group, Empire determined that the avoided distribution costs for demand-side screening purposes for its system would be close to zero. The graph below illustrates the projections for price ($/kW) over the 20-year planning horizon that Ventyx developed as assumptions for avoided demand costs. The subsequent chart details the assumptions for generation, transmission, and distribution that comprised the avoided demand cost ($/kW).

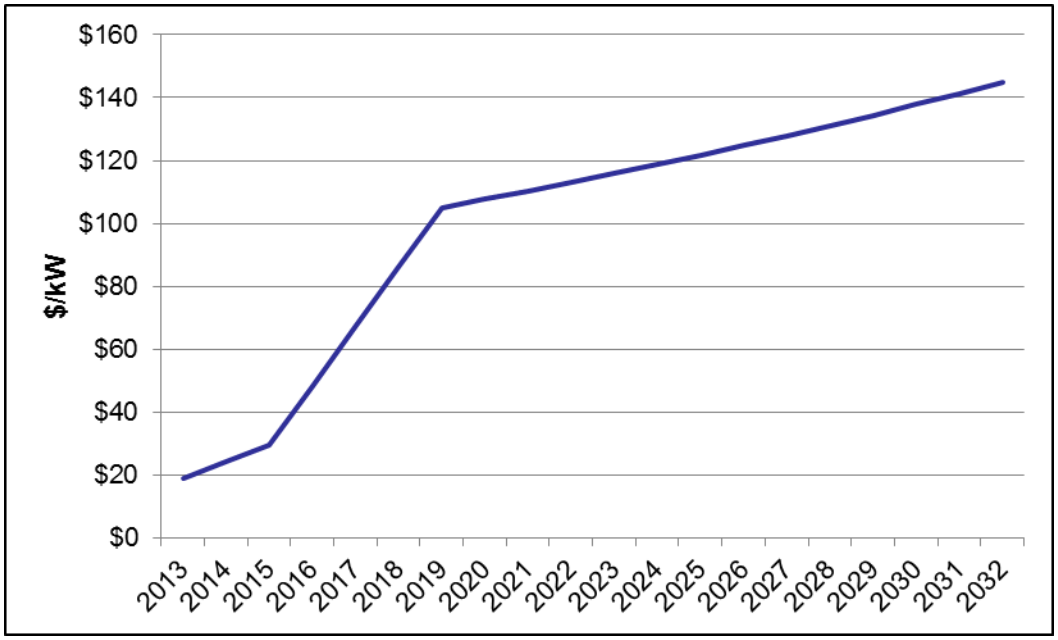


Figure 5-44 - Forecasted Electricity Market Price ($/kW)
Over the 20-Year Planning Horizon

	Year	Generation * $/KW/Yr	Transmission $/KW/Yr	Distribution $/KW/Yr	Total $/KW/Yr
1	2013	10.00	8.86	-	18.86
2	2014	15.00	9.08	-	24.08
3	2015	20.00	9.31	-	29.31
4	2016	38.68	9.54	-	48.22
5	2017	57.36	9.78	-	67.14
6	2018	76.03	10.02	-	86.06
7	2019	94.71	10.27	-	104.99
8	2020	97.08	10.53	-	107.61
9	2021	99.51	10.80	-	110.30
10	2022	101.99	11.06	-	113.06
11	2023	104.54	11.34	-	115.89
12	2024	107.16	11.63	-	118.78
13	2025	109.84	11.92	-	121.75
14	2026	112.58	12.21	-	124.80
15	2027	115.40	12.52	-	127.92
16	2028	118.28	12.83	-	131.11
17	2029	121.24	13.15	-	134.39
18	2030	124.27	13.48	-	137.75
19	2031	127.38	13.82	-	141.20
20	2032	130.56	14.16	-	144.72

5.1.2 Avoided Energy Cost

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

Empire engaged Ventyx to develop its avoided energy costs. Upon the input of Empire's IRP Stakeholder Advisory Group, it was decided that Empire would utilize market prices as the avoided energy cost. Ventyx created a forward view of the SPP-KSMO regional electricity market, which includes the Empire generation portfolio. The database uses publicly available information through 2022 and is further extrapolated to 2032 using general trends for prices, demand growth and resource expansion. The forward view is a proprietary perspective of the future based on public or commercial information and experience in working in electricity markets. This fundamental approach relies on first identifying the basic components of electricity price: supply, transmission and demand, and, using best available sources, project the components over time and geography. Supply is disaggregated into types of generation, and further disaggregated into fuels (or drivers), operations of the resources (capacity, heat rates, planned outages, and forced outages), the amount of additions (and retirements) over time and other factors such as emissions from power generation. Demand is the demand for electricity by zone (187 zones in North America). Monthly peak and energy demand is forecast over a ten year period. Then, reference hourly demand of electricity is applied to forecasts to produce forecasts of hourly demand by region. Empire used these market prices, with input of its Stakeholder Advisory Group as basis for its DSM Potential Study, and subsequently its preferred DSM portfolio. The graph below illustrates Empire's assumptions for avoided energy costs ($/MWh), for each of the four avoided probable environmental cost scenarios (Base, Moderate, High, and a Weighted average of the three). The Base, Moderate, High and Weighted avoided energy cost with probable environmental costs are shown in the following figure.

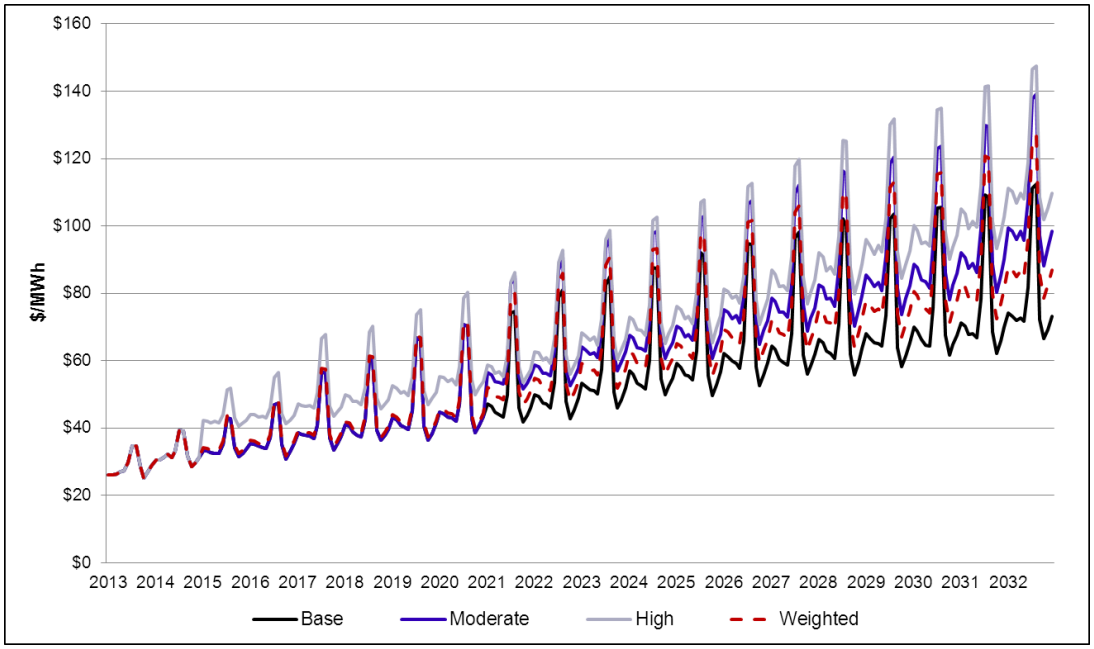


Figure 5-45 - Forecasted Energy Costs ($/MWh) for the Four Avoided Probable Environmental Cost Scenarios

5.1.3 Avoided Environmental Cost

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

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

1. Base avoided environmental cost scenario: Assumes there will not be a CO_2 tax during the 20-year planning horizon

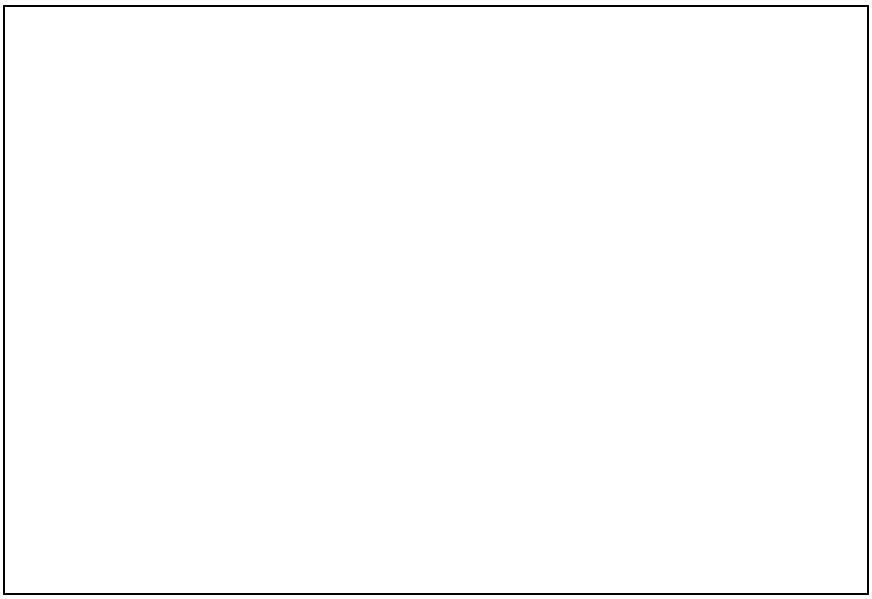
2. Moderate avoided environmental cost scenario: Assumes there will be a CO_2 tax beginning in 2021.

3. High avoided environmental cost scenario: Assumes there will be a CO_2 tax beginning in 2015

4. Weighted avoided environmental cost scenario: Assumes a weighted average of the three environmental cost scenarios with a 50-percent probability placed on the Base avoided probable environmental cost scenario, a 40-percent

probability placed on the Moderate avoided probable environmental cost scenario and a 10-percent probability placed on the High avoided probable environmental cost scenario.

Projections of price for CO_2 ($/ton) for the Base, Moderate, and High avoided probable environmental cost scenarios is illustrated in the graph below.



****Highly Confidential in its Entirety****
Figure 5-46 - Projections of Price for CO2 ($/ton) for the Base, Moderate, and High Avoided Probable Environmental Cost Scenarios

Empire used these assumptions about CO_2 prices combined with the previously-described assumptions about avoided demand costs and avoided energy costs to create the following graphs, which illustrate Empire's assumptions for avoided energy costs for each of the avoided probable environmental cost scenarios. The following graph illustrates Empire's assumptions for the avoided energy costs ($/MWh) for the Base avoided probable environmental cost scenario.

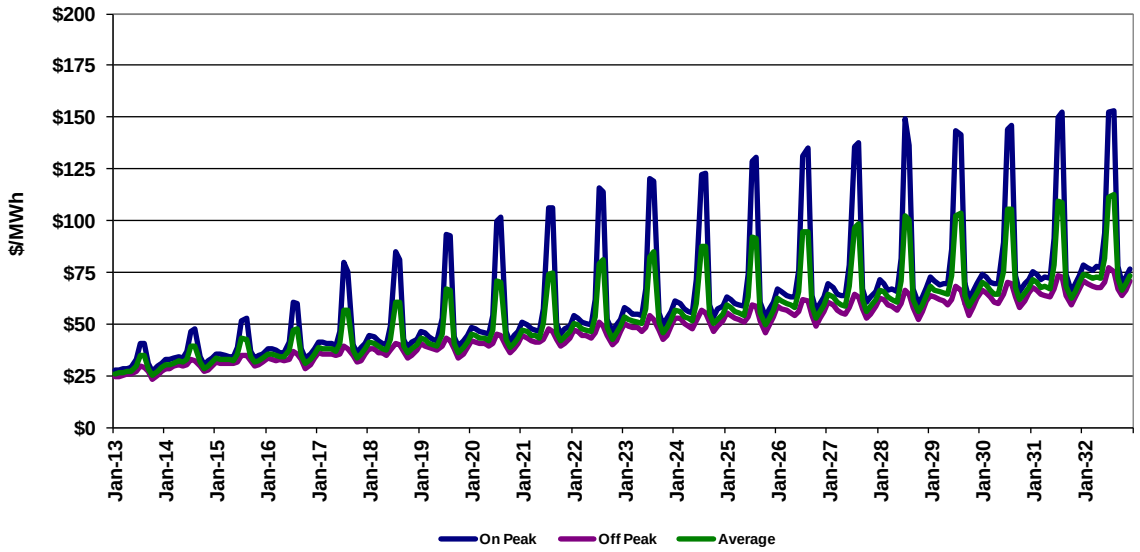


Figure 5-47 - Empire's Assumptions for Avoided Energy Costs for the Base Avoided Probable Environmental Cost Scenario

The following graph illustrates Empire's assumptions for the avoided energy costs ($/MWh) for the Moderate avoided probable environmental cost scenario.

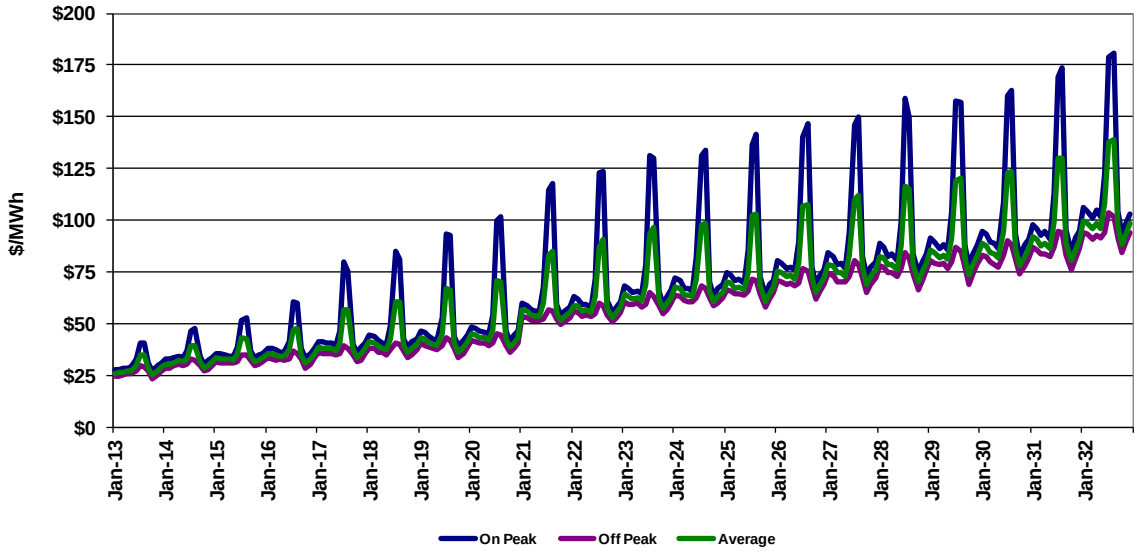


Figure 5-48 - Empire's Assumptions for the Avoided Energy Costs ($/MWh) for the Moderate Avoided Probable Environmental Cost Scenario

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

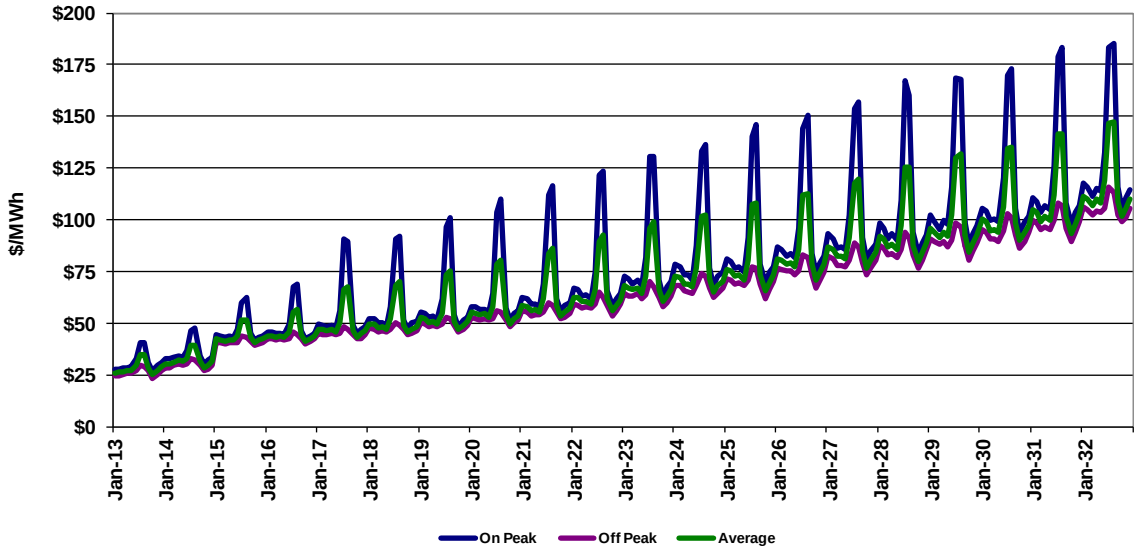


Figure 5-49 - Empire's Assumptions for the Avoided Energy Costs ($/MWh) for the High Avoided Probable Environmental Cost Scenario

5.2 Cost Effectiveness

(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—

5.2.1 Demand-Side Program Costs

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

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

Program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Program																				
Residential Products Program	$1,066,492	$1,002,826	$885,972	$834,888	$765,880	$702,546	$644,424	$591,085	$124,211	$114,590	$105,714	$97,526	$89,972	$85,586	$78,982	$72,913	$67,449	$62,394	$57,837	$53,611
Residential Appliance Recycling	$121,215	$141,353	$157,683	$169,332	$155,091	$142,039	$130,076	$119,114	$125,107	$114,548	$104,872	$96,008	$88,260	$89,457	$82,235	$75,594	$69,489	$63,875	$58,714	$53,968
Residential High Efficiency HVAC	$836,738	$921,185	$952,808	$1,013,048	$949,506	$890,060	$834,507	$782,303	$777,426	$729,065	$683,597	$641,087	$335,293	$368,529	$342,270	$317,877	$295,233	$274,353	$254,993	$236,992
Whole House	$764,810	$706,065	$651,833	$604,598	$561,672	$520,944	$483,924	$448,983	$625,809	$581,493	$539,662	$501,595	$468,630	$435,520	$404,878	$376,373	$349,343	$324,837	$302,034	$280,412
Low Income Weatherization	$714,000	$659,158	$608,528	$568,397	$530,840	$495,934	$463,259	$432,877	$404,430	$377,969	$353,344	$330,272	$308,794	$288,667	$269,925	$252,358	$235,996	$220,747	$206,449	$193,122
Low Income New Homes	$15,121	$13,960	$12,887	$12,384	$11,636	$10,933	$10,273	$9,655	$9,075	$8,529	$8,015	$7,532	$7,080	$6,655	$6,255	$5,880	$5,527	$5,196	$4,885	$4,593
School Kits	$47,211	$43,584	$40,237	$37,146	$34,293	$31,659	$29,227	$26,982	$24,910	$22,997	$21,230	$19,599	$18,094	$16,704	$15,421	$14,237	$13,143	$12,134	$11,202	$10,341
Non-Residential Program																				
Small Business Lighting	$1,338,299	$1,235,505	$1,039,283	$959,456	$885,761	$797,609	$736,345	$679,786	$627,572	$579,369	$521,377	$481,330	$444,360	$410,229	$378,719	$349,630	$314,423	$290,273	$267,977	$247,394
C&I Custom Rebate	$77,352	$95,214	$109,876	$116,323	$107,388	$99,140	$87,365	$80,654	$74,459	$68,740	$60,438	$55,796	$51,510	$47,554	$43,901	$38,503	$35,545	$32,815	$30,295	$27,968
C&I Prescriptive	$398,589	$406,794	$435,926	$398,550	$364,418	$333,189	$304,641	$278,755	$255,292	$233,801	$214,114	$196,079	$174,632	$159,879	$146,374	$134,007	$122,933	$112,776	$103,817	$95,581
Building Operator Certificate	$39,891	$55,240	$67,996	$63,859	$59,957	$56,317	$52,883	$49,678	$46,654	$43,830	$41,165	$38,676	$36,326	$34,130	$32,077	$30,138	$28,324	$26,611	$25,009	$23,508
Interruptible Service Rider	$2,640	$2,437	$2,250	$2,077	$1,918	$1,770	$1,634	$1,509	$1,393	$1,286	$1,187	$1,096	$1,012	$934	$862	$796	$735	$679	$626	$578

Table 5-88 - Total Resource Cost Test Program Costs

5.2.2 Demand-Side Rate Costs

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

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

5.2.3 Costs Not to Include

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.

5.3 Cost Comparisons

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

5.3.1 Test Costs

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

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

Program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Program																				
Residential Products Program	$906,092	$847,338	$792,264	$640,934	$591,704	$546,255	$504,298	$465,563	$62,908	$58,076	$53,615	$49,497	$45,695	$44,786	$41,346	$38,170	$35,239	$32,532	$30,033	$27,726
Residential Appliance Recycling	$93,665	$109,226	$121,844	$131,880	$121,750	$112,399	$103,765	$95,795	$101,443	$93,651	$86,458	$79,817	$73,686	$75,003	$69,242	$63,924	$59,014	$54,481	$50,296	$46,433
Residential High Efficiency HVAC	$561,960	$618,397	$678,353	$706,180	$651,938	$601,863	$555,634	$512,957	$498,612	$460,314	$424,957	$392,317	$210,730	$232,801	$214,920	$198,412	$183,172	$169,102	$156,114	$144,123
Whole House	$1,138,410	$1,050,969	$970,245	$895,721	$835,082	$770,940	$718,680	$663,478	$927,667	$864,623	$798,211	$743,898	$698,530	$650,839	$606,353	$564,862	$521,475	$485,752	$452,440	$417,689
Low Income Weatherization	$294,000	$271,418	$250,571	$231,324	$213,556	$197,153	$182,010	$168,030	$155,124	$143,209	$132,209	$122,054	$112,679	$104,024	$96,034	$88,658	$81,848	$75,561	$69,758	$64,400
Low Income New Homes	$7,371	$6,805	$6,282	$7,250	$6,693	$6,179	$5,704	$5,266	$4,861	$4,488	$4,143	$3,825	$3,531	$3,260	$3,010	$2,778	$2,565	$2,368	$2,186	$2,018
School Kits	$47,211	$43,584	$40,237	$37,146	$34,293	$31,659	$29,227	$26,982	$24,910	$22,997	$21,230	$19,599	$18,094	$16,704	$15,421	$14,237	$13,143	$12,134	$11,202	$10,341
Non-Residential Program																				
Small Business Lighting	$1,558,118	$1,438,440	$1,226,631	$1,132,414	$1,045,434	$965,135	$891,003	$822,566	$759,385	$701,057	$647,209	$597,497	$551,604	$509,235	$470,121	$434,012	$400,675	$369,900	$341,488	$315,258
C&I Custom Rebate	$44,352	$54,594	$63,001	$116,323	$107,388	$99,140	$87,365	$80,654	$74,459	$68,740	$60,438	$55,796	$51,510	$47,554	$43,901	$38,503	$35,545	$32,815	$30,295	$27,968
C&I Prescriptive	$231,007	$235,430	$252,489	$233,096	$215,192	$198,663	$183,404	$170,162	$157,092	$145,025	$133,886	$123,602	$94,844	$87,559	$80,833	$74,625	$68,893	$63,601	$58,716	$54,206
Building Operator Certificate	$22,641	$31,352	$38,592	$35,628	$32,892	$30,365	$28,033	$25,880	$23,892	$22,057	$20,363	$18,799	$17,355	$16,022	$14,791	$13,655	$12,606	$11,638	$10,744	$9,919
Interruptible Service Rider	$17,640	$16,285	$15,034	$13,879	$12,813	$11,829	$10,921	$10,082	$9,307	$8,593	$7,933	$7,323	$6,761	$6,241	$5,762	$5,319	$4,911	$4,534	$4,185	$3,864

Table 5-89 - Utility Cost Test Costs

5.3.2 Costs Not to Include

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

The utility cost test did not include lost revenues.

5.3.3 Rate of Return or Incentive Costs

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

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

5.4 Cost Test Benefit - Cost Ratio

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

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

5.5 Results

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

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

Program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Program																				
Residential Products Program	$1,066,492	$1,002,826	$885,972	$834,888	$765,880	$702,546	$644,424	$591,085	$124,211	$114,590	$105,714	$97,526	$89,972	$85,586	$78,982	$72,913	$67,449	$62,394	$57,837	$53,611
Residential Appliance Recycling	$121,215	$141,353	$157,683	$169,332	$155,091	$142,039	$130,076	$119,114	$125,107	$114,548	$104,872	$96,008	$88,260	$89,457	$82,235	$75,594	$69,489	$63,875	$58,714	$53,968
Residential High Efficiency HVAC	$836,738	$921,185	$952,808	$1,013,048	$949,506	$890,060	$834,507	$782,303	$777,426	$729,065	$683,597	$641,087	$335,293	$368,529	$342,270	$317,877	$295,233	$274,353	$254,993	$236,992
Whole House	$764,810	$706,065	$651,833	$604,598	$561,672	$520,944	$483,924	$448,983	$625,809	$581,493	$539,662	$501,595	$468,630	$435,520	$404,878	$376,373	$349,343	$324,837	$302,034	$280,412
Low Income Weatherization	$714,000	$659,158	$608,528	$568,397	$530,840	$495,934	$463,259	$432,877	$404,430	$377,969	$353,344	$330,272	$308,794	$288,667	$269,925	$252,358	$235,996	$220,747	$206,449	$193,122
Low Income New Homes	$15,121	$13,960	$12,887	$12,384	$11,636	$10,933	$10,273	$9,655	$9,075	$8,529	$8,015	$7,532	$7,080	$6,655	$6,255	$5,880	$5,527	$5,196	$4,885	$4,593
School Kits	$47,211	$43,584	$40,237	$37,146	$34,293	$31,659	$29,227	$26,982	$24,910	$22,997	$21,230	$19,599	$18,094	$16,704	$15,421	$14,237	$13,143	$12,134	$11,202	$10,341
Non-Residential Program																				
Small Business Lighting	$1,338,299	$1,235,505	$1,039,283	$959,456	$885,761	$797,609	$736,345	$679,786	$627,572	$579,369	$521,377	$481,330	$444,360	$410,229	$378,719	$349,630	$314,423	$290,273	$267,977	$247,394
C&I Custom Rebate	$77,352	$95,214	$109,876	$116,323	$107,388	$99,140	$87,365	$80,654	$74,459	$68,740	$60,438	$55,796	$51,510	$47,554	$43,901	$38,503	$35,545	$32,815	$30,295	$27,968
C&I Prescriptive	$398,589	$406,794	$435,926	$398,550	$364,418	$333,189	$304,641	$278,755	$255,292	$233,801	$214,114	$196,079	$174,632	$159,879	$146,374	$134,007	$122,933	$112,776	$103,817	$95,581
Building Operator Certificate	$39,891	$55,240	$67,996	$63,859	$59,957	$56,317	$52,883	$49,678	$46,654	$43,830	$41,165	$38,676	$36,326	$34,130	$32,077	$30,138	$28,324	$26,611	$25,009	$23,508
Interruptible Service Rider	$2,640	$2,437	$2,250	$2,077	$1,918	$1,770	$1,634	$1,509	$1,393	$1,286	$1,187	$1,096	$1,012	$934	$862	$796	$735	$679	$626	$578

Table 5-90 - Total Resource Cost Test Program Costs

Program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Program																				
Residential Products Program	$1,428,970	$1,488,629	$1,007,250	$1,049,176	$1,044,543	$1,024,621	$1,000,654	$970,991	$190,050	$181,987	$173,976	$166,080	$158,413	$153,964	$146,699	$139,807	$133,251	$127,095	$121,277	$115,766
Residential Appliance Recycling	$127,009	$162,782	$197,672	$232,118	$230,646	$225,919	$219,753	$211,959	$233,792	$224,576	$215,104	$205,362	$195,877	$207,026	$197,085	$187,685	$178,814	$170,490	$162,665	$155,318
Residential High Efficiency HVAC	$1,073,822	$1,267,810	$1,329,518	$1,470,469	$1,444,913	$1,402,800	$1,350,042	$1,287,602	$1,298,372	$1,236,770	$1,176,832	$1,118,935	$1,063,459	$852,697	$809,985	$769,526	$731,069	$694,934	$660,788	$628,442
Whole House	$1,000,468	$995,110	$975,756	$961,807	$941,690	$913,015	$880,650	$844,389	$1,212,985	$1,160,583	$1,108,439	$1,057,157	$1,007,487	$959,603	$913,400	$869,663	$827,973	$788,994	$752,258	$717,456
Low Income Weatherization	$565,360	$566,774	$564,252	$559,458	$549,633	$533,670	$514,646	$492,520	$470,832	$449,690	$428,741	$408,325	$388,679	$369,743	$351,622	$334,461	$318,079	$302,810	$288,403	$274,726
Low Income New Homes	$8,077	$8,097	$8,061	$7,992	$7,852	$7,624	$7,352	$7,036	$6,726	$6,424	$6,125	$5,833	$5,553	$5,282	$5,023	$4,778	$4,544	$4,326	$4,120	$3,925
School Kits	$53,183	$55,719	$57,854	$59,502	$60,130	$59,492	$58,245	$56,361	$54,414	$52,513	$50,473	$48,294	$46,056	$43,863	$41,639	$39,595	$37,674	$35,888	$34,226	$32,681
Non-Residential Program																				
Small Business Lighting	$1,407,143	$1,397,541	$1,185,131	$1,165,030	$1,138,310	$1,102,986	$1,063,725	$1,020,854	$978,612	$937,221	$896,148	$855,365	$815,592	$777,518	$740,488	$705,393	$672,152	$640,819	$611,276	$583,427
C&I Custom Rebate	$362,758	$480,445	$592,464	$582,569	$569,312	$551,709	$532,097	$510,622	$489,476	$468,764	$448,208	$427,824	$407,945	$388,898	$370,385	$352,837	$336,197	$320,530	$305,749	$291,800
C&I Prescriptive	$1,140,182	$1,248,643	$1,391,606	$1,371,853	$1,344,135	$1,304,619	$1,259,832	$1,210,021	$1,160,712	$1,112,160	$1,063,671	$1,015,240	$967,972	$922,727	$878,647	$836,889	$797,348	$760,126	$725,068	$692,049
Building Operator Certificate	$55,254	$89,140	$126,865	$133,391	$136,506	$135,983	$133,218	$128,323	$123,398	$118,621	$113,652	$108,515	$103,327	$98,273	$93,230	$88,559	$84,156	$80,059	$76,233	$72,660
Interruptible Service Rider	$54,898	$64,364	$71,971	$107,691	$138,060	$162,497	$182,597	$173,027	$163,860	$155,293	$147,022	$139,122	$131,771	$124,697	$117,995	$111,729	$105,635	$99,941	$94,614	$89,499

Table 5-91 - Total Resource Cost Test Program Benefits

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Portfolio	1.34	1.48	1.51	1.61	1.72	1.82	1.91	1.97	2.06	2.12	2.20	2.25	2.61	2.52	2.59	2.66	2.75	2.82	2.90	2.98
Residential Program	1.19	1.30	1.25	1.34	1.42	1.49	1.55	1.61	1.66	1.70	1.74	1.78	2.18	2.01	2.05	2.10	2.15	2.20	2.26	2.31
Residential Products Program	1.34	1.48	1.14	1.26	1.36	1.46	1.55	1.64	1.53	1.59	1.65	1.70	1.76	1.80	1.86	1.92	1.98	2.04	2.10	2.16
Residential Appliance Recycling	1.05	1.15	1.25	1.37	1.49	1.59	1.69	1.78	1.87	1.96	2.05	2.14	2.22	2.31	2.40	2.48	2.57	2.67	2.77	2.88
Residential High Efficiency HVAC	1.28	1.38	1.40	1.45	1.52	1.58	1.62	1.65	1.67	1.70	1.72	1.75	3.17	2.31	2.37	2.42	2.48	2.53	2.59	2.65
Whole House	1.31	1.41	1.50	1.59	1.68	1.75	1.82	1.88	1.94	2.00	2.05	2.11	2.15	2.20	2.26	2.31	2.37	2.43	2.49	2.56
Low Income Weatherization	0.79	0.86	0.93	0.98	1.04	1.08	1.11	1.14	1.16	1.19	1.21	1.24	1.26	1.28	1.30	1.33	1.35	1.37	1.40	1.42
Low Income New Homes	0.53	0.58	0.63	0.65	0.67	0.70	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84	0.85
School Kits	1.13	1.28	1.44	1.60	1.75	1.88	1.99	2.09	2.18	2.28	2.38	2.46	2.55	2.63	2.70	2.78	2.87	2.96	3.06	3.16
Non-Residential Program	1.63	1.83	2.03	2.18	2.34	2.53	2.68	2.79	2.90	3.01	3.18	3.29	3.43	3.54	3.66	3.79	3.98	4.11	4.24	4.38
Small Business Lighting	1.05	1.13	1.14	1.21	1.29	1.38	1.44	1.50	1.56	1.62	1.72	1.78	1.84	1.90	1.96	2.02	2.14	2.21	2.28	2.36
C&I Custom Rebate	4.69	5.05	5.39	5.01	5.30	5.56	6.09	6.33	6.57	6.82	7.42	7.67	7.92	8.18	8.44	9.16	9.46	9.77	10.09	10.43
C&I Prescriptive	2.86	3.07	3.19	3.44	3.69	3.92	4.14	4.34	4.55	4.76	4.97	5.18	5.54	5.77	6.00	6.25	6.49	6.74	6.98	7.24
Building Operator Certificate	1.39	1.61	1.87	2.09	2.28	2.41	2.52	2.58	2.64	2.71	2.76	2.81	2.84	2.88	2.91	2.94	2.97	3.01	3.05	3.09

Table 5-92 - Total Resource Cost Test Benefit-Cost Ratio

Program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Program																				
Residential Products Program	$906,092	$847,338	$792,264	$640,934	$591,704	$546,255	$504,298	$465,563	$62,908	$58,076	$53,615	$49,497	$45,695	$44,786	$41,346	$38,170	$35,239	$32,532	$30,033	$27,726
Residential Appliance Recycling	$93,665	$109,226	$121,844	$131,880	$121,750	$112,399	$103,765	$95,795	$101,443	$93,651	$86,458	$79,817	$73,686	$75,003	$69,242	$63,924	$59,014	$54,481	$50,296	$46,433
Residential High Efficiency HVAC	$561,960	$618,397	$678,353	$706,180	$651,938	$601,863	$555,634	$512,957	$498,612	$460,314	$424,957	$392,317	$210,730	$232,801	$214,920	$198,412	$183,172	$169,102	$156,114	$144,123
Whole House	$1,138,410	$1,050,969	$970,245	$895,721	$835,082	$770,940	$718,680	$663,478	$927,667	$864,623	$798,211	$743,898	$698,530	$650,839	$606,353	$564,862	$521,475	$485,752	$452,440	$417,689
Low Income Weatherization	$294,000	$271,418	$250,571	$231,324	$213,556	$197,153	$182,010	$168,030	$155,124	$143,209	$132,209	$122,054	$112,679	$104,024	$96,034	$88,658	$81,848	$75,561	$69,758	$64,400
Low Income New Homes	$7,371	$6,805	$6,282	$7,250	$6,693	$6,179	$5,704	$5,266	$4,861	$4,488	$4,143	$3,825	$3,531	$3,260	$3,010	$2,778	$2,565	$2,368	$2,186	$2,018
School Kits	$47,211	$43,584	$40,237	$37,146	$34,293	$31,659	$29,227	$26,982	$24,910	$22,997	$21,230	$19,599	$18,094	$16,704	$15,421	$14,237	$13,143	$12,134	$11,202	$10,341
Non-Residential Program																				
Small Business Lighting	$1,558,118	$1,438,440	$1,226,631	$1,132,414	$1,045,434	$965,135	$891,003	$822,566	$759,385	$701,057	$647,209	$597,497	$551,604	$509,235	$470,121	$434,012	$400,675	$369,900	$341,488	$315,258
C&I Custom Rebate	$44,352	$54,594	$63,001	$116,323	$107,388	$99,140	$87,365	$80,654	$74,459	$68,740	$60,438	$55,796	$51,510	$47,554	$43,901	$38,503	$35,545	$32,815	$30,295	$27,968
C&I Prescriptive	$231,007	$235,430	$252,489	$233,096	$215,192	$198,663	$183,404	$170,162	$157,092	$145,025	$133,886	$123,602	$94,844	$87,559	$80,833	$74,625	$68,893	$63,601	$58,716	$54,206
Building Operator Certificate	$22,641	$31,352	$38,592	$35,628	$32,892	$30,365	$28,033	$25,880	$23,892	$22,057	$20,363	$18,799	$17,355	$16,022	$14,791	$13,655	$12,606	$11,638	$10,744	$9,919
Interruptible Service Rider	$17,640	$16,285	$15,034	$13,879	$12,813	$11,829	$10,921	$10,082	$9,307	$8,593	$7,933	$7,323	$6,761	$6,241	$5,762	$5,319	$4,911	$4,534	$4,185	$3,864

Table 5-93 - Utility Cost Test Program Costs

Program	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Residential Program																				
Residential Products Program	$1,428,970	$1,488,629	$1,007,250	$1,049,176	$1,044,543	$1,024,621	$1,000,654	$970,991	$190,050	$181,987	$173,976	$166,080	$158,413	$153,964	$146,699	$139,807	$133,251	$127,095	$121,277	$115,766
Residential Appliance Recycling	$127,009	$162,782	$197,672	$232,118	$230,646	$225,919	$219,753	$211,959	$233,792	$224,576	$215,104	$205,362	$195,877	$207,026	$197,085	$187,685	$178,814	$170,490	$162,665	$155,318
Residential High Efficiency HVAC	$1,073,822	$1,267,810	$1,329,518	$1,470,469	$1,444,913	$1,402,800	$1,350,042	$1,287,602	$1,298,372	$1,236,770	$1,176,832	$1,118,935	$1,063,459	$852,697	$809,985	$769,526	$731,069	$694,934	$660,788	$628,442
Whole House	$1,000,468	$995,110	$975,756	$961,807	$941,690	$913,015	$880,650	$844,389	$1,212,985	$1,160,583	$1,108,439	$1,057,157	$1,007,487	$959,603	$913,400	$869,663	$827,973	$788,994	$752,258	$717,456
Low Income Weatherization	$565,360	$566,774	$564,252	$559,458	$549,633	$533,670	$514,646	$492,520	$470,832	$449,690	$428,741	$408,325	$388,679	$369,743	$351,622	$334,461	$318,079	$302,810	$288,403	$274,726
Low Income New Homes	$8,077	$8,097	$8,061	$7,992	$7,852	$7,624	$7,352	$7,036	$6,726	$6,424	$6,125	$5,833	$5,553	$5,282	$5,023	$4,778	$4,544	$4,326	$4,120	$3,925
School Kits	$53,183	$55,719	$57,854	$59,502	$60,130	$59,492	$58,245	$56,361	$54,414	$52,513	$50,473	$48,294	$46,056	$43,863	$41,639	$39,595	$37,674	$35,888	$34,226	$32,681
Non-Residential Program																				
Small Business Lighting	$1,407,143	$1,397,541	$1,185,131	$1,165,030	$1,138,310	$1,102,986	$1,063,725	$1,020,854	$978,612	$937,221	$896,148	$855,365	$815,592	$777,518	$740,488	$705,393	$672,152	$640,819	$611,276	$583,427
C&I Custom Rebate	$362,758	$480,445	$592,464	$582,569	$569,312	$551,709	$532,097	$510,622	$489,476	$468,764	$448,208	$427,824	$407,945	$388,898	$370,385	$352,837	$336,197	$320,530	$305,749	$291,800
C&I Prescriptive	$1,140,182	$1,248,643	$1,391,606	$1,371,853	$1,344,135	$1,304,619	$1,259,832	$1,210,021	$1,160,712	$1,112,160	$1,063,671	$1,015,240	$967,972	$922,727	$878,647	$836,889	$797,348	$760,126	$725,068	$692,049
Building Operator Certificate	$55,254	$89,140	$126,865	$133,391	$136,506	$135,983	$133,218	$128,323	$123,398	$118,621	$113,652	$108,515	$103,327	$98,273	$93,230	$88,559	$84,156	$80,059	$76,233	$72,660
Interruptible Service Rider	$54,898	$64,364	$71,971	$107,691	$138,060	$162,497	$182,597	$173,027	$163,860	$155,293	$147,022	$139,122	$131,771	$124,697	$117,995	$111,729	$105,635	$99,941	$94,614	$89,499

Table 5-94 - Utility Cost Test Program Benefits

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Portfolio	1.48	1.66	1.69	1.84	1.97	2.08	2.18	2.27	2.28	2.35	2.44	2.51	2.81	2.73	2.81	2.89	2.98	3.06	3.15	3.25
Residential Program	1.40	1.54	1.45	1.64	1.74	1.84	1.92	2.00	1.95	2.01	2.08	2.13	2.46	2.30	2.36	2.42	2.49	2.55	2.62	2.71
Residential Products Program	1.58	1.76	1.27	1.64	1.77	1.88	1.98	2.09	3.02	3.13	3.24	3.36	3.47	3.44	3.55	3.66	3.78	3.91	4.04	4.18
Residential Appliance Recycling	1.36	1.49	1.62	1.76	1.89	2.01	2.12	2.21	2.30	2.40	2.49	2.57	2.66	2.76	2.85	2.94	3.03	3.13	3.23	3.34
Residential High Efficiency HVAC	1.91	2.05	1.96	2.08	2.22	2.33	2.43	2.51	2.60	2.69	2.77	2.85	5.05	3.66	3.77	3.88	3.99	4.11	4.23	4.36
Whole House	0.88	0.95	1.01	1.07	1.13	1.18	1.23	1.27	1.31	1.34	1.39	1.42	1.44	1.47	1.51	1.54	1.59	1.62	1.66	1.72
Low Income Weatherization	1.92	2.09	2.25	2.42	2.57	2.71	2.83	2.93	3.04	3.14	3.24	3.35	3.45	3.55	3.66	3.77	3.89	4.01	4.13	4.27
Low Income New Homes	1.10	1.19	1.28	1.10	1.17	1.23	1.29	1.34	1.38	1.43	1.48	1.52	1.57	1.62	1.67	1.72	1.77	1.83	1.88	1.94
School Kits	1.13	1.28	1.44	1.60	1.75	1.88	1.99	2.09	2.18	2.28	2.38	2.46	2.55	2.63	2.70	2.78	2.87	2.96	3.06	3.16
Non-Residential Program	1.61	1.85	2.11	2.19	2.35	2.50	2.64	2.74	2.85	2.95	3.07	3.17	3.36	3.47	3.58	3.70	3.82	3.94	4.07	4.21
Small Business Lighting	0.90	0.97	0.97	1.03	1.09	1.14	1.19	1.24	1.29	1.34	1.38	1.43	1.48	1.53	1.58	1.63	1.68	1.73	1.79	1.85
C&I Custom Rebate	8.18	8.80	9.40	5.01	5.30	5.56	6.09	6.33	6.57	6.82	7.42	7.67	7.92	8.18	8.44	9.16	9.46	9.77	10.09	10.43
C&I Prescriptive	4.94	5.30	5.51	5.89	6.25	6.57	6.87	7.11	7.39	7.67	7.94	8.21	10.21	10.54	10.87	11.21	11.57	11.95	12.35	12.77
Building Operator Certificate	2.44	2.84	3.29	3.74	4.15	4.48	4.75	4.96	5.16	5.38	5.58	5.77	5.95	6.13	6.30	6.49	6.68	6.88	7.10	7.33

Table 5-95 - Utility Cost Test Benefit-Cost Ratio

5.6 Other Test Results

(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.

In addition to the total resource cost test and the utility cost test, AEG utilized three other cost-tests to analyze cost-effectiveness from different perspectives:

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

The cost-effectiveness analysis was performed using Empire-specific data. The software used to perform the benefit-cost screening has been adapted from Minnesota Office of Energy Security "BenCost" software and is consistent with the California Standard Practice Manual. The input data gathered for the model included:

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)	Project Life (Years)
Environmental Damage Cost ($/kWh)	kWh/Participant Saved (Net and Gross)
Discount Rate (percent)	kW/Participant Saved (Net and Gross)
Growth Rate (percent)	Number of Participants
Line Losses (percent)	
Load Shapes	

Table 5-96 - Cost-Effectiveness Model Inputs

Empire provided commodity costs for four scenarios:

1. Base CO_2 assumes no carbon cost.
2. Moderate CO_2 assumes carbon allowances in 2021.

3. High CO_2 assumes carbon allowances in 2015.

4. Weighted CO_2 is a weighted average of the three commodity cost scenarios, assuming 50 percent Base CO_2, 40 percent Moderate CO_2 and 10 percent High CO_2.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Portfolio	7.02	6.83	5.99	5.78	5.74	5.76	5.73	5.69	5.14	5.09	5.08	5.03	5.88	5.55	5.51	5.49	5.50	5.46	5.42	5.37
Residential Program	6.59	6.34	5.29	4.99	4.95	4.89	4.84	4.79	3.96	3.90	3.84	3.78	4.72	4.32	4.28	4.24	4.19	4.14	4.10	4.05
Residential Products Program	12.42	12.16	9.05	8.51	8.63	8.75	8.87	9.00	3.06	3.06	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.06	3.04	3.03
Residential Appliance Recycling	10.09	10.08	10.07	10.28	10.51	10.76	11.01	11.27	11.55	11.84	12.15	12.47	12.64	12.84	13.02	13.21	13.39	13.59	13.79	13.99
Residential High Efficiency HVAC	2.70	2.68	2.59	2.48	2.43	2.38	2.33	2.29	2.22	2.18	2.14	2.09	3.35	2.59	2.57	2.55	2.53	2.51	2.49	2.46
Whole House	14.15	14.15	13.96	13.68	13.47	13.21	13.01	12.75	12.55	12.36	12.11	11.91	11.75	11.57	11.38	11.20	10.99	10.81	10.63	10.43
Low Income Weatherization	1.81	1.81	1.81	1.78	1.74	1.71	1.68	1.64	1.61	1.58	1.55	1.52	1.49	1.46	1.43	1.40	1.37	1.35	1.32	1.30
Low Income New Homes	1.23	1.23	1.23	1.31	1.28	1.26	1.23	1.21	1.19	1.16	1.14	1.12	1.10	1.07	1.05	1.03	1.01	0.99	0.97	0.95
School Kits	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
Non-Residential Program	7.93	7.87	7.37	7.45	7.48	7.74	7.80	7.83	7.85	7.87	8.19	8.21	8.18	8.20	8.22	8.28	8.58	8.59	8.58	8.57
Small Business Lighting	8.41	8.41	7.48	7.48	7.48	8.11	8.11	8.11	8.11	8.11	8.84	8.84	8.84	8.84	8.84	8.84	9.73	9.73	9.73	9.73
C&I Custom Rebate	10.98	10.98	10.98	11.48	11.48	11.48	11.98	11.98	11.98	11.98	12.53	12.53	12.53	12.53	12.53	13.14	13.14	13.14	13.14	13.14
C&I Prescriptive	7.11	7.04	6.84	6.92	7.00	7.08	7.16	7.24	7.31	7.38	7.45	7.53	7.50	7.58	7.65	7.72	7.78	7.84	7.87	7.89
Building Operator Certificate	4.04	4.04	4.04	3.96	3.88	3.81	3.73	3.66	3.59	3.52	3.45	3.38	3.32	3.25	3.19	3.13	3.06	3.00	2.94	2.89

Table 5-97 - Participant Cost Test Benefit-Cost Ratio

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Portfolio	0.38	0.42	0.46	0.50	0.53	0.56	0.59	0.62	0.67	0.69	0.71	0.74	0.78	0.78	0.80	0.83	0.85	0.88	0.91	0.94
Residential Program	0.37	0.41	0.45	0.50	0.54	0.56	0.59	0.61	0.69	0.71	0.74	0.76	0.81	0.80	0.82	0.84	0.87	0.89	0.92	0.95
Residential Products Program	0.28	0.31	0.31	0.36	0.39	0.41	0.43	0.46	0.64	0.66	0.69	0.71	0.73	0.75	0.77	0.80	0.83	0.85	0.88	0.91
Residential Appliance Recycling	0.31	0.35	0.38	0.41	0.44	0.47	0.49	0.51	0.54	0.56	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.75	0.77
Residential High Efficiency HVAC	0.62	0.67	0.71	0.76	0.81	0.85	0.89	0.92	0.95	0.98	1.01	1.04	1.27	1.16	1.19	1.23	1.26	1.30	1.34	1.38
Whole House	0.36	0.38	0.41	0.44	0.46	0.49	0.51	0.53	0.54	0.56	0.58	0.60	0.61	0.63	0.65	0.66	0.69	0.70	0.72	0.75
Low Income Weatherization	0.51	0.55	0.60	0.64	0.68	0.72	0.75	0.78	0.80	0.83	0.86	0.89	0.91	0.94	0.97	1.00	1.03	1.06	1.09	1.13
Low Income New Homes	0.42	0.46	0.50	0.49	0.52	0.54	0.57	0.59	0.61	0.63	0.65	0.67	0.69	0.71	0.74	0.76	0.78	0.81	0.83	0.86
School Kits	0.28	0.31	0.35	0.39	0.43	0.46	0.49	0.51	0.53	0.56	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.75	0.77
Non-Residential Program	0.39	0.42	0.46	0.50	0.53	0.56	0.59	0.62	0.64	0.66	0.69	0.71	0.74	0.76	0.79	0.81	0.84	0.86	0.89	0.92
Small Business Lighting	0.33	0.35	0.36	0.39	0.41	0.43	0.45	0.47	0.49	0.50	0.52	0.54	0.56	0.58	0.59	0.61	0.63	0.65	0.67	0.70
C&I Custom Rebate	0.48	0.52	0.55	0.55	0.59	0.62	0.65	0.67	0.70	0.72	0.75	0.78	0.81	0.83	0.86	0.89	0.92	0.95	0.98	1.01
C&I Prescriptive	0.45	0.49	0.52	0.56	0.59	0.62	0.65	0.67	0.70	0.73	0.75	0.78	0.82	0.84	0.87	0.90	0.93	0.96	0.99	1.02
Building Operator Certificate	0.36	0.42	0.48	0.55	0.61	0.66	0.70	0.73	0.76	0.79	0.82	0.85	0.88	0.90	0.93	0.96	0.98	1.01	1.05	1.08

Table 5-98 - Ratepayer Impact Cost Test Benefit-Cost Ratio

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Portfolio	1.44	1.58	1.60	1.70	1.81	1.92	2.01	2.08	2.16	2.23	2.30	2.36	2.74	2.65	2.72	2.79	2.88	2.96	3.04	3.12
Residential Program	1.28	1.39	1.32	1.41	1.50	1.57	1.63	1.68	1.73	1.77	1.82	1.85	2.27	2.10	2.15	2.20	2.25	2.30	2.36	2.42
Residential Products Program	1.47	1.62	1.23	1.36	1.47	1.57	1.66	1.76	1.62	1.68	1.74	1.80	1.87	1.91	1.97	2.03	2.09	2.16	2.22	2.28
Residential Appliance Recycling	1.14	1.24	1.35	1.47	1.59	1.69	1.80	1.89	1.98	2.08	2.18	2.27	2.35	2.45	2.54	2.63	2.73	2.83	2.93	3.05
Residential High Efficiency HVAC	1.34	1.43	1.45	1.50	1.57	1.63	1.67	1.70	1.72	1.75	1.78	1.80	3.27	2.39	2.44	2.50	2.56	2.62	2.68	2.74
Whole House	1.39	1.49	1.58	1.68	1.77	1.84	1.91	1.98	2.04	2.10	2.16	2.21	2.26	2.31	2.37	2.43	2.49	2.55	2.61	2.69
Low Income Weatherization	0.83	0.90	0.97	1.03	1.08	1.12	1.16	1.19	1.21	1.24	1.26	1.29	1.31	1.33	1.36	1.38	1.40	1.43	1.46	1.48
Low Income New Homes	0.56	0.61	0.66	0.68	0.70	0.73	0.75	0.76	0.77	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89
School Kits	1.23	1.38	1.55	1.71	1.87	2.00	2.11	2.21	2.31	2.42	2.51	2.60	2.69	2.77	2.85	2.94	3.03	3.12	3.23	3.34
Non-Residential Program	1.74	1.95	2.17	2.32	2.48	2.68	2.83	2.95	3.06	3.18	3.36	3.47	3.62	3.74	3.86	4.00	4.19	4.33	4.47	4.61
Small Business Lighting	1.13	1.21	1.22	1.29	1.37	1.47	1.53	1.59	1.65	1.71	1.82	1.88	1.94	2.01	2.07	2.13	2.26	2.34	2.41	2.49
C&I Custom Rebate	5.03	5.39	5.75	5.33	5.63	5.91	6.46	6.71	6.97	7.22	7.85	8.12	8.38	8.65	8.93	9.70	10.01	10.33	10.67	11.03
C&I Prescriptive	3.07	3.28	3.41	3.67	3.92	4.16	4.39	4.60	4.82	5.04	5.26	5.48	5.87	6.11	6.35	6.61	6.86	7.13	7.39	7.66
Building Operator Certificate	1.49	1.72	1.98	2.20	2.39	2.53	2.64	2.70	2.77	2.83	2.89	2.93	2.97	3.01	3.04	3.07	3.11	3.15	3.19	3.23

Table 5-99 - Societal Cost Test Benefit-Cost Ratio

5.7 Sources and Quality of Information

(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.

A comprehensive list of energy efficiency measures was developed and screened for cost-effectiveness (i.e. a TRC benefit-cost ratio of at least 1.0). The list of measures, as well as energy and demand impacts, were developed using a variety of sources, including Empire's historic demand-side management (DSM) programs, the 2008 Residential Management Survey and the 2010 Commercial and Industrial Baseline study as well as ENERGY STAR, the Consortium for Energy Efficiency and regional and national sources.

AEG gathered Empire's economic data and technical data for the energy efficiency measures identified. Energy efficient measure energy and demand impacts were calculated using generally accepted engineering algorithms based on a set of reasonable assumptions. Because of the diversity in equipment and energy consumption patterns across multiple building types and end-uses, there exists a variability in these savings estimates as they relate to program design and target markets, particularly at the planning stage of these programs.

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

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

1. Participant Cost Test quantifies the benefits and costs to the customer due to program participation.

2. Ratepayer Impact Measure (RIM) Cost Test measures what happens to a customer's rates due to changes in utility revenues and operating costs.

3. Utility Cost Test measures the net costs of a program as a resource option based on the costs incurred by the program administrator, excluding any net costs incurred by the participant.

4. Societal Cost Test measures the effects of a program on society as a whole.

The cost-effectiveness analysis was performed using Empire-specific data. The software used to perform the benefit-cost screening has been adapted from Minnesota Office of Energy Security "BenCost" software and is consistent with the California Standard Practice Manual. The input data gathered for the model included:

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)	Project Life (Years)
Environmental Damage Cost ($/kWh)	kWh/Participant Saved (Net and Gross)
Discount Rate (percent)	kW/Participant Saved (Net and Gross)
Growth Rate (percent)	Number of Participants
Line Losses (percent)	
Load Shapes	

Table 5-100 - Cost-Effectiveness Model Inputs

Empire provided commodity costs for four scenarios:

1. Base CO_2 assumes no carbon cost.

2. Moderate CO_2 assumes carbon allowances in 2021.

3. High CO_2 assumes carbon allowances in 2015.

4. Weighted CO_2 is a weighted average of the three commodity cost scenarios, assuming 50 percent Base CO_2, 40 percent Moderate CO_2 and 10 percent High CO_2.

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

Measure	Savings	Incremental Cost	Measure Life
CFL	ENERGY STAR/Illinois	Illinois	ENERGY STAR
LED	ENERGY STAR/Illinois	ENERGY STAR	ENERGY STAR
ENERGY STAR Indoor Fixture	ENERGY STAR/Illinois	ENERGY STAR	ENERGY STAR
ENERGY STAR Exterior Fixture	ENERGY STAR/Illinois	Illinois	ENERGY STAR
Efficient Nightlight	Penn	Michigan	Penn
ENERGY STAR Dehumidifier	ENERGY STAR/DOE	Illinois	ENERGY STAR
ENERGY STAR Clothes Washer	Illinois/ ENERGY STAR /DOE	ENERGY STAR	Illinois
ENERGY STAR Refrigerator	Illinois/ ENERGY STAR /DOE	Illinois/Estimate	New York
ENERGY STAR Dishwasher	ENERGY STAR /DOE	ENERGY STAR	Illinois
ENERGY STAR Room Air Conditioner	ENERGY STAR /DOE	ENERGY STAR/Michigan	Illinois
ENERGY STAR Pool Pumps	CEE Pool/ ENERGY STAR	NREL Pool	Ohio
ENERGY STAR Windows	Arkansas	Michigan	Arkansas
Refrigerator Recycle	NMR	Michigan	Illinois
Freezer Recycle	NMR	Michigan	Illinois
Room Air Conditioner Recycle	Arkansas/Ohio	Michigan	Illinois
Advanced Power Strip	NYSERDA	NYSERDA	NYSERDA
ENERGY STAR Computers	ENERGY STAR	ENERGY STAR	ENERGY STAR
ENERGY STAR Computer Monitor	ENERGY STAR	ENERGY STAR	ENERGY STAR
ENERGY STAR Ink Jet Printer	ENERGY STAR /NYSERDA	ENERGY STAR	ENERGY STAR
ENERGY STAR Laser Color Printer	ENERGY STAR /NYSERDA	ENERGY STAR	ENERGY STAR
Air Sealing	Illinois	PSC Colorado	Illinois
Attic Insulation	Illinois	PSC Colorado	Illinois
Wall Insulation	Illinois	PSC Colorado	Illinois
Duct Insulation	Arkansas	Michigan	Arkansas
Floor Insulation	Arkansas	Michigan	Arkansas
Faucet Aerators	Illinois	Illinois	Illinois
Low Flow Showerhead	Illinois	Illinois	Illinois
Central Air Conditioner Tune-Up	Illinois/ ENERGY STAR	Illinois	Mass
Central Air Conditioner Systems	New York/DOE/ENERGY STAR/Mass	Michigan	Illinois
ASHP Tune-Up	Illinois/ ENERGY STAR	Illinois	Mass
Heat Pump Systems	New York/DOE/ENERGY STAR/Mass	Michigan	Illinois
Ductless Mini-Split SEER 21	Mass/CT/DOE	Michigan	Mass
Geothermal	Illinois/ ENERGY STAR	Illinois/Ohio	Illinois
Heat Pump Water Heater	Illinois/Arkansas/DOE/ENERGY STAR	Michigan/Illinois	Illinois
Solar Water Heater	Penn	Michigan	Penn
Furnace Fan Motor	Illinois	Illinois	Illinois
Water Heater Temperature Setback	Illinois	Illinois	Illinois
HE Bathroom Exhaust Fan	Illinois	Illinois	Illinois
Water Heater Tank Wrap	Ohio	ACEEE	Ohio
Hot Water Pipe Insulation	Ohio/Arkansas	Ohio	Ohio
Whole House Fan	Penn	Michigan	Penn
Programmable Thermostat	New York/DOE/ ENERGY STAR /Mass	Illinois	Illinois

Table 5-101 - Residential End-Use Measure Documentation

Measure	Savings	Incremental Cost	Measure Life
T5 Fixture	Illinois	Illinois	Illinois
High Performance T8	Illinois	Illinois	Illinois
Low Wattage Fluorescent T8	Illinois	Illinois	Illinois
High Bay Fluorescent Fixture T8	Illinois	Illinois	Illinois
High Bay Fluorescent Fixture T5	Illinois	Illinois	Illinois
CFLs	Illinois	Illinois	Illinois
LED Lamp	Illinois	Illinois	Illinois
Exit Sign	PSC Colorado/Illinois	Michigan	Arkansas
Lighting Occupancy Sensors	Illinois	Illinois	Illinois
CAC <65kBtuh	Illinois/CEE	Michigan	Illinois
CAC 65 - 135 kBtuh	Illinois/CEE	Michigan	Illinois
CAC 135 - 240 kBtuh	Illinois/CEE	Michigan	Illinois
CAC 240 - 760 kBtuh	Illinois/CEE	Michigan	Illinois
CAC >760 kBtuh	Illinois/CEE	Michigan	Illinois
Split Package Heat Pump	Illinois/CEE	Michigan	Illinois
Single System Heat Pump	Illinois/CEE	Michigan	Illinois
Heat Pump 65 < 135 kBtuh	Illinois/CEE	Michigan	Illinois
Heat Pump 135 < 240 kBtuh	Illinois/CEE	Michigan	Illinois
Heat Pump >240 kBtuh	Illinois/CEE	Michigan	Illinois
Hotel Occupancy Sensors	Mass	Michigan	Mass
Electric Storage Water Heater	Illinois	Illinois	Illinois
Tankless Water Heater	Illinois	Illinois	Illinois
High Efficiency Furnace w/ ECM Motor	Illinois	Illinois	Illinois
Chiller	Arkansas/Michigan	Illinois	Illinois
Motor	Arkansas	Ohio	Ohio
VFD	Ohio	Ohio	Ohio
Solid Door Refrigerator	Illinois	Illinois	Illinois
Glass Door Refrigerator	Illinois	Illinois	Illinois
Solid Door Freezer	Illinois	Illinois	Illinois
Glass Door Freezer	Illinois	Illinois	Illinois
Live Stock Waterer	Illinois	Illinois	Illinois
Engine Block Timer	Illinois	Illinois	Illinois
High Volume Low Speed Fans	Illinois	Illinois	Illinois
High Speed Fans	Illinois	Illinois	Illinois

Table 5-102 - C&I End-Use Measure Documentation

AEG gathered the end-use measure data from multiple sources, including the sources below:

1. American Council for an Energy-Efficient Economy. Water Heating. http://aceee.org/consumer/water-heating

2. Connecticut Energy Efficiency Fund. Connecticut Program Savings Documentation for 2012 Program Year.

3. Consortium for Energy Efficiency (2011). Residential Swimming Pool Initiative (DRAFT); Consortium for Energy Efficiency (2012). Efficient Residential Swimming Pool Initiative (DRAFT).

4. Consortium for Energy Efficiency. High-Efficiency Commercial Air Conditioning and Heat Pump Initiative.

5. ENERGY STAR. Qualified Product Savings Calculator.

6. Frontier Associates, LLC (2010). Arkansas Comprehensive Programs Deemed Savings. Prepared by Nexant.

7. Mass Save (2010). Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures. 2011 Program Year.

8. Michigan Public Service Commission (2013). Michigan Energy Measures Database. Prepared by Morgan Marketing Partners.

9. NMR Group, Inc. (2011). Massachusetts Appliance Turn-In Program Impact Evaluation.

10. New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs (October 15, 2010).

11. NREL. Building America Retrofit Alliance. (2012). Measure Guideline: Replacing Single-Speed Pool Pumps with Variable Speed Pool Pumps for Energy Savings.

12. NYSERDA (2011). Advanced Power Strip Research Report. Prepared by Lockheed Martin and Energy Solutions.

13. Pennsylvania Utility Commission (June 2013). Technical Reference Manual. State of Pennyslvania Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards.

14. Public Service Company of Colorado. (2012). 2012/2013 Demand-Side Management Plan: Electric & Natural Gas. Docket No. 11A-631EG.

15. Public Utilities Commission of Ohio (2010). State of Ohio Energy Efficiency Technical Reference Manual. Prepared by Vermont Energy Investment Corporation.

16. State of Illinois. (2012). Energy Efficiency Technical Reference Manual.

17. U.S. Department of Energy. Building Technologies Program: Residential Products.

SECTION 6 CANDIDATE DEMAND-SIDE RESOURCE OPTIONS

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

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

6.1 Candidate Options and Portfolios

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

End-use measures were screened for cost-effectiveness on a stand-alone and bundled basis. Measures that were cost-effective on a stand-alone basis were bundled into programs and re-screened for cost-effectiveness. Except for the low-income weatherization and low-income new homes programs, the programs were designed to be cost-effective. Measures were bundled based on end-use and implementation. For example, space cooling and heating end-use measures benefit from being installed by an experienced HVAC contractor.

AEG considered nine energy efficiency portfolios based on the cost-effective measures.

1. Base CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the Base CO_2 avoided cost (assuming no carbon cost).

2. Moderate CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the Moderate CO_2 avoided cost (assuming carbon allowances in 2021).

3. High CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the High CO_2 avoided cost (assuming carbon allowances in 2015).

4. RAP+. A portfolio designed to represent one-third of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

5. RAP++. A portfolio designed to represent two-thirds of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

6. Moderate Portfolio. A portfolio designed to achieve 1 percent incremental energy and demand savings by 2015.

7. Aggressive Portfolio. A portfolio designed to achieve 2 percent incremental energy and demand savings by 2020.

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

9. Missouri Energy Efficiency Investment Act of 2009 (MEEIA) Portfolio. A portfolio designed to achieve the MEEIA energy and demand savings goals, as outlined in 4 CSR 240-20.094.

6.2 Time-Differentiated Load Impacts

(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 load impacts estimate development for each demand-side candidate resource option is described below.

Residential Light Bulbs

The CFL and LED bulb savings are adjusted in 2015 to account for the United States Congress Energy Independence and Security Act (EISA) of 2007 to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for 'general service' light bulbs. The efficiency standards will be implemented in two phases, with higher efficiency requirements in each phase. From 2012 to 2014, new standard light bulbs will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. Phase 2 calls for a 60 percent reduction in light bulb energy use by 2020, or 45 lumens per watt.[16]

The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock. For example, while the first phase of the EISA legislation went into effect on January 1, 2012, customers will be able to purchase non-EISA mandated bulbs until stock runs out. AEG assumes that EISA legislated bulbs will be widely available and purchased in 2015. In 2015, CFL bulb savings are adjusted to 29 kWh savings per unit and 0.026 kW savings per unit and LED bulb savings are adjusted to 39 kWh savings per unit and 0.036 kW savings per unit.

[16] See Database of State Incentives for Renewables & Efficiency (DSIRE). *Federal Appliance Standards*. Available at: www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US04R&re=1&ee=1

2013 to 2014 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
CFL	46	0.042
LED	64	0.058

2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
CFL	29	0.026
LED	39	0.036

Efficient nightlights utilize LED bulbs while a standard nightlight utilizes an incandescent bulb.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Efficient Nightlight	26	-

Residential ENERGY STAR Light Fixtures

An ENERGY STAR Indoor Fixture is wired for pin-based compact fluorescent lamps and is installed in an interior residential setting. The baseline measure is a standard incandescent interior fixture. ENERGY STAR estimates that a 120 Watt incandescent fixture can be replaced with a 26 Watt compact fluorescent lamp.

An ENERGY STAR Exterior Fixture is wired for pin-based compact fluorescent lamps and is installed in an exterior residential setting. The baseline measure is a standard incandescent exterior fixture. ENERGY STAR estimates that a 120 Watt incandescent fixture can be replaced with a 19 Watt compact fluorescent lamp.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Indoor Fixture	90	0.082
ENERGY STAR Exterior Fixture	97	0.088

ENERGY STAR Refrigerator

The ENERGY STAR Refrigerator energy and demand savings are estimated based on a 26 cubic foot top-freezer refrigerator.

Product Category	NAECA	ENERGY STAR
Refrigerators and Refrigerator-freezers with manual defrost	8.82 * Volume + 248.4	7.056 * Volume + 198.72
Refrigerator-Freezer--partial automatic defrost	8.82 * Volume + 248.4	7.056 * Volume + 198.72
Refrigerator-Freezers--automatic defrost with top-mounted freezer without through-the-door ice service and all-refrigerators--automatic defrost	9.80 * Volume + 276	7.84 * Volume + 220.8
Refrigerator-Freezers--automatic defrost with side-mounted freezer without through-the-door ice service	4.91 * Volume + 507.5	3.928 * Volume + 406
Refrigerator-Freezers--automatic defrost with bottom-mounted freezer without through-the-door ice service	4.60 * Volume + 459	3.68 * Volume + 367.2
Refrigerator-Freezers--automatic defrost with top-mounted freezer with through-the-door ice service	10.20 * Volume + 356	8.16 * Volume + 284.8
Refrigerator-Freezers--automatic defrost with side-mounted freezer with through-the-door ice service	10.10 * Volume + 406	8.08 * Volume + 24.8

Table 5-103 - Maximum Energy Usage in kWh per Year

Revised ENERGY STAR and federal Refrigerator standards will be effective in 2014. In 2014, the ENERGY STAR Refrigerator savings are adjusted to 103 kWh savings per unit and 0.016 kW savings per unit.

2013 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Refrigerator	106	0.016

2014 to 2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Refrigerator	103	0.016

ENERGY STAR Dehumidifier

The ENERGY STAR and federal Dehumidifier standards were updated in October 2012. A dehumidifier <75 pints per day must have an energy factor of at least 1.85 liters per kWh and a dehumidifier ≥75 pints per day must have an energy factor of at least 2.8 liters per kWh. An average dehumidifier capacity of 40 pints per day was assumed, based on the ENERGY STAR energy savings calculator.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR Dehumidifier	161	0.099

ENERGY STAR Pool Pump

An ENERGY STAR Pool Pump can run at different speeds and be programmed to match the pool operation with its appropriate pool pump speed. Two-speed pool pumps have the ability to operate at two speeds, high and low. Effective February 2013, the ENERGY STAR Pool Pump standards require an energy factor of at least 3.8 for two-speed speed pool pumps. The Consortium for Energy Efficiency has conducted extensive research on residential pool pump efficiency. The energy and demand savings are estimated based on Consortium for Energy Efficiency analysis regarding typical pool capacity, turnover rates per day and pool pump usage per day (by pool pump speed).

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
ENERGY STAR 2-Speed Pool Pump	790	0.552

Appliance Recycling

Program evaluations have found a range of energy savings associated with refrigerator recycling, ranging from 1,074 kWh per refrigerator to 1,946 kWh per refrigerator. The refrigerator and freezer recycling analysis utilized savings estimates from a 2011 impact evaluation of the Massachusetts Appliance Turn-In Program, conducted by the NMR Group. The refrigerator and freezer are assumed to have eight years of remaining life before the homeowner would need to replace the unit(s).

	Gross kWh
KEMA-XENERGY (2004)[17]	1,946
ADM (2008)[18]	1,775
Cadmus (2010)[19]	PGE 1,220
	SCE 1,181
	SDGE 1,074
Cadmus (2009)[20]	1,447
NMR (2011)[21]	1,289

End-Use Measure	**Gross kWh Savings per Unit**	**Gross kW Savings per Unit**
Refrigerator Recycle	1,289	0.226
Freezer Recycle	1,105	0.158

[17] KEMA-XENERGY (February 2004). Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program. Prepared for Southern California Edison.
[18] ADM Associates (April 2008). Evaluation Study of the 2004-05 Statewide Residential Appliance Recycling Program. Prepared for the California Public Utilities Commission.
[19] The Cadmus Group (February 2010). Residential Retrofit High Impact Measure Evaluation Report. Prepared for the California Public Utilities Commission Energy Division.
[20] The Cadmus Group (January 2009). Impact Evaluation of the 2007 Appliance Management Program and Low Income Weatherization Program. Prepared for National Grid.
[21] NMR Group (June 2011). Massachusetts Appliance Turn-In Program Impact Evaluation. Submitted to National Grid, NSTAR Electric, Cape Light Compact, Western Massachusetts Electric Company.

Advanced Power Strips

Advanced Power Strips are power strips with the ability to automatically disconnect power to specific measures plugged into the power strip. In a 2011 evaluation, Lockheed Martin and Energy Solutions identified seven major types of advanced power strips:[22]

1. Master Control have one master control outlet, four to six controlled outlets that automatically power down designated devices when the load is turned off by the user, and one or two uncontrolled outlets that are always on.

2. Load Sensing sense the drop in current that occurs when the control device enters a low-power mode. When the power draw drops below a certain threshold, power is disconnected from the controlled outlets on the plug strip.

3. Occupancy Sensing detect the presence or absence of a user, and automatically turn the attached equipment on and off accordingly.

4. Timer can turn equipment off based on a programmable timer.

5. Remote/Wireless Control enable consumers to disconnect power to all devices plugged into the strip by using a designated remote that is programmed into the power strip.

6. USB Interface or Toggle Control plug into the computer via a USB connection. When the computer is turned off, a signal from the USB port shuts down the flow of power to peripherals.

7. Informational have power meters and display screens that show the user the power of each device plugged into the outlets, voltage, power factors, and/or current.

Advanced power strips can be used for a multitude of measures. For the analysis, the energy and demand savings are associated with home entertainment measures, such as a television, DVD player, video game console, etc. The baseline measure is a standard power strip that is manually controlled.

[22] NYSERDA (2011). Advanced Power Strip Research Report. Prepared by Lockheed Martin and Energy Solutions.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Advanced Power Strip	75	0.011

Residential Air Sealing and Insulation

ENERGY STAR considers sealing and insulating a residential home one of most cost-effective ways to improve energy efficiency and comfort. A homeowner can save an estimated 20 percent of heating and cooling costs. Thermal shell air leaks are identified and sealed to reduce infiltration levels. Insulation can be added and/or upgraded throughout the home, including the ceiling, walls, floors and ducts. These areas typically have little to no insulation. The analysis assumed wall insulation was upgraded from a baseline R-value of 5 to an efficient R-value of 11.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Air Sealing	521	0.251
Attic Insulation	2,038	0.346

Faucet Aerators and Low Flow Showerheads

A low flow faucet aerator must be rated no more than 1.5 gallons per minute for bathrooms and no more than 2.2 gallons per minute for kitchens. A standard bathroom faucet aerator is rated at 2.25 gallons per minute and a standard kitchen faucet aerator is rated at 2.75 gallons per minute. A low flow showerhead must be rated at 2.0 gallons per minute or less. A standard showerhead typically is rated at 2.5 gallons per minute.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Faucet Aerator - Kitchen	131	0.667
Faucet Aerator - Bathroom	56	0.283
Low Flow Showerhead	124	0.327

Hot Water Heater Pipe Insulation

Hot water heater pipe insulation assumes that un-insulated hot water heater hot and cold pipes are insulated up to the first elbow. The water pipes act as an extension of the hot water tank up to the first elbow, therefore the insulation reduces standby loss. The savings assumed 6 feet of insulated hot water heater pipe and 3 feet of insulated cold water heater pipe. The baseline measure is a hot water heater without pipe insulation.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Hot Water Pipe Insulation	122	0.014

Water Heater Temperature Setback

Water heater temperature setback lowers the thermostat setting on a hot water tank to 120 degrees. Under baseline conditions, the hot water tank thermostat is set higher than 120 degrees, typically 135 degrees.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Water Heater Temperature Setback	86	0.010

Water Heater Tank Wrap

Water heater tank wrap is insulation 'blanket' that is wrapped around an electric hot water tank to reduce standby loss. The insulation must be at least R-8. The baseline is a standard electric hot water tank without a water heater tank wrap.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Water Heater Tank Wrap	79	0.009

Furnace Fan Motor

A new furnace with a brushless permanent magnet blower motor is installed instead of a new furnace with a lower efficiency motor. Savings can be maximized with duct improvements and low pressure drop filters. The furnace fan motor savings are decreased if the homeowner runs the motor more often than the lower efficiency motor would have been run. The baseline is a new furnace with a low efficiency motor. The savings vary depending on whether the motor operates with a central air conditioner as well as the furnace.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Furnace Fan Motor (with CAC)	732	0.621
Furnace Fan Motor (w/o CAC)	644	0.547

High Efficiency Bathroom Exhaust Fan

A high efficiency bathroom exhaust fan provides more adequate ventilation. A new efficient exhaust-only ventilation fan will have an average fan efficacy of 8.3. The baseline unit is a standard exhaust-only fan with an average fan efficacy of 3.1.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
High Efficiency Bathroom Exhaust Fan	89	0.010

Residential Central Air Conditioner

The Central Air Conditioner relates to the replacement of an existing unit at the end of its useful life or the installation of a new system. A residential system is typically 36,000 Btu/hour. A standard central air conditioner unit has a 13 SEER and 11.09 EER, based on current federal standards. An efficient central air conditioner is more efficient than a standard unit. The analysis examined a 15 SEER, 16 SEER and 17 SEER that receives a quality installation (verification of proper charge and airflow).

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Central Air Conditioner SEER 15	576	0.557
Central Air Conditioner SEER 16	744	0.615
Central Air Conditioner SEER 17	892	0.803

Residential Air Source Heat Pump

The Air Source Heat Pump relates to the replacement of an existing unit at the end of its useful life or the installation of a new system. A residential system is typically 36,000 Btu/hour. A standard air source heat pump unit has a 13 SEER and 7.7 HSPF, based on current federal standards. An efficient air source heat pump is more efficient than a standard unit. The analysis examined a 15 SEER, 8.5 HSPF and 16 SEER, 8.5 HSPF and 17 SEER, 8.6 HSPF that receives a quality installation (verification of proper charge and airflow).

An updated federal Air Source Heat Pump standard will be effective in January 2015. Therefore, in 2015 the Air Source Heat Pump savings will be adjusted to the following:

- A SEER 15 unit will achieve 1,076 kWh savings per unit and 0.708 kW savings per unit.
- A SEER 16 unit will achieve 1,243 kWh savings per unit and 0.708 kW savings per unit.
- A SEER 17 unit will achieve 1,485 kWh savings per unit and 0.759 kW savings per unit.

2013 to 2014 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Heat Pump SEER 15	1,878	1.162
Heat Pump SEER 16	2,046	1.162
Heat Pump SEER 17	2,287	1.213

2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Heat Pump SEER 15	1,076	0.708
Heat Pump SEER 16	1,243	0.708
Heat Pump SEER 17	1,485	0.759

The Early Retirement Air Source Heat Pump relates to the early removal of an existing inefficient air source heat pump prior to the natural end of useful life and replacement with a qualifying efficient air source heat pump. A residential system is typically 36,000 Btu/hr. An existing air source heat pump unit is estimated to have a 10 SEER, 6.8 HSPF. The analysis examined a 16 SEER, 8.5 HSPF and 17 SEER, 8.6 HSPF that receives a quality installation (verification of proper charge and airflow). An air source heat pump has a measure life of 18 years and an estimated remaining useful life of 8 years.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Early Retirement HP SEER 16	4,260	2.553
Early Retirement HP SEER 17	4,502	2.600

Programmable Thermostat

A Programmable Thermostat has the capability to adjust temperature set-points according to a schedule without manual intervention. The baseline is a manual thermostat. The Programmable Thermostat savings is dependent upon the heating and/or cooling equipment that exists at the residence. The analysis screened six programmable thermostats:

- Central Air Conditioner SEER 15
- Central Air Conditioner SEER 16
- Central Air Conditioner SEER 17
- Air Source Heat Pump SEER 15

- Air Source Heat Pump SEER 16
- Air Source Heat Pump SEER 17

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Programmable Thermostat (CAC SEER 15)	254	0.255
Programmable Thermostat (CAC SEER 16)	239	0.249
Programmable Thermostat (CAC SEER 16)	225	0.231
Programmable Thermostat (Heat Pump SEER 15)	830	0.259
Programmable Thermostat (Heat Pump SEER 16)	814	0.259
Programmable Thermostat (Heat Pump SEER 17)	793	0.259

Non-Residential Lighting

T5 lamps have higher lumens per watt than a standard T8 or an existing T8 or T12 system. The smaller lamp diameter allows for better optical systems, and more precise control of lighting. These characteristics result in light fixtures that produce equal or greater light than standard T8 or T12 fixtures, while using fewer watts.

1. A 4-lamp industrial T5 fixture consumes 128 Watts. A comparable standard 3-lamp T8 fixture consumes 178 Watts.

2. A 4-lamp High Bay Fluorescent fixture T5 consumes 240 Watts. A comparable standard Metal Halide fixture consumes 455 Watts.

Efficient T8 lamps have higher lumens per watt than a standard T8.

1. A 3-Lamp High Performance T5 fixture consumes 58 Watts. A comparable standard T8 with electronic ballast consumes 88 Watts.

2. A Low-Wattage Fluorescent T8 fixture consumes 25 Watts. A comparable standard T8 consumes 28 Watts.

3. A 6-lamp High Bay Fluorescent T8 fixture consumes 206 Watts. A comparable standard Metal Halide fixture consumes 455 Watts.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
T5 Fixture	195	0.048
High Performance T8	117	0.029
Low Wattage Fluorescent T8	12	0.003
High Bay Fluorescent Fixture T8	1,259	0.310
High Bay Fluorescent Fixture T5	1,208	0.298

The CFL and LED bulb savings are adjusted in 2015 to account for the United States Congress passed the Energy Independence and Security Act (EISA) of 2007 to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for 'general service' light bulbs. The efficiency standards will be implemented in two phases, with higher efficiency requirements in each phase. From 2012 to 2014, new standard light bulbs will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. Phase 2 calls for a 60 percent reduction in light bulb energy use by 2020, or 45 lumens per watt.

The effective dates of the EISA legislation pertain to newly manufactured bulbs, not existing stock. For example, while the first phase of the EISA legislation went into effect on January 1, 2012, customers will be able to purchase non-EISA mandated bulbs until stock runs out. AEG assumes that EISA-legislated bulbs will be widely available and widely purchased in 2015. In 2015, CFL bulb savings are adjusted to 132 kWh savings per unit and 0.038 kW savings per unit and LED bulb savings are adjusted to 125 kWh savings per unit and 0.036 kW savings per unit.

2013 to 2014 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
CFLs	208	0.060
LED Lamp	201	0.058

2015 Savings per Unit

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
CFLs	132	0.038
LED Lamp	125	0.036

Single-Package and Split System Unitary Air Conditioners

Air conditioning systems are a major consumer of electricity and systems that exceed baseline efficiencies can save considerable amounts of energy. High Efficiency Air Conditioners includes single-package and split systems unitary air-, water-, and evaporatively-cooled air conditioning equipment. The efficient equipment must exceed the energy efficiency requirements of the International Energy Conservation Code (IECC) 2009.

The baseline equipment is a standard-efficiency air-, water, or evaporatively cooled air conditioner that meets the energy efficiency requirements of the International Energy Conservation Code (IECC) 2006.

UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
Air conditioners, Air cooled	< 65,000 Btu/h[d]	Split system	13.0 SEER	AHRI 210/240
		Single package	13.0 SEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	10.3 EER[c] (before Jan 1, 2010) 11.2 EER[c] (as of Jan 1, 2010)	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	9.7 EER[c] (before Jan 1, 2010) 11.0 EER[c] (as of Jan 1, 2010)	AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split system and single package	9.5 EER[c] 9.7 IPLV[c] (before Jan 1, 2010) 10.0 EER[c] 9.7 IPLV[g] (as of Jan 1, 2010)	
	≥ 760,000 Btu/h	Split system and single package	9.2 EER[c] 9.4 IPLV[c] (before Jan 1, 2010) 9.7 EER[c] 9.4 IPLV[c] (as of Jan 1, 2010)	
Through-the-wall, Air cooled	< 30,000 Btu/h[d]	Split system	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	AHRI 210/240
		Single package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Air conditioners, Water and evaporatively cooled	< 65,000 Btu/h	Split system and single package	12.1 EER	AHRI 210/240
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	11.5 EER[c]	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	11.0 EER[c]	AHRI 340/360
	≥ 240,000 Btu/h	Split system and single package	11.5 EER[c]	

For SI: 1 British thermal unit per hour = 0.2931 W.

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. IPLVs are only applicable to equipment with capacity modulation.

c. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

d. Single-phase air-cooled air conditioners < 65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA); SEER values are those set by NAECA.

Table 5-104 - International Energy Conservation Code (IECC) 2009

High efficiency air conditioners have a measure lifetime of 15 years.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
SEER 14 (<65kBtuh)	270	0.330	$300
EER 11.5 (65 - 135 kBtuh)	996	1.216	$1,490
EER 11.5 (135 - 240 kBtuh)	3,172	3.873	$2,220
EER 10.3 (240 - 760 kBtuh)	2,009	2.453	$2,878
EER 9.7 (>760 kBtuh)	3,579	4.370	$6,395

Heat Pump Systems

Efficient heat pump systems are high-efficiency air cooled, water source, ground water source, or ground source heat pump systems that exceeds the energy efficiency requirements of the International Energy Conservation Code.

The baseline equipment is assumed to be a standard-efficiency air cooled, water source, ground water source, or ground source heat pump system that meets the energy efficiency requirements of the International Energy Conservation Code.

UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
Air cooled, (Cooling mode)	< 65,000 Btu/h[d]	Split system	13.0 SEER	AHRI 210/240
		Single package	13.0 SEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	10.1 EER[c] (before Jan 1, 2010) 11.0 EER[c] (as of Jan 1, 2010)	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	9.3 EER[c] (before Jan 1, 2010) 10.6 EER[c] (as of Jan 1, 2010)	AHRI 340/360
	≥ 240,000 Btu/h	Split system and single package	9.0 EER[c] 9.2 IPLV[c] (before Jan 1, 2010) 9.5 EER[c] 9.2 IPLV[c] (as of Jan 1, 2010)	
Through-the-Wall (Air cooled, cooling mode)	< 30,000 Btu/h[d]	Split system	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	AHRI 210/240
		Single package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Water Source (Cooling mode)	< 17,000 Btu/h	86°F entering water	11.2 EER	AHRI/ASHRAE 13256-1
	≥ 17,000 Btu/h and < 135,000 Btu/h	86°F entering water	12.0 EER	AHRIASHRAE 13256-1
Groundwater Source (Cooling mode)	< 135,000 Btu/h	59°F entering water	16.2 EER	AHRI/ASHRAE 13256-1
Ground source (Cooling mode)	< 135,000 Btu/h	77°F entering water	13.4 EER	AHRI/ASHRAE 13256-1
Air cooled (Heating mode)	< 65,000 Btu/h[d] (Cooling capacity)	Split system	7.7 HSPF	AHRI 210/240
		Single package	7.7 HSPF	
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb Outdoor air	3.2 COP (before Jan 1, 2010) 3.3 COP (as of Jan 1, 2010)	
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb Outdoor air	3.1 COP (before Jan 1, 2010) 3.2 COP (as of Jan 1, 2010)	AHRI 340/360

Table 5-105 - International Energy Conservation Code (IECC) 2009

An efficient heat pump system has a measure life of 15 years.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit	Incremental Cost per Unit
EER 11.1 (65 < 135 kBtuh)	745	0.098	$1,825
EER 10.7 (135 < 240 kBtuh)	530	0.647	$2,510
EER 10.1 (>240 kBtuh)	3,971	2.555	$3,250

Motors

An efficient motor meets the minimum efficiency levels of NEMA premium efficiency motors. The baseline equipment assumes a standard motor.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Motor	430	0.154

Variable Frequency Drive

A variable frequency drive installed on an HVAC system pump or fan motor will modulate the speed of the motor when it is not needed to run at full load. Since the power of the motor is proportional to the cube of the speed, this will result in significant energy savings. A baseline measure is a constant volume motor.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
VFD	35,533	16.667

Commercial Refrigeration

ENERGY STAR-labeled commercial refrigerators and freezers are more energy efficient because they are designed with components such as ECM evaporator and condenser fan motors, hot gas anti-sweat heaters, or high-efficiency compressors, which will significantly reduce energy consumption.

The efficient equipment is a new vertical solid or glass door refrigerator or freezer or vertical chest freezer meeting the minimum ENERGY STAR efficiency level standards. The average volume is 24 cubic feet.

Volume	Refrigerator kWh	Freezer kWh
Solid Door		
0 < 15	0.089 * Volume + 1.411	0.250 * Volume + 1.250
15 ≤ 30	0.037 * Volume + 2.200	0.400 * Volume – 1.000
30 ≤ 50	0.056 * Volume + 1.635	0.163 * Volume + 6.125
50	0.060 * Volume + 1.416	0.158 * Volume + 6.333
Glass Door		
0 < 15	0.118 * Volume + 1.382	0.607 * Volume + 0.893
15 ≤ 30	0.140 * Volume + 1.050	0.733 * Volume – 1.000
30 ≤ 50	0.088 * Volume + 2.625	0.250 * Volume + 13.500
≥ 50	0.110 * Volume + 1.500	0.450 * Volume + 3.500

The baseline equipment is assumed to be an existing solid or glass door refrigerator or freezer meeting the minimum federal manufacturing standards as specified by the Energy Policy Act of 2005.

Type	kWh
Solid Door Refrigerator	0.10 * Volume + 2.04
Glass Door Refrigerator	0.12 * Volume + 3.34
Solid Door Freezer	0.40 * Volume + 1.38
Glass Door Freezer	0.75 * Volume + 4.10

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Solid Door Refrigerator	493	0.056
Glass Door Refrigerator	661	0.075
Solid Door Freezer	869	0.099
Glass Door Freezer	2,010	0.230

Engine Block Timer for Agricultural Equipment

An Engine Block Timer is a plug-in timer activated below a specific outdoor temperature to control an engine block heater in agricultural equipment. Engine block heaters are typically used during cold weather to pre-warm an engine prior to start, for convenience heaters are typically plugged in considerably longer than necessary to improve startup performance. A timer allows a user to preset the heater to come on for only the amount of time necessary to pre-warm the engine block, reducing unnecessary run time even if the baseline equipment has an engine block temperature sensor.

An efficient measure is an engine block heater operated by an outdoor plug-in timer that turns on the heater only when the outdoor temperature is below 25 degrees Fahrenheit.

The baseline measure is an engine block heater that is manually plugged in by the farmer to facilitate equipment startup at a later time.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Engine Block Timer	664	-

Live Stock Waterer

An efficient live-stock waterer is an electrically-heated, thermally-insulated waterer with minimum of 2 inches of insulation. A thermostat is required on a unit with a heating element greater than or equal to 250 watts. The baseline measure is an electric open waterer with sinking or floating water heaters that has reached the end of useful life.

End-Use Measure	Gross kWh Savings per Unit	Gross kW Savings per Unit
Live Stock Waterer	1,593	0.525

6.3 Load Impact Uncertainties

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

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

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

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

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

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

1. Base CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the Base CO_2 avoided cost (assuming no carbon cost).

2. Moderate CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the Moderate avoided cost (assuming carbon allowances in 2021).

3. High CO_2 Planned Portfolio. A portfolio designed for program years 2013 through 2015 utilizing the High CO_2 avoided cost (assuming carbon allowances in 2015).

4. RAP+. A portfolio designed to represent one-third of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.

5. RAP++. A portfolio designed to represent two-thirds of the difference between the Realistic Achievable Potential and Maximum Achievable Potential scenarios.
6. Moderate Portfolio. A portfolio designed to achieve 1 percent incremental energy and demand savings by 2015.

7. Aggressive Portfolio. A portfolio designed to achieve 2 percent incremental energy and demand savings by 2020.

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

9. Missouri Energy Efficiency Investment Act of 2009 (MEEIA) Portfolio. A portfolio designed to achieve the MEEIA energy and demand savings goals, as outlined in 4 CSR 240-20.094.

A comparison of the program scenario analysis is shown in the following tables.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Base CO2 Planned Portfolio	30,352	30,996	31,695	32,444	32,444	32,444	32,444	32,444	8,953	8,953	8,953	8,953	8,953	8,580	8,580	8,580	8,580	8,580	8,580	8,580
Moderate CO2 Planned Portfolio	30,352	30,996	31,695	32,444	32,444	32,444	32,444	32,444	8,953	8,953	8,953	8,953	8,953	8,580	8,580	8,580	8,580	8,580	8,580	8,580
High CO2 Planned Portfolio	30,352	30,996	31,775	32,524	32,524	32,524	32,524	33,116	9,033	9,033	9,033	9,033	9,100	8,660	8,660	8,660	8,660	8,660	8,660	8,660
RAP+	32,606	34,932	43,260	48,240	59,816	70,780	87,200	97,635	75,092	79,987	79,903	79,820	79,639	79,151	78,993	68,764	68,847	66,628	66,795	66,795
RAP++	35,353	39,635	55,557	64,820	87,935	110,006	142,726	163,532	142,112	151,796	151,696	151,496	151,096	150,429	150,129	129,596	129,696	125,296	125,596	125,696
Moderate Portfolio	44,993	47,390	73,958	65,303	64,293	61,833	79,833	79,008	55,558	55,083	54,922	53,888	53,888	52,683	52,683	47,988	47,988	45,163	45,163	45,163
Aggressive Portfolio	44,993	47,390	73,958	102,995	126,580	150,013	210,768	243,038	219,063	221,213	220,963	220,743	216,927	216,927	216,927	198,473	198,473	181,098	181,098	181,098
Aggressive Capacity Portfolio	29,952	30,526	31,135	31,814	31,814	31,814	31,814	31,814	8,293	8,293	8,293	23,788	25,538	83,708	94,858	99,358	107,008	172,575	172,575	172,575
MEEIA Portfolio	37,918	43,740	67,507	81,090	115,818	148,718	197,973	229,278	208,693	223,377	223,127	222,877	222,335	221,218	220,743	190,053	190,303	183,648	184,148	184,148

Table 5-106 - Comparison of Incremental Participation by Scenario

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Base CO2 Planned Portfolio	18,534	19,459	16,866	17,170	17,170	17,170	17,170	17,170	13,090	13,090	13,090	13,090	13,090	12,990	12,990	12,990	12,990	12,990	12,990	12,990
Moderate CO2 Planned Portfolio	18,534	19,459	17,361	17,664	17,664	17,664	17,664	17,664	13,791	13,791	13,791	13,791	13,791	13,690	13,690	13,690	13,690	13,690	13,690	13,690
High CO2 Planned Portfolio	18,534	19,953	17,570	17,874	17,874	17,874	17,874	19,086	14,069	14,069	14,069	14,069	14,165	13,969	13,969	13,969	13,969	13,969	13,969	13,969
RAP+	21,873	26,648	28,813	33,287	36,571	40,224	43,397	46,938	44,580	44,736	44,576	44,280	44,882	45,120	45,474	34,131	34,625	30,936	31,442	31,948
RAP++	24,983	33,499	42,132	49,207	55,478	64,232	70,188	74,966	76,507	74,301	76,272	73,363	74,743	75,420	78,354	54,976	55,952	49,138	50,141	51,361
Moderate Portfolio	33,270	41,466	50,320	50,320	50,305	49,505	47,627	45,697	43,768	43,737	43,482	43,346	43,346	43,351	43,351	31,143	31,143	29,722	29,722	29,722
Aggressive Portfolio	33,270	41,466	50,320	60,872	71,575	81,648	90,890	100,178	98,322	98,291	97,039	95,426	95,397	95,397	95,397	80,158	80,158	57,401	57,401	57,401
Aggressive Capacity Portfolio	18,839	19,753	17,204	17,507	17,507	17,507	17,507	17,507	13,634	13,634	13,634	17,680	19,886	36,455	59,578	72,938	91,773	109,178	109,178	109,178
MEEIA Portfolio	24,827	35,042	45,286	55,773	66,430	76,500	85,690	94,991	93,866	94,766	94,414	93,753	94,683	95,594	96,670	67,185	68,249	58,831	59,930	61,058

Table 5-107 - Comparison of Net MWh Savings by Scenario

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Base CO2 Planned Portfolio	3.4	3.6	3.5	3.6	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.5	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Moderate CO2 Planned Portfolio	3.4	3.6	3.6	3.8	3.8	3.8	3.8	3.8	3.6	3.6	3.6	3.6	3.6	3.4	3.4	3.4	3.4	3.4	3.4	3.4
High CO2 Planned Portfolio	3.4	3.7	3.8	3.9	3.9	3.9	3.9	4.2	3.8	3.8	3.8	3.8	3.8	3.6	3.6	3.6	3.6	3.6	3.6	3.6
RAP+	4.2	5.4	6.9	8.9	9.8	10.8	11.4	12.3	12.7	12.6	12.6	12.5	12.4	12.4	12.4	9.3	9.5	8.4	8.6	8.7
RAP++	5.0	7.1	10.5	14.0	15.6	17.9	19.0	20.4	21.7	21.1	21.4	20.8	20.8	20.9	21.4	15.0	15.3	13.2	13.5	13.9
Moderate Portfolio	7.6	9.6	13.1	13.1	14.5	14.0	12.6	12.1	12.7	12.8	12.9	12.9	12.9	12.1	12.1	9.3	9.3	8.9	8.9	8.9
Aggressive Portfolio	7.6	9.6	13.1	15.9	19.5	22.1	23.8	25.7	26.2	26.2	26.0	25.7	24.7	24.7	24.7	20.6	20.6	15.2	15.2	15.2
Aggressive Capacity Portfolio	3.4	3.7	3.6	3.7	3.7	3.7	3.7	3.7	3.6	3.6	3.6	4.8	5.6	9.1	15.6	19.1	25.4	29.7	29.7	29.7
MEEIA Portfolio	5.3	7.9	12.4	15.1	18.4	21.0	22.7	24.9	25.6	25.6	25.5	25.3	24.8	25.0	25.1	17.7	17.9	15.5	15.7	16.0

Table 5-108 - Comparison of Net Coincidence MW Savings by Scenario

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Base CO2 Planned Portfolio	$2,101,549	$2,220,189	$2,363,194	$2,379,344	$2,389,344	$2,389,344	$2,394,344	$2,395,444	$2,566,719	$2,581,719	$2,576,719	$2,591,719	$2,325,919	$2,418,069	$2,433,069	$2,443,069	$2,443,069	$2,458,069	$2,473,069	$2,473,069
Moderate CO2 Planned Portfolio	$2,086,549	$2,205,189	$2,598,194	$2,614,344	$2,624,344	$2,624,344	$2,629,344	$2,664,444	$2,948,219	$2,963,219	$2,958,219	$2,973,219	$2,733,919	$2,826,069	$2,841,069	$2,851,069	$2,851,069	$2,866,069	$2,881,069	$2,881,069
High CO2 Planned Portfolio	$2,086,549	$2,452,989	$2,738,819	$2,754,969	$2,764,969	$2,764,969	$2,769,969	$3,286,944	$3,168,844	$3,183,844	$3,178,844	$3,193,844	$2,974,294	$3,062,944	$3,077,944	$3,087,944	$3,087,944	$3,102,944	$3,117,944	$3,117,944
RAP+	$2,926,432	$4,120,929	$5,506,199	$7,358,241	$8,023,610	$8,676,958	$9,184,226	$10,394,073	$11,320,290	$11,125,930	$11,024,470	$10,944,950	$11,318,686	$11,507,573	$11,632,277	$7,987,114	$8,245,954	$6,862,462	$7,146,322	$7,408,602
RAP++	$3,749,967	$6,184,863	$9,092,503	$12,669,955	$14,171,580	$15,914,005	$16,935,955	$18,705,886	$20,036,930	$19,478,930	$19,347,680	$19,097,180	$19,860,555	$20,200,828	$20,466,101	$12,655,736	$13,154,736	$10,323,117	$10,858,117	$11,538,117
Moderate Portfolio	$4,956,518	$6,845,898	$10,429,906	$11,545,826	$12,797,701	$13,072,338	$11,708,080	$10,924,005	$12,260,255	$12,579,630	$12,698,755	$12,707,005	$12,171,330	$12,667,469	$12,727,469	$8,788,418	$8,788,418	$8,095,843	$8,130,843	$8,130,843
Aggressive Portfolio	$5,098,538	$7,129,528	$10,889,426	$13,831,597	$16,838,724	$19,331,949	$20,079,301	$21,983,441	$23,657,420	$23,816,045	$24,288,785	$24,072,072	$22,996,516	$22,996,516	$22,996,516	$20,226,269	$20,226,269	$12,289,122	$12,289,122	$12,289,122
Aggressive Capacity Portfolio	$2,379,599	$2,508,489	$2,665,244	$2,691,894	$2,701,894	$2,701,894	$2,706,894	$2,709,319	$2,995,094	$3,010,094	$3,005,094	$4,009,644	$4,516,119	$9,545,119	$17,880,290	$23,921,655	$31,913,355	$35,213,318	$35,413,318	$35,413,318
MEEIA Portfolio	$3,493,592	$6,228,136	$9,934,495	$12,822,797	$16,004,639	$18,541,349	$19,971,174	$22,461,175	$24,680,049	$24,196,299	$24,919,924	$24,650,549	$24,415,811	$24,607,720	$24,837,811	$15,962,597	$16,491,347	$13,102,667	$13,641,417	$14,180,167

Table 5-109 - Comparison of Incentives by Scenario

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Base CO2 Planned Portfolio	$2,803,278	$2,879,033	$2,846,953	$2,917,811	$2,919,046	$2,919,046	$2,918,561	$2,918,939	$2,721,729	$2,723,582	$2,721,862	$2,723,714	$2,574,794	$2,634,689	$2,636,542	$2,636,674	$2,636,674	$2,638,527	$2,640,379	$2,640,379
Moderate CO2 Planned Portfolio	$2,797,803	$2,873,558	$2,931,888	$3,002,746	$3,003,981	$3,003,981	$3,003,496	$3,016,200	$2,860,053	$2,861,905	$2,860,185	$2,862,038	$2,722,706	$2,782,601	$2,784,454	$2,784,586	$2,784,586	$2,786,439	$2,788,291	$2,788,291
High CO2 Planned Portfolio	$2,797,803	$2,963,211	$2,985,447	$3,056,305	$3,057,540	$3,057,540	$3,057,055	$3,455,736	$2,942,812	$2,944,665	$2,942,945	$2,944,797	$2,827,878	$2,871,554	$2,873,407	$2,873,539	$2,873,539	$2,875,392	$2,877,244	$2,877,244
RAP+	$3,611,952	$4,670,424	$5,969,297	$6,997,937	$7,368,435	$7,764,991	$8,132,412	$8,623,388	$8,952,901	$8,845,423	$8,776,229	$8,706,170	$8,907,437	$9,081,423	$9,201,012	$6,552,686	$6,708,499	$5,659,101	$5,818,586	$5,964,211
RAP++	$4,741,967	$6,922,441	$9,667,964	$11,805,828	$12,827,995	$13,910,078	$14,657,177	$15,388,184	$16,366,748	$16,035,146	$15,944,959	$15,748,132	$16,169,226	$16,489,862	$16,775,962	$10,987,255	$11,300,241	$9,042,030	$9,360,974	$9,761,298
Moderate Portfolio	$7,605,494	$9,902,074	$13,062,161	$13,212,452	$13,309,185	$12,647,528	$11,469,297	$10,847,224	$11,449,235	$11,562,223	$11,560,206	$11,533,240	$11,129,003	$11,725,886	$11,732,666	$7,690,398	$7,690,398	$7,201,793	$7,205,748	$7,205,748
Aggressive Portfolio	$7,668,148	$10,033,070	$13,254,315	$15,108,989	$16,897,820	$18,399,898	$19,130,030	$20,404,810	$21,268,407	$21,329,147	$20,941,974	$20,637,971	$20,360,306	$20,360,306	$20,360,306	$17,343,487	$17,343,487	$10,923,094	$10,923,094	$10,923,094
Aggressive Capacity Portfolio	$3,027,143	$3,117,443	$3,103,922	$3,187,319	$3,188,449	$3,188,449	$3,187,334	$3,187,871	$3,044,718	$3,046,413	$3,044,168	$3,634,882	$3,953,257	$7,688,118	$13,705,321	$18,584,259	$23,964,627	$27,580,540	$27,603,140	$27,603,140
MEEIA Portfolio	$5,046,395	$7,961,714	$12,048,860	$14,189,762	$15,961,767	$17,497,611	$18,647,137	$19,885,656	$21,031,616	$20,759,064	$20,690,307	$20,494,893	$20,538,458	$20,890,948	$21,232,253	$13,781,441	$14,167,149	$11,207,143	$11,597,972	$11,953,520

Table 5-110 - Comparison of Total Utility Administrative Costs by Scenario

SECTION 7 DEVELOPMENT OF EVALUATION PLANS

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

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

Project Initiation Meetings

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

Evaluation Plans

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

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

Program Design and Delivery Review

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

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

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

Evaluation Management and Reporting

The evaluation contractor will meet with Empire in person or via teleconference to summarize tasks completed for the month, problems encountered and solutions implemented, schedule

and budget issues and updates, and tasks planned in the next month. The evaluation contractor will have ad-hoc meetings with Empire staff as needed to resolve issues as they arise and maintain ongoing communication.

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

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

Process Evaluation Approach

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

1. Assist program implementers and managers with managing programs to achieve cost effective savings while maintaining high levels of customer satisfaction.

2. Determine awareness levels to refine marketing strategies and reduce barriers to participation.

3. Provide recommendations for changing the program's structure, management, administration, design, delivery, operations or targets.

4. Determine if best practices should be incorporated.

5. Gather information from a variety of sources to address the issues stated above.

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

Data Collection and Sampling Plan

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

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

The sample size of each group will be calculated at a 90 percent confidence interval with an error margin of +/- 10 percent. 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:

1. Strategies to measure and verify energy efficiency installation and determine energy impacts for each program, as appropriate, in kilowatt-hour or kilowatt reductions:
    a. Sample for field verification activities.
    b. Field verification activities and observations.
    c. Adjusted measure savings values based on field activities and data reviews.
2. Program-specific realization rates.
3. Energy savings based on four annual time periods (on-peak and off-peak).
4. Billing analyses.
5. Applications and supporting documentation provided to Empire from customers, as appropriate.
6. Conclusions and recommendations for more accurately estimating energy savings for each program.

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

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

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

SECTION 8 DEMAND-SIDE RESOURCES AND LOAD-BUILDING PROGRAMS

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

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