2019
Integrated Resource Plan

Technical Appendix

Volume 2

Demand Side Management

REDACTED

DEMAND SIDE MANAGEMENT ANALYSIS

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Executive Summary

East Kentucky Power Cooperative (EKPC) selects Demand Side Management (DSM) programs to offer on the basis of meeting End-Use Retail Member (retail member) needs and resource planning objectives in a cost-effective manner. EKPC analyzes DSM measures and programs using both qualitative and quantitative criteria. These criteria include retail member acceptance, measure applicability, savings potential, and cost-effectiveness. The cost-effectiveness of DSM resources is analyzed in a rigorous fashion using standard (California) tests for cost-effectiveness.

For the 2019 IRP, EKPC has continued to enhance its DSM planning capabilities by undertaking an updated study of savings potential in its service territory. EKPC expanded the scope this time to also examine demand response (DR) measures. EKPC retained GDS Associates, Inc. (GDS) to prepare this Energy Efficiency and Demand Response Potential Study which provided a cost-effectiveness screening of a comprehensive set of measures using the Total Resource Cost (TRC) test from the California standard. This resulted in a greater number of DSM measures receiving cost-benefit analysis and a comprehensive evaluation of DSM measures for this 2019 Integrated Resource Plan (IRP).

EKPC evaluated 388 DSM measures for the 2019 Integrated Resource Plan. These included 372 energy efficiency (EE) measures, and 16 DR response programs.

For more details on the EE measures and the results of the economic screening of those measures, please see the GDS Energy Efficiency and Demand Response Potential study (**Exhibit DSM-1**).

DSM programs include a package of one or more measures. EKPC prepared cost and participation estimates for the DSM programs it selected and conducted a final cost-effectiveness analysis for each program using the widely-accepted Demand Side Management Option Risk Evaluator (*DSMore)* software tool.

EKPC used the $3 million residential EE budget scenario from the GDS potential study to develop participation estimates for the DSM programs.

All of the programs selected, with the exception of the EKPC Community Assistance Resources for Energy Savings (CARES) low-income program and the energy audit program[1], were shown to be cost-effective using the TRC test.

The DSM portfolio for the 2019 IRP includes nine programs: Seven EE programs and two DR programs. The DSM portfolio was approved by the EKPC Board of Directors on November 13, 2018.

EKPC presents the following DSM Program Portfolio for the 2019 IRP:

[1] Low income programs are historically difficult to pass the TRC, and Commissions including the PSC here in Kentucky have allowed utilities to offer them to serve this disadvantaged community. The energy audit program is a member service tool for high bill complaints; it also saves electricity.

Table DSM-1

DSM Programs[2]

Program Name	Class	Summer Peak Demand Impact in 2033 (MW)	Annual Energy Impact in 2033 (MWh)	Total Resource Cost Test Benefit/ Cost Ratio
Button-Up Weatherization	Residential	0.8	4,162	1.13
CARES - Low Income	Residential	0.8	5,294	0.96
Heat Pump Retrofit	Residential	4.2	82,851	1.55
Touchstone Energy (TSE) Home	Residential	4.8	21,290	1.60
ENERGY STAR® Manufactured Home	Residential	1.1	9,237	1.71
Residential Energy Audit	Residential	0.7	3,002	0.69
Residential Efficient Lighting	Residential	1.1	9,240	2.78
Direct Load Control - Residential: AC switches[3]	Residential	6.9	207	2.92
Direct Load Control - Residential: AC -Bring Your Own Thermostat	Residential	6.9	207	3.96

This portfolio of DSM programs is projected to produce $81.1 million of benefits and $31.6 million of net benefits in 2019 dollars on a total resource basis over the lifetime of the cost-effectiveness study. The programs will require an investment of $49.5 million in current year dollars by EKPC, its Owner-Member Cooperatives (owner-members), and participating retail members in order to produce these savings.

[2] All impacts are cumulative incremental starting with new participation in 2019. All impacts represent net savings at the retail member meter.

[3] The tariff allows small commercial customers to participate. However, we are not projecting to have any small commercial participants in this IRP.

Major Enhancements Since Last IRP

EKPC has made several improvements to its DSM planning since the 2015 IRP. They include:

1. EKPC retained GDS to prepare an updated Energy Efficiency and Demand Response Potential Study for EKPC. The project scope was expanded in 2019 to include DR resources in addition to EE measures. The measure list for EE was also expanded. As a result, a more comprehensive set of DSM measures have been evaluated for this 2019 IRP.
2. In accordance with Commission Orders, EKPC updated its methodology for calculating avoided generation capacity costs to correspond to the PJM Interconnection, LLC (PJM) capacity market prices.
3. Added functionality and reports to its DSM Tracking software system provided by Direct Technology to improve data collection, program administration, Measurement and Verification, and reporting capabilities for DSM programs.
4. EKPC prepared and submitted DSM Annual Reports for 2014, 2015, 2016, and 2017 (see **Exhibit DSM-2**).

Introduction

EKPC evaluates the future electric service requirements for its owner-members with balanced consideration of demand side and supply-side resource options. The purpose of this section is to describe the evaluation of DSM resources for inclusion in the integrated analysis portion of the IRP.

DSM resources consist of owner-member energy programs that seek to change the power consumption of retail member facilities in a way that meets planning objectives. They include energy efficiency, load management, DR, and other demand side programs. EKPC's DSM analysis is conducted on an aggregate basis, with all owner-members combined, rather than on an individual retail member basis.

Screening Criteria

EKPC analyzes DSM measures and programs using both qualitative and quantitative criteria. These criteria include retail member acceptance, measure applicability, savings potential, and cost-effectiveness. The cost-effectiveness of DSM resources is analyzed in a rigorous fashion using standard (California) tests for cost-effectiveness.

Description of DSM Screening and Evaluation

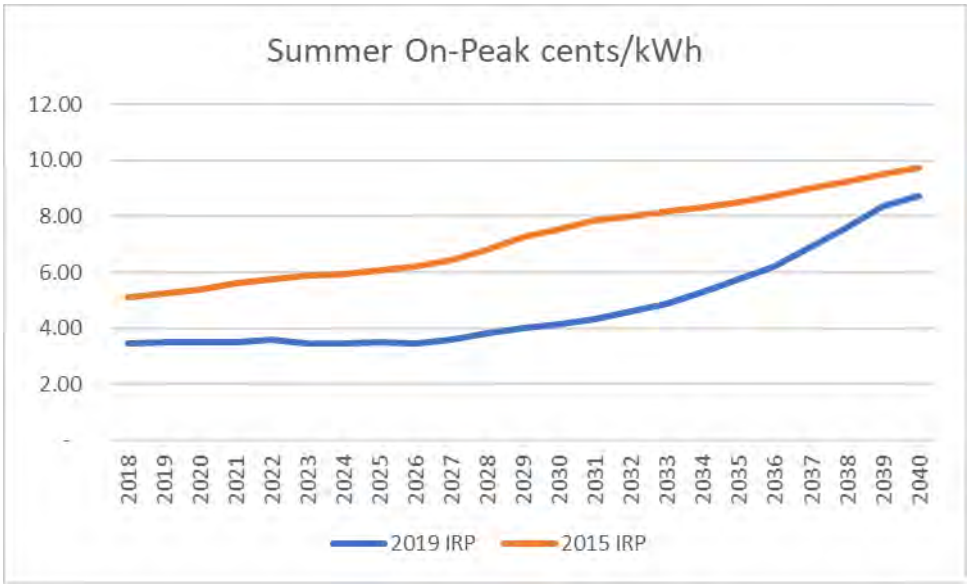
EKPC uses a robust process to screen and evaluate DSM resources for inclusion in this plan. For the IRP, EKPC has improved its DSM planning capabilities by undertaking a more comprehensive study of EE and DR savings potential. EKPC selected GDS as its contractor to conduct this EE and DR potential study.

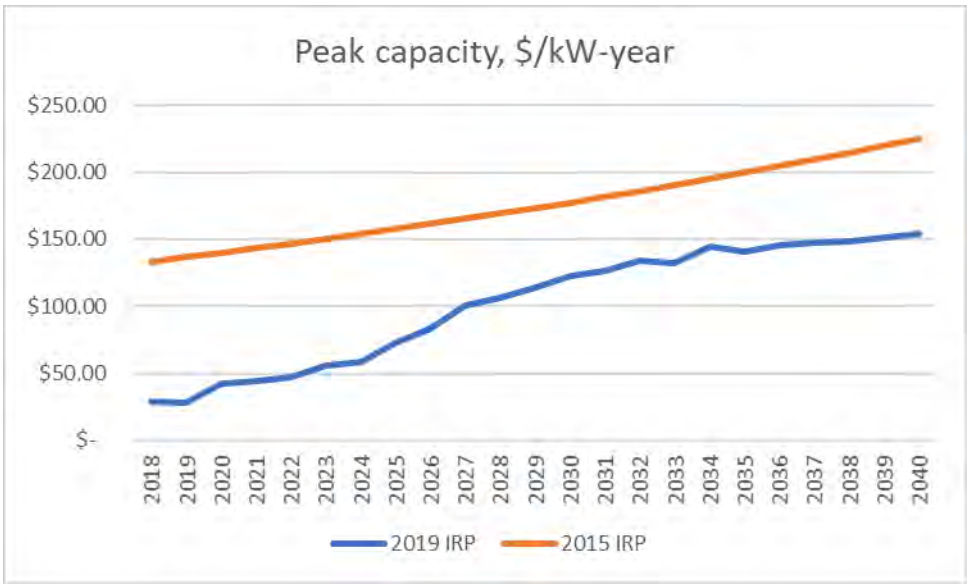
GDS conducted a cost-effectiveness screening of a comprehensive set of measures using the TRC test from the California standard. The EE potential study also used applicability factors for each measure in determining the savings potential. For more details, including the measure lists, screening results, and estimates of economic and achievable potential, please refer to the Final Report for the Energy Efficiency and Demand Response Potential Study submitted by GDS.

GDS also developed a set of funding scenarios which determined the achievable potential given a specified budget level. This provided a basis for determining participation rates in DSM programs. EKPC evaluated 388 DSM measures for the IRP. These include 372 EE measures as well as 16 DR programs.

New operating environment drives change in strategy

The operating environment for DSM has changed significantly since the last IRP in 2015. First, the avoided energy and capacity costs are significantly lower now. This in turn reduces the cost-effectiveness of DSM programs and measures. In some cases, this has resulted in programs and measures that had previously been cost-effective to no longer be so. The following graphs compare the avoided costs for the 2015 IRP with the avoided costs for this IRP:





Second, many of EKPC's owner-members have expressed concern about revenue erosion that could negatively impact their long-term financial health.

Third, the repeal of the Federal Clean Power Plan has removed any value that EE would have had as a compliance option."

Finally, more stringent efficiency codes and standards have reduced the incremental savings for certain measures.

In response to this different operating environment, EKPC has made changes to its program offerings. Some programs have been discontinued, while others have been modified.

The following programs have been <u>eliminated:</u>

- ENERGY STAR® Appliances
- Appliance Recycling
- HVAC Duct Seal
- C&I Lighting
- Industrial Compressed Air

The following programs have been modified:

- Button-Up Weatherization: There will no longer be three tiers. The program will be Button-Up with Air Sealing only. This program will provide incentives for ceiling insulation and air sealing only. Furthermore, ceiling insulation will only receive a rebate if air sealing is also performed at the home.

- Heat Pump Retrofit: This program will have two SEER levels rather than the previous three. Ductless mini-spilt systems are new to the US market and EKPC has seen significant growth in installations. Thus, three levels of ductless mini-splits have been added: 1-head, 2-head, and 3-head units.

- Touchstone Energy Home: This program will now have (1) one efficiency target: 30% lower energy use than the typical home built in Kentucky.

- ENERGY STAR® Manufactured Home: The rebate has been lowered to reflect lower energy savings per home.

- Residential Direct Load Control: The water heater switch option is eliminated while the smart thermostat option for air conditioners has been added.

The remaining programs have not been changed:

- CARES Low-Income Weatherization
- Residential Energy Audit (home information)
- Residential Efficient Lighting

EKPC has filed updated tariffs with the Kentucky Public Service Commission that reflect these changes to programs.

In IRP, EKPC has set participation levels for DSM programs to meet targeted funding levels. These targets correspond to the $3 million residential EE scenario in the GDS report. EKPC will allocate that funding to existing programs. No new programs are proposed in this IRP.

In addition, EKPC and its owner-members have made the strategic decision to dedicate all DSM resources to the residential class. Residential retail members consume over 60% of the electricity produced by EKPC for its owner-members. Therefore, there are no non-residential EE programs proposed in this IRP.

Should future conditions warrant it, EKPC's priorities for starting up non-residential EE programs would be lighting, HVAC, refrigeration, machine drive, and process heating & cooling.

DSM Program choices and Final Cost-Effectiveness Analysis

A DSM program consists of a package of one or more EE and/or DR measures. EKPC selected a portfolio of DSM programs in order to best achieve its objectives of meeting retail member needs and acquiring cost-effective savings with a specified budget. EKPC made the strategic decision to devote all of its budget to programs for residential retail members, and to rely on approved programs with a track record of success.

EKPC used the $3 million EE budget scenario from the GDS study to develop participation estimates for the selected EE programs. In the same way, EKPC developed participation estimates for the DR programs.

Each program was designed using savings, costs, incentives, and participation estimates. Using these parameters, EKPC used the widely-used *DSMore* software tool to conduct a final cost-effectiveness analysis for each DSM program.

Quantitative Evaluation Process

For this IRP, EKPC is once again using the *DSMore* software package to conduct the more detailed quantitative evaluation. *DSMore* was developed in 2003 by Integral Analytics. The *DSMore* is a financial analysis tool designed to evaluate the costs, benefits, and risk profile of DSM programs and measures. This tool combines Microsoft Excel spreadsheets with a separate component that performs detailed calculations. The user interfaces only with the Excel spreadsheet, which accepts inputs and returns outputs.

All the standard DSM cost-effectiveness tests in the California Standard Practice Manual for Economic Analysis of Demand Side Programs, can be calculated using this tool: The TRC test, the Utility Cost test, the Participant Cost (PC) test, the Ratepayer Impact (RIM) Test, and the Societal Cost (SC) test. *DSMore* provides the results of those tests for both EE and DR programs. This tool is viewed as "best practice" in the industry. *DSMore* has been used by more than 20 utilities, including other utilities in Kentucky.

DSMore calculates the impact of DSM programs on the owner-members and their retail members. The software tracks both the physical changes, such as the level of power demand, and the dollar flows. *DSMore* produces a quantitative estimate of the costs and benefits for each of the parties using models of each owner-member and its retail members.

EKPC uses these tests to examine cost-effectiveness from three major perspectives: PC, RIM, and TRC. A fourth perspective, SC, is treated as a variation on the TRC test.

The results of each test can be expressed in a variety of ways, but in all cases, it is necessary to calculate the net present value of program impacts over the life cycle of those impacts. *DSMore* uses this information to calculate the benefit/cost (b/c) ratio for each of these four tests.

These tests are not intended to be used individually or in isolation. The first critical test that a DSM program must pass is the PC test, because without participants, no savings occur. The results of tests that measure efficiency, such as the TRC and the SC, must be compared not only to each other, but also to the RIM test. The use of multiple tests helps ensure that the resulting portfolio of DSM programs attracts participants, results in the wise use of resources, and limits cross-subsidization.

EKPC is a full requirements Generation and Transmission provider for its 16 owner-members. Each owner-member is an independent non-profit corporation and operates distinct from EKPC. As a result, it is necessary to examine the impacts of DSM programs separately for EKPC and for the typical owner-member. EKPC uses a customized version of *DSMore* to separately report the RIM test for EKPC and for each owner-member.

Each of the programs was modeled in detail with *DSMore*. For certain programs, two or three measures were modeled individually and then aggregated at the program level.

Each DSM program model includes:

- Typical participant electricity savings (kWh and kW)
- Lifetime of the measure savings
- Incremental measure costs (PC)

- EKPC and owner-member administrative costs
- Rebates to retail members, and rebates from EKPC to its owner-members
- Detailed retail and wholesale rate schedules
- Retail member participation levels including free rider estimates.

In addition to the detailed modeling of the DSM programs, *DSMore* also includes a detailed model of the supply side costs.

Major categories of supply side costs that are accounted for by the model include:

- Marginal energy costs (by hour of the year, correlated with weather and load)
- Marginal generation capacity costs (by year, including seasonal allocation)
- Marginal transmission & distribution capacity costs (by year, including seasonal allocation)
- Fossil fuel (natural gas & propane) costs (by year)
- Environmental externality costs (costs not internalized in energy or capacity costs; chiefly carbon related)

Accounting for program impacts

Impacts from the first five years of future participation (2019-2023) are considered existing resources and are accounted for in the load forecast. Impacts from participation in 2024-2033 are considered new resources and are accounted for in the integrated plan.

For simplicity, impacts from participation in all 15 years are reported together in the program tables in this plan.

The program portfolio

The DSM portfolio for the IRP incudes seven EE programs and two DR programs.

All of the programs selected, with the exception of the CARES low-income program and the energy audit program[4], were shown to be cost-effective using the TRC test.

Recommendations

EKPC presents the following DSM Program Portfolio for this IRP:

Table DSM-2

DSM Programs[5]

Program Name	Class	Summer Peak Impact in 2033 (MW)	Annual Energy Impact in 2033 (MWh)	TRC Benefit/ Cost Ratio
Button-Up Weatherization	Residential	0.8	4,162	1.13
CARES – Low Income	Residential	0.8	5,294	0.96
Heat Pump Retrofit	Residential	4.2	82,851	1.55
Touchstone Energy (TSE) Home	Residential	4.8	21,290	1.60
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[4] Low income programs are historically difficult to get to pass the TRC, and commissions including the PSC here in Kentucky have allowed utilities to offer them to serve this disadvantaged community. The energy audit program is a member service tool for high bill complaints; it also saves electricity.

[5] All impacts are cumulative incremental starting with new participation in 2019. All impacts represent net savings at the retail member meter.

[6] The tariff allows small commercial customers to participate. However, EKPC is not projecting to have any small commercial participants in this IRP.

This portfolio of DSM programs is projected to produce $81.1 million of benefits and $31.6 million of net benefits in 2019 dollars on a total resource basis over the lifetime of the cost-effectiveness study. They will require an investment of $49.5 million in current-year dollars by EKPC, its owner-members, and participating retail members in order to produce these savings.

Descriptions of the DSM Programs

Exhibit DSM-3 provides assumptions sheets for each DSM program. For two programs, separate analysis was performed for individual measures and then aggregated. Separate assumptions sheets were completed for each measure in those programs: The Heat Pump Retrofit program (3 measures); and the Residential Audit program (2 options).

Exhibit DSM-4 provides more detailed results of the quantitative screen in the form of summary sheets for each DSM program.

Exhibit DSM-5 provides program descriptions for each of the programs.

DSM program design and implementation are complex and dynamic undertakings. It is possible that DSM programs selected through this evaluation process may not be implemented as they have been described in this document.

Estimated Impacts

The following table provides the forecasted impacts of the DSM programs on utility sales and coincident peak demands. Negative values denote reductions in load requirements while positive values denote increases in load requirements.

Table DSM-3

Load Impacts of DSM Programs

(negative value= reduction in load)

Year	Impact on Energy Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	-10,651	-2.2	-1.6
2020	-20,473	-4.1	-3.5
2021	-30,295	-6.0	-5.5
2022	-40,117	-8.0	-7.5
2023	-49,939	-9.9	-9.4
2024	-59,552	-11.7	-11.3
2025	-68,981	-13.5	-13.2
2026	-78,411	-15.3	-15.1
2027	-86,621	-16.9	-16.8
2028	-94,765	-18.4	-18.5
2029	-102,910	-20.0	-20.3
2030	-111,054	-21.6	-22.0
2031	-119,199	-23.1	-23.7
2032	-127,344	-24.7	-25.4
2033	-135,488	-26.3	-27.1

Year-by-year impacts for each individual program are provided in **Exhibit DSM-6**.

Other Exhibits

Exhibit DSM-7 contains the remaining required program-specific tables: targeted classes and end uses, the expected duration of each program, projected costs, and projected cost savings.

Exhibit DSM-8 contains the updated activities with the DSM Collaborative.

Exhibit DSM-9 contains a table that shows the amount of DR peak savings that EKPC has offered into the PJM auction.

Factoring Environmental Cost Considerations into DSM Evaluation

EKPC has explicitly factored environmental costs into this evaluation of DSM resources. There are three major categories of environmental cost:

(1) Cost of purchasing allowances;
(2) Capital costs of compliance at power plants; and
(3) Future environmental compliance costs.

EKPC has accounted for all three categories of environmental cost in its DSM evaluation. The following table describes how this was accomplished:

Table DSM-7
Accounting for Environmental Costs

ENVIRONMENTAL COST	WHERE ACCOUNTED FOR	SPECIFICS
Allowance purchases	Marginal energy costs	SOx and NOx
Capital investments for compliance	Marginal capacity costs	Primarily Scrubbers, SCRs, other controls
Future Environmental Compliance Costs	Future Environmental Compliance Cost adder	Used in Societal Cost test; value is set to $0/MWh. Assessment of likely Future Environmental Compliance Cost value to be placed on carbon dioxide by government legislation and/or regulation over the 15 year planning period.

Exhibit DSM-1

EE Potential Report

EAST KENTUCKY POWER COOPERATIVE

Energy Efficiency & Demand Response Potential

FINAL REPORT

November 2018

prepared by

GDS Associates, Inc.
ENGINEERS & CONSULTANTS
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1 Executive Summary

1.1 BACKGROUND

This energy efficiency and demand response potential study for the East Kentucky Power Cooperative (EKPC) provides a roadmap and identifies the energy efficiency and demand response measures having the greatest potential savings and the measures that are the most cost-effective. In addition to technical and economic potential estimates, the development of achievable potential estimates for a range of feasible energy efficiency measures is useful for program planning and modification purposes. Unlike achievable potential estimates, technical and economic potential estimates do not include customer acceptance considerations for energy efficiency measures, which are often among the most important factors when estimating the likely customer response to new programs.

All energy efficiency results were developed using customized residential, commercial and industrial sector-level energy efficiency potential assessment Excel models and Company-specific cost effectiveness criteria including the most recent EKPC avoided energy and capacity cost projections for electricity. Demand response results were calculated in a separate model.

The results of this study provide detailed information on measures that are cost-effective and have potential kWh and kW savings. The data referenced in this report were the best available at the time this analysis was developed. As building and appliance codes and energy efficiency standards change, and as energy prices fluctuate, additional opportunities for energy efficiency may occur while current practices may become outdated. Actual energy and demand savings will depend upon the level and degree of voluntary member system participation in DSM programs.

1.2 STUDY SCOPE

This study examines the potential to reduce electric consumption and peak demand through the implementation of DSM technologies and practices in residential, commercial, and industrial facilities. The study assessed energy efficiency potential and demand response throughout EKPC Members' service territories over fifteen years, from 2019 through 2033.

The scope of this study distinguishes three types of energy efficiency potential: (1) technical, (2) economic, and (3) achievable.

- ***Technical Potential*** is the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end users to adopt the efficiency measures. Technical potential is constrained only by factors such as technical feasibility and applicability of measures.
- ***Economic Potential*** refers to the subset of the technical potential that is economically cost-effective as compared to conventional supply-side energy resources. Economic potential follows the same adoption rates as technical potential. Like technical potential, the economic scenario ignores market barriers to ensuring actual implementation of efficiency. Finally, economic potential only considers the costs of efficiency measures themselves, ignoring any programmatic costs (e.g., marketing, analysis, administration) that would be necessary to capture them.[1]
- ***Achievable Potential*** is the amount of energy use that efficiency can realistically be expected to displace, assuming the most aggressive program scenario possible (e.g., providing end users with payments for the entire incremental cost of more efficient equipment). Achievable potential considers real-world barriers to encouraging end users to adopt efficiency measures, the non-measure costs of delivering programs (for administration, marketing, tracking systems, and

[1] National Action Plan for Energy Efficiency, "Guide for Conducting Energy Efficiency Potential Studies" (November 2007), page 2-4.

monitoring and evaluation), and the capability of programs and administrators to boost program activity over time.[2] The study assessed two types of achievable potential: maximum (MAP) and realistic (RAP). See section 2.4.4 for a description.

1.3 ENERGY EFFICIENCY POTENTIAL

Figure 1-1 provides the 15-yr technical, economic, and achievable potential across all sectors in the EKPC service territory. The realistic achievable potential is approximately 9% of forecasted sales for both the commercial and industrial sectors and 12% for the residential sector.

FIGURE 1-1 ELECTRIC EFFICIENCY POTENTIAL SAVINGS SUMMARY – BY 2033

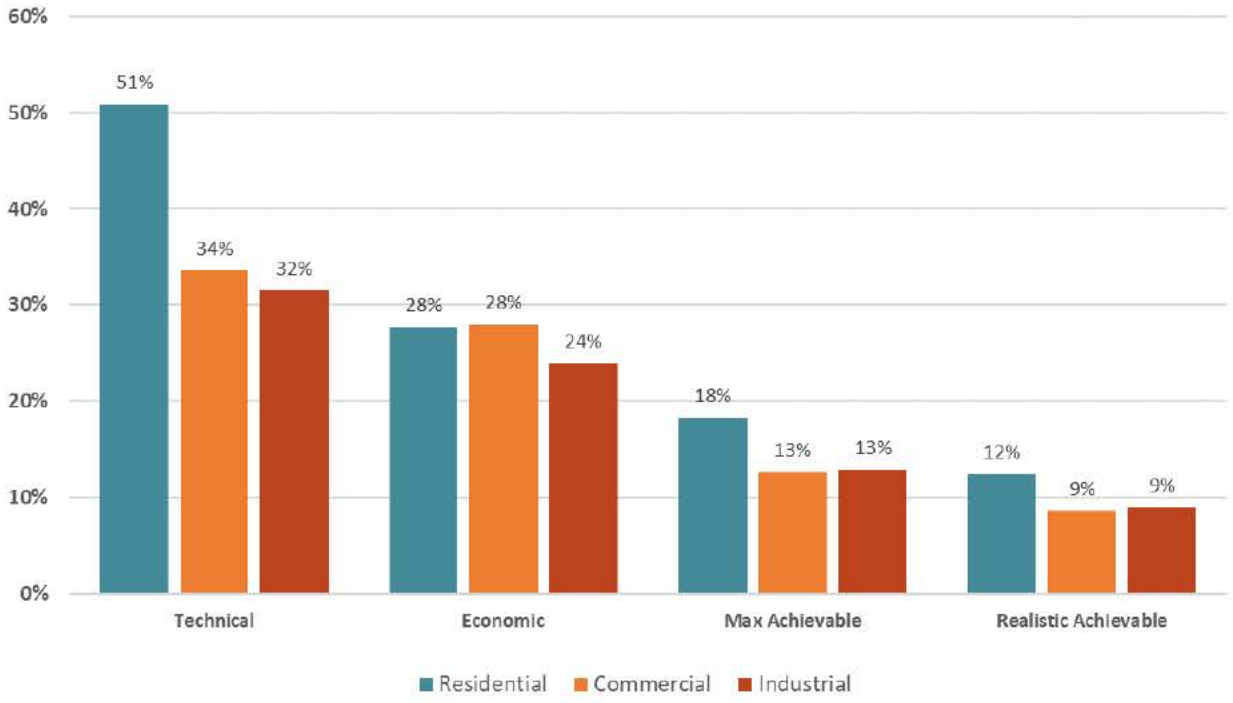


Table 1-1 provides the 15-yr energy potential in total MWh as well as the percent savings of the forecasted sales. The overall EKPC realistic achievable potential is approximately 1.6 million MWh, or nearly 11% of the total forecasted sales.

TABLE 1-1 SECTOR-LEVEL CUMULATIVE ANNUAL ENERGY EFFICIENCY SAVINGS – BY 2033

Sector	Technical	Economic	MAP	RAP
Cumulative Annual Savings %				
Residential	50.8%	27.7%	18.3%	12.4%
Commercial	33.6%	28.0%	12.6%	8.6%
Industrial	31.5%	23.9%	12.9%	8.9%
Total	42.3%	26.6%	15.7%	10.8%
Cumulative Annual MWh				
Residential	4,101,328	2,235,491	1,474,578	1,000,348
Commercial	833,818	693,952	313,605	214,307
Industrial	1,386,909	1,051,536	566,253	392,850
Total	6,322,055	3,980,979	2,354,436	1,607,505

[2] National Action Plan for Energy Efficiency, "Guide for Conducting Energy Efficiency Potential Studies" (Nov. 2007), page 2-4.

Table 1-2 shows the net present value benefits, costs and benefit-cost ratios for the MAP and RAP scenarios examined in this study. The overall TRC ratio in the RAP scenario is 2.4 and yields more than $ $600 million in NPV net benefits.

TABLE 1-2 ACHIEVABLE POTENTIAL COST-EFFECTIVENESS ($ IN MILLIONS)

Potential	NPV Benefits	NPV Costs	TRC Test Ratio
Maximum Achievable	$1,547	$712	2.2
Realistic Achievable	$1,056	$446	2.4

1.4 DEMAND RESPONSE POTENTIAL

The demand response assessment included a switch scenario and a thermostat scenario (see Section 2.5 for details). Table 1-3 shows the technical, economic, and achievable (MAP and RAP) cumulative annual potential for years 5, 10 and 15 of the study in the switch scenario. Table 1-4 shows results for each level of potential in the thermostat scenario.

Achievable potential includes a participation rate to estimate the realistic number of customers that are expected to participate in each cost-effective demand response program option. These values are at the customer meter. The maximum achievable potential (MAP) assumes the maximum participation that would happen in the real-world, while the realistically achievable potential (RAP) discounts MAP by considering barriers to program implementation that could limit the amount of savings achieved.

TABLE 1-3 SUMMARY OF TECHNICAL, ECONOMIC, AND ACHIEVABLE POTENTIAL – SWITCH SCENARIO

Potential Level (MW)	5-Year Savings (2023)	10-Year Savings (2028)	15-Year Savings (2033)
Technical	1265	1275	1282
Economic	1126	1131	1134
MAP	358	409	455
RAP	130	172	214

TABLE 1-4 SUMMARY OF TECHNICAL, ECONOMIC, AND ACHIEVABLE POTENTIAL – THERMOSTAT SCENARIO

Potential Level (MW)	5-Year Savings (2023)	10-Year Savings (2028)	15-Year Savings (2033)
Technical	962	987	1012
Economic	822	843	865
MAP	357	408	453
RAP	118	149	180

1.5 REPORT ORGANIZATION

The body of the report is divided into six subsequent chapters:

- *Chapter 2: Methodology* describes the approaches taken to each sector for the energy efficiency assessment and the demand response assessment.
- *Chapter 3: Market Characterization* provides the sales forecasts by sector and breakdown of sales by market segment.
- *Chapter 4: Residential Energy Efficiency Potential* provides the residential sector energy efficiency potential results. In addition to technical, economic, and achievable potential results, there are results for several other budget scenarios.
- *Chapter 5: Commercial Energy Efficiency Potential* provides the commercial sector energy efficiency potential results.

- ***Chapter 6: Industrial Energy Efficiency Potential*** provides the industrial sector energy efficiency potential results.
- ***Chapter 7: Demand Response Analysis*** provides the demand response results.
- ***Appendices:*** The appendices provide additional sector level detail and global assumptions.

2 Methodology

This section describes the overall methodology that was utilized by GDS to develop the energy efficiency potential study for EKPC. The main objective of this energy efficiency potential study is to quantify the technical, economic and achievable potential for electric energy efficiency savings in EKPC member service territories. This report provides estimates of the potential kWh and kW electric savings for each level (technical, economic and achievable potential) of energy efficiency potential. This document describes the general steps and methods that were used at each stage of the analytical process necessary to produce the various estimates of energy efficiency potential. GDS did not examine delivery approaches for energy efficiency programs as this task was not included in the scope of work for this study.

Energy efficiency potential studies involve several analytical steps to produce estimates of each type of energy efficiency potential: technical, economic, and achievable. This study utilizes benefit/cost screening tools for the residential and non-residential sectors to assess the cost effectiveness of energy efficiency measures. These cost effectiveness screening tools are Excel-based models that integrate technology-specific impacts and costs, customer characteristics, utility avoided cost forecasts and more. Excel was used as the modeling platform to provide transparency to the estimation process and allow for simple customization based on EKPC's unique characteristics and the availability of specific model input data. The major analytical steps and an overview of the potential savings are summarized below, and specific changes in methodology from one sector to another have been noted throughout this section

2.1 OVERVIEW OF APPROACH

For the residential sector, GDS took a bottom-up approach to the modeling, whereby measure-level estimates of costs, savings, and useful lives were used as the basis for developing the technical, economic, and achievable potential estimates. The measure data was used to build-up the technical potential, by applying the data to each relevant market segment. The measure data allowed for benefit-cost screening to assess economic potential, which was in turn used as the basis for achievable potential, which took into consideration incentives and estimates of annual adoption rates.

For the commercial and industrial sectors, GDS took a bottom-up modeling approach to first estimate measure-level savings and costs as well as cost-effectiveness, and then applied cost-effective measure savings to all applicable shares of energy load. Disaggregated forecast data served as the foundation for the development of the energy efficiency potential estimates. The creation of the disaggregation involved two steps. First, GDS looked at actual customer groupings based on NAICS code and then calibrated our top down load allocation based these codes to determine whether the customer was captured in the load forecast. Second, GDS determined the appropriate industry for industrial customers and the building type for commercial customers.

2.2 MARKET CHARACTERIZATION

The initial step in the analysis was to gather a clear understanding of the current market segments in the EKPC service area. The GDS team coordinated with EKPC to gather utility sales and customer data and existing market research to define appropriate market sectors and market segments. This information served as the basis for completing a forecast disaggregation and market characterization of both the residential and nonresidential sectors.

2.2.1 Forecast Disaggregation

In the residential sector, GDS calibrated its building energy modeling simulations with EKPC's electric sales forecasts.[3] This process began with the construction of building energy models, using the BEopt™ (Building Energy Optimization)[4] software, which were specified in accordance with the most currently available data describing the residential building stock in the EKPC service area. Models were constructed for both single-family and manufactured homes, as well as various types of heating and cooling equipment. Key characteristics defining these models include conditioned square footage, typical building envelope conditions such as insulation levels and representative appliance and HVAC efficiency levels. The simulations yielded estimated energy consumption for each building prototype, including estimates of each key end use. These end use estimates were then multiplied by the estimated proportion of customers that applied to each end use, to calculate an estimated service territory total consumption for each end use. For example, simulated heat pump electric heating consumption was multiplied by the proportion of homes that rely on heat pumps for their electric heating needs, to calculate the total heat pump electric heating load in the EKPC service territory.

In the commercial and industrial sectors, disaggregated forecast data provides the foundation for the development of energy efficiency potential estimates. GDS disaggregated the commercial sector sales into building type using data provided by EKPC with regional energy use estimates from the US Energy Information Administration (EIA) 2012 Commercial Building Energy Consumption Survey (CBECS) data for the East South-Central Census region. For the industrial sector, the baseline electric forecasts were disaggregated by industry type using detailed sales by customer for all customers over 1,000 kW demand, and a sample of customers under 1,000 kW demand. Table 2-1 provides the segmentation by segment.

TABLE 2-1 NON-RESIDENTIAL SEGMENTS

COMMERCIAL		INDUSTRIAL	
☑ Food Sales	☑ Public Order & Safety	☑ Food	☑ Non-metallic Mineral
☑ Food Service	☑ Religious Worship	☑ Textile Mill Products	☑ Fabricated Metals
☑ Education	☑ Service	☑ Wood	☑ Transportation Equipment
☑ Health Care	☑ Warehouse & Storage	☑ Printing	☑ Miscellaneous
☑ Lodging	☑ Other	☑ Petroleum	
☑ Retail	☑ Vacant	☑ Chemicals	
☑ Office		☑ Plastics & Rubber	
☑ Public Assembly		☑ Primary Metals	

GDS further disaggregated sales for each of the segments into end uses. For commercial segments, GDS again primarily used EIA 2012 Commercial Building Energy Consumption Survey (CBECS) data for the East South-Central Census region. This information was used to determine energy use intensities, expressed in kWh per square foot, for each end use within each segment.[5] For the industrial sector, the analysis relied on the EIA's Manufacturing Energy Consumption survey to disaggregate industry-specific estimates of electric consumption into end uses.[6]

[3] East Kentucky Power Cooperative. 2016 Load Forecast. Prepared by Load Forecasting Department. December 2016.
[4] BEopt can be used to analyze both new construction and existing home retrofits, as well as single-family detached and multi-family buildings, through evaluation of single building designs, parametric sweeps, and cost-based optimizations.
[5] U.S. Energy Information Agency. *Commercial Buildings Energy Consumption Survey (CBECS)*. May 20, 2016. https://www.eia.gov/consumption/commercial/..
[6] U.S. EIA. *Manufacturing Energy Consumption Survey (MECS) 2010*. March 2013. https://www.eia.gov/consumption/manufacturing/data/2010/.

Table 2-2 and lists the electric end-uses considered in the forecast disaggregation and subsequent potential assessment.

TABLE 2-2 ELECTRIC END USES

RESIDENTIAL	COMMERCIAL	
☑ Lighting	☑ Interior Lighting	☑ Facility Lighting
☑ HVAC Equipment	☑ Exterior Lighting	☑ Facility HVAC
☑ HVAC Shell	☑ Space Cooling – Chillers	☑ Conventional Boiler Use
☑ Refrigerator/ Freezer	☑ Space Cooling – Unitary/Split	☑ Process Heating
☑ Clothes Washer/Dryer	☑ Space Heating	☑ Process Cooling and Refrigeration
☑ Dishwasher	☑ Ventilation	☑ Machine Drive
☑ Electronics	☑ Motors	☑ Electro-Chemical Processes
☑ Hot Water	☑ Water Heating	☑ Other Process Use
☑ Pool/Spa	☑ Cooking	☑ Other Facility Support
☑ Cross-Cutting/ Behavior	☑ Refrigeration	☑ Onsite Transportation
	☑ Office Equipment	☑ Other Non-Process Use
	☑ Compressed Air	
	☑ Pools	

2.3 MEASURE CHARACTERIZATION

2.3.1 Measure Lists

The energy efficiency measures included in this study cover energy efficiency measures currently included in EKPC's energy efficiency programs, as well as additional measures suggested by the GDS Team based on existing knowledge and current databases of electric end-use technologies and energy efficiency measures. The study scope includes measures and practices that are currently commercially available as well as emerging technologies. The commercially available measures are of the most immediate interest to EKPC. However, a small number of well documented emerging technologies were considered for each sector. Emerging technology research was focused on measures that are commercially available but may not be widely accepted at the current time. These measure lists were then reviewed, discussed and updated as necessary. A complete listing of the energy efficiency measures included in this study is provided in the Appendices of this report.

In addition, this study includes measures that could be relatively easily substituted for, or applied to, existing technologies on a retrofit or replace-on-burnout basis. Replace-on-burnout applies to equipment replacements that are made normally in the market when a piece of equipment is at the end of its useful life. A retrofit measure is eligible to be replaced at any time in the life of the equipment or building. Replace-on-burnout measures are generally characterized by incremental measure costs and savings (e.g. the costs and savings of a high-efficiency versus standard efficiency air conditioner); whereas retrofit measures are generally characterized by full costs and savings (e.g. the full costs and savings associated with adding ceiling insulation into an existing attic). For new construction, energy efficiency measures can be implemented when each new home or building is constructed, thus the rate of availability is a direct function of the rate of new construction.

In total, GDS analyzed 372 measure types for EKPC. Many measures required multiple permutations for different applications, such as different building types, efficiency levels, and replacement options. GDS developed a total of 3,651 measure permutations for this study Table 2-3 provides a breakdown of the sector-level number of measures and permutations.

TABLE 2-3 NUMBER OF MEASURES EVALUATED

	# of Measures	Total # of Measure Permutations
Residential	120	351
Commercial	138	1,932
Industrial	114	1,368
Total	372	3,651

2.3.2 Assumptions and Source

A significant amount of data is needed to estimate the kWh and kW savings potential for individual energy efficiency and demand response measures or programs across the entire existing residential and non-residential sectors for EKPC. GDS used Kentucky specific data wherever it was available and up-to-date. Considerable effort was expended to identify, review, and document all available data sources.[7]

This review has allowed the development of reasonable and supportable assumptions regarding: measure lives; measure installed incremental or full costs (as appropriate); and electric savings and saturations for each energy efficiency measure included in the final list of measures in this study.

Costs and savings for new construction and replace on burnout measures are calculated as the incremental difference between the code minimum equipment and the energy efficiency measure. This approach is utilized because the consumer must select an efficiency level that is at least the code minimum equipment. The incremental cost is calculated as the difference between the cost of high efficiency and standard (code compliant) equipment. However, for retrofit measures, the measure cost is considered the "full" cost of the measure, as the baseline scenario assumes the consumer would do nothing. In general, the savings for retrofit measures are calculated as the difference between the energy use of the removed equipment and the energy use of the new high efficiency equipment (until the removed equipment would have reached the end of its useful life).

Measure Savings: GDS utilized several sources including the 2015 Indiana (IN) TRM to inform calculations supporting estimates of annual measure savings as a percentage of base equipment usage. Other sources used include:

- Mid-Atlantic TRM, Illinois TRM, Maine TRM, Minnesota TRM and other existing deemed savings databases
- Building energy simulation software (BEopt) and engineering analyses
- Secondary sources such as the American Council for an Energy-Efficient Economy (ACEEE), Department of Energy (DOE), Energy Information Administration (EIA), ENERGY STAR©, and other technical potential studies

Measure Costs: Measure costs represent either incremental or full costs. These costs typically include the incremental cost of measure installation, when appropriate based on the measure definition. For purposes of this study, nominal measure costs held constant over time. One exception is an assumed decrease in costs for light emitting diode (LED) bulbs over the study horizon. LED bulb consumer costs have been declining rapidly over the last several years and future cost projections indicate a continued decrease in bulb costs.[8] GDS' treatment of LED bulb costs and market penetration are discussed in greater detail in Section 2.3.5, "Review of LED Lighting Assumptions."

[7] The appendices and supporting databases to this report provide the data sources used by GDS to obtain up-to-date data on energy efficiency measure costs, savings, useful lives, and saturations.
[8] LED Incremental Cost Study Overall Final Report. The Cadmus Group. February 2016

GDS obtained measure cost estimates from a variety of sources, starting with the IN TRM. Other sources leveraged include:

- Mid-Atlantic TRM, Illinois TRM, Maine TRM, Minnesota TRM and other existing deemed savings databases
- Secondary sources such as the ACEEE, ENERGY STAR, National Renewable Energy Lab (NREL),), California Database for Energy Efficient Resources (DEER) database, Northeast Energy Efficiency Partnership (NEEP) Incremental Cost Study, and other technical potential studies

Measure Life: Measure life represents the number of years that energy using equipment is expected to operate. GDS obtained measure life estimates from the 2015 IN VT TRM, and used the following other data sources:

- TRMs in other states
- Manufacturer data
- Savings calculators and life-cycle cost analyses
- The California DEER database
- Other consultant research or technical reports

Building/Equipment Saturation Data: To assess the amount of electric energy efficiency savings still available, estimates of the current saturation of baseline equipment and energy efficiency measures, or for the non-residential sector, the amount of energy use that is associated with a specific end-use (such as HVAC) and percent of that energy use that is associated with energy efficient equipment are necessary. Up-to-date measure saturation data were primarily obtained from the following recent studies:

- 2016 EKPC Member System End-Use Survey
- 2015 EIA Residential Energy Consumption Survey (RECS)
- Energy Stat Unit Shipment Data
- 2014 EIA Manufacturing Energy Consumption Survey (MECS)
- 2012 EIA Commercial Building Energy Consumption Survey (CBECS)

2.3.3 Remaining Factor

The remaining factor is the proportion of a given market segment that is not yet efficient and can still be converted to an efficient alternative. If is by definition, the inverse of the saturation of an energy efficient measure, prior to any adjustments. For this study we made two key adjustments to recognize that the energy efficient saturation does not necessarily always fully represent the state of market transformation. In other words, while a percentage of installed measures may already be efficient, this does not preclude customers from backsliding, or reverting to standard technologies, or otherwise less efficient alternatives in the future, based on considerations like measure cost and availability and customer preferences (e.g. historically, some customers have disliked CFL light quality, and have reverted to incandescent and halogen bulbs after the CFLs burn out).

For measures categorized as market opportunity (i.e. replace-on-burnout), we assumed that 50% of the instances in which an efficient measure is already installed, the burnout or failure of those measures would be eligible for inclusion in the estimate of future savings potential. Essentially this adjustment implies that we are assuming that 50% of the market is transformed, and no future savings potential exists, whereas the remaining 50% of the market is not transformed and could backslide without the intervention of an EKPC program and an incentive. Similarly, for retrofit measures, we assumed that only 10% of the instances in which an efficient measure is already installed, the burnout or failure of those measures would be eligible for inclusion in the estimate of future savings potential. This recognizes the more proactive nature of retrofit measures, as the implementation of these measures are more likely to be elective in nature, compared to market opportunity measures, which are more likely to be needs-based.

We recognize the uncertainty in these assumptions, but we believe these are appropriate assumptions, as they recognize a key component of the nature of customer decision making.

2.3.4 Treatment of Codes and Standards

Although this analysis does not attempt to predict how energy codes and standards will change over time, the analysis does account for the impacts of several known improvements to federal codes and standards. Although not exhaustive, key adjustments include[9]:

- The baseline efficiency for air source heat pumps (ASHP) is anticipated to improve to 14 SEER/8.2 HSPF[10] in 2015. As the existing stock of ASHPs was estimated to turn over and allowing for a sell-through period, the baseline efficiency was assumed to be the new federal standard, beginning in FY18.
- In 2015, the DOE makes amended standards effective for residential water heaters that required updated energy factors (EF) depending on the type of water heater and the rated storage volume. For electric storage water heaters with a volume greater than 55 gallons, the standards effectively require heat pumps for electric storage products. For storage tank water heaters with a volume of 55 gallons or less, the new standard (EF=0.948) becomes essentially the equivalent of today's efficient storage tank water heaters. [11]
- In March 2015, the DOE amended the standards for residential clothes washers. The new standards will require the Integrated Modified Energy Factor (MEF) (ft^3/kWh/cycle) to meet certain thresholds based on the machine configurations. The ENERGY STAR specifications for residential clothes washers will also be amended to increase the efficiency of units that can earn the ENERGY STAR label. Version 7.0 of the ENERGY STAR specification is scheduled to go into effect in March 2015. These amended federal and ENERGY STAR standards have been factored into the study.
- In line with the phase-in of 2005 EPAct regulations, the baseline efficiency for general service linear fluorescent lamps was moved from the T12 light bulb to a T8 light bulb effective June 1, 2016.

2.3.5 Review of LED Lighting Assumptions

Recognizing that there remains significant uncertainty regarding the future potential of residential screw-in lighting, GDS reviewed the latest lighting-specific program designs and consulted with industry peers to develop critical assumptions regarding the future assumed baselines for LED screw base omnidirectional, specialty/decorative, and reflector/directional lamps over the study timeframe.

- *EISA Impacts:* LED screw base omnidirectional and decorative lamps are impacted by the EISA 2007 regulation backstop provision, which requires all non-exempt lamps to be 45 lumens/watt, beginning in 2020. Based on this current legislation, the federal baseline in 2020 will be roughly equivalent to a CFL bulb. However, in January 2017, the Department of Energy expanded the scope of the standard to include directional and specialty bulb but stated that they may delay enforcement based on ongoing dialog with industry stakeholders. Although there is uncertainty surrounding EISA and the backstop provision, this study assumes the backstop provision for standard (A-lamp) screw-in bulbs will take effect beginning in 2020. The analysis assumes the expanded definition of general service lamps to include specialty and reflector sockets will impact those sockets beginning in 2021.

- *LED Bulb Costs:* Based on EIA Technology Forecast Report, LED bulb costs were assumed to decrease over the analysis period. LED bulb costs ranged between $3 (standard) and $8.60 (reflector) in 2020,

[9] Key adjustments for LED screw-in lighting are addressed separately later in this section.
[10] SEER: Seasonal Energy Efficiency Ratio; HSPF: Heating Seasonal Performance Factor.
[11] Ultimately, GDS did not incorporate the requirements for large capacity water heaters into the analysis due to recent legislation that allows grid-enabled water heaters to remain at lower efficiency levels.

decreasing to $2-$3 by 2038. Incentives were modeled as a % of incremental cost, resulting in decreasing incentives over the analysis timeframe as well.

- *LED Lighting Efficacy:* Using the same EIA Technical Forecast Report, LED efficacy was also assumed to improve over the analysis timeframe. By 2040, the LED wattage of a bulb equivalent to a 60W incandescent will improve from 8W (today's typical LED) down to 4W.

2.3.6 Net to Gross (NTG)

All estimates of technical, economic, and achievable potential, as well as measure level cost-effectiveness screening were conducted in terms of gross savings to reflect the absence of program design considerations in these phases of the analysis.

2.4 ENERGY EFFICIENCY POTENTIAL

This section reviews the types of potential analyzed in this report, as well as some key methodological considerations in the development of technical, economic, and achievable potential.

2.4.1 Types of Potential

Potential studies often distinguish between several types of energy efficiency potential: technical, economic, achievable, and program. However, because there are often important definitional issues between studies, it is important to understand the definition and scope of each potential estimate as it applies to this analysis.

The first two types of potential, technical and economic, provide a theoretical upper bound for energy savings from energy efficiency measures. Still, even the best-designed portfolio of programs is unlikely to capture 100% of the technical or economic potential. Therefore, achievable potential attempts to estimate what savings may realistically be achieved through market interventions, when it can be captured, and how much it would cost to do so. Figure 2-1 illustrates the types of energy efficiency potential considered in this analysis. Program potential, including specific delivery mechanisms and funding levels was not specifically analyzed as part of this study.[12]

FIGURE 2-1 ILLUSTRATION OF TYPES OF POTENTIAL

2.4.2 Technical Potential

Technical potential is the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end users to adopt the efficiency measures. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. Under technical potential, GDS assumed that 100% of

[12] GDS did analyze several funding scenarios in the residential sector. The results of these scenarios are presented in section 4.2.6. While these scenarios can be used by EKPC as guidance for program planning, these scenarios are scaled from the Realistic Achievable Potential results. Actual EKPC may adopt alternative delivery mechanisms or include additional program considerations that would could result in different savings projections.

new construction and market opportunity measures are adopted as those opportunities become available (e.g., as new buildings are constructed they immediately adopt efficiency measures, or as existing measures reach the end of their useful life). For retrofit measures, implementation was assumed to be resource constrained and that it was not possible to install all retrofit measures all at once. Rather, retrofit opportunities were assumed to be replaced incrementally until 100% of stock were converted to the efficient measure over a period of no more than 15 years.

2.4.2.1 Competing Measures and Interactive Effects Adjustments

GDS prevents double-counting of savings, and accounts for competing measures and interactive savings effects, through three primary adjustment factors:

- *Baseline Saturation Adjustment:* Competing measure shares may be factored into the baseline saturation estimates. For example, nearly all homes can receive insulation, but the analysis has created multiple measure permutations to account for varying impacts of different heating/cooling combinations and have applied baseline saturations to reflect proportions of households with each heating/cooling combination

- *Applicability Factor Adjustment:* Grouped measures into measure groups, where total applicability across measures is set to 100%(*). For example, homes cannot receive a programmable thermostat and smart thermostat. Generally, the models assign the measure with the most savings the largest applicability, with competing measures picking up any remaining share.

- *Interactive Savings Adjustment:* As savings are introduced from select measures, the per-unit savings from other measures need to be adjusted (downward) to avoid over-counting. The analysis typically prioritizes market opportunity equipment measures (versus retrofit measures that can be installed at any time). For example, the savings from a smart thermostat are adjusted down to reflect the efficiency gains of installing an efficient air source heat pump. *The analysis also prioritizes efficiency measures relative to conservation (behavioral) measures.

2.4.3 Economic Potential

Economic potential refers to the subset of the technical potential that is economically cost-effective (based on screening with the TRC test utilized for this study) as compared to conventional supply-side energy resources. The TRC measures the net benefits of the energy efficiency program for the region. Costs included in the TRC are costs to purchase and install the energy efficiency measure and overhead costs of running the energy efficiency program, regardless of who pays these costs. The benefits included are the avoided costs of electric energy as well as fuel avoided costs, water avoided costs, and other non-energy benefits (e.g. avoided bulb purchases).

GDS has calculated the benefit/cost ratios for this study according to the cost effectiveness test definitions provided in the November 2008 National Action Plan for Energy Efficiency (NAPEE) guide titled "Understanding Cost Effectiveness of Energy Efficiency Programs". Both technical and economic potential are theoretical numbers that assume immediate implementation of energy efficiency measures, with no regard for the gradual "ramping up" process of real-life programs. In addition, they ignore market barriers to ensuring actual implementation of energy efficiency. *Finally, they typically only consider the costs of efficiency measures themselves, ignoring any programmatic costs (e.g., marketing, analysis, administration, program evaluation, etc.) that would be necessary to capture them.*

All measures that were not found to be cost-effective based on the results of the measure-level cost effectiveness screening were excluded from the economic and achievable potential. Then allocation factors were re-adjusted and applied to the remaining measures that were cost effective.

2.4.3.1 Avoided Costs

Avoided energy supply costs are used to assess the value of energy savings. Avoided cost values for electric energy, electric capacity, avoided T&D, and avoided natural gas were provided directly from EKPC as part of an initial data request. Electric energy is based on an annual system marginal cost. Natural gas and water avoided costs (considered in the Total Resource Cost Test) were based on the Henry Hub forward price curve and the 2016 water and sewer rates for Kentucky-American Water Company, respectively. For years outside of the avoided cost forecast timeframe, future year avoided costs are escalated by the rate of inflation (2.2%).

2.4.3.2 Measure Costs and Incentive Levels

As noted earlier, all measure costs, except for screw-in LED lighting, were held constant in nominal dollars. GDS reviewed the deemed measure cost assumptions included in the Illinois TRM from 2012 (v1) through 2018 (v7). Where a direct comparison of cost was applicable, GDS found no change in measure cost across 80% of residential and nonresidential measures. In a similar search of the Michigan Energy Measure Database (MEMD) from 2011 to 2018, GDS again found that most of incremental measure costs in 2018 were either the same or higher than the recorded incremental measure cost in 2011.

As measure costs were held constant in nominal dollars, incentives were also held constant over the analysis timeframe. GDS relied on EKPC's latest DSM Annual Report and filings to map current measure offerings to their historical incentive levels. For study measures that did not map directly to a current offering, GDS applied "typical" incentive levels to the new measures. In the residential sector, lighting incentive levels were assumed to represent 50% of the measure cost. Remaining residential incentive levels generally ranged from 35%-50%. Direct Install measures received incentives equal to 100% of the measure cost. In the nonresidential sector, incentives were set at 14% of measure cost for lighting ns 50% for all non-lighting measures. As in the residential sector, these incentive levels were based on current incentive levels offered by EKPC.

In the maximum achievable potential (MAP) scenario, all incentives for all sectors were set to 100% of the incremental measure cost.

2.4.4 Achievable Potential

Achievable potential is the amount of energy that can realistically be saved given various market barriers. Achievable potential considers real-world barriers to encouraging end users to adopt efficiency measures; the non-measure costs of delivering programs (for administration, marketing, analysis, and EM&V); and the capability of programs and administrators to boost program activity over time. Barriers include financial, customer awareness and willingness to participate in programs, technical constraints, and other barriers the "program intervention" is modeled to overcome. Additional considerations include political and/or regulatory constraints. The potential study evaluated two achievable potential scenarios:

- ***Maximum Achievable Potential*** estimates achievable potential on paying incentives equal to 100% of measure incremental costs and aggressive adoption rates.
- ***Realistic Achievable Potential*** estimates achievable potential on EKPC paying incentive levels (as a percent of incremental measure costs) closely calibrated to historical levels but is not constrained by any previously determined EKPC spending levels.

2.4.4.1 Market Adoption Rates

GDS assessed achievable potential on a measure-by-measure basis. In addition to accounting for the natural replacement cycle of equipment in the achievable potential scenario, GDS estimated measure specific maximum adoption rates that reflect the presence of possible market barriers and associated difficulties in achieving the 100% market adoption assumed in the technical and economic scenarios.

The initial step in the market penetration methodology was to assess the long-term market adoption potential for energy efficiency technologies. Due to the wide variety of measures across multiple end-uses, GDS employed varied measure and end-use-specific ultimate adoption rates versus a singular universal market adoption curve. These long-term market adoption estimates were based on publicly available DSM research including market adoption rate surveys. These surveys include questions to residential homeowners and nonresidential facility managers regarding their perceived willingness to purchase and install energy efficient technologies across various end uses and incentive levels.

GDS utilized likelihood and willingness-to-participate data to estimate the long-term (20-year) market adoption potential for both the maximum and realistic achievable scenarios. Table 2-4 presents the long-term market adoption rates at varied incentive levels used for both the residential and nonresidential sectors. When incentives are assumed to represent 100% of the measure cost (maximum achievable), the long-term market adoption ranged by sector and end-use from 41% to 90%. For the realistic achievable potential scenario, the incentive levels also varied by measure resulting in measure-specific market adoption rates. Table 2-4 provides the long-term adoption rates by incentive level.

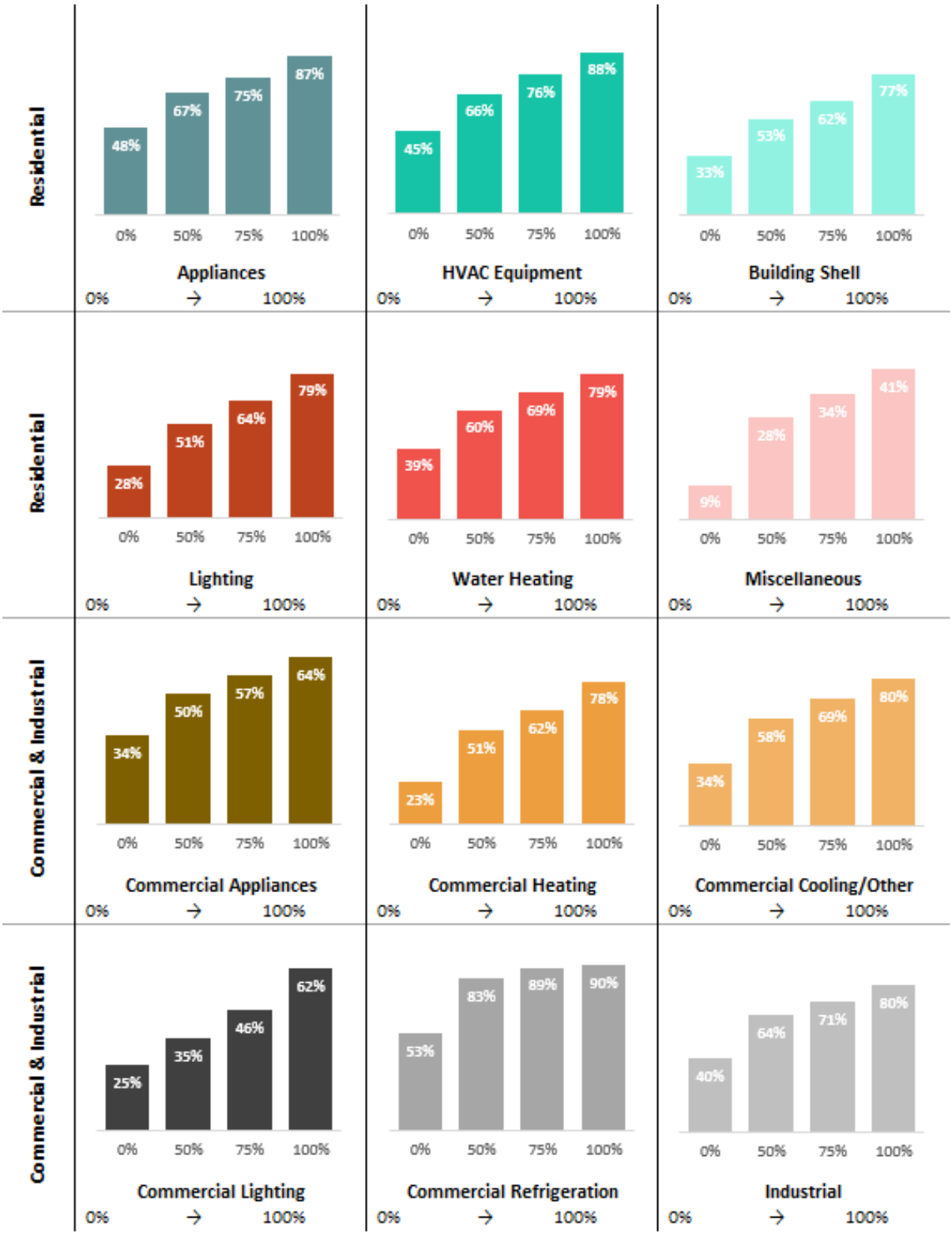
Once the long-term market adoption rate was determined, GDS estimated initial year adoption rates by reviewing the current saturation levels of efficient technologies and (if necessary) calibrating the estimates of 2019 annual potential to recent historical levels achieved by EKPC's DSM portfolio. This calibration effort ensures that the forecasted achievable potential in 2019 is realistic and attainable. GDS then assumed an annual ramp rate from the initial year market adoption rate to the various long-term market adoption rates for each specific end-use.

One caveat to this approach is that the ultimate long-term adoption rate is generally a simple function of incentive levels and payback. There are many other possible elements that may influence a customer's willingness to purchase an energy efficiency measure. For example, increased marketing and education programs can have a critical impact on the success of energy efficiency programs. Additionally, other perceived measure benefits, such as increased comfort or safety as well as reduced maintenance costs could also factor into a customer's decision to purchase and install energy efficiency measures. Although these additional elements are not explicitly accounted for under this incentive/payback analysis, the estimated adoption rates and penetration curves provide a concise method for estimating achievable savings potential over a specified timeframe.

2.4.4.2 Funding Scenarios (Residential Sector Only)

Once achievable potential scenarios were developed, GDS also developed several funding scenarios that mapped select cost-effective energy efficient measures into likely programs and scaled the achievable potential savings and costs into the selected funding scenarios. GDS calculated the residential potential results for four funding scenarios: $750,000, $1.5 million, $3 million, and $6 million. Currently, EKPC does not plan to operate energy efficiency programs in the nonresidential sector; as a result, no funding scenarios were run in the commercial and industrial sectors.

TABLE 2-4 LONG-TERM MARKET ADOPTION RATES AT DISCRETE INCENTIVE LEVELS (*BASED ON WILLINGNESS-TO-PARTICIPATE SURVEY RESULTS*)



2.5 DEMAND RESPONSE POTENTIAL

2.5.1 Demand Response Program Options

Table 2-5 provides a brief description of the demand response program options considered and identifies the eligible customer segment for each demand response program that was considered in this study.

TABLE 2-5 DEMAND RESPONSE PROGRAM OPTIONS AND ELIGIBLE MARKETS

DR Program Option	Program Description	Eligible Markets
DLC AC (Switch)	The compressor of the air conditioner is remotely shut off (cycled) by the system operator for periods that may range from 7 ½ to 15 minutes during every 30-minute period (i.e., 25%-50% duty cycle)	Residential and Small Non-Residential Customers
DLC AC (Thermostat)	The system operator can remotely raise the AC's thermostat set point during peak load conditions, lowering AC load.	Residential and Small Non-Residential Customers
DLC Pool Pumps	The swimming pool pump is remotely shut off by the system operator for periods normally ranging from 2 to 4 hours.	Residential Customers
DLC Water Heaters	The water heater is remotely shut off by the system operator for periods normally ranging from 2 to 8 hours.	Residential and Small Non-Residential Customers
DLC Agricultural Irrigation	The irrigation pump is remotely shut off by the system operator for periods normally ranging from 2 to 4 hours.	Farms
Interruptible Rate	A discounted rate is offered to the customer for agreeing to interrupt or curtail load during peak period. The interruption is mandatory. No buy-through options are available.	Large Non-Residential Customers
Large C&I Behavioral	Participants are required to be available to curtail their load any non-holiday weekday during peak hours. Each event typically lasts 4 hours in duration.	Large Non-Residential Customers
Demand Buyback	A year-round, flexible, Internet-based bidding program that offers business customers credits for voluntarily reducing power when an event is called.	Large Non-Residential Customers
Critical Peak Pricing with Enabling Technology	A retail rate in which an extra-high price for electricity is provided during a limited number of critical periods (e.g. 100 hours) of the year. Market-based prices are typically provided on a day-ahead basis, or an hour-ahead basis. Includes enabling technology that connects technologies within building. Only for customers with AC.	Residential and Non-Residential Customers

DR Program Option	Program Description	Eligible Markets
Critical Peak Pricing without Enabling Technology	A retail rate in which an extra-high price for electricity is provided during a limited number of critical periods (e.g. 100 hours) of the year. Market-based prices are typically provided on a day-ahead basis, or an hour-ahead basis.	Residential and Non-Residential Customers
PEV Charging	Special rate service for electric vehicles that charge off-peak	Residential and Non-Residential Customers

Double-counting savings from demand response programs that affect the same end uses is a common issue that must be addressed when calculating the demand response savings potential. For example, a direct load control program of air conditioning and a rate program both assume load reduction of the customers' air conditioners. For this reason, it is typically assumed that customers cannot participate in multiple programs that affect the same end uses. As EKPC and its owner-member cooperatives have offered a Direct Load Control program since 2008, it was assumed that participation in this offering be prioritized before rate-based DR options. The order of the rest of the programs is based on savings where programs with higher savings per customer are prioritized.

2.5.2 Demand Response Potential Assessment Approach Overview

The analysis of DR, where possible, closely followed the approach outlined for energy efficiency. The framework for assessing the cost-effectiveness of demand response programs is based *on A Framework for Evaluating the Cost-Effectiveness of Demand Response, prepared for the National Forum on the National Action Plan (NAPA) on Demand Response*.[13] Additionally, GDS reviewed the May 2017 National Standard Practice Manual published by the National Efficiency Screening Project.[14] GDS utilized this guide to define avoided ancillary services and energy and/or capacity price suppression benefits.

The demand response analysis was conducted using the GDS DR Model. The GDS Demand Response Model determines the estimated savings for each demand response program by performing a review of all benefits and cost associated with each program. GDS developed the model such that the value of future programs could be determined and to help facilitate demand response program planning strategies. The model contains approximately 50 required inputs for each program including: expected life, CP kW load reductions, proposed rebate levels, program related expenses such as vendor service fees, marketing and evaluation cost and on-going O&M expenses. This model and future program planning features can be used to standardize the cost-effectiveness screening process between EKPC departments interested in the deployment of demand response resources.

The Total Cost Resource Cost (TRC) test was used to determine the cost-effectiveness of each demand response program. Benefits are based on avoided demand, energy (including load shifting), wholesale cost reductions and T&D costs. Costs include incremental program equipment costs (such as control switches or smart thermostats), fixed program capital costs (such as the cost of a central controller), program administrative, marketing, and evaluation costs. Incremental equipment program costs are included for both new and replacement units (such as control switches) to account for units that are replaced at the end of their useful life.

[13] Study was prepared by Synapse Energy Economics and the Regulatory Assistance Project, February 2013.
[14] National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, May 18, 2017, Prepared by The National Efficiency Screening Project

The demand response analysis includes estimates of technical, economic, and achievable potential. Achievable potential is broken into maximum and realistic achievable potential in this study:

MAP represents an estimate of the maximum cost-effective demand response potential that can be achieved over the 20-year study period. For this study, this is defined as customer participation in demand response program options that reflect a "best practices" estimate of what could eventually be achieved. MAP assumes no barriers to effective delivery of programs.

RAP represents an estimate of the amount of demand response potential that can be realistically achieved over the 20-year study period. For this study, this is defined as achieving customer participation in demand response program options that reflect a realistic estimate of what could eventually be achieved assuming typical or "average" industry experience. RAP is a discounted MAP, by considering program barriers that limit participation, therefore reducing savings that could be achieved.

Last, the analysis evaluated DR potential under two possible conditions: 1) a ***switch scenario*** that assumes all cost-effective DR programs will be implemented by EKPC, and load switches will be used to control central air conditioning; and 2) a ***smart thermostat scenario*** that also assumes that all cost-effective DR programs will be implemented, but in this scenario controllable smart thermostats will be used to control central air conditioning. In both scenarios, no spending caps are placed on achievable potential.

2.5.3 Avoided Costs

Avoided costs for demand response were consistent with those utilized in the energy efficiency potential analysis and were provided by EKPC. The primary benefit of demand responses is avoided generation capacity, resulting from a reduction in the need for new peaking generation capacity. Demand response can also produce energy related benefits. If the demand response option is considered "load shifting", such as direct load control of electric water heating, the consumption of energy is shifted from the control period to the period immediately following the period of control. For this study, GDS assumed that the energy is shifted with no loss of energy. If the program is not considered to be "load shifting" the measure is turned off during peak control hours, and the energy is saved altogether. Demand response programs can also potentially delay the construction of new transmission and distribution lines and facilities, which is reflected in avoided T&D costs.

2.5.4 Demand Response Program Assumptions

This section briefly discusses the general assumptions and sources used to complete the demand response potential analysis. Appendix F provides additional detail by program and sector related to load reduction, program costs, and projected participation.

Load Reduction: Demand reductions were based on load reductions found in East Kentucky's existing demand response programs, and various secondary data sources including the FERC and other industry reports, including demand response potential studies. DLC and thermostat-based DR options were typically calculated based on a per-unit kW demand reduction whereas rate-based DR options were typically assumed to reduce a percentage of the total facility peak load.

Useful Life: The useful life of a smart thermostat is assumed to be 15 years . Load control switches have a useful life of 15 years . This life was used for all direct load control measures in this study.

Program Costs: One-time program development costs included in the first year of the analysis for new programs. No program development costs are assumed for programs that already exist. It was assumed that there would be a cost of $50 per new participant for marketing for residential and small C&I programs. Large C&I programs require a higher marketing costs due to more time spent to acquire a

participant, including potential site visits. Marketing costs are assumed to be 33.3% higher for MAP. All program costs were escalated each year by the general rate of inflation assumed for this study.

Saturation: The number of control units per participant was assumed to be 1 for all direct load control programs using switches (such as water heaters and air conditioning switches), because load control switches can control up to two units. However, for controllable thermostats, some participants have more than one thermostat. The average number of residential thermostats per single family home was assumed to be 1.72 thermostats

2.5.5 DR Program Adoption Levels

Long-term program adoption levels (or "steady state" participation) represents the enrollment rate once the fully achievable participation has been reached. GDS reviewed industry data and program adoption levels from several utility DR programs. The main sources of participant rates are several studies completed by the Brattle Group. Additional detail about participation rates and sources are shown in Appendix F. As noted earlier in this section, for direct load control programs, interruptible rate, behavioral, and demand bidding DR programs, maximum achievable potential participation rates rely on industry best adoption rates and realistic achievable potential participation rates are based on industry average adoption levels. For critical peak pricing and PEV charging, the MAP steady-state participation rates assumed programs were opt-out based and RAP participation assumed opt-in status.

Customer participation in new demand response programs is assumed to reach the steady state take rate over a five-year period. The path to steady state customer participation follows an "S-shaped" curve, in which participation growth accelerates over the first half of the five-year period, and then slows over the second half of the period (see Figure 2-2). Existing programs have already gone through this ramp-up period, so they were escalated linearly to the final participation rate.

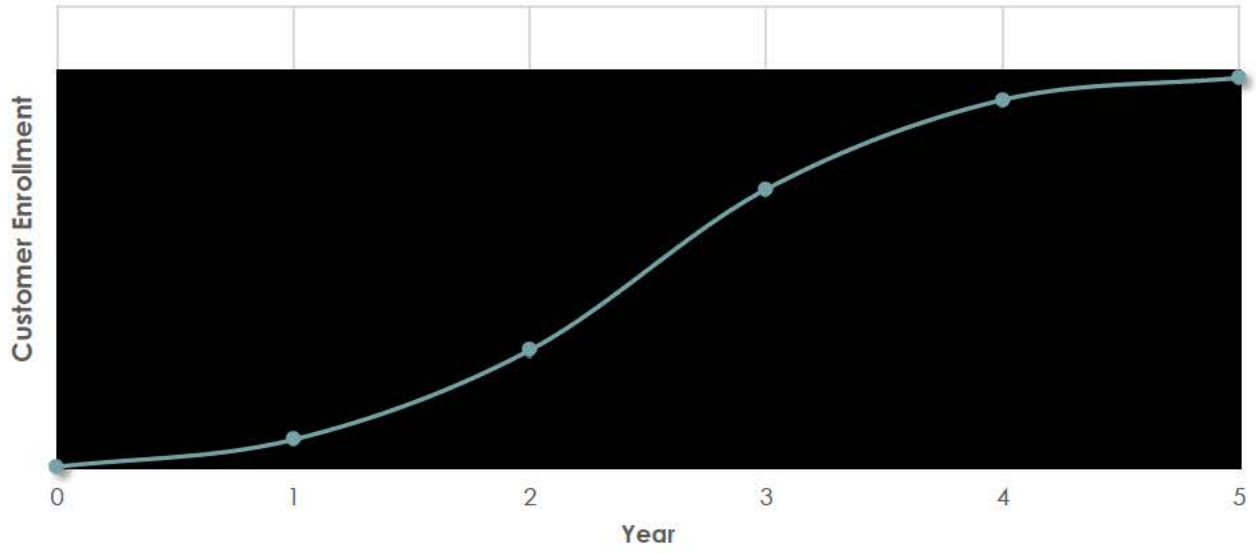


FIGURE 2-2 ILLUSTRATION OF S-SHAPED MARKET ADOPTION CURVE

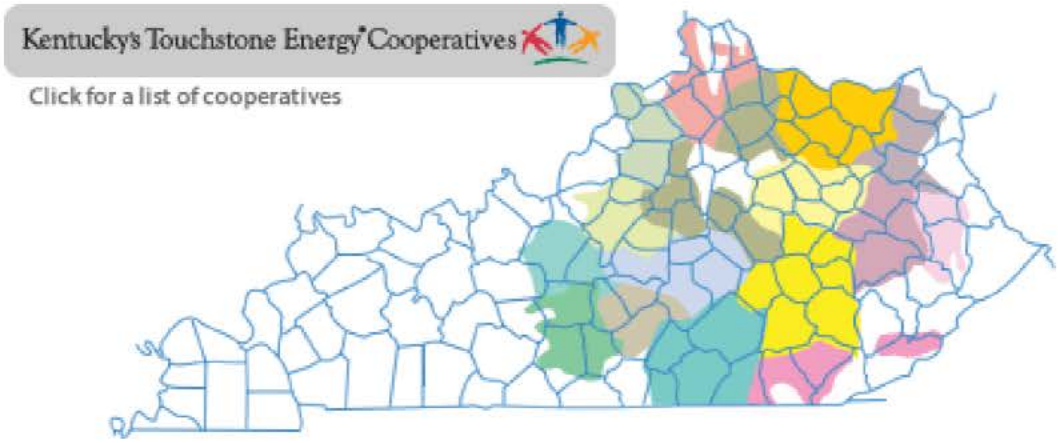
3 Market Characterization

This chapter provides up-to-date historical and forecast information on electricity consumption, consumption by market segment and by energy end use in EKPC's member service territories. This chapter also provides an overview of the number of households and housing units in EKPC's service area. Developing this information is a fundamental part of any energy efficiency potential study. It is necessary to understand how energy is consumed in a state or region before one can assess the energy efficiency savings potential that remains to be tapped.

3.1 EKPC MEMBER SERVICE TERRITORIES

EKPC member service territories are located in an area from central Kentucky to eastern Kentucky. Figure 3-1 shows a map of the 16 cooperatives in EKPC's service area. Note that the size of service areas varies.

FIGURE 3-1 MAP OF THE 16 COOPERATIVES IN THE EKPC SERVICE AREA



3.2 SECTOR-LEVEL FORECASTS AND MARKET SEGMENTATIONS

Table 3-1 provides the sales by sector across the 2019-2033 timeframe. Sales are forecasted to gradually increase in each of the three major sales categories: residential, small commercial, and large commercial. Total sales are forecasted to be nearly 15 million MWh by 2033.

TABLE 3-1 15-YR SALES FORECAST BY SECTOR

Year	Residential Sales (MWh)	Small Comm. Sales (MWh)	Large Comm. Sales (MWh)	Other	Total Retail Sales (MWh)
2019	7,078,677	2,064,437	3,619,935	50,081	12,813,131
2020	7,133,148	2,086,506	3,708,426	50,510	12,978,589
2021	7,155,553	2,098,818	3,775,624	50,940	13,080,935
2022	7,217,794	2,117,881	3,828,426	51,357	13,215,458
2023	7,286,842	2,139,806	3,882,149	51,765	13,360,562
2024	7,392,857	2,167,353	3,940,308	52,163	13,552,681
2025	7,453,978	2,188,120	3,990,232	52,554	13,684,884
2026	7,533,318	2,216,091	4,048,992	52,954	13,851,356
2027	7,613,196	2,242,410	4,099,771	53,349	14,008,726
2028	7,717,310	2,272,256	4,159,107	53,745	14,202,418
2029	7,763,173	2,294,131	4,212,911	54,123	14,324,337
2030	7,821,563	2,313,139	4,266,265	54,479	14,455,446
2031	7,897,604	2,333,454	4,326,871	54,815	14,612,744

Year	Residential Sales (MWh)	Small Comm. Sales (MWh)	Large Comm. Sales (MWh)	Other	Total Retail Sales (MWh)
2032	8,007,592	2,360,013	4,388,273	55,150	14,811,028
2033	8,068,609	2,378,642	4,450,138	55,488	14,952,877

Figure 3-2 provides the distribution of end use consumption by building type in the commercial sector. Water heating, ventilation, and lighting are among the leading end uses throughout the various building types.

FIGURE 3-2 COMMERCIAL SECTOR ENERGY END USE BREAKDOWN BY BUILDING TYPE

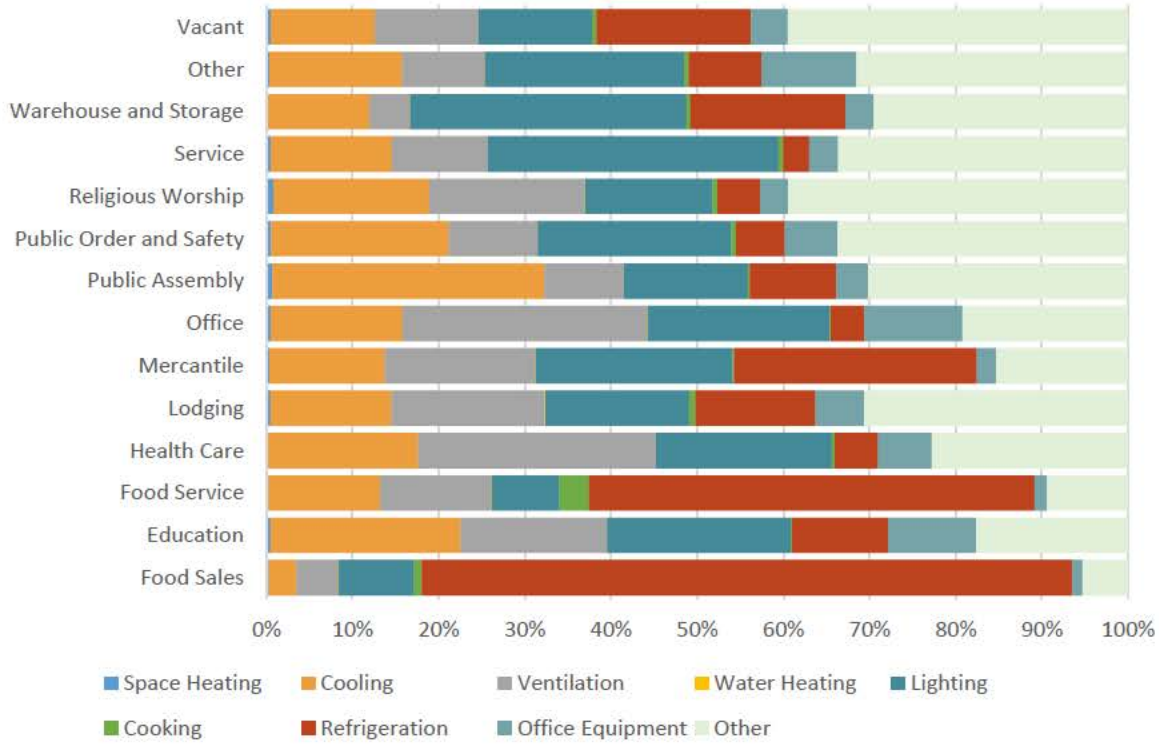


Figure 3-3 provides the distribution of sales by business type in the commercial sector.

FIGURE 3-3 COMMERCIAL SALES BY BUILDING TYPE

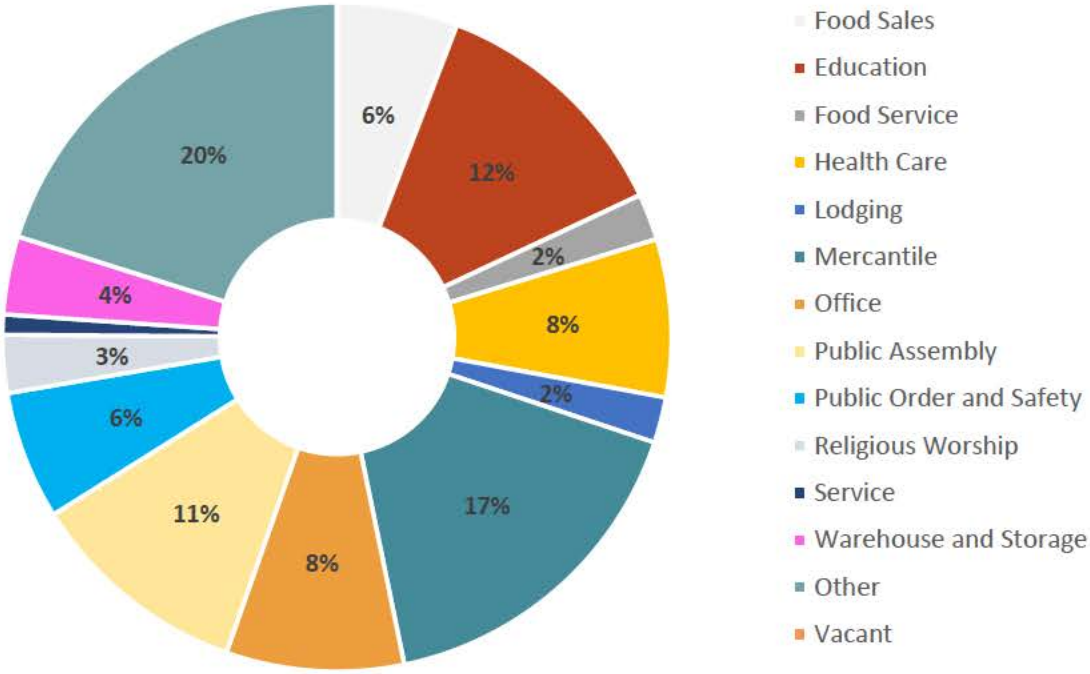


Figure 3-4 provides a breakdown of sales by industrial market segment.

FIGURE 3-4 INDUSTRIAL SALES MARKET SEGMENTATION

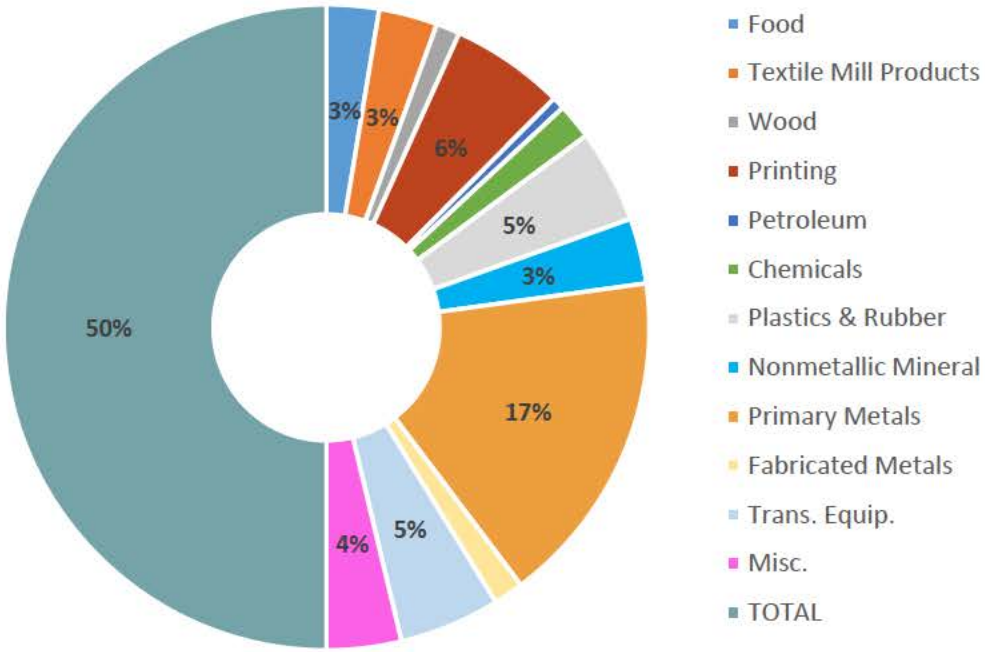
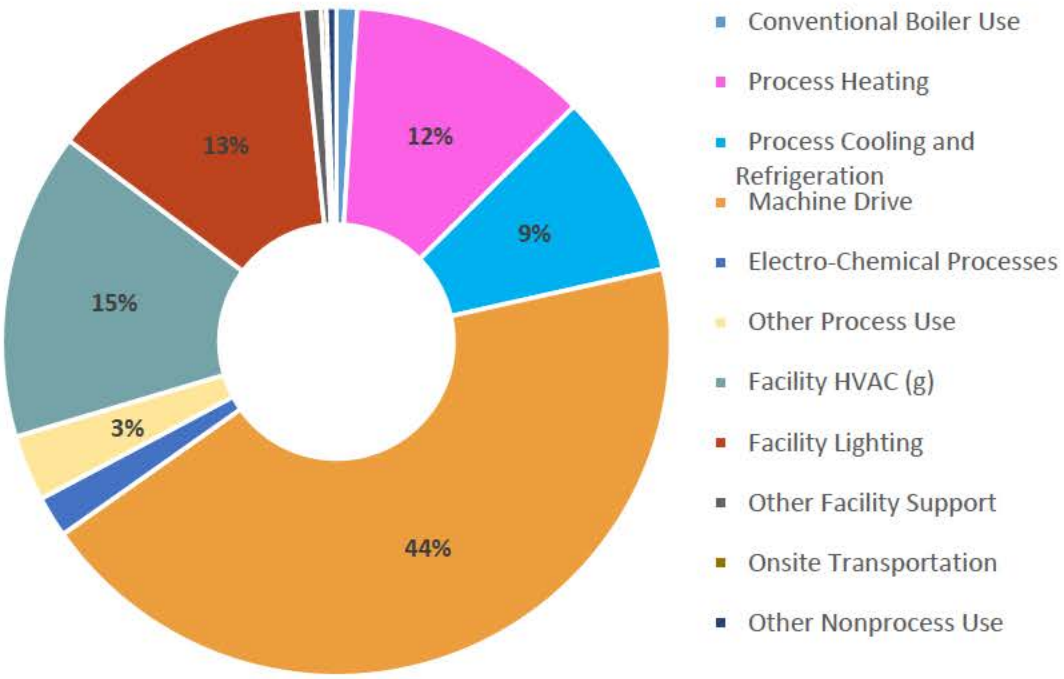


Figure 3-5 provides an industrial sector end use level breakdown.

FIGURE 3-5 INDUSTRIAL SECTOR ENERGY END USE BREAKDOWN



4 Residential Energy Efficiency Potential

This chapter provides the potential results for technical, economic, and achievable potential for the residential sector. The chapter breakdowns of the potential by end use and market segment. The results are provided on a five, ten and fifteen-year basis. Budget and benefit-cost data are provided for the achievable potential scenarios.

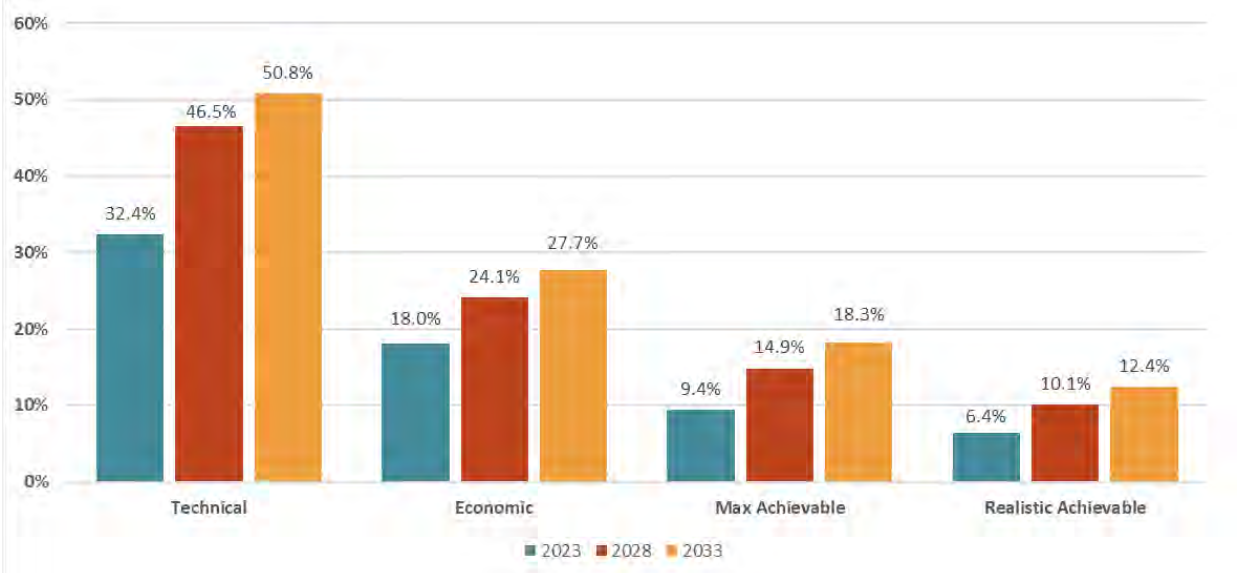
4.1 MEASURES EXAMINED

There were 351 total electric energy efficiency measures included in the analysis. The list of measures was developed based on a review of the Illinois TRM, the current EKPC program offerings, and the 2014 residential potential study measure list. Measure data includes incremental costs, electric energy and demand savings, natural gas savings, and measure life. See Appendix B for residential measure list and assumptions details.

4.2 RESULTS

Figure 4-1 provides the technical, economic, and achievable results for the 5-yr, 10-yr, and 15-yr timeframes. The 5-yr technical potential is 32.4% of forecasted sales, and the economic potential is 18.0% of forecasted sales, indicating that about half of the technical potential is cost-effective. The 3-yr realistic achievable potential is 6.4%. Achievable potential grows to 12.4% over a fifteen-year timeframe.

FIGURE 4-1 RESIDENTIAL ELECTRIC ENERGY (MWH) CUMULATIVE ANNUAL POTENTIAL (AS A % OF RESIDENTIAL SALES)



4.2.1 Technical Potential

Table 4-1 provides 5-, 10-, and 15-yr estimates of cumulative annual technical potential for energy and summer peak demand. The energy savings are provided by end use, and the overall peak demand savings are also provided. HVAC Shell, HVAC Equipment and Water Heating are the leading end uses.

TABLE 4-1 RESIDENTIAL SECTOR TECHNICAL POTENTIAL SAVINGS

End Use	2023	2028	2033
Cumulative Annual MWh			
Appliances	71,567	124,520	145,019
Behavioral	150,194	122,072	115,108
Bundles	2,087	1,728	2,612
Clothes Washer/ Dryer	42,761	85,370	119,884
Dishwasher	3,394	6,776	7,679
Electronics	247,964	318,242	330,787
HVAC Shell	883,068	1,249,403	1,312,698
HVAC Equipment	353,659	641,146	934,857
Lighting	120,997	142,295	135,204
New Construction	66,177	129,902	187,754
Pool/Spa	8,746	17,491	17,507
Water Heating	408,976	753,376	792,219
Total	2,359,591	3,592,320	4,101,328
% of Forecasted Sales	32.4%	46.5%	50.8%
Cumulative Annual MW			
Total	393	624	684
% of Forecasted Demand	19.1%	29.2%	31.4%

4.2.2 Economic Potential

Table 4-2 provides 5-, 10-, and 15-yr estimates of cumulative annual economic potential for energy and summer peak demand. The energy savings are provided by end use, and the overall peak demand savings are also provided. HVAC Shell, HVAC Equipment and Water Heating are the leading end uses.

TABLE 4-2 RESIDENTIAL SECTOR ECONOMIC POTENTIAL SAVINGS

End Use	2023	2028	2033
Cumulative Annual MWh			
Appliances	46,264	74,022	74,022
Behavioral	125,540	118,765	115,362
Bundles	0	0	0
Clothes Washer/ Dryer	31,010	61,905	86,943
Dishwasher	0	0	0
Electronics	136,804	171,233	179,332
HVAC Shell	435,050	534,520	600,651
HVAC Equipment	260,125	466,025	677,926
Lighting	120,993	142,286	135,194
New Construction	51,568	101,224	146,305
Pool/Spa	8,746	17,491	17,507
Water Heating	97,502	173,509	202,250
Total	1,313,601	1,860,979	2,235,491
% of Forecasted Sales	18.0%	24.1%	27.7%
Cumulative Annual MW			
Total	179	243	273
% of Forecasted Demand	8.7%	11.4%	12.6%

4.2.3 Achievable Potential

Figure 4-2 provides a graphical representation of the 5-, 10-, and 15-yr cumulative annual achievable potential results by end use. HVAC Shell, HVAC Equipment and Electronics are the leading end uses.

FIGURE 4-2 RESIDENTIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL GWH) MAXIMUM ACHIEVABLE POTENTIAL BY END-USE

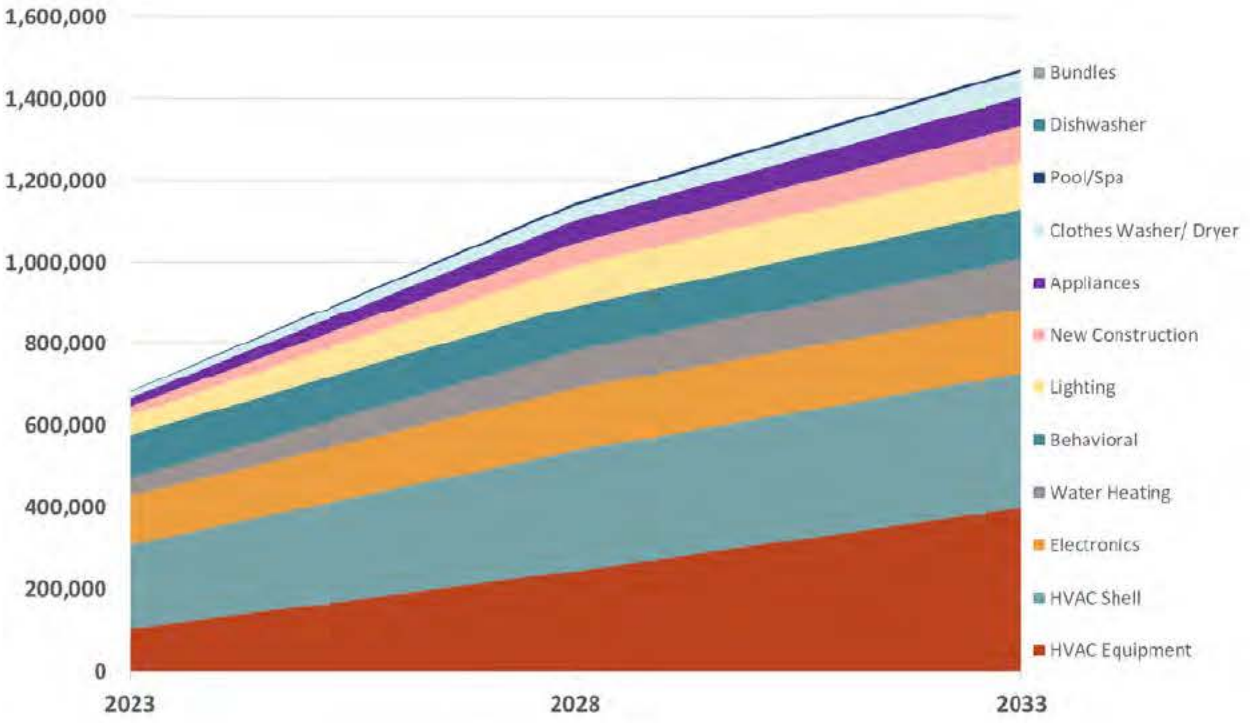


Table 4-3 provides 5-, 10-, and 15-yr cumulative annual maximum achievable potential estimates. The maximum achievable potential rises from 9.4% in 2023, to 14.9% in 2028, and 18.3% in 2033.

TABLE 4-3 RESIDENTIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL MWH) MAXIMUM ACHIEVABLE POTENTIAL BY END-USE

End Use	2023	2028	2033
Cumulative Annual MWh			
Appliances	20,093	54,528	71,589
Behavioral	104,087	111,302	120,753
Bundles	0	0	0
Clothes Washer/ Dryer	14,022	37,230	62,005
Dishwasher	0	0	0
Electronics	120,037	151,123	158,273
HVAC Shell	205,206	293,865	327,975
HVAC Equipment	102,407	244,631	398,293
Lighting	48,900	100,806	114,266
New Construction	21,580	54,486	88,678
Pool/Spa	3,356	6,942	7,177
Water Heating	43,949	92,171	125,569
Total	683,638	1,147,083	1,474,578
% of Forecasted Sales	9.4%	14.9%	18.3%
Cumulative Annual MW			
Total	94	151	178

End Use	2023	2028	2033
% of Forecasted Demand	4.6%	7.1%	8.2%

Figure 4-3 provides a graphical representation of the 5-, 10-, and 15-yr cumulative annual achievable potential results by end use. HVAC Shell, HVAC Equipment and Electronics are the leading end uses.

FIGURE 4-3 RESIDENTIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL GWH) REALISTIC ACHIEVABLE POTENTIAL BY END-USE

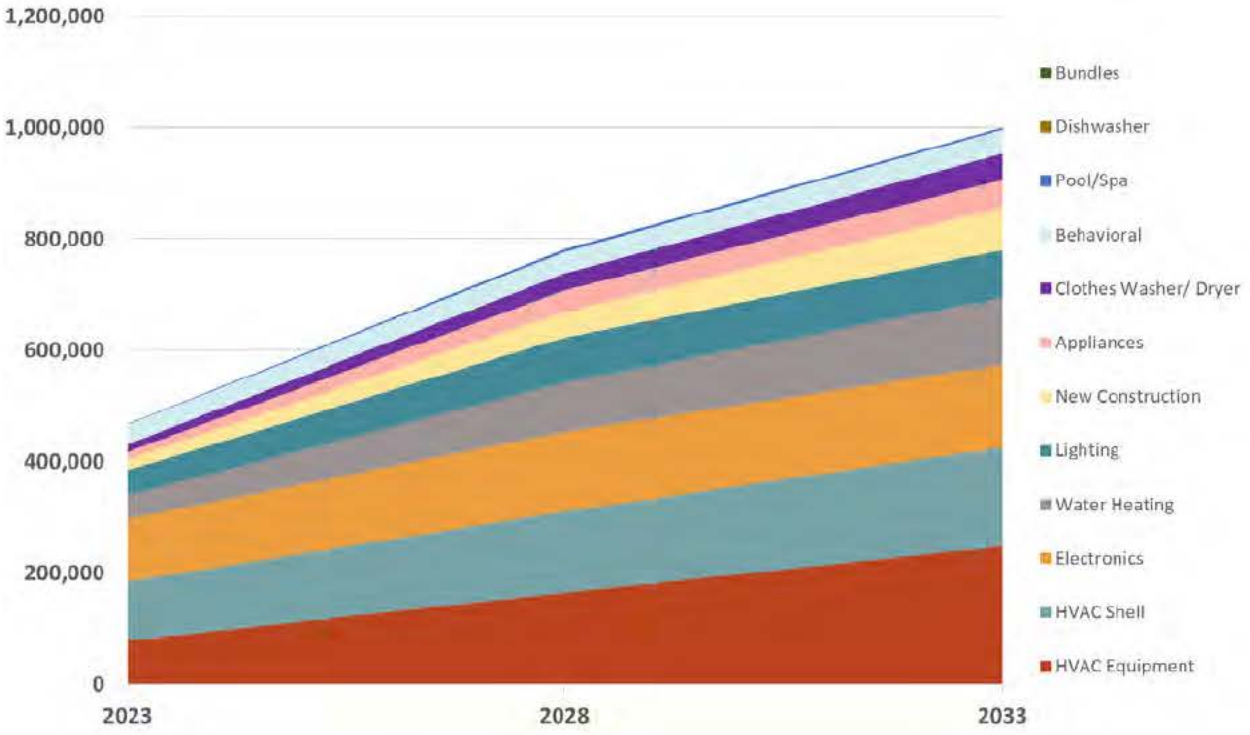


Table 4-4 provides 5-, 10-, and 15-yr cumulative annual realistic achievable potential estimates. The realistic achievable potential rises from 6.4% in 2023, to 10.1% in 2028, and 12.4% in 2033.

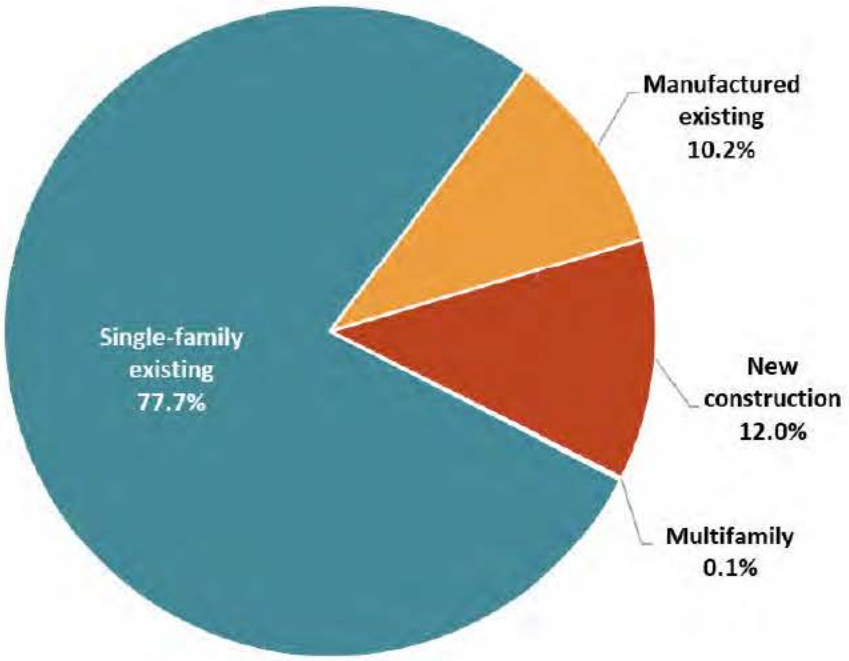
TABLE 4-4 RESIDENTIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL MWH) REALISTIC ACHIEVABLE POTENTIAL BY END-USE

End Use	2023	2028	2033
Cumulative Annual MWh			
Appliances	14,255	38,685	50,789
Behavioral	35,097	38,338	42,196
Bundles	0	0	0
Clothes Washer/ Dryer	12,776	30,404	47,305
Dishwasher	0	0	0
Electronics	112,851	142,103	148,798
HVAC Shell	105,142	145,514	176,882
HVAC Equipment	78,952	165,179	248,261
Lighting	45,728	80,837	85,714
New Construction	18,738	46,620	75,144
Pool/Spa	2,425	4,849	4,853
Water Heating	42,555	88,951	120,405
Total	468,518	781,480	1,000,348
% of Forecasted Sales	6.4%	10.1%	12.4%

End Use	2023	2028	2033
Cumulative Annual MW			
Total	67	107	126
% of Forecasted Demand	3.2%	5.0%	5.8%

Figure 4-4 illustrates a market segmentation of the achievable potential in the residential sector by 2033. The leading market segment is single-family existing homes at 78% of total savings. Manufactured homes account for 10% of savings. New construction accounts for 12% of savings.

FIGURE 4-4 2033 RESIDENTIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL) ACHIEVABLE POTENTIAL BY MARKET SEGMENT



4.2.4 Measure Level Detail

Table 4-5 below presents the measure-level technical, economic, and achievable MWh savings. Measures with significant remaining potential either possess significant per unit savings opportunities or are applicable to a large number homes in the EKPC territory. Measures with zero economic and achievable potential were not found to be cost effective.

TABLE 4-5 RESIDENTIAL TECHNICAL, ECONOMIC, ACHIEVABLE SAVINGS POTENTIAL (MWH), BY MEASURE (2033)

Measure Name	Technical	Economic	Max	Realistic
Heat Pump	496,084	361,978	211,653	125,361
ENERGY STAR TV	120,222	120,222	106,088	106,088
Duct Sealing	190,774	207,532	121,090	88,846
Touchstone Energy Home	187,754	146,305	88,678	75,144
Air Sealing	230,056	136,184	82,044	67,679
ENERGY STAR Clothes Washer	86,943	86,943	62,005	47,305
Standard LEDs	70,529	70,529	60,739	45,796
ENERGY STAR Printer	59,110	59,110	52,185	42,710
Water Heater Pipe Wrap	28,707	57,211	38,244	37,379
Thermostatic Restriction Valve	28,015	55,832	37,840	37,295
Specialty/Reflector LEDs	59,161	59,161	49,040	37,229

Measure Name	Technical	Economic	Max	Realistic
Dual Fuel Heat Pump	135,672	100,288	58,640	33,962
Refrigerator Recycling	49,324	49,324	47,703	33,843
Low Flow Showerhead	33,503	66,586	35,820	32,976
Programmable Thermostat	0	67,026	32,803	32,803
Home Energy Report	50,726	85,549	91,458	31,959
Ductless Mini-Split AC/HP	140,563	93,214	54,503	26,443
Ceiling Insulation	315,125	173,382	124,842	20,357
Freezer Recycling	24,698	24,698	23,886	16,946
Smart Thermostat	108,303	23,606	16,531	14,347
Low Flow Faucet Aerators	11,375	22,621	13,664	12,755
Home Energy Display Monitor	64,383	29,814	29,295	10,237
Room AC Recycling	11,398	11,398	9,003	9,003
Efficient Furnace Fan	20,417	20,417	15,160	6,342
Pool Pump	17,507	17,507	7,177	4,853
All Other Measures	1,560,981	89,057	4,486	2,689
Total	**4,101,328**	**2,235,491**	**1,474,578**	**1,000,348**
% of Forecasted Sales	**50.8%**	**27.7%**	**18.3%**	**12.4%**

*For some measures, the economic and achievable potential may exceed technical potential. This is due primarily to an adjustment to the applicability factors among measures in the same measure group that compete to save the same kWh (e.g. not all smart thermostats are cost-effective, which requires shifting some of the applicability factors to programmable thermostats, which are excluded from technical potential in favor of higher saving smart thermostats).

4.2.5 Benefits and Costs – Achievable Scenarios

Figure 4-5 shows the annual budgets for both achievable potential scenarios. The incentive and admin budgets are listed separately. The RAP budget fluctuates between $18 million and $26 million across the 15-year timeframe.

FIGURE 4-5 RESIDENTIAL SECTOR ANNUAL BUDGETS – MAX AND REALISTIC ACHIEVABLE POTENTIAL (15-YR)

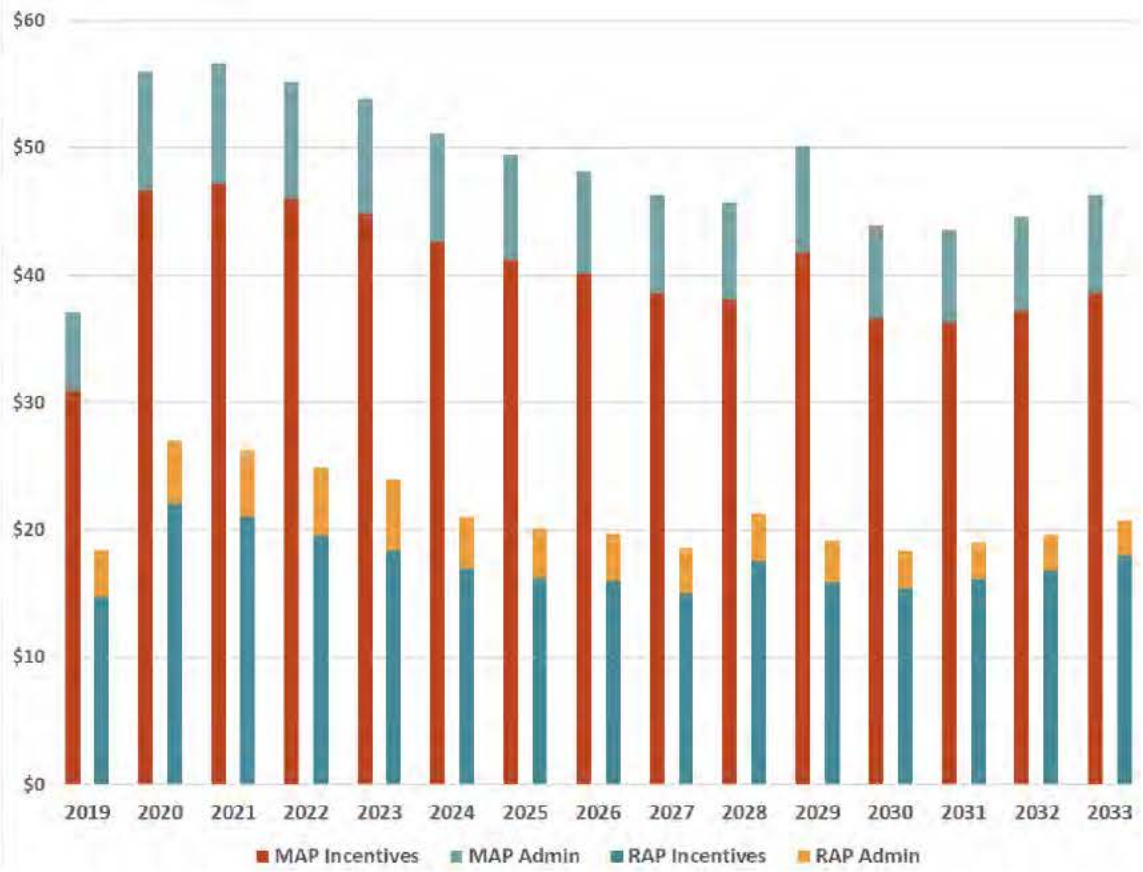


FIGURE 4-5 RESIDENTIAL SECTOR ANNUAL BUDGETS – MAX AND REALISTIC ACHIEVABLE POTENTIAL (15-YR)

Table 4-6 provides the net present value (NPV) benefits and costs across the 2019-2033 timeframe for both achievable potential scenarios. The TRC ratio ranges between 2.0 and 2.2 across the two scenarios. NPV benefits exceed $1.1 billion in the MAP scenario.

TABLE 4-6 RESIDENTIAL NPV BENEFITS AND COSTS (15-YR, $ IN MILLIONS) – MAX AND REALISTIC ACHIEVABLE POTENTIAL

Scenario	NPV Benefits	NPV Costs	TRC Ratio
Max Achievable	$1,151	$574	2.0
Realistic Achievable	$824	$372	2.2

4.2.6 Additional Scenario Analysis

GDS calculated the residential potential results for four additional funding scenarios: $750,000, $1.5 million, $3 million, and $6 million. Table 4-7 below provides the end-use level and total potential energy savings across the 15-yr timeframe of the study for each of these scenarios. HVAC Equipment is the leading end-use in all scenarios. The savings percentages relative to forecasted sales range from 0.3% to 2.7%.

TABLE 4-7 RESIDENTIAL SCENARIO POTENTIAL – BY END USE THROUGH 2033

End Use	$750k	$1.5M	$3.0M	$6.0M
Cumulative Annual MWh				
Appliances	0	0	0	0
Behavioral	724	1,328	1,690	3,984

End Use	$750k	$1.5M	$3.0M	$6.0M
Cumulative Annual MWh				
Bundles	0	0	0	0
Clothes Washer/ Dryer	0	0	0	0
Dishwasher	0	0	0	0
Electronics	0	0	0	0
HVAC Shell	0	2,148	6,284	14,265
HVAC Equipment	20,090	36,318	80,318	165,017
Lighting	1,114	1,150	1,185	1,433
New Construction	2,599	6,232	14,211	30,569
Pool/Spa	0	0	0	0
Water Heating	0	0	0	0
Total	24,528	47,175	103,688	215,269
% of Forecasted Sales	**0.3%**	**0.6%**	**1.3%**	**2.7%**

Table 4-8 provides the net present value (NPV) benefits and costs across the 2019-2033 timeframe for the additional scenarios. The TRC ratio equals 1.6 for each scenario.

TABLE 4-8 RESIDENTIAL NPV BENEFITS AND COSTS (15-YR, $ IN MILLIONS) – ADDITIONAL SCENARIOS

Scenario	NPV Benefits	NPV Costs	TRC Ratio
$750k	$13.7	$8.6	1.6
$1.5M	$27.3	$16.9	1.6
$3.0M	$60.5	$37.2	1.6
$6.0M	$126.2	$77.5	1.6

5 Commercial Energy Efficiency Potential

This chapter provides the potential results for technical, economic, and achievable potential for the commercial sector. The chapter breakdowns of the potential by end use and market segment. The results are provided on a five, ten and fifteen-year basis. Budget and benefit-cost data are provided for the achievable potential scenarios.

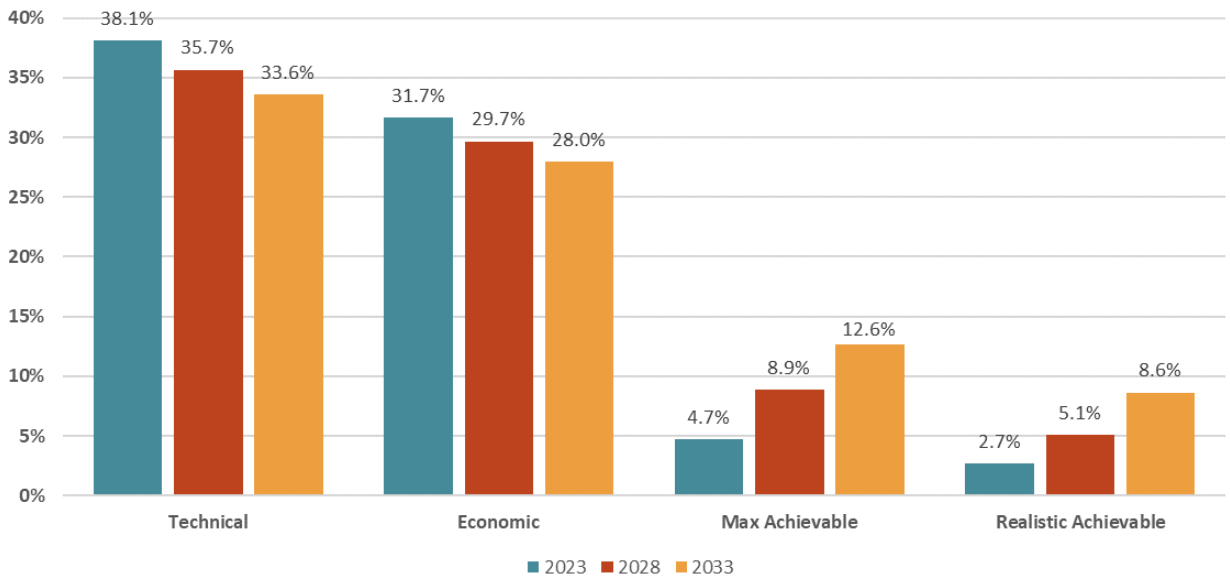
5.1 MEASURES EXAMINED

There were 138 total electric energy efficiency measures included in the analysis. The list of measures was developed based on a review of the Illinois TRM, the current EKPC program offerings, and the 2014 residential potential study measure list. Measure data includes incremental costs, electric energy and demand savings, natural gas savings, and measure life. See Appendix C for commercial measure list and assumptions details.

5.2 RESULTS

Figure 5-1 provides the technical, economic, and achievable results for the 5-yr, 10-yr, and 15-yr timeframes. The 5-yr technical potential is 38.1% of forecasted sales, and the economic potential is 31.7% of forecasted sales, indicating that most technical potential is cost-effective. The 3-yr realistic achievable potential is 2.7%. Achievable potential grows to 8.6% over a fifteen-year timeframe.

FIGURE 5-1 COMMERCIAL ELECTRIC ENERGY (MWH) CUMULATIVE ANNUAL POTENTIAL (AS A % OF COMMERCIAL SALES)



5.2.1 Technical Potential

Table 5-1 provides 5-, 10-, and 15-yr estimates of cumulative annual technical potential for energy and summer peak demand. The energy savings are provided by end use, and the overall peak demand savings are also provided. Refrigeration, Ventilation, and Interior Lighting are the leading end uses.

TABLE 5-1 COMMERCIAL SECTOR TECHNICAL POTENTIAL SAVINGS

End Use	2023	2028	2033
Cumulative Annual MWh			
Interior Lighting	181,311	181,311	181,311
Exterior Lighting	23,850	23,850	23,850
Space Cooling - Chillers	56,647	56,647	56,647
Space Cooling - Unitary / Split	107,369	107,369	107,369
Space Heating	5,039	5,039	5,039
Ventilation	110,241	110,241	110,241
Motors	14,532	14,532	14,532
Water Heating	274	274	274
Cooking	2,606	2,606	2,606
Refrigeration	219,564	219,564	219,564
Office Equipment	29,780	29,780	29,780
Compressed Air	60,211	60,211	60,211
Pools	22,395	22,395	22,395
Total	833,818	833,818	833,818
% of Forecasted Sales	38.1%	35.7%	33.6%
Cumulative Annual MW			
Total	81	81	81
% of Forecasted Demand	18.1%	16.9%	15.9%

5.2.2 Economic Potential

Table 5-2 provides 5-, 10-, and 15-yr estimates of cumulative annual economic potential for energy and summer peak demand. The energy savings are provided by end use, and the overall peak demand savings are also provided. Refrigeration, Ventilation, and Interior Lighting are the leading end uses.

TABLE 5-2 COMMERCIAL SECTOR ECONOMIC POTENTIAL SAVINGS

End Use	2023	2028	2033
Cumulative Annual MWh			
Interior Lighting	161,617	161,617	161,617
Exterior Lighting	23,850	23,850	23,850
Space Cooling - Chillers	43,231	43,231	43,231
Space Cooling - Unitary / Split	69,398	69,398	69,398
Space Heating	5,783	5,783	5,783
Ventilation	91,642	91,642	91,642
Motors	14,532	14,532	14,532
Water Heating	273	273	273
Cooking	2,000	2,000	2,000
Refrigeration	191,470	191,470	191,470
Office Equipment	21,185	21,185	21,185
Compressed Air	59,735	59,735	59,735
Pools	9,237	9,237	9,237
Total	693,952	693,952	693,952
% of Forecasted Sales	31.7%	29.7%	28.0%
Cumulative Annual MW			

End Use	2023	2028	2033
Total	67	67	67
% of Forecasted Demand	15.0%	14.0%	13.2%

5.2.3 Achievable Potential

Figure 5-2 provides a graphical representation of the 5-, 10-, and 15-yr cumulative annual achievable potential results by end use. Refrigeration, Lighting and Ventilation are the leading end uses.

FIGURE 5-2 COMMERCIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL GWH) MAXIMUM ACHIEVABLE POTENTIAL BY END-USE

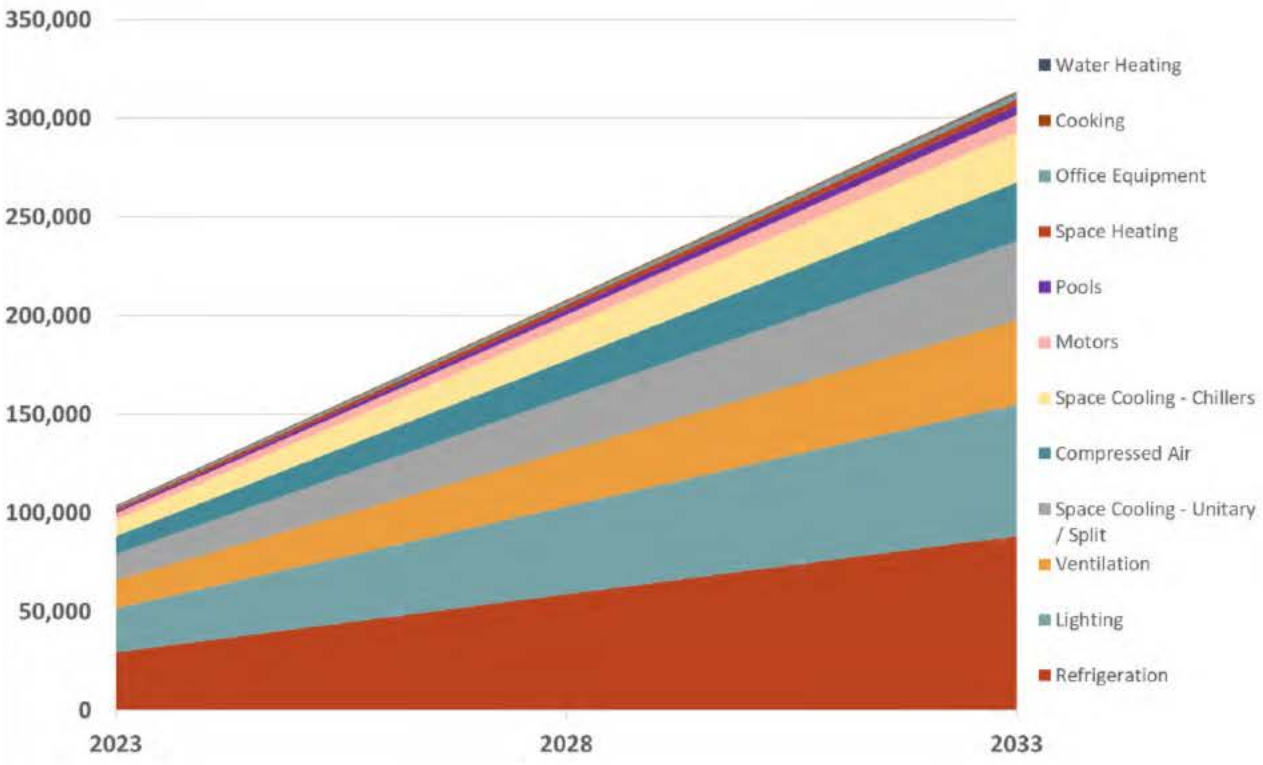


Table 5-3 provides 5-, 10-, and 15-yr cumulative annual maximum achievable potential estimates. The maximum achievable potential rises from 4.7% in 2023, to 8.9% in 2028, and 12.6% in 2033.

TABLE 5-3 COMMERCIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL MWH) MAXIMUM ACHIEVABLE POTENTIAL BY END-USE

End Use	2023	2028	2033
Cumulative Annual MWh			
Lighting	22,270	44,540	66,810
Space Cooling - Chillers	8,493	16,987	25,480
Space Cooling - Unitary / Split	13,421	26,843	40,264
Space Heating	1,115	2,230	3,344
Ventilation	14,178	28,357	42,535
Motors	2,896	5,792	8,688
Water Heating	54	107	161
Cooking	386	771	1,157
Refrigeration	29,363	58,725	88,088
Office Equipment	871	1,741	2,612
Compressed Air	8,989	18,958	29,906

End Use	2023	2028	2033
Pools	1,520	3,040	4,560
Total	103,556	208,091	313,605
% of Forecasted Sales	4.7%	8.9%	12.6%
Cumulative Annual MW			
Total	14	**28**	42
% of Forecasted Demand	3.2%	5.9%	8.4%

Figure 5-3 provides a graphical representation of the 5-, 10-, and 15-yr cumulative annual achievable potential results by end use. Refrigeration, Ventilation and Space Cooling – Unitary/Split are the leading end uses.

FIGURE 5-3 COMMERCIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL GWH) REALISTIC ACHIEVABLE POTENTIAL BY END-USE

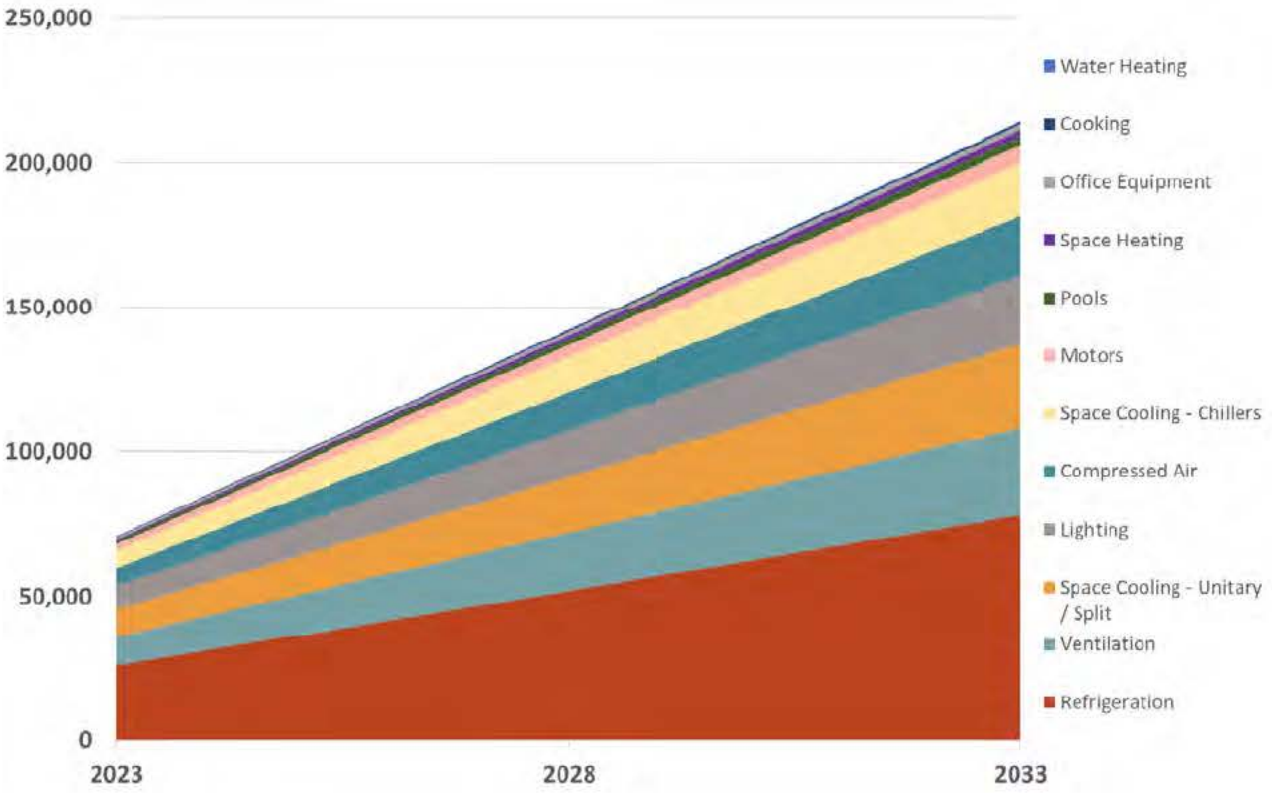


Table 5-3 provides 5-, 10-, and 15-yr cumulative annual realistic achievable potential estimates. The maximum achievable potential rises from 2.7% in 2023, to 5.1% in 2028, and 8.6% in 2033.

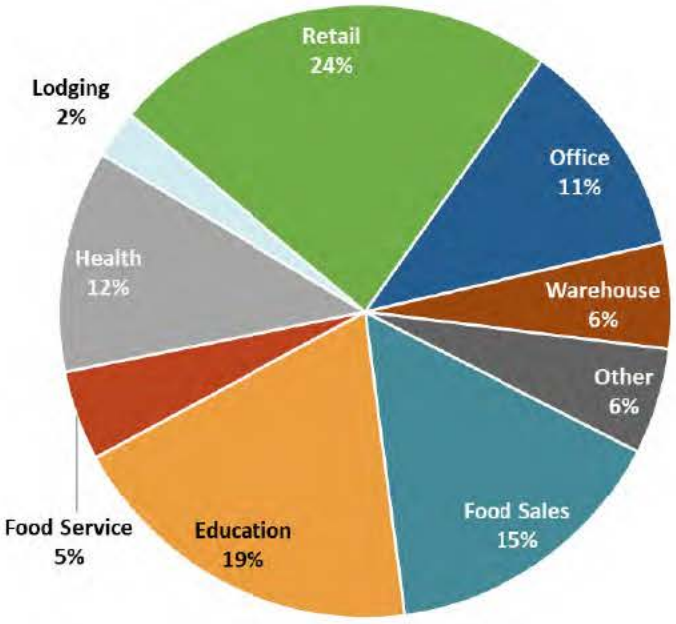
TABLE 5-4 COMMERCIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL MWH) REALISTIC ACHIEVABLE POTENTIAL BY END-USE

End Use	2023	2028	2033
Cumulative Annual MWh			
Lighting	7,981	15,961	23,942
Space Cooling - Chillers	6,115	12,229	18,344
Space Cooling - Unitary / Split	9,602	19,205	28,807
Space Heating	733	1,466	2,199
Ventilation	10,055	20,109	30,164
Motors	2,096	4,193	6,289

End Use	2023	2028	2033
Water Heating	37	74	111
Cooking	265	529	794
Refrigeration	26,061	52,123	78,184
Office Equipment	680	1,359	2,039
Compressed Air	6,210	13,060	20,552
Pools	961	1,922	2,883
Total	70,795	142,230	214,307
% of Forecasted Sales	3.2%	6.1%	8.6%
Cumulative Annual MW			
Total	9	18	28
% of Forecasted Demand	2.0%	3.8%	5.4%

Figure 5-4 illustrates a market segmentation of the achievable potential in the commercial sector by 2033. The leading market segment is retail (24%), followed by education (19%), food service (11%), food sales (15%), and health care (12%).

FIGURE 5-4 2033 COMMERCIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL) ACHIEVABLE POTENTIAL BY MARKET SEGMENT



5.2.4 Measure Level Detail

Table 5-5 below presents the measure-level technical, economic, and achievable MWh savings. Measures with significant remaining potential either possess significant per unit savings opportunities or are applicable to a large number of homes in the EKPC territory. Measures with zero economic and achievable potential were not found to be cost effective.

TABLE 5-5 COMMERCIAL TECHNICAL, ECONOMIC, ACHIEVABLE SAVINGS POTENTIAL (MWH), BY MEASURE (2033)

Measure Name	Technical	Economic	Max	Realistic
Evaporator Fan Motor Control for freezers and coolers	37,574	37,574	19,516	17,531
Electronically-Commutated Permanent Magnet Motors	25,221	33,628	19,962	15,441
Efficient Air Compressors	35,359	35,359	20,914	15,110
Zero Energy Doors for freezers and coolers	6,861	24,426	16,312	15,015
Water-Side Economizer - 200 Tons	33,430	33,430	19,774	14,286
Anti-sweat heater controls on freezers	21,171	21,171	12,096	10,976
LED Linear Replacement Lamps	37,330	52,811	24,346	10,911
Brushless DC Motors (ECM) for freezers and coolers	14,116	14,116	9,427	8,677
Anti-sweat heater controls, on refrigerators	13,248	13,248	7,569	6,868
VFD Supply and Return Fans, 11 to 50 HP	14,935	19,914	8,127	5,457
VFD Supply and Return Fans, <3 to 10 HP	14,935	19,914	8,127	5,457
Split AC (11.4 IEER to 15 IEER), 8.3 ton	6,731	10,096	5,972	4,314
VFD on Chilled Water Pump, 20 HP	9,497	9,497	5,617	4,058
Compressed Air Leak Survey and Repair	12,912	12,912	6,104	3,988
DX Packaged System (CEE Tier 2), 10 ton	5,284	7,925	4,688	3,387
Split AC (11.4 IEER to 14 IEER), 8.3 ton	5,208	7,812	4,621	3,338
Vending Miser, Cold Beverage	7,723	7,723	3,725	3,318
DX Packaged System (CEE Tier 2), > 20 ton	5,099	7,648	4,524	3,268
VFD Retrofit on Pool Circulation Pump	9,237	9,237	4,511	2,847
DX Packaged System (CEE Tier 2), < 20 ton	4,314	6,472	3,828	2,766
Programable Thermostats - Cooling	7,788	7,788	4,029	2,751
High Bay 8 lamp HPT8 vs (Metal Halide 400W)	11,026	11,026	5,083	2,278
Solid Door Refrigerator, 50+ cu ft, Energy Star	10,344	10,344	2,802	2,260
Split AC (11.4 IEER to 13 IEER), 8.3 ton	3,452	5,177	3,062	2,212
Solid Door Freezer, 50+ cu ft, Energy Star	9,991	9,991	2,706	2,183
All Other Measures	471,030	264,711	86,163	45,608
Total	**833,818**	**693,952**	**313,605**	**214,307**
% of Forecasted Sales	**33.6%**	**28.0%**	**12.6%**	**8.6%**

*For some measures, the economic and achievable potential may exceed technical potential. This is due primarily to an adjustment to the applicability factors among measures in the same measure group that compete to save the same kWh (e.g. Zero Energy Doors for freezers and coolers have greater economic and achievable potential than technical potential).

5.2.5 Benefits and Costs – Achievable Scenarios

Figure 5-5 shows the annual budgets for both achievable potential scenarios. The incentive and admin budgets are listed separately. The RAP budget fluctuates between $1.9 million and $2.8 million across the 15-year timeframe.

FIGURE 5-5 COMMERCIAL SECTOR ANNUAL BUDGETS – MAX AND REALISTIC ACHIEVABLE POTENTIAL (15-YR)

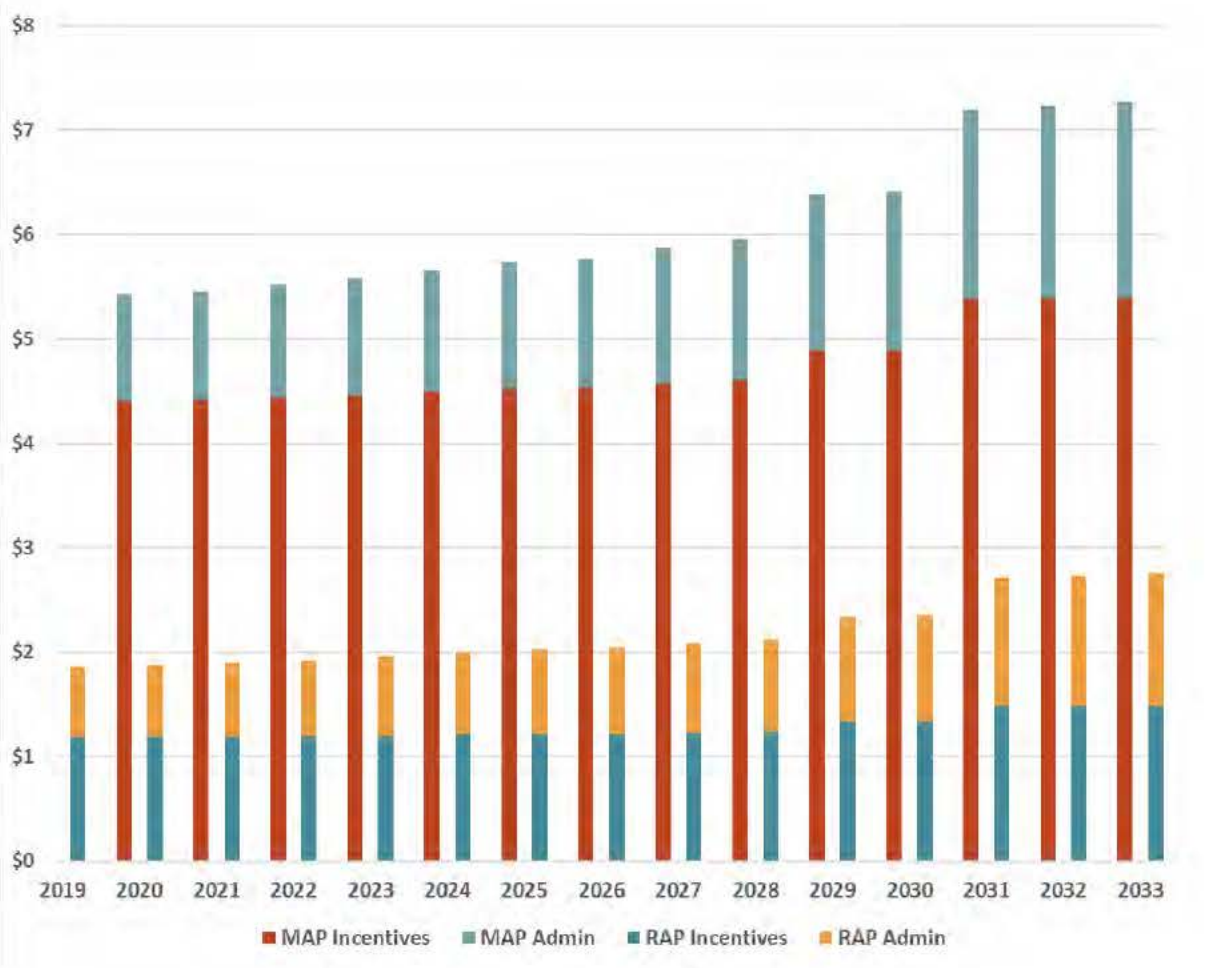


Table 5-6 provides the net present value (NPV) benefits and costs across the 2019-2033 timeframe for both achievable potential scenarios. The TRC ratio is 2.2 in both scenarios. NPV benefits exceed $45 million in the RAP scenario.

TABLE 5-6 COMMERCIAL NPV BENEFITS AND COSTS (15-YR) – MAX AND REALISTIC ACHIEVABLE POTENTIAL

Scenario	NPV Benefits	NPV Costs	TRC Ratio
Max Achievable	$129.2	$57.4	2.2
Realistic Achievable	$46.5	$20.7	2.2

6 Industrial Energy Efficiency Potential

This chapter provides the potential results for technical, economic, and achievable potential for the industrial sector. The chapter breakdowns of the potential by end use and market segment. The results are provided on a five, ten and fifteen-year basis. Budget and benefit-cost data are provided for the achievable potential scenarios.

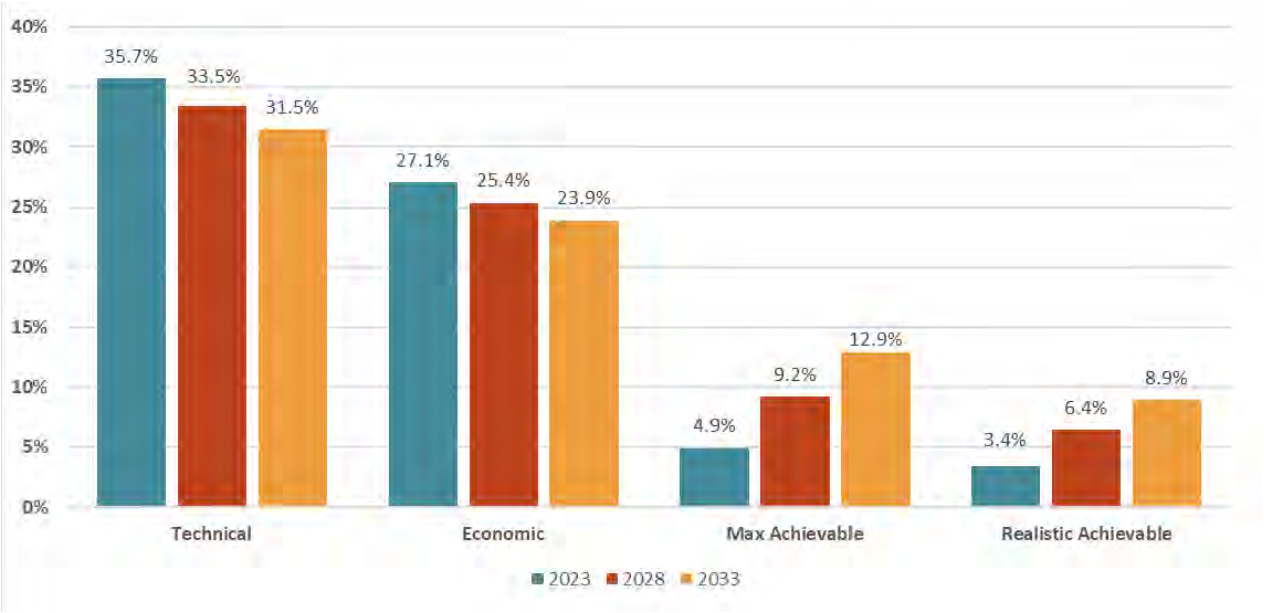
6.1 MEASURES EXAMINED

There were 114 total electric energy efficiency measures included in the analysis. The list of measures was developed based on a review of the Illinois TRM, the current EKPC program offerings, and the 2014 residential potential study measure list. Measure data includes incremental costs, electric energy and demand savings, natural gas savings, and measure life. See Appendix D for industrial measure list and assumptions details.

6.2 RESULTS

Figure 6-1 provides the technical, economic, and achievable results for the 5-yr, 10-yr, and 15-yr timeframes. The 5-yr technical potential is 35.7% of forecasted sales, and the economic potential is 27.1% of forecasted sales, indicating that most technical potential is cost-effective. The 3-yr realistic achievable potential is 3.4%. Achievable potential grows to 8.9% over a fifteen-year timeframe.

FIGURE 6-1 INDUSTRIAL ELECTRIC ENERGY (MWH) CUMULATIVE ANNUAL POTENTIAL (AS A % OF INDUSTRIAL SALES)



6.2.1 Technical Potential

Table 6-1 provides 5-, 10-, and 15-yr estimates of cumulative annual technical potential for energy and summer peak demand. The energy savings are provided by end use, and the overall peak demand savings are also provided. Machine drive, lighting, and space cooling are the leading end uses. These three end uses account for 80% of the technical potential.

TABLE 6-1 INDUSTRIAL SECTOR TECHNICAL POTENTIAL SAVINGS

End Use	2023	2028	2033
Cumulative Annual MWh			
Machine Drive	507,289	507,289	507,289
Lighting	359,670	359,670	359,670
Space Cooling	244,626	244,626	244,626
Ventilation	76,114	76,114	76,114
Process Heating and Cooling	117,816	117,816	117,816
Space Heating	63,120	63,120	63,120
Other	5,307	5,307	5,307
Agriculture	11,357	11,357	11,357
Water Heating	637	637	637
Computers & Office Equipment	972	972	972
Total	1,386,909	1,386,909	1,386,909
% of Forecasted Sales	35.7%	33.5%	31.5%
Cumulative Annual MW			
Total	236	236	236
% of Forecasted Demand	29.8%	28.3%	27.1%

6.2.2 Economic Potential

Table 6-2 provides 5-, 10-, and 15-yr estimates of cumulative annual economic potential for energy and summer peak demand. The energy savings are provided by end use, and the overall peak demand savings are also provided. Machine drive, lighting, and process heating and cooling are the leading end uses. These three end uses account for 85% of the economic potential.

TABLE 6-2 INDUSTRIAL SECTOR ECONOMIC POTENTIAL SAVINGS

End Use	2023	2028	2033
Cumulative Annual MWh			
Machine Drive	507,289	507,289	507,289
Lighting	271,044	271,044	271,044
Space Cooling	44,654	44,654	44,654
Ventilation	67,060	67,060	67,060
Process Heating and Cooling	117,815	117,815	117,815
Space Heating	28,097	28,097	28,097
Other	3,962	3,962	3,962
Agriculture	10,341	10,341	10,341
Water Heating	482	482	482
Computers & Office Equipment	792	792	792
Total	1,051,536	1,051,536	1,051,536
% of Forecasted Sales	27%	25%	24%
Cumulative Annual MW			
Total	179	179	179
% of Forecasted Demand	22.6%	21.5%	20.6%

6.2.3 Achievable Potential

Figure 6-2 provides a graphical representation of the 5-, 10-, and 15-yr cumulative annual maximum achievable potential results by end use. Machine drive, lighting, and process heating and cooling are the leading end uses. These three end uses account for 85% of the maximum achievable potential.

FIGURE 6-2 INDUSTRIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL GWH) MAXIMUM ACHIEVABLE POTENTIAL BY END-USE

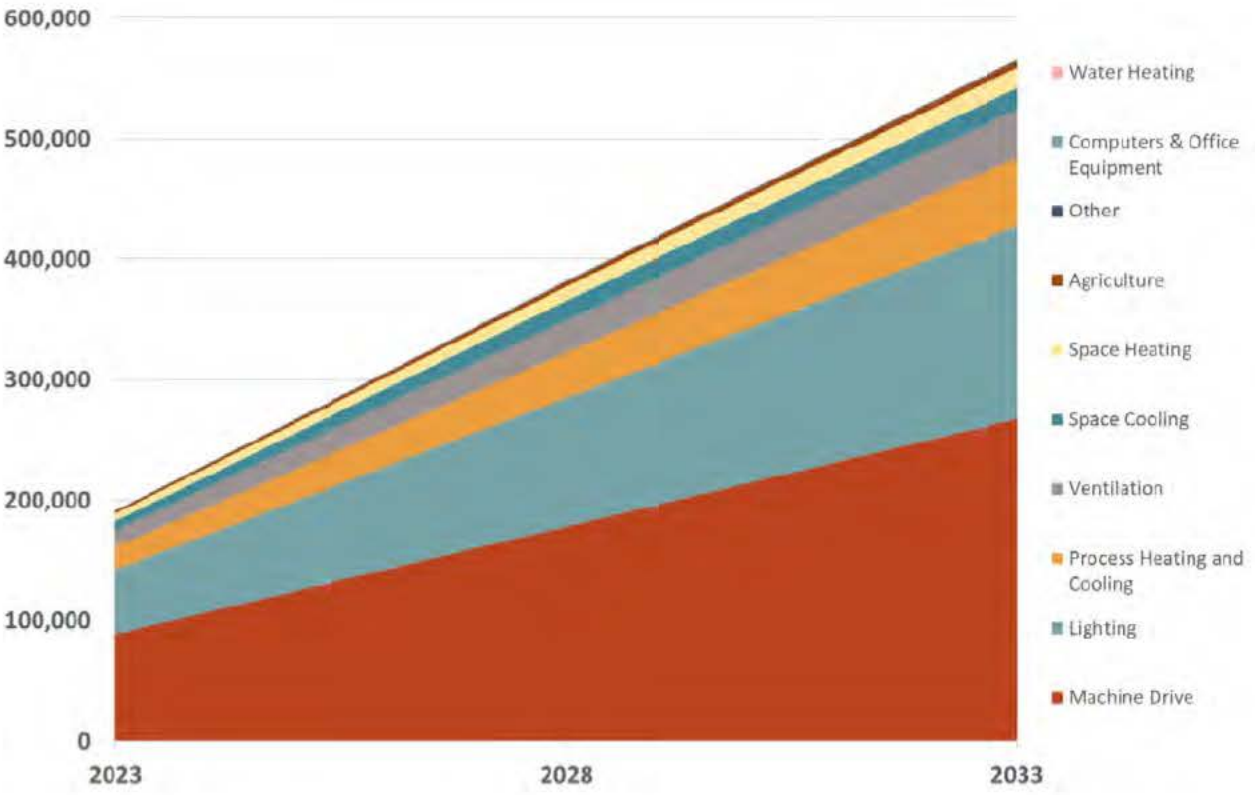


Table 6-3 provides 5-, 10-, and 15-yr cumulative annual maximum achievable potential estimates. The maximum achievable potential rises from 4.0% in 2023, to 7.7% in 2028, and 11.1% in 2033.

TABLE 6-3 INDUSTRIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL MWH) MAXIMUM ACHIEVABLE POTENTIAL BY END-USE

End Use	2023	2028	2033
Cumulative Annual MWh			
Machine Drive	89,116	178,232	267,347
Lighting	53,383	106,765	160,148
Space Cooling	8,167	16,314	18,185
Ventilation	13,350	26,699	40,049
Process Heating and Cooling	18,946	37,891	56,837
Space Heating	5,907	11,814	16,409
Other	385	770	1,156
Agriculture	1,822	3,644	5,465
Water Heating	79	159	238
Computers & Office Equipment	140	279	419
Total	191,294	382,567	566,253
% of Forecasted Sales	4.9%	9.2%	12.9%
Cumulative Annual MW			

End Use	2023	2028	2033
Total	32	64	96
% of Forecasted Demand	4.0%	7.7%	11.1%

Figure 6-3 provides a graphical representation of the 5-, 10-, and 15-yr cumulative annual realistic achievable potential results by end use. Machine drive, lighting, and ventilation are the leading end uses. These three end uses account for 85% of the realistic achievable potential.

FIGURE 6-3 INDUSTRIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL GWH) REALISTIC ACHIEVABLE POTENTIAL BY END-USE

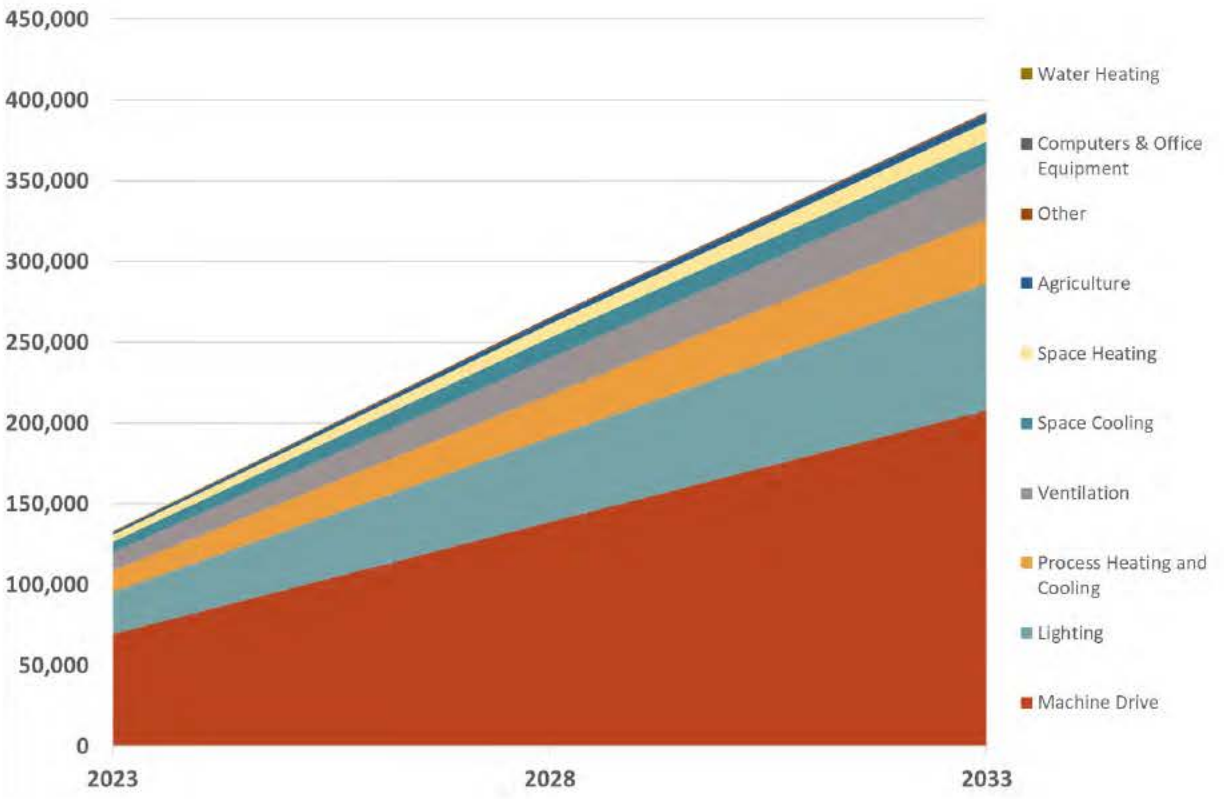


Table 6-4 provides 5-, 10-, and 15-yr cumulative annual realistic achievable potential estimates. The realistic achievable potential rises from 2.8% in 2023, to 6.4% in 2028, and 7.6% in 2033.

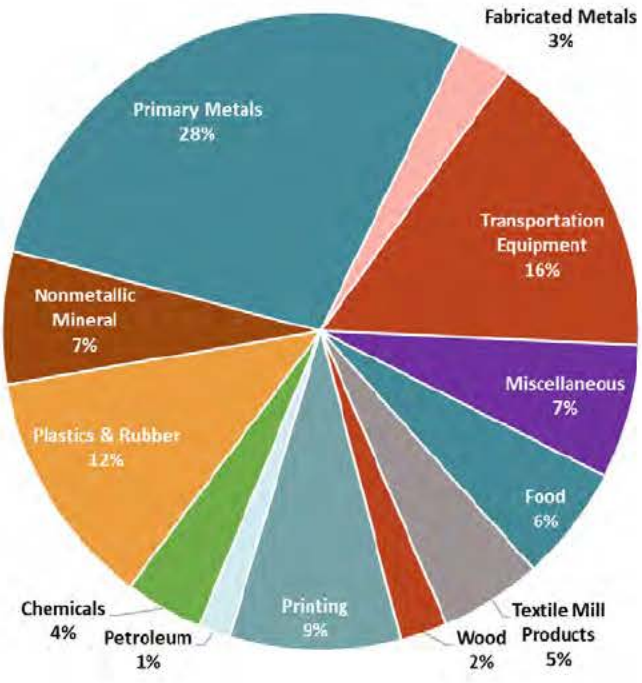
TABLE 6-4 INDUSTRIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL MWH) REALISTIC ACHIEVABLE POTENTIAL BY END-USE

End Use	2023	2028	2033
Cumulative Annual MWh			
Machine Drive	69,258	138,517	207,775
Lighting	26,162	52,324	78,487
Space Cooling	6,324	12,631	14,164
Ventilation	11,315	22,629	33,944
Process Heating and Cooling	13,312	26,623	39,935
Space Heating	4,312	8,624	12,069
Other	350	700	1,050
Agriculture	1,657	3,314	4,970
Water Heating	64	128	193

End Use	2023	2028	2033
Computers & Office Equipment	88	175	263
Total	132,841	265,666	392,850
% of Forecasted Sales	3.4%	6.4%	8.9%
Cumulative Annual MW			
Total	22	44	66
% of Forecasted Demand	2.8%	5.3%	7.6%

Figure 6-4 illustrates a market segmentation of the realistic achievable potential in the industrial sector by 2033. The leading market segment is primary metals (28%), followed by transportation equipment (16%), and plastics and rubber (12%).

FIGURE 6-4 2033 INDUSTRIAL ELECTRIC ENERGY (CUMULATIVE ANNUAL) ACHIEVABLE POTENTIAL BY MARKET SEGMENT



6.2.4 Measure Level Detail

Table 6-5 below presents the measure-level technical, economic, and achievable MWh savings. Measures with significant remaining potential either possess significant per unit savings opportunities or are applicable to a large number homes in the EKPC territory. Measures with zero economic and achievable potential were not found to be cost effective.

TABLE 6-5 INDUSTRIAL TECHNICAL, ECONOMIC, ACHIEVABLE SAVINGS POTENTIAL (MWH), BY MEASURE (2033)

Measure Name	Technical	Economic	Max	Realistic
Motor System Optimization (Including ASD)	151,038	151,038	115,417	89,977
High Efficiency Pumps and Pump VFDs	90,980	90,980	68,284	52,353
Compressed Air Measures (Nozzles, Tank, Drains, Blower, Filters)	62,286	62,286	42,296	36,947
VFD for Process Fans	38,655	38,655	29,539	23,029
Sensors & Controls	47,257	47,257	31,697	21,958
Pump System Efficiency Improvements	41,733	41,733	28,752	20,179

Measure Name	Technical	Economic	Max	Realistic
High bay 4 lamp HPT8 vs (Metal halide 250 W)	52,698	52,698	40,994	18,114
Improved Refrigeration	38,080	38,080	25,441	17,411
VFD Supply and Return Fans	21,523	21,523	16,664	13,811
Occupancy Sensors and Central Lighting Control	29,959	29,959	24,597	13,701
LED Linear Replacement Lamps	38,676	38,676	29,752	12,416
Switching Controls for Multilevel Lighting (Non-HID)	21,390	21,390	17,722	10,203
EMS for Manufacturing HVAC Fan	15,784	15,784	12,220	10,128
Compressed Air Audits and Leak Repair	14,452	14,452	9,799	8,567
Advanced Efficient Motors	13,959	13,959	9,762	6,867
Fan System Improvements	6,775	6,775	4,455	3,130
High performance T5 (replacing T8)	16,964	16,964	11,971	2,944
Industrial Motor Management	5,965	5,965	3,916	2,824
Evaporator Fan Motor Controls Ag	4,422	4,422	656	2,737
Energy Information System	5,252	5,252	3,589	2,445
Compressed Air Outdoor Air Intake	3,867	3,867	2,621	2,292
Lamp & Ballast Retrofit (HPT8 Replacing Standard T8)	13,026	13,026	9,192	2,261
Compressed Air Pressure Flow Controller	3,633	3,633	2,467	2,150
Retrocommissioning	3,042	3,042	2,382	1,869
Injection Molding Machine - efficient (plastics)	3,231	3,231	1,869	1,818
All Other Measures	642,261	306,888	20,199	12,719
Total	**1,386,909**	**1,051,536**	**566,253**	**392,850**
% of Forecasted Sales	**31.5%**	**23.9%**	**12.9%**	**8.9%**

*For some measures, the economic and achievable potential may exceed technical potential. This is due primarily to an adjustment to the applicability factors among measures in the same measure group that compete to save the same kWh.

6.2.5 Benefits and Costs – Achievable Scenarios

Figure 6-5 shows the annual budgets for both achievable potential scenarios. The incentive and admin budgets are listed separately. The RAP budget rises from $2.9 million in 2019 to $4.2 million in 2033.

FIGURE 6-5 INDUSTRIAL SECTOR ANNUAL BUDGETS ($ MILLIONS) – MAX AND REALISTIC ACHIEVABLE POTENTIAL (15-YR)

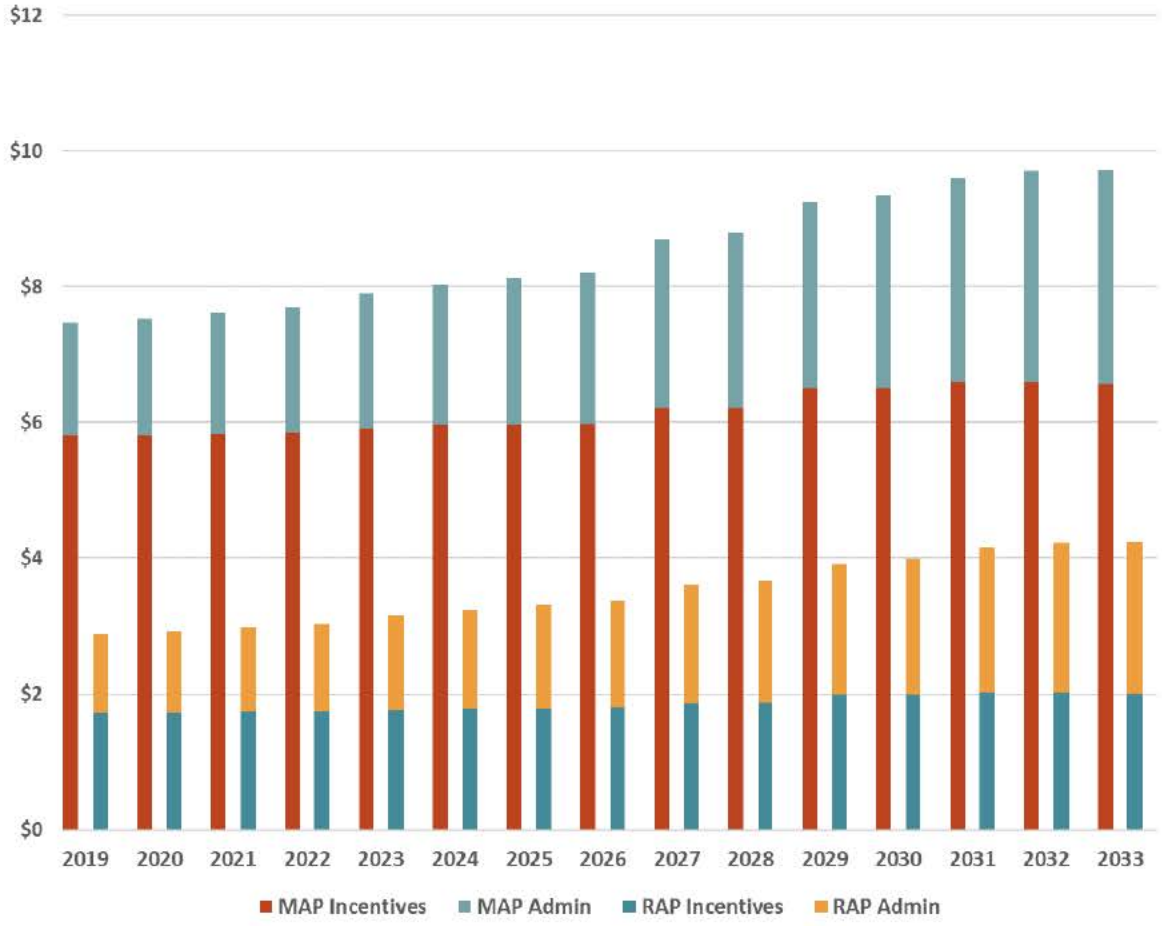


Table 6-6 provides the net present value (NPV) benefits and costs across the 2019-2033 timeframe for both achievable potential scenarios. The TRC ratio exceeds 3.0 in both scenarios. NPV benefits exceed $180 million in the RAP scenario.

TABLE 6-6 INDUSTRIAL NPV BENEFITS AND COSTS (15-YR) – MAX AND REALISTIC ACHIEVABLE POTENTIAL

Scenario	NPV Benefits	NPV Costs	TRC Ratio
Max Achievable	$266	$81	3.3
Realistic Achievable	$185	$54	3.5

7 Demand Response Analysis

7.1 TOTAL DEMAND RESPONSE POTENTIAL

Table 7-1 and Table 7-2 show the MAP and RAP residential net present values of the total benefits, costs, and savings, along with the TRC ratio for each program for the length of the study. The study period is 2019 to 2038. Two scenarios were looked at for the demand response study: control of air conditioners by load control switches or smart thermostats. Therefore, the programs lower in the hierarchy that are affected by the DLC AC programs are affected differently depending on which option is selected.

TABLE 7-1 MAP NPV BENEFITS, COSTS, AND TRC RATIOS FOR EACH DEMAND RESPONSE PROGRAM

	Program	NPV Benefits	NPV Costs	TRC Ratio
Residential	DLC AC (Thermostat)	$21,081,013	$17,741,946	1.19
	DLC AC (Switch)	$106,755,835	$58,860,975	1.81
	DLC Swimming Pool Pumps	$11,973,360	$5,923,242	2.02
	DLC Water Heating	$46,684,625	$71,128,160	0.66
	Critical Peak Pricing with Enabling Tech (Switch Scenario)	$213,850,280	$11,549,673	18.52
	Critical Peak Pricing with Enabling Tech (Thermostat Scenario)	$282,128,763	$13,086,453	21.56
	Critical Peak Pricing without Enabling Tech (Switch Scenario)	$39,716,779	$5,182,629	7.66
	Critical Peak Pricing without Enabling Tech (Thermostat Scenario)	$41,974,704	$5,519,620	7.60
Non-Residential	DLC AC (Thermostat)	$6,626,535	$2,277,924	2.91
	DLC AC (Switch)	$5,612,310	$2,406,594	2.33
	DLC Water Heating	$3,592,755	$1,694,337	2.12
	DLC Agricultural Irrigation	$11,972,545	$424,982	28.17
	Interruptible Rate	$252,238,015	$18,409,681	13.70
	Large C&I Behavioral	$1,205,665	$307,891	3.92
	Demand Buyback	$12,661	$209,594	0.06
	Critical Peak Pricing with Enabling Tech (Switch Scenario)	$46,280,645	$919,429	50.34
	Critical Peak Pricing with Enabling Tech (Thermostat Scenario)	$43,600,839	$899,118	48.49
	Critical Peak Pricing without Enabling Tech (Switch Scenario)	$3,913,583	$490,426	7.98
	Critical Peak Pricing without Enabling Tech (Thermostat Scenario)	$3,764,066	$485,887	7.75
Residential & Non-Residential	PEV Charging	$27,297,597	$3,767,785	7.24

TABLE 7-2 RAP NPV BENEFITS, COSTS, AND TRC RATIOS FOR EACH DEMAND RESPONSE PROGRAM

	Program	NPV Benefits	NPV Costs	TRC Ratio
Residential	DLC AC (Thermostat)	$14,639,592	$12,081,430	1.21
	DLC AC (Switch)	$73,702,593	$36,532,895	2.02
	DLC Swimming Pool Pumps	$5,986,680	$2,978,129	2.01
	DLC Water Heating	$29,840,941	$44,168,725	0.68
	Critical Peak Pricing with Enabling Tech (Switch Scenario)	$59,521,437	$2,359,648	25.22
	Critical Peak Pricing with Enabling Tech (Thermostat Scenario)	$69,958,942	$2,565,635	27.27
	Critical Peak Pricing without Enabling Tech (Switch Scenario)	$20,035,223	$2,056,281	9.74
	Critical Peak Pricing without Enabling Tech (Thermostat Scenario)	$22,415,144	$2,208,960	10.15
Non-Residential	DLC AC (Thermostat)	$2,790,120	$997,719	2.80
	DLC AC (Switch)	$1,202,638	$590,940	2.04
	DLC Water Heating	$1,569,941	$791,738	1.98
	DLC Agricultural Irrigation	$5,986,272	$349,866	17.11
	Interruptible Rate	$232,693,895	$17,229,759	13.51
	Large C&I Behavioral	$183,006	$218,574	0.84
	Demand Buyback	$1,876	$204,204	0.01
	Critical Peak Pricing with Enabling Tech (Switch Scenario)	$15,151,632	$352,660	42.96
	Critical Peak Pricing with Enabling Tech (Thermostat Scenario)	$14,374,876	$341,056	42.15
	Critical Peak Pricing without Enabling Tech (Switch Scenario)	$2,472,786	$323,581	7.64
	Critical Peak Pricing without Enabling Tech (Thermostat Scenario)	$2,364,058	$315,203	7.50
Residential & Non-Residential	PEV Charging	$16,569,037	$2,268,482	7.30

Table 7-3 shows the technical, economic, and achievable (MAP and RAP) cumulative annual potential for years 5, 10 and 15 of the study in the switch scenario. Table 7-4 shows results for each level of potential in the thermostat scenario.

Achievable potential includes a participation rate to estimate the realistic number of customers that are expected to participate in each cost-effective demand response program option. These values are at the customer meter. The maximum achievable potential (MAP) assumes the maximum participation that would happen in the real-world, while the realistically achievable potential (RAP) discounts MAP by considering barriers to program implementation that could limit the amount of savings achieved.

TABLE 7-3 SUMMARY OF TECHNICAL, ECONOMIC, AND ACHIEVABLE POTENTIAL – SWITCH SCENARIO

Potential Level (MW)	5-Year Savings (2023)	10-Year Savings (2028)	15-Year Savings (2033)
Technical	1639	1668	1697
Economic	1302	1320	1340

Potential Level (MW)	5-Year Savings (2023)	10-Year Savings (2028)	15-Year Savings (2033)
MAP	514	563	608
RAP	286	326	367

TABLE 7-4 SUMMARY OF TECHNICAL, ECONOMIC, AND ACHIEVABLE POTENTIAL – THERMOSTAT SCENARIO

Potential Level (MW)	5-Year Savings (2023)	10-Year Savings (2028)	15-Year Savings (2033)
Technical	1336	1381	1428
Economic	999	1032	1070
MAP	499	552	601
RAP	260	294	328

Table 7-5 and Table 7-6 show the achievable potential savings for years 5, 10, and 15, by program. Only those programs that were found to be cost-effective are included.

TABLE 7-5 MAP SAVINGS BY PROGRAM

Sector	Program	5-Year Savings (2023)	10-Year Savings (2028)	15-Year Savings (2033)
Residential	DLC AC (Thermostat)	7	15	22
	DLC AC (Switch)	47	75	104
	DLC Swimming Pool Pumps	4	8	13
	Critical Peak Pricing with Enabling Tech (Switch Scenario)	208	187	159
	Critical Peak Pricing with Enabling Tech (Thermostat Scenario)	232	236	234
	Critical Peak Pricing without Enabling Tech (Switch Scenario)	32	31	31
	Critical Peak Pricing without Enabling Tech (Thermostat Scenario)	33	33	33
	Total (Switch Scenario)	**290**	**302**	**307**
	Total (Thermostat Scenario)	**276**	**292**	**303**
Non-Residential	DLC AC (Thermostat)	2	5	7
	DLC AC (Switch)	2	4	6
	DLC Water Heating	2	4	6
	DLC Agricultural Irrigation	9	10	10
	Interruptible Rate	160	182	207
	Large C&I Behavioral	1	1	1
	Critical Peak Pricing with Enabling Tech (Switch Scenario)	39	39	38
	Critical Peak Pricing with Enabling Tech (Thermostat Scenario)	38	37	35
	Critical Peak Pricing without Enabling Tech (Switch Scenario)	3	3	3
	Critical Peak Pricing without Enabling Tech (Thermostat Scenario)	3	3	3

Sector	Program	5-Year Savings (2023)	10-Year Savings (2028)	15-Year Savings (2033)
	Total (Switch Scenario)	**216**	**242**	**270**
	Total (Thermostat Scenario)	**215**	**241**	**268**
Residential & Non-Residential	PEV Charging	8	19	31
	Total (Switch Scenario)	**514**	**563**	**608**
	Total (Thermostat Scenario)	**499**	**552**	**601**

TABLE 7-6 RAP SAVINGS BY PROGRAM

Sector	Program	5-Year Savings (2023)	10-Year Savings (2028)	15-Year Savings (2033)
Residential	DLC AC (Thermostat)	5	10	16
	DLC AC (Switch)	36	52	69
	DLC Swimming Pool Pumps	2	4	6
	Critical Peak Pricing with Enabling Tech (Switch Scenario)	53	51	47
	Critical Peak Pricing with Enabling Tech (Thermostat Scenario)	57	58	59
	Critical Peak Pricing without Enabling Tech (Switch Scenario)	17	17	16
	Critical Peak Pricing without Enabling Tech (Thermostat Scenario)	18	19	19
	Total (Switch Scenario)	**108**	**124**	**139**
	Total (Thermostat Scenario)	**81**	**91**	**99**
Non-Residential	DLC AC (Thermostat)	1	2	3
	DLC AC (Switch)	0.4	1	1
	DLC Water Heating	1	2	2
	DLC Agricultural Irrigation	5	5	5
	Interruptible Rate	154	169	186
	Critical Peak Pricing with Enabling Tech (Switch Scenario)	12	13	13
	Critical Peak Pricing with Enabling Tech (Thermostat Scenario)	12	12	12
	Critical Peak Pricing without Enabling Tech (Switch Scenario)	2	2	2
	Critical Peak Pricing without Enabling Tech (Thermostat Scenario)	2	2	2
	Total (Switch Scenario)	**173**	**191**	**209**
	Total (Thermostat Scenario)	**174**	**191**	**210**
Residential & Non-Residential	PEV Charging	5	11	19
	Total (Switch Scenario)	**286**	**326**	**367**
	Total (Thermostat Scenario)	**260**	**294**	**328**

7.2 GENERAL COSTS OF DEMAND RESPONSE

Table 7-7 and Table 7-8 show the MAP and RAP costs (for only cost-effective programs) that would be required to achieve the cumulative annual potential. The current and future hardware and software cost of a Demand Response Management System and the cost of non-equipment incentives are included in these budgets.

TABLE 7-7 SUMMARY OF MAP BUDGET REQUIREMENTS

	Switch Scenario	Thermostat Scenario
2019	$11,577,488	$5,974,266
2020	$10,649,843	$8,415,078
2021	$15,686,683	$10,578,371
2022	$9,126,679	$7,140,993
2023	$7,349,132	$5,089,765
2024	$6,227,937	$3,683,322
2025	$6,545,527	$3,587,650
2026	$8,530,128	$4,857,444
2027	$8,981,131	$5,043,883
2028	$9,402,147	$5,244,157
2029	$9,897,483	$5,526,024
2030	$10,230,411	$5,635,407
2031	$10,675,598	$5,846,811
2032	$11,113,477	$6,050,629
2033	$11,565,921	$6,265,800
2034	$12,053,034	$6,505,834
2035	$12,563,952	$6,756,135
2036	$13,050,886	$6,993,825
2037	$13,042,639	$6,958,922
2038	$13,457,635	$7,145,240

TABLE 7-8 SUMMARY OF RAP BUDGET REQUIREMENTS

	Switch Scenario	Thermostat Scenario
2019	$5,663,381	$1,946,374
2020	$3,689,931	$1,976,973
2021	$6,503,304	$2,878,173
2022	$6,907,886	$3,258,160
2023	$5,020,881	$3,313,347
2024	$7,802,517	$4,240,144
2025	$5,270,757	$3,749,655
2026	$4,759,784	$3,104,987
2027	$4,445,760	$2,670,289
2028	$4,603,787	$2,693,286
2029	$5,490,716	$3,495,214

	Switch Scenario	Thermostat Scenario
2030	$5,768,070	$3,604,207
2031	$6,006,049	$3,725,768
2032	$6,321,288	$3,931,328
2033	$6,469,903	$3,964,447
2034	$6,721,184	$4,094,545
2035	$6,967,172	$4,219,490
2036	$7,221,974	$4,351,582
2037	$7,496,296	$4,498,507
2038	$7,784,099	$4,651,922

APPENDIX A. List of Key Data Sources

This appendix provides a list of key data sources used in the development of the measure assumptions (to be updated).

1 BEOpt: Building Energy Optimization software

2 EIA - Technology Forecast Updates – Residential and Commercial Building Technologies – Reference Case

3 Energy Efficiency Emerging Technologies

4 Illinois TRM (Version 7.0)

5 Indiana TRM (Version 2.2) ***Hyperlink unavailable - embedded document provided below***

2018 MPS RFP
(Appendix I) Indiana

6 Michigan Energy Measures Database (MEMD)

7 Mid-Atlantic Technical Reference Manual V7, Dated May 2017

8 National Residential Efficiency Measures Database

APPENDIX B. Residential Measure Detail

EKPC DSM **Measure Assumptions**

Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Annual Electric	% Elec Savings	Per Unit Elec Savings	Per Unit Summer NCP kW	Per Unit Winter NCP kW	Per unit NG Saving	Per Unit Water Savings	RC EUL	EE EUL	Initial Measure Cost	TRC Ratio
1001	Appliances	Energy Star Compliant Top-Mount Refrigerator	SF	All	MO	441.7	10%	44.3	0.007	0.007	0.00	0	17.0	17.0	$30	0.85
1002	Appliances	CEE Tier 2 Compliant Top-Mount Refrigerator	SF	All	MO	441.7	25%	110.5	0.017	0.017	0.00	0	17.0	17.0	$140	0.45
1003	Appliances	Energy Star Compliant Side-by-Side Refrigerator	SF	All	MO	517.1	10%	51.7	0.008	0.008	0.00	0	17.0	17.0	$30	0.99
1004	Appliances	CEE Tier 2 Compliant Side-by-Side Refrigerator	SF	All	MO	517.1	25%	129.3	0.020	0.020	0.00	0	17.0	17.0	$140	0.53
1005	Appliances	Energy Star Compliant Chest Freezer	SF	All	MO	311.4	10%	31.2	0.005	0.005	0.00	0	11.0	11.0	$35	0.25
1006	Appliances	Energy Star Compliant Upright Freezer (Manual Def.)	SF	All	MO	349.2	10%	35.0	0.006	0.006	0.00	0	11.0	11.0	$35	0.28
1007	Appliances	Second Refrigerator Turn In	SF	All	Recycle	1,036.0	100%	1,036.0	0.152	0.152	0.00	0	8.0	8.0	$131	2.31
1008	Appliances	Second Freezer Turn In	SF	All	Recycle	942.0	100%	942.0	0.138	0.138	0.00	0	8.0	8.0	$131	2.07
1009	Appliances	Energy Star Compliant Top-Mount Refrigerator	MH	All	MO	441.7	10%	44.3	0.007	0.007	0.00	0	17.0	17.0	$30	0.85
1010	Appliances	CEE Tier 2 Compliant Top-Mount Refrigerator	MH	All	MO	441.7	25%	110.5	0.017	0.017	0.00	0	17.0	17.0	$140	0.45
1011	Appliances	Energy Star Compliant Side-by-Side Refrigerator	MH	All	MO	517.1	10%	51.7	0.008	0.008	0.00	0	17.0	17.0	$30	0.99
1012	Appliances	CEE Tier 2 Compliant Side-by-Side Refrigerator	MH	All	MO	517.1	25%	129.3	0.020	0.020	0.00	0	17.0	17.0	$140	0.53
1013	Appliances	Energy Star Compliant Chest Freezer	MH	All	MO	311.4	10%	31.2	0.005	0.005	0.00	0	11.0	11.0	$35	0.25
1014	Appliances	Energy Star Compliant Upright Freezer (Manual Def.)	MH	All	MO	349.2	10%	35.0	0.006	0.006	0.00	0	11.0	11.0	$35	0.28
1015	Appliances	Second Refrigerator Turn In	MH	All	Recycle	1,036.0	100%	1,036.0	0.152	0.152	0.00	0	8.0	8.0	$131	2.31
1016	Appliances	Second Freezer Turn In	MH	All	Recycle	942.0	100%	942.0	0.138	0.138	0.00	0	8.0	8.0	$131	2.07
1017	Appliances	Energy Star Compliant Top-Mount Refrigerator	SF	All	NC	441.7	10%	44.3	0.007	0.007	0.00	0	17.0	17.0	$30	0.85
1018	Appliances	CEE Tier 2 Compliant Top-Mount Refrigerator	SF	All	NC	441.7	25%	110.5	0.017	0.017	0.00	0	17.0	17.0	$140	0.45
1019	Appliances	Energy Star Compliant Side-by-Side Refrigerator	SF	All	NC	517.1	10%	51.7	0.008	0.008	0.00	0	17.0	17.0	$30	0.99
1020	Appliances	CEE Tier 2 Compliant Side-by-Side Refrigerator	SF	All	NC	517.1	25%	129.3	0.020	0.020	0.00	0	17.0	17.0	$140	0.53
1021	Appliances	Energy Star Compliant Chest Freezer	SF	All	NC	311.4	10%	31.2	0.005	0.005	0.00	0	11.0	11.0	$35	0.25
1022	Appliances	Energy Star Compliant Upright Freezer (Manual Def.)	SF	All	NC	349.2	10%	35.0	0.006	0.006	0.00	0	11.0	11.0	$35	0.28
1023	Appliances	Energy Star Compliant Top-Mount Refrigerator	MH	All	NC	441.7	10%	44.3	0.007	0.007	0.00	0	17.0	17.0	$30	0.85
1024	Appliances	CEE Tier 2 Compliant Top-Mount Refrigerator	MH	All	NC	441.7	25%	110.5	0.017	0.017	0.00	0	17.0	17.0	$140	0.45
1025	Appliances	Energy Star Compliant Side-by-Side Refrigerator	MH	All	NC	517.1	10%	51.7	0.008	0.008	0.00	0	17.0	17.0	$30	0.99
1026	Appliances	CEE Tier 2 Compliant Side-by-Side Refrigerator	MH	All	NC	517.1	25%	129.3	0.020	0.020	0.00	0	17.0	17.0	$140	0.53
1027	Appliances	Energy Star Compliant Chest Freezer	MH	All	NC	311.4	10%	31.2	0.005	0.005	0.00	0	11.0	11.0	$35	0.25
1028	Appliances	Energy Star Compliant Upright Freezer (Manual Def.)	MH	All	NC	349.2	10%	35.0	0.006	0.006	0.00	0	11.0	11.0	$35	0.28
2001	Behavioral	Pre-Paid Energy Display Monitor - Gas/CAC	SF	All	Opt-In	13,949.3	11%	1,534.4	0.523	0.070	6.73	0	1.0	1.0	$100	0.82
2002	Behavioral	Home Energy Reports - Gas/CAC	SF	All	Opt-Out	13,949.3	2%	279.0	0.095	0.013	1.22	0	1.0	1.0	$7	2.20
2003	Behavioral	Pre-Paid Energy Display Monitor - ASHP	SF	All	Opt-In	17,770.4	11%	1,954.7	0.369	0.772	0.00	0	1.0	1.0	$100	0.76
2004	Behavioral	Home Energy Reports - ASHP	SF	All	Opt-Out	17,770.4	2%	355.4	0.067	0.140	0.00	0	1.0	1.0	$7	2.03
2005	Behavioral	Pre-Paid Energy Display Monitor - Elec Furn/CAC	SF	All	Opt-In	24,655.7	11%	2,712.1	0.384	1.265	0.00	0	1.0	1.0	$100	1.03
2006	Behavioral	Home Energy Reports - Elec Furn/CAC	SF	All	Opt-Out	24,655.7	2%	493.1	0.070	0.230	0.00	0	1.0	1.0	$7	2.78
2007	Behavioral	Pre-Paid Energy Display Monitor - Gas/CAC	MH	All	Opt-In	11,217.1	11%	1,233.9	0.367	0.056	5.20	0	1.0	1.0	$100	0.64
2008	Behavioral	Home Energy Reports - Gas/CAC	MH	All	Opt-Out	11,217.1	2%	224.3	0.067	0.010	0.95	0	1.0	1.0	$7	1.73
2009	Behavioral	Pre-Paid Energy Display Monitor - ASHP	MH	All	Opt-In	15,080.5	11%	1,658.9	0.344	0.602	0.00	0	1.0	1.0	$100	0.65
2010	Behavioral	Home Energy Reports - ASHP	MH	All	Opt-Out	15,080.5	2%	301.6	0.063	0.109	0.00	0	1.0	1.0	$7	1.74
2011	Behavioral	Pre-Paid Energy Display Monitor - Elec Furn/CAC	MH	All	Opt-In	20,487.9	11%	2,253.7	0.351	1.048	0.00	0	1.0	1.0	$100	0.87
2012	Behavioral	Home Energy Reports - Elec Furn/CAC	MH	All	Opt-Out	20,487.9	2%	409.8	0.064	0.191	0.00	0	1.0	1.0	$7	2.33
2013	Behavioral	Pre-Paid Energy Display Monitor - Gas/CAC	SF	All	NC	12,067.5	11%	1,327.4	0.269	0.053	4.52	0	1.0	1.0	$100	0.63
2014	Behavioral	Home Energy Reports - Gas/CAC	SF	All	NC	12,067.5	2%	241.4	0.049	0.010	0.82	0	1.0	1.0	$7	1.69
2015	Behavioral	Pre-Paid Energy Display Monitor - ASHP	SF	All	NC	14,766.1	11%	1,624.3	0.236	0.483	0.00	0	1.0	1.0	$100	0.61
2016	Behavioral	Home Energy Reports - ASHP	SF	All	NC	14,766.1	2%	295.3	0.043	0.088	0.00	0	1.0	1.0	$7	1.64
2017	Behavioral	Pre-Paid Energy Display Monitor - Gas/CAC	MH	All	NC	9,870.7	11%	1,085.8	0.243	0.046	4.43	0	1.0	1.0	$100	0.54
2018	Behavioral	Home Energy Reports - Gas/CAC	MH	All	NC	9,870.7	2%	197.4	0.044	0.008	0.81	0	1.0	1.0	$7	1.45
2019	Behavioral	Pre-Paid Energy Display Monitor - ASHP	MH	All	NC	12,747.2	11%	1,402.2	0.225	0.441	0.00	0	1.0	1.0	$100	0.53
2020	Behavioral	Home Energy Reports - ASHP	MH	All	NC	12,747.2	2%	254.9	0.041	0.080	0.00	0	1.0	1.0	$7	1.42
3001	Bundles	Multi-Family Homes Efficiency Kit	MF	All	Retrofit	9,460.0	4%	347.0	0.061	0.056	0.00	0	7.0	7.0	$1,000	0.10
3002	Bundles	Multi-Family Homes Efficiency Kit	MF	All	NC	9,460.0	4%	347.0	0.061	0.056	0.00	0	7.0	7.0	$1,000	0.10
4001	Clothes Washer/ Dryer	Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer)	SF	All	MO	613.1	27%	162.7	0.552	0.552	0.00	2,024	14.0	14.0	$65	4.27
4002	Clothes Washer/ Dryer	Energy Star Most Efficient Clothes Washer (w/ Elec. WH & E	SF	All	MO	613.1	39%	242.1	0.821	0.821	0.00	2,760	14.0	14.0	$210	2.12
4003	Clothes Washer/ Dryer	Energy Star Clothes Washer (w/ NG WH & Elec. Dryer)	SF	All	MO	421.8	18%	77.0	0.261	0.261	0.37	2,024	14.0	14.0	$65	3.87
4004	Clothes Washer/ Dryer	Energy Star Most Efficient Clothes Washer (w/ NG WH & Ele	SF	All	MO	421.8	21%	88.2	0.299	0.299	0.66	2,760	14.0	14.0	$210	1.87

EKPC DSM **Measure Assumptions**

Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Annual Electric	% Elec Savings	Per Unit Elec Savings	Per Unit Summer NCP kW	Per Unit Winter NCP kW	Per unit NG Saving	Per Unit Water Savings	RC EUL	EE EUL	Initial Measure Cost	TRC Ratio
4005	Clothes Washer/ Dryer	ENERGY STAR Clothes Dryer	SF	All	MO	768.9	21%	160.0	0.565	0.565	0.00	0	14.0	14.0	$152	0.50
4006	Clothes Washer/ Dryer	Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer)	MH	All	MO	613.1	27%	162.7	0.552	0.552	0.00	2,024	14.0	14.0	$65	4.27
4007	Clothes Washer/ Dryer	Energy Star Most Efficient Clothes Washer (w/ Elec. WH & E	MH	All	MO	613.1	39%	242.1	0.821	0.821	0.00	2,760	14.0	14.0	$210	2.12
4008	Clothes Washer/ Dryer	Energy Star Clothes Washer (w/ NG WH & Elec. Dryer)	MH	All	MO	421.8	18%	77.0	0.261	0.261	0.37	2,024	14.0	14.0	$65	3.87
4009	Clothes Washer/ Dryer	Energy Star Most Efficient Clothes Washer (w/ NG WH & Ele	MH	All	MO	421.8	21%	88.2	0.299	0.299	0.66	2,760	14.0	14.0	$210	1.87
4010	Clothes Washer/ Dryer	ENERGY STAR Clothes Dryer	MH	All	MO	768.9	21%	160.0	0.565	0.565	0.00	0	14.0	14.0	$152	0.50
4011	Clothes Washer/ Dryer	Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer)	SF	All	NC	613.1	27%	162.7	0.552	0.552	0.00	2,024	14.0	14.0	$65	4.27
4012	Clothes Washer/ Dryer	Energy Star Most Efficient Clothes Washer (w/ Elec. WH & E	SF	All	NC	613.1	39%	242.1	0.821	0.821	0.00	2,760	14.0	14.0	$210	2.12
4013	Clothes Washer/ Dryer	Energy Star Clothes Washer (w/ NG WH & Elec. Dryer)	SF	All	NC	421.8	18%	77.0	0.261	0.261	0.37	2,024	14.0	14.0	$65	3.87
4014	Clothes Washer/ Dryer	Energy Star Most Efficient Clothes Washer (w/ NG WH & Ele	SF	All	NC	421.8	21%	88.2	0.299	0.299	0.66	2,760	14.0	14.0	$210	1.87
4015	Clothes Washer/ Dryer	ENERGY STAR Clothes Dryer	SF	All	NC	768.9	21%	160.0	0.565	0.565	0.00	0	14.0	14.0	$152	0.50
4016	Clothes Washer/ Dryer	Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer)	MH	All	NC	613.1	27%	162.7	0.552	0.552	0.00	2,024	14.0	14.0	$65	4.27
4017	Clothes Washer/ Dryer	Energy Star Most Efficient Clothes Washer (w/ Elec. WH & E	MH	All	NC	613.1	39%	242.1	0.821	0.821	0.00	2,760	14.0	14.0	$210	2.12
4018	Clothes Washer/ Dryer	Energy Star Clothes Washer (w/ NG WH & Elec. Dryer)	MH	All	NC	421.8	18%	77.0	0.261	0.261	0.37	2,024	14.0	14.0	$65	3.87
4019	Clothes Washer/ Dryer	Energy Star Most Efficient Clothes Washer (w/ NG WH & Ele	MH	All	NC	421.8	21%	88.2	0.299	0.299	0.66	2,760	14.0	14.0	$210	1.87
4020	Clothes Washer/ Dryer	ENERGY STAR Clothes Dryer	MH	All	NC	768.9	21%	160.0	0.565	0.565	0.00	0	14.0	14.0	$152	0.50
5001	Dishwasher	Energy Star Dishwasher (Electric Water Heating)	SF	All	MO	307.0	12%	37.0	0.147	0.147	0.00	252	11.0	11.0	$50	0.87
5002	Dishwasher	Energy Star Dishwasher (Non-Electric WH)	SF	All	MO	135.1	12%	16.3	0.065	0.065	0.09	252	11.0	11.0	$50	0.72
5003	Dishwasher	Energy Star Dishwasher (Electric Water Heating)	MH	All	MO	307.0	12%	37.0	0.147	0.147	0.00	252	11.0	11.0	$50	0.87
5004	Dishwasher	Energy Star Dishwasher (Non-Electric WH)	MH	All	MO	135.1	12%	16.3	0.065	0.065	0.09	252	11.0	11.0	$50	0.72
5005	Dishwasher	Energy Star Dishwasher (Electric Water Heating)	SF	All	NC	307.0	12%	37.0	0.147	0.147	0.00	252	11.0	11.0	$50	0.87
5006	Dishwasher	Energy Star Dishwasher (Non-Electric WH)	SF	All	NC	135.1	12%	16.3	0.065	0.065	0.09	252	11.0	11.0	$50	0.72
5007	Dishwasher	Energy Star Dishwasher (Electric Water Heating)	MH	All	NC	307.0	12%	37.0	0.147	0.147	0.00	252	11.0	11.0	$50	0.87
5008	Dishwasher	Energy Star Dishwasher (Non-Electric WH)	MH	All	NC	135.1	12%	16.3	0.065	0.065	0.09	252	11.0	11.0	$50	0.72
6001	Electronics	Efficient Televisions	SF	All	MO	246.0	64%	158.1	0.234	0.234	0.00	0	6.0	6.0	$10	2.04
6002	Electronics	Energy Star Desktop Computer	SF	All	MO	238.5	32%	76.6	0.023	0.023	0.00	0	4.0	4.0	$20	0.55
6003	Electronics	Energy Star Computer Monitor	*SF*	All	MO	56.8	25%	14.2	0.001	0.001	0.00	0	5.0	5.0	$3	0.81
6004	Electronics	Energy Star Laptop Computer	*SF*	All	MO	30.7	25%	7.7	0.001	0.001	0.00	0	4.0	4.0	$3	0.37
6005	Electronics	Smart Strip Power Strip - Tier 1	SF	All	MO	173.6	13%	23.0	0.003	0.003	-0.04	0	4.0	4.0	$21	0.15
6006	Electronics	Smart Strip Power Strip - Tier 2	SF	All	MO	432.0	55%	238.0	0.054	0.054	0.00	0	7.0	7.0	$80	0.78
6007	Electronics	Office Multifunction Device	SF	All	MO	573.6	46%	263.3	0.030	0.030	0.00	0	6.0	6.0	$30	1.56
6008	Electronics	Efficient Televisions	MH	All	MO	246.0	64%	158.1	0.234	0.234	0.00	0	6.0	6.0	$10	2.04
6009	Electronics	Energy Star Desktop Computer	MH	All	MO	238.5	32%	76.6	0.023	0.023	0.00	0	4.0	4.0	$20	0.55
6010	Electronics	Energy Star Computer Monitor	MH	All	MO	56.8	25%	14.2	0.001	0.001	0.00	0	5.0	5.0	$3	0.81
6011	Electronics	Energy Star Laptop Computer	MH	All	MO	30.7	25%	7.7	0.001	0.001	0.00	0	4.0	4.0	$3	0.37
6012	Electronics	Smart Strip Power Strip - Tier 1	MH	All	MO	173.6	13%	23.0	0.003	0.003	-0.04	0	4.0	4.0	$21	0.15
6013	Electronics	Smart Strip Power Strip - Tier 2	MH	All	MO	432.0	55%	238.0	0.054	0.054	0.00	0	7.0	7.0	$80	0.78
6014	Electronics	Office Multifunction Device	MH	All	MO	573.6	46%	263.3	0.030	0.030	0.00	0	6.0	6.0	$30	1.56
6015	Electronics	Efficient Televisions	SF	All	NC	246.0	64%	158.1	0.234	0.234	0.00	0	6.0	6.0	$10	2.04
6016	Electronics	Energy Star Desktop Computer	SF	All	NC	238.5	32%	76.6	0.023	0.023	0.00	0	4.0	4.0	$20	0.55
6017	Electronics	Energy Star Computer Monitor	SF	All	NC	56.8	25%	14.2	0.001	0.001	0.00	0	5.0	5.0	$3	0.81
6018	Electronics	Energy Star Laptop Computer	SF	All	NC	30.7	25%	7.7	0.001	0.001	0.00	0	4.0	4.0	$3	0.37
6019	Electronics	Smart Strip Power Strip - Tier 1	SF	All	NC	173.6	13%	23.0	0.003	0.003	-0.04	0	4.0	4.0	$21	0.15
6020	Electronics	Smart Strip Power Strip - Tier 2	SF	All	NC	432.0	55%	238.0	0.054	0.054	0.00	0	7.0	7.0	$80	0.78
6021	Electronics	Office Multifunction Device	*SF*	All	NC	573.6	46%	263.3	0.030	0.030	0.00	0	6.0	6.0	$30	1.56
6022	Electronics	Efficient Televisions	*MH*	All	NC	246.0	64%	158.1	0.234	0.234	0.00	0	6.0	6.0	$10	2.04
6023	Electronics	Energy Star Desktop Computer	MH	All	NC	238.5	32%	76.6	0.023	0.023	0.00	0	4.0	4.0	$20	0.55
6024	Electronics	Energy Star Computer Monitor	MH	All	NC	56.8	25%	14.2	0.001	0.001	0.00	0	5.0	5.0	$3	0.81
6025	Electronics	Energy Star Laptop Computer	MH	All	NC	30.7	25%	7.7	0.001	0.001	0.00	0	4.0	4.0	$3	0.37
6026	Electronics	Smart Strip Power Strip - Tier 1	MH	All	NC	173.6	13%	23.0	0.003	0.003	-0.04	0	4.0	4.0	$21	0.15
6027	Electronics	Smart Strip Power Strip - Tier 2	MH	All	NC	432.0	55%	238.0	0.054	0.054	0.00	0	7.0	7.0	$80	0.78
6028	Electronics	Office Multifunction Device	MH	All	NC	573.6	46%	263.3	0.030	0.030	0.00	0	6.0	6.0	$30	1.56
7001	HVAC Shell	Insulation - Ceiling (R-0 to R-38) - (Elec AC & Gas Heat)	SF	All	Retrofit	6,658.7	40%	2,633.5	3.930	0.407	41.80	0	25.0	25.0	$2,340	2.74
7002	HVAC Shell	Insulation - Ceiling (R-11 to R-49) - (Elec AC & Gas Heat)	SF	All	Retrofit	4,333.7	8%	354.9	0.772	0.083	10.38	0	25.0	25.0	$2,145	0.59

EKPC DSM **Measure Assumptions**

Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Annual Electric	% Elec Savings	Per Unit Elec Savings	Per Unit Summer NCP kW	Per Unit Winter NCP kW	Per unit NG Saving	Per Unit Water Savings	RC EUL	EE EUL	Initial Measure Cost	TRC Ratio
7003	HVAC Shell	Insulation - Ceiling (R-19 to R-49) - (Elec AC & Gas Heat)	SF	All	Retrofit	4,206.1	5%	227.3	0.455	0.046	6.18	0	25.0	25.0	$1,794	0.43
7004	HVAC Shell	Insulation - Floor (R-0 to R-19) - (Elec AC & Gas Heat)	SF	All	Retrofit	4,015.3	-9%	-364.8	-0.206	0.098	9.18	0	25.0	25.0	$1,268	0.28
7005	HVAC Shell	Insulation - Floor (R-11 to R-30) - (Elec AC & Gas Heat)	SF	All	Retrofit	4,296.4	-3%	-145.9	-0.096	0.029	2.84	0	25.0	25.0	$1,268	0.10
7006	HVAC Shell	Wall Insulation - (Elec AC & Gas Heat)	SF	All	Retrofit	4,862.3	14%	666.0	1.039	0.172	16.82	0	25.0	25.0	$1,920	1.02
7007	HVAC Shell	Basement Wall Insulation - (Elec AC & Gas Heat)	SF	All	Retrofit	4,206.1	3%	130.7	-0.098	0.105	9.61	0	25.0	25.0	$1,360	0.34
7008	HVAC Shell	Energy Star Windows - (Elec AC & Gas Heat)	SF	All	Retrofit	4,206.1	6%	246.8	0.367	0.036	3.18	0	25.0	25.0	$5,624	0.10
7009	HVAC Shell	Air Sealing (Tier 1) - (Elec AC & Gas Heat)	SF	All	Retrofit	4,625.4	5%	246.7	0.340	0.177	15.86	0	15.0	15.0	$605	1.23
7010	HVAC Shell	Air Sealing (Tier 2) - (Elec AC & Gas Heat)	SF	All	Retrofit	4,327.3	8%	359.9	0.476	0.130	12.34	0	15.0	15.0	$605	1.21
7011	HVAC Shell	Duct Sealing - (Elec AC & Gas Heat)	SF	All	Retrofit	4,253.6	10%	425.4	0.300	0.050	6.28	0	20.0	20.0	$330	1.90
7012	HVAC Shell	Cool Roof - (Elec AC & Gas Heat)	SF	All	Retrofit	4,206.1	41%	1,726.6	2.550	-0.043	-3.02	0	25.0	25.0	$2,925	0.83
7013	HVAC Shell	Insulation - Ceiling (R-0 to R-38) - (Elec HP)	SF	All	Retrofit	13,962.0	47%	6,561.3	3.007	5.354	0.00	0	25.0	25.0	$2,340	2.56
7014	HVAC Shell	Insulation - Ceiling (R-11 to R-49) - (Elec HP)	SF	All	Retrofit	8,836.2	18%	1,585.6	0.721	1.260	0.00	0	25.0	25.0	$2,145	0.67
7015	HVAC Shell	Insulation - Ceiling (R-19 to R-49) - (Elec HP)	SF	All	Retrofit	8,027.3	10%	776.7	0.376	0.559	0.00	0	25.0	25.0	$1,794	0.40
7016	HVAC Shell	Insulation - Floor (R-0 to R-19) - (Elec HP)	SF	All	Retrofit	8,448.0	8%	667.6	-0.148	1.377	0.00	0	25.0	25.0	$1,268	0.24
7017	HVAC Shell	Insulation - Floor (R-11 to R-30) - (Elec HP)	SF	All	Retrofit	7,890.2	2%	184.0	-0.064	0.421	0.00	0	25.0	25.0	$1,268	0.05
7018	HVAC Shell	Wall Insulation - (Elec HP)	SF	All	Retrofit	10,518.3	24%	2,555.8	0.864	2.663	0.00	0	25.0	25.0	$1,920	1.10
7019	HVAC Shell	Basement Wall Insulation - (Elec HP)	SF	All	Retrofit	8,027.3	4%	297.4	-0.137	0.648	0.00	0	25.0	25.0	$1,360	0.06
7020	HVAC Shell	Energy Star Windows - (Elec HP)	SF	All	Retrofit	8,027.3	6%	515.0	0.305	0.486	0.00	0	25.0	25.0	$5,624	0.09
7021	HVAC Shell	Air Sealing (Tier 1) - (Elec HP)	SF	All	Retrofit	9,766.5	12%	1,159.3	0.224	1.420	0.00	0	15.0	15.0	$605	0.90
7022	HVAC Shell	Air Sealing (Tier 2) - (Elec HP)	SF	All	Retrofit	8,414.2	9%	774.3	0.201	0.910	0.00	0	15.0	15.0	$605	0.63
7023	HVAC Shell	Duct Sealing - (Elec HP)	SF	All	Retrofit	8,347.3	10%	834.7	0.300	0.970	0.00	0	20.0	20.0	$330	1.77
7024	HVAC Shell	Cool Roof - (Elec HP)	SF	All	Retrofit	8,027.3	21%	1,653.3	1.237	0.926	0.00	0	25.0	25.0	$2,925	0.59
7025	HVAC Shell	Insulation - Ceiling (R-0 to R-38) - (Elec Furnace / AC)	SF	All	Retrofit	25,990.7	48%	12,401.6	3.285	9.041	0.00	0	25.0	25.0	$2,340	4.12
7026	HVAC Shell	Insulation - Ceiling (R-11 to R-49) - (Elec Furnace / AC)	SF	All	Retrofit	16,373.7	19%	3,102.0	0.710	2.120	0.00	0	25.0	25.0	$2,145	1.08
7027	HVAC Shell	Insulation - Ceiling (R-19 to R-49) - (Elec Furnace / AC)	SF	All	Retrofit	14,912.6	11%	1,640.9	0.377	1.012	0.00	0	25.0	25.0	$1,794	0.68
7028	HVAC Shell	Insulation - Floor (R-0 to R-19) - (Elec Furnace / AC)	SF	All	Retrofit	14,912.6	5%	772.6	-0.081	0.933	0.00	0	25.0	25.0	$1,268	0.32
7029	HVAC Shell	Insulation - Floor (R-11 to R-30) - (Elec Furnace / AC)	SF	All	Retrofit	14,490.4	4%	592.4	-0.069	0.738	0.00	0	25.0	25.0	$1,268	0.24
7030	HVAC Shell	Wall Insulation - (Elec Furnace / AC)	SF	All	Retrofit	19,681.6	25%	4,909.0	0.886	4.181	0.00	0	25.0	25.0	$1,920	1.84
7031	HVAC Shell	Basement Wall Insulation - (Elec Furnace / AC)	SF	All	Retrofit	14,912.6	8%	1,157.3	-0.173	1.707	0.00	0	25.0	25.0	$1,360	0.42
7032	HVAC Shell	Energy Star Windows - (Elec Furnace / AC)	SF	All	Retrofit	14,912.6	6%	961.5	0.308	0.851	0.00	0	25.0	25.0	$5,624	0.14
7033	HVAC Shell	Air Sealing (Tier 1) - (Elec Furnace / AC)	SF	All	Retrofit	18,873.6	14%	2,636.1	0.240	2.407	0.00	0	15.0	15.0	$605	1.84
7034	HVAC Shell	Air Sealing (Tier 2) - (Elec Furnace / AC)	SF	All	Retrofit	15,795.5	11%	1,759.5	0.201	1.595	0.00	0	15.0	15.0	$605	1.25
7035	HVAC Shell	Duct Sealing - (Elec Furnace / AC)	SF	All	Retrofit	15,277.2	10%	1,527.7	0.300	0.970	0.00	0	20.0	20.0	$330	2.75
7036	HVAC Shell	Cool Roof - (Elec AC & Gas Heat)	SF	All	Retrofit	14,912.6	4%	606.4	1.305	-0.465	0.00	0	25.0	25.0	$2,925	0.39
7037	HVAC Shell	Insulation - Ceiling (R-0 to R-38) - (Elec AC & Gas Heat)	MH	All	Retrofit	3,029.8	1%	45.4	0.365	0.205	23.84	0	25.0	25.0	$1,613	0.91
7038	HVAC Shell	Energy Star Windows - (Elec AC & Gas Heat)	MH	All	Retrofit	3,047.8	21%	628.8	0.894	0.052	4.40	0	25.0	25.0	$3,507	0.33
7039	HVAC Shell	Air Sealing (Tier 1) - (Elec AC & Gas Heat)	MH	All	Retrofit	3,343.7	6%	197.0	0.243	0.115	10.31	0	15.0	15.0	$417	1.02
7040	HVAC Shell	Air Sealing (Tier 2) - (Elec AC & Gas Heat)	MH	All	Retrofit	3,211.4	6%	200.2	0.261	0.088	8.82	0	15.0	15.0	$417	0.94
7041	HVAC Shell	Duct Sealing - (Elec AC & Gas Heat)	MH	All	Retrofit	3,131.2	10%	313.1	0.300	0.050	4.91	0	20.0	20.0	$296	1.78
7042	HVAC Shell	Insulation - Ceiling (R-0 to R-38) - (Elec HP)	MH	All	Retrofit	9,747.6	33%	3,181.8	0.883	3.266	0.00	0	25.0	25.0	$1,613	1.56
7043	HVAC Shell	Energy Star Windows - (Elec HP)	MH	All	Retrofit	6,911.3	16%	1,080.2	0.890	0.676	0.00	0	25.0	25.0	$3,507	0.35
7044	HVAC Shell	Air Sealing (Tier 1) - (Elec HP)	MH	All	Retrofit	8,039.0	10%	784.3	0.176	0.851	0.00	0	15.0	15.0	$417	0.76
7045	HVAC Shell	Air Sealing (Tier 2) - (Elec HP)	MH	All	Retrofit	7,480.9	9%	681.4	0.189	0.732	0.00	0	15.0	15.0	$417	0.69
7046	HVAC Shell	Duct Sealing - (Elec HP)	MH	All	Retrofit	7,225.3	10%	722.5	0.300	0.970	0.00	0	20.0	20.0	$296	1.81
7047	HVAC Shell	Insulation - Ceiling (R-0 to R-38) - (Elec Furnace / AC)	MH	All	Retrofit	17,588.2	34%	6,021.5	0.433	5.374	0.00	0	25.0	25.0	$1,613	2.40
7048	HVAC Shell	Energy Star Windows - (Elec Furnace / AC)	MH	All	Retrofit	12,318.6	14%	1,679.7	0.889	1.218	0.00	0	25.0	25.0	$3,507	0.45
7049	HVAC Shell	Air Sealing (Tier 1) - (Elec Furnace / AC)	MH	All	Retrofit	14,818.2	12%	1,748.2	0.185	1.575	0.00	0	15.0	15.0	$417	1.50
7050	HVAC Shell	Air Sealing (Tier 2) - (Elec Furnace / AC)	MH	All	Retrofit	13,574.2	11%	1,519.9	0.198	1.343	0.00	0	15.0	15.0	$417	1.33
7051	HVAC Shell	Duct Sealing - (Elec Furnace / AC)	MH	All	Retrofit	12,786.1	10%	1,278.6	0.300	0.970	0.00	0	20.0	20.0	$296	2.70
8001	HVAC Equipment	HVAC Tune-Up (Central AC) (from 10seer to 11 seer)	SF	All	Retrofit	3,753.6	5%	187.7	0.238	0.000	0.00	0	5.0	5.0	$64	0.93
8002	HVAC Equipment	High Efficiency Central AC - 16 SEER from 14 seer	SF	All	MO	2,181.5	14%	312.4	0.436	0.000	0.00	0	18.0	18.0	$533	0.70
8003	HVAC Equipment	High Efficiency Central AC - 17 SEER from 14 seer	SF	All	MO	2,181.5	20%	436.3	0.423	0.000	0.00	0	18.0	18.0	$829	0.50
8004	HVAC Equipment	Ductless mini-split AC replacing central AC (gas)	SF	All	MO	2,181.5	34%	735.8	0.863	0.000	0.00	0	18.0	18.0	$3,913	0.20
8005	HVAC Equipment	HVAC Tune-Up (Heat Pump) (from 10 seer to 11 seer)	SF	All	Retrofit	8,027.3	5%	401.4	0.238	0.351	0.00	0	5.0	5.0	$128	0.73

EKPC DSM **Measure Assumptions**

Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Annual Electric	% Elec Savings	Per Unit Elec Savings	Per Unit Summer NCP kW	Per Unit Winter NCP kW	Per unit NG Saving	Per Unit Water Savings	RC EUL	EE EUL	Initial Measure Cost	TRC Ratio
8006	HVAC Equipment	High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF	SF	All	MO	6,455.6	9%	597.0	0.509	0.237	0.00	0	18.0	18.0	$1,097	0.47
8007	HVAC Equipment	High Efficiency Heat Pump (HP Upgrade) - 17 SEER/9.5 HSPF	SF	All	MO	6,455.6	12%	743.3	0.628	0.325	0.00	0	18.0	18.0	$1,645	0.39
8008	HVAC Equipment	Ground Source Heat Pump (HP Upgrade) 18.2 eer from 14 s	SF	All	MO	6,455.6	21%	1,331.5	0.421	1.274	0.00	0	25.0	25.0	$18,391	0.06
8009	HVAC Equipment	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	SF	All	MO	6,455.6	36%	2,304.5	0.509	2.678	-22.87	0	18.0	18.0	$1,097	0.66
8010	HVAC Equipment	Ductless mini-split HP (replacing ASHP)	SF	All	MO	6,455.6	24%	1,545.4	0.507	0.628	0.00	0	18.0	18.0	$3,125	0.30
8011	HVAC Equipment	Heat Pump (Replacing Electric Furnace and 14 seer AC) - 16	SF	All	MO	14,181.9	59%	8,323.3	0.613	12.605	0.00	0	18.0	18.0	$3,470	1.14
8012	HVAC Equipment	Dual Fuel Heat Pump (Replacing Electric Furnace)	SF	All	MO	14,912.6	72%	10,761.5	1.567	11.655	-22.87	0	18.0	18.0	$4,197	1.10
8013	HVAC Equipment	Ductless mini-split HP (replacing electric furnace)	SF	All	MO	14,912.6	67%	10,002.3	1.445	7.348	0.00	0	18.0	18.0	$4,768	1.09
8014	HVAC Equipment	Efficient Room A/C (11 EER to 11.5 EER)	SF	All	MO	489.9	10%	49.0	0.110	0.000	0.00	0	9.0	9.0	$114	0.25
8015	HVAC Equipment	Ductless mini-split AC seer 16 (from 11eer RAC)	SF	All	MO	489.9	22%	108.5	0.244	0.000	0.00	0	18.0	18.0	$3,307	0.04
8016	HVAC Equipment	Room Air Conditioner Recycling	SF	All	Recycle	693.5	100%	693.5	1.558	0.000	0.00	0	4.0	4.0	$49	1.34
8017	HVAC Equipment	Programmable Thermostat - Gas/AC	SF	All	Retrofit	4,206.1	4%	151.4	0.000	0.000	2.20	0	15.0	15.0	$35	3.44
8018	HVAC Equipment	Programmable Thermostat - ASHP	SF	All	Retrofit	8,027.3	4%	289.0	0.000	0.000	0.00	0	15.0	15.0	$35	2.92
8019	HVAC Equipment	Programmable Thermostat - Elec Furnace/AC	SF	All	Retrofit	14,912.6	4%	536.9	0.000	0.000	0.00	0	15.0	15.0	$35	5.42
8020	HVAC Equipment	Smart Thermostat - Gas Heat / AC	SF	All	Retrofit	4,206.1	5%	227.1	0.000	0.000	3.30	0	15.0	15.0	$250	0.72
8021	HVAC Equipment	Smart Thermostat - ASHP	SF	All	Retrofit	8,027.3	5%	433.5	0.000	0.000	0.00	0	15.0	15.0	$250	0.61
8022	HVAC Equipment	Smart Thermostat - Elec Furnace/AC	SF	All	Retrofit	14,912.6	5%	805.3	0.000	0.000	0.00	0	15.0	15.0	$250	1.14
8023	HVAC Equipment	ECM Furnace Fan	SF	All	Retrofit	5,304.8	8%	408.1	0.187	0.000	0.00	0	20.0	20.0	$97	3.52
8024	HVAC Equipment	HVAC Tune-Up (Central AC) (from 10seer to 11 seer)	MH	All	Retrofit	2,697.3	5%	134.9	0.167	0.000	0.00	0	5.0	5.0	$64	0.67
8025	HVAC Equipment	High Efficiency Central AC - 16 SEER from 14 seer	MH	All	MO	1,957.6	12%	226.7	0.281	0.000	0.00	0	18.0	18.0	$533	0.46
8026	HVAC Equipment	High Efficiency Central AC - 17 SEER from 14 seer	MH	All	MO	1,957.6	18%	361.4	0.483	0.000	0.00	0	18.0	18.0	$829	0.51
8027	HVAC Equipment	Ductless mini-split AC replacing central AC (gas)	MH	All	MO	2,302.8	40%	910.5	0.650	0.000	0.00	0	18.0	18.0	$3,913	0.19
8028	HVAC Equipment	HVAC Tune-Up (Heat Pump) (from 10 seer to 11 seer)	MH	All	Retrofit	6,911.3	5%	345.6	0.167	0.273	0.00	0	5.0	5.0	$128	0.59
8029	HVAC Equipment	High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF	MH	All	MO	5,541.2	9%	510.0	0.442	0.153	0.00	0	18.0	18.0	$1,097	0.41
8030	HVAC Equipment	High Efficiency Heat Pump (HP Upgrade) - 17 SEER/9.5 HSPF	MH	All	MO	5,541.2	12%	638.9	0.554	0.223	0.00	0	18.0	18.0	$1,645	0.34
8031	HVAC Equipment	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	MH	All	MO	5,541.2	26%	1,432.5	0.340	1.898	-17.16	0	18.0	18.0	$1,097	0.47
8032	HVAC Equipment	Ductless mini-split HP (replacing ASHP)	MH	All	MO	5,541.2	21%	1,151.3	0.438	0.362	0.00	0	18.0	18.0	$3,125	0.24
8033	HVAC Equipment	Heat Pump (Replacing Electric Furnace and 14 seer AC) - 16	MH	All	MO	11,457.4	56%	6,426.2	0.485	9.549	0.00	0	18.0	18.0	$3,470	0.89
8034	HVAC Equipment	Dual Fuel Heat Pump (Replacing Electric Furnace)	MH	All	MO	12,318.6	67%	8,210.0	1.324	9.372	-17.16	0	18.0	18.0	$4,197	0.89
8035	HVAC Equipment	Ductless mini-split HP (replacing electric furnace)	MH	All	MO	12,318.6	64%	7,928.8	1.316	5.438	0.00	0	18.0	18.0	$4,768	0.88
8036	HVAC Equipment	Efficient Room A/C (11 EER to 11.5 EER)	MH	All	MO	489.9	10%	49.0	0.110	0.000	0.00	0	9.0	9.0	$114	0.25
8037	HVAC Equipment	Ductless mini-split AC seer 16 (from 11eer RAC)	MH	All	MO	489.9	22%	108.5	0.244	0.000	0.00	0	18.0	18.0	$2,480	0.05
8038	HVAC Equipment	Room Air Conditioner Recycling	MH	All	Recycle	693.5	100%	693.5	1.558	0.000	0.00	0	4.0	4.0	$49	1.34
8039	HVAC Equipment	Programmable Thermostat - Gas/AC	MH	All	Retrofit	3,047.8	4%	109.7	0.000	0.000	1.70	0	15.0	15.0	$35	2.59
8040	HVAC Equipment	Programmable Thermostat - ASHP	MH	All	Retrofit	6,911.3	4%	248.8	0.000	0.000	0.00	0	15.0	15.0	$35	2.51
8041	HVAC Equipment	Programmable Thermostat - Elec Furnace/AC	MH	All	Retrofit	12,318.6	4%	443.5	0.000	0.000	0.00	0	15.0	15.0	$35	4.48
8042	HVAC Equipment	Smart Thermostat - Gas Heat / AC	MH	All	Retrofit	3,047.8	5%	164.6	0.000	0.000	2.55	0	15.0	15.0	$250	0.54
8043	HVAC Equipment	Smart Thermostat - ASHP	MH	All	Retrofit	6,911.3	5%	373.2	0.000	0.000	0.00	0	15.0	15.0	$250	0.53
8044	HVAC Equipment	Smart Thermostat - Elec Furnace/AC	MH	All	Retrofit	12,318.6	5%	665.2	0.000	0.000	0.00	0	15.0	15.0	$250	0.94
8045	HVAC Equipment	ECM Furnace Fan	MH	All	Retrofit	5,304.8	8%	408.1	0.187	0.000	0.00	0	20.0	20.0	$97	3.52
8046	HVAC Equipment	High Efficiency Central AC - 16 SEER from 14 seer	SF	All	NC	2,225.9	11%	242.8	0.246	0.000	0.00	0	18.0	18.0	$533	0.44
8047	HVAC Equipment	High Efficiency Central AC - 17 SEER from 14 seer	SF	All	NC	2,225.9	18%	389.9	0.414	0.000	0.00	0	18.0	18.0	$829	0.48
8048	HVAC Equipment	Ductless mini-split AC replacing central AC (gas)	SF	All	NC	2,534.4	40%	1,004.1	0.692	0.000	0.00	0	18.0	18.0	$3,913	0.21
8049	HVAC Equipment	High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF	SF	All	NC	5,233.8	6%	307.2	0.285	-0.062	0.00	0	18.0	18.0	$1,097	0.25
8050	HVAC Equipment	High Efficiency Heat Pump (HP Upgrade) - 17 SEER/9.5 HSPF	SF	All	NC	5,233.8	9%	449.5	0.400	0.005	0.00	0	18.0	18.0	$1,645	0.24
8051	HVAC Equipment	Ground Source Heat Pump (HP Upgrade) 18.2 eer from 14 s	SF	All	NC	5,233.8	21%	1,121.1	0.355	1.062	0.00	0	25.0	25.0	$18,391	0.05
8052	HVAC Equipment	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	SF	All	NC	5,233.8	32%	1,683.9	0.285	2.237	-15.71	0	18.0	18.0	$1,097	0.54
8053	HVAC Equipment	Ductless mini-split HP (replacing ASHP)	SF	All	NC	5,233.8	23%	1,220.6	0.402	0.471	0.00	0	18.0	18.0	$3,125	0.24
8054	HVAC Equipment	Efficient Room A/C (11 EER to 11.5 EER)	SF	All	NC	489.9	10%	49.0	0.110	0.000	0.00	0	9.0	9.0	$114	0.25
8055	HVAC Equipment	Ductless mini-split AC seer 16 (from 11eer RAC)	SF	All	NC	489.9	22%	108.5	0.244	0.000	0.00	0	18.0	18.0	$3,307	0.04
8056	HVAC Equipment	Programmable Thermostat - Gas/AC	SF	All	NC	2,534.4	4%	91.2	0.000	0.000	1.48	0	15.0	15.0	$35	2.21
8057	HVAC Equipment	Programmable Thermostat - ASHP	SF	All	NC	5,233.8	4%	188.4	0.000	0.000	0.00	0	15.0	15.0	$35	1.90
8058	HVAC Equipment	Smart Thermostat - Gas Heat / AC	SF	All	NC	2,534.4	5%	136.9	0.000	0.000	2.22	0	15.0	15.0	$250	0.46
8059	HVAC Equipment	Smart Thermostat - ASHP	SF	All	NC	5,233.8	5%	282.6	0.000	0.000	0.00	0	15.0	15.0	$250	0.40

EKPC DSM **Measure Assumptions**

Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Annual Electric	% Elec Savings	Per Unit Elec Savings	Per Unit Summer NCP kW	Per Unit Winter NCP kW	Per unit NG Saving	Per Unit Water Savings	RC EUL	EE EUL	Initial Measure Cost	TRC Ratio
8060	HVAC Equipment	ECM Furnace Fan	SF	All	NC	4,866.5	7%	361.4	0.160	0.000	0.00	0	20.0	20.0	$97	3.07
8061	HVAC Equipment	High Efficiency Central AC - 16 SEER from 14 seer	MH	All	NC	1,791.3	13%	225.4	0.260	0.000	0.00	0	18.0	18.0	$533	0.44
8062	HVAC Equipment	High Efficiency Central AC - 17 SEER from 14 seer	MH	All	NC	1,791.3	19%	348.0	0.414	0.000	0.00	0	18.0	18.0	$829	0.45
8063	HVAC Equipment	Ductless mini-split AC replacing central AC (gas)	MH	All	NC	1,791.3	29%	522.3	0.564	0.000	0.00	0	18.0	18.0	$3,913	0.13
8064	HVAC Equipment	High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF	MH	All	NC	4,970.5	8%	422.5	0.372	0.053	0.00	0	18.0	18.0	$1,097	0.33
8065	HVAC Equipment	High Efficiency Heat Pump (HP Upgrade) - 17 SEER/9.5 HSPF	MH	All	NC	4,970.5	11%	537.0	0.467	0.113	0.00	0	18.0	18.0	$1,645	0.28
8066	HVAC Equipment	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	MH	All	NC	4,970.5	34%	1,695.7	0.372	1.969	-14.17	0	18.0	18.0	$1,097	0.58
8067	HVAC Equipment	Ductless mini-split HP (replacing ASHP)	MH	All	NC	4,970.5	21%	1,022.8	0.361	0.333	0.00	0	18.0	18.0	$3,125	0.20
8068	HVAC Equipment	Efficient Room A/C (11 EER to 11.5 EER)	MH	All	NC	489.9	10%	49.0	0.110	0.000	0.00	0	9.0	9.0	$114	0.25
8069	HVAC Equipment	Ductless mini-split AC seer 16 (from 11eer RAC)	MH	All	NC	489.9	22%	108.5	0.244	0.000	0.00	0	18.0	18.0	$2,480	0.05
8070	HVAC Equipment	Programmable Thermostat - Gas/AC	MH	All	NC	2,093.6	4%	75.4	0.000	0.000	1.45	0	15.0	15.0	$35	2.03
8071	HVAC Equipment	Programmable Thermostat - ASHP	MH	All	NC	2,093.6	4%	75.4	0.000	0.000	0.00	0	15.0	15.0	$35	0.76
8072	HVAC Equipment	Smart Thermostat - Gas Heat / AC	MH	All	NC	2,093.6	5%	113.1	0.000	0.000	2.17	0	15.0	15.0	$250	0.43
8073	HVAC Equipment	Smart Thermostat - ASHP	MH	All	NC	4,970.5	5%	268.4	0.000	0.000	0.00	0	15.0	15.0	$250	0.38
8074	HVAC Equipment	ECM Furnace Fan	MH	All	NC	4,866.5	7%	361.4	0.160	0.000	0.00	0	20.0	20.0	$97	3.07
9001	Lighting	Standard CFL (Replacing EISA Bulb)	SF	All	MO	36.5	67%	24.6	0.031	0.031	-0.04	0	5.0	5.0	$0	9.38
9002	Lighting	Specialty CFL (Replacing Specialty Incandescent)	SF	All	MO	67.2	77%	51.5	0.049	0.049	-0.11	0	5.0	5.0	$1	4.39
9003	Lighting	Standard LED (Replacing EISA Bulb)	SF	All	MO	36.5	85%	30.9	0.038	0.038	-0.05	0	5.0	15.0	$2	5.36
9004	Lighting	Specialty LED (Replacing Specialty Incandescent)	SF	All	MO	67.2	89%	59.8	0.056	0.056	-0.13	0	5.0	15.0	$4	3.89
9005	Lighting	Standard CFL (Replacing CFL)	SF	All	MO	36.5	67%	24.6	0.031	0.031	-0.04	0	5.0	5.0	$0	9.38
9006	Lighting	Specialty CFL (Replacing Specialty CFL)	SF	All	MO	67.2	77%	51.5	0.049	0.049	-0.11	0	5.0	5.0	$1	4.39
9007	Lighting	Standard LED (Replacing CFL)	SF	All	MO	36.5	85%	30.9	0.038	0.038	-0.05	0	5.0	15.0	$2	5.36
9008	Lighting	Specialty LED (Replacing Specialty CFL)	SF	All	MO	67.2	89%	59.8	0.056	0.056	-0.13	0	5.0	15.0	$4	3.89
9009	Lighting	Reflector CFL (Replacing EISA Bulb)	SF	All	MO	72.8	77%	56.0	0.053	0.053	-0.12	0	5.0	5.0	$2	3.74
9010	Lighting	Reflector LED (Replacing EISA Bulb)	SF	All	MO	72.8	87%	63.4	0.060	0.060	-0.14	0	5.0	15.0	$7	3.47
9011	Lighting	Reflector CFL (Replacing CFL)	SF	All	MO	72.8	77%	56.0	0.053	0.053	-0.12	0	5.0	5.0	$2	3.74
9012	Lighting	Reflector LED (Replacing CFL Bulb)	SF	All	MO	72.8	87%	63.4	0.060	0.060	-0.14	0	5.0	15.0	$7	3.47
9013	Lighting	T8 Replacing T12 Linear Fluorescent Bulb	SF	All	Retrofit	70.1	29%	20.6	0.025	0.025	0.00	0	8.0	8.0	$60	0.10
9014	Lighting	Residential Occupancy Sensors	SF	All	Retrofit	486.2	30%	145.9	0.093	0.093	0.00	0	10.0	10.0	$30	1.53
9015	Lighting	LED Nightlights	SF	All	Retrofit	14.6	93%	13.6	0.005	0.005	0.00	0	16.0	16.0	$3	1.80
9016	Lighting	Standard CFL (Replacing EISA Bulb)	SF	All	NC	36.5	67%	24.6	0.031	0.031	-0.04	0	5.0	5.0	$0	9.38
9017	Lighting	Specialty CFL (Replacing Specialty Incandescent)	SF	All	NC	67.2	77%	51.5	0.049	0.049	-0.11	0	5.0	5.0	$1	4.39
9018	Lighting	Standard LED (Replacing EISA Bulb)	SF	All	NC	36.5	85%	30.9	0.038	0.038	-0.05	0	5.0	15.0	$2	5.36
9019	Lighting	Specialty LED (Replacing Specialty Incandescent)	SF	All	NC	67.2	89%	59.8	0.056	0.056	-0.13	0	5.0	15.0	$4	3.89
9020	Lighting	Standard CFL (Replacing CFL)	SF	All	NC	36.5	67%	24.6	0.031	0.031	-0.04	0	5.0	5.0	$0	9.38
9021	Lighting	Specialty CFL (Replacing Specialty CFL)	SF	All	NC	67.2	77%	51.5	0.049	0.049	-0.11	0	5.0	5.0	$1	4.39
9022	Lighting	Standard LED (Replacing CFL)	SF	All	NC	36.5	85%	30.9	0.038	0.038	-0.05	0	5.0	15.0	$2	5.36
9023	Lighting	Specialty LED (Replacing Specialty CFL)	SF	All	NC	67.2	89%	59.8	0.056	0.056	-0.13	0	5.0	15.0	$4	3.89
9024	Lighting	Reflector CFL (Replacing EISA Bulb)	SF	All	NC	72.8	77%	56.0	0.053	0.053	-0.12	0	5.0	5.0	$2	3.74
9025	Lighting	Reflector LED (Replacing EISA Bulb)	SF	All	NC	72.8	87%	63.4	0.060	0.060	-0.14	0	5.0	15.0	$7	3.47
9026	Lighting	Reflector CFL (Replacing CFL)	SF	All	NC	72.8	77%	56.0	0.053	0.053	-0.12	0	5.0	5.0	$2	3.74
9027	Lighting	Reflector LED (Replacing CFL Bulb)	SF	All	NC	72.8	87%	63.4	0.060	0.060	-0.14	0	5.0	15.0	$7	3.47
9028	Lighting	Residential Occupancy Sensors	SF	All	NC	486.2	30%	145.9	0.093	0.093	0.00	0	10.0	10.0	$30	1.53
9029	Lighting	Standard CFL (Replacing EISA Bulb)	MF	All	MO	36.5	67%	24.6	0.031	0.031	-0.04	0	5.0	5.0	$0	9.38
9030	Lighting	Specialty CFL (Replacing Specialty Incandescent)	MF	All	MO	67.2	77%	51.5	0.049	0.049	-0.11	0	5.0	5.0	$1	4.39
9031	Lighting	Standard LED (Replacing EISA Bulb)	MF	All	MO	36.5	85%	30.9	0.038	0.038	-0.05	0	5.0	15.0	$2	5.36
9032	Lighting	Specialty LED (Replacing Specialty Incandescent)	MF	All	MO	67.2	89%	59.8	0.056	0.056	-0.13	0	5.0	15.0	$4	3.89
9033	Lighting	Standard CFL (Replacing CFL)	MF	All	MO	36.5	67%	24.6	0.031	0.031	-0.04	0	5.0	5.0	$0	9.38
9034	Lighting	Specialty CFL (Replacing Specialty CFL)	MF	All	MO	67.2	77%	51.5	0.049	0.049	-0.11	0	5.0	5.0	$1	4.39
9035	Lighting	Standard LED (Replacing CFL)	MF	All	MO	36.5	85%	30.9	0.038	0.038	-0.05	0	5.0	15.0	$2	5.36
9036	Lighting	Specialty LED (Replacing Specialty CFL)	MF	All	MO	67.2	89%	59.8	0.056	0.056	-0.13	0	5.0	15.0	$4	3.89
9037	Lighting	Reflector CFL (Replacing EISA Bulb)	MF	All	MO	72.8	77%	56.0	0.053	0.053	-0.12	0	5.0	5.0	$2	3.74
9038	Lighting	Reflector LED (Replacing EISA Bulb)	MF	All	MO	72.8	87%	63.4	0.060	0.060	-0.14	0	5.0	15.0	$7	3.47
9039	Lighting	Reflector CFL (Replacing CFL)	MF	All	MO	72.8	77%	56.0	0.053	0.053	-0.12	0	5.0	5.0	$2	3.74

EKPC DSM **Measure Assumptions**

Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Annual Electric	% Elec Savings	Per Unit Elec Savings	Per Unit Summer NCP kW	Per Unit Winter NCP kW	Per unit NG Saving	Per Unit Water Savings	RC EUL	EE EUL	Initial Measure Cost	TRC Ratio
9040	Lighting	Reflector LED (Replacing CFL Bulb)	MF	All	MO	72.8	87%	63.4	0.060	0.060	-0.14	0	5.0	15.0	$7	3.47
9041	Lighting	T8 Replacing T12 Linear Fluorescent Bulb	MF	All	Retrofit	70.1	29%	20.6	0.025	0.025	0.00	0	8.0	8.0	$60	0.10
9042	Lighting	Residential Occupancy Sensors	MF	All	Retrofit	486.2	30%	145.9	0.093	0.093	0.00	0	10.0	10.0	$30	1.53
9043	Lighting	LED Nightlights	MF	All	Retrofit	14.6	93%	13.6	0.005	0.005	0.00	0	16.0	16.0	$3	1.80
9044	Lighting	Standard CFL (Replacing EISA Bulb)	MF	All	NC	36.5	67%	24.6	0.031	0.031	-0.04	0	5.0	5.0	$0	9.38
9045	Lighting	Specialty CFL (Replacing Specialty Incandescent)	MF	All	NC	67.2	77%	51.5	0.049	0.049	-0.11	0	5.0	5.0	$1	4.39
9046	Lighting	Standard LED (Replacing EISA Bulb)	MF	All	NC	36.5	85%	30.9	0.038	0.038	-0.05	0	5.0	15.0	$2	5.36
9047	Lighting	Specialty LED (Replacing Specialty Incandescent)	MF	All	NC	67.2	89%	59.8	0.056	0.056	-0.13	0	5.0	15.0	$4	3.89
9048	Lighting	Standard CFL (Replacing CFL)	MF	All	NC	36.5	67%	24.6	0.031	0.031	-0.04	0	5.0	5.0	$0	9.38
9049	Lighting	Specialty CFL (Replacing Specialty CFL)	MF	All	NC	67.2	77%	51.5	0.049	0.049	-0.11	0	5.0	5.0	$1	4.39
9050	Lighting	Standard LED (Replacing CFL)	MF	All	NC	36.5	85%	30.9	0.038	0.038	-0.05	0	5.0	15.0	$2	5.36
9051	Lighting	Specialty LED (Replacing Specialty CFL)	MF	All	NC	67.2	89%	59.8	0.056	0.056	-0.13	0	5.0	15.0	$4	3.89
9052	Lighting	Reflector CFL (Replacing EISA Bulb)	MF	All	NC	72.8	77%	56.0	0.053	0.053	-0.12	0	2.0	5.0	$2	3.74
9053	Lighting	Reflector LED (Replacing EISA Bulb)	MF	All	NC	72.8	87%	63.4	0.060	0.060	-0.14	0	2.0	15.0	$7	3.47
9054	Lighting	Reflector CFL (Replacing CFL)	MF	All	NC	72.8	77%	56.0	0.053	0.053	-0.12	0	5.0	5.0	$2	3.74
9055	Lighting	Reflector LED (Replacing CFL Bulb)	MF	All	NC	72.8	87%	63.4	0.060	0.060	-0.14	0	5.0	15.0	$7	3.47
9056	Lighting	Residential Occupancy Sensors	MF	All	NC	486.2	30%	145.9	0.093	0.093	0.00	0	10.0	10.0	$30	1.53
10001	New Construction	New Construction - 15% more efficient (w/AC only)	SF	All	NC	12,067.5	15%	1,810.1	0.367	0.072	6.17	0	20.0	20.0	$990	1.01
10002	New Construction	New Construction - 15% more efficient (w/Elec. HP)	SF	All	NC	14,766.1	15%	2,214.9	0.321	0.659	0.00	0	20.0	20.0	$761	0.97
10003	New Construction	New Construction - 30% more efficient (w/AC only)	SF	All	NC	12,067.5	30%	3,620.3	0.733	0.144	12.34	0	20.0	20.0	$1,980	1.28
10004	New Construction	New Construction - 30% more efficient (w/Elec. HP)	SF	All	NC	14,766.1	30%	4,429.8	0.643	1.318	0.00	0	20.0	20.0	$1,522	1.59
10005	New Construction	New Construction - 15% more efficient (w/AC only)	MH	All	NC	9,870.7	15%	1,480.6	0.331	0.062	6.04	0	20.0	20.0	$990	0.87
10006	New Construction	New Construction - 15% more efficient (w/Elec. HP)	MH	All	NC	12,747.2	15%	1,912.1	0.307	0.601	0.00	0	20.0	20.0	$761	0.84
10007	New Construction	New Construction - 30% more efficient (w/AC only)	MH	All	NC	9,870.7	30%	2,961.2	0.663	0.124	12.08	0	20.0	20.0	$1,980	1.10
10008	New Construction	New Construction - 30% more efficient (w/Elec. HP)	MH	All	NC	12,747.2	30%	3,824.2	0.614	1.202	0.00	0	20.0	20.0	$1,522	1.39
11001	Pool/Spa	Two Speed Pool Pumps	SF	All	MO	1,363.5	32%	436.3	1.341	1.341	0.00	0	10.0	10.0	$235	3.29
11002	Pool/Spa	Variable Speed Pool Pumps	SF	All	MO	1,363.5	86%	1,172.6	2.068	2.068	0.00	0	10.0	10.0	$549	2.39
11003	Pool/Spa	Premium Efficiency Pool Pump Motor	SF	All	MO	1,363.5	30%	404.3	0.674	0.674	0.00	0	10.0	10.0	$50	8.64
11004	Pool/Spa	Two Speed Pool Pumps	MH	All	NC	1,363.5	32%	436.3	1.341	1.341	0.00	0	10.0	10.0	$235	3.29
11005	Pool/Spa	Variable Speed Pool Pumps	MH	All	NC	1,363.5	86%	1,172.6	2.068	2.068	0.00	0	10.0	10.0	$549	2.39
11006	Pool/Spa	Premium Efficiency Pool Pump Motor	MH	All	NC	1,363.5	30%	404.3	0.674	0.674	0.00	0	10.0	10.0	$50	8.64
11007	Pool/Spa	Two Speed Pool Pumps	SF	All	MO	1,363.5	32%	436.3	1.341	1.341	0.00	0	10.0	10.0	$235	3.29
11008	Pool/Spa	Variable Speed Pool Pumps	SF	All	MO	1,363.5	86%	1,172.6	2.068	2.068	0.00	0	10.0	10.0	$549	2.39
11009	Pool/Spa	Premium Efficiency Pool Pump Motor	SF	All	MO	1,363.5	30%	404.3	0.674	0.674	0.00	0	10.0	10.0	$50	8.64
11010	Pool/Spa	Two Speed Pool Pumps	MH	All	NC	1,363.5	32%	436.3	1.341	1.341	0.00	0	10.0	10.0	$235	3.29
11011	Pool/Spa	Variable Speed Pool Pumps	MH	All	NC	1,363.5	86%	1,172.6	2.068	2.068	0.00	0	10.0	10.0	$549	2.39
11012	Pool/Spa	Premium Efficiency Pool Pump Motor	MH	All	NC	1,363.5	30%	404.3	0.674	0.674	0.00	0	10.0	10.0	$50	8.64
12001	Water Heating	Low Flow Faucet Aerators	SF	All	Retrofit	3,460.0	1%	29.7	0.012	0.012	0.00	469	10.0	10.0	$2	26.62
12002	Water Heating	Low Flow Showerhead	SF	All	Retrofit	3,460.0	5%	168.4	0.067	0.067	0.00	1,641	10.0	10.0	$19	11.02
12003	Water Heating	Thermostatic Restriction Valve	SF	All	Retrofit	3,460.0	2%	80.1	0.032	0.032	0.00	859	10.0	10.0	$50	2.17
12004	Water Heating	Water Heater Blanket	SF	All	Retrofit	3,460.0	2%	79.0	0.009	0.009	0.00	0	5.0	5.0	$35	0.42
12005	Water Heating	Water Heater Pipe Wrap	SF	All	Retrofit	3,460.0	4%	134.0	0.015	0.015	0.00	0	15.0	15.0	$45	1.40
12006	Water Heating	Heat Pump Water Heater (resistance heat)	SF	All	MO	3,460.0	14%	499.0	0.197	0.197	0.00	0	10.0	10.0	$700	0.21
12007	Water Heating	Heat Pump Water Heater (ASHP heat)	SF	All	MO	3,460.0	37%	1,297.0	0.512	0.512	0.00	0	10.0	10.0	$700	0.54
12008	Water Heating	Heat Pump Water Heater (non-electric heat)	SF	All	MO	3,460.0	60%	2,076.0	0.820	0.820	-7.38	0	10.0	10.0	$700	0.71
12009	Water Heating	CO2 Heat Pump Water Heater	SF	All	MO	3,460.0	66%	2,283.6	0.902	0.902	0.00	0	10.0	10.0	$3,800	0.18
12010	Water Heating	Solar Water Heating	SF	All	MO	3,460.0	64%	2,207.0	1.833	1.833	0.00	0	10.0	20.0	$9,506	0.14
12011	Water Heating	Drain Water Heat Recovery	SF	All	Retrofit	3,460.0	6%	208.0	0.033	0.033	0.00	0	20.0	20.0	$1,022	0.10
12012	Water Heating	Low Flow Faucet Aerators	MH	All	Retrofit	3,460.0	1%	29.7	0.012	0.012	0.00	469	10.0	10.0	$2	26.62
12013	Water Heating	Low Flow Showerhead	MH	All	Retrofit	3,460.0	5%	168.4	0.067	0.067	0.00	1,641	10.0	10.0	$19	11.02
12014	Water Heating	Thermostatic Restriction Valve	MH	All	Retrofit	3,460.0	2%	80.1	0.032	0.032	0.00	859	10.0	10.0	$50	2.17
12015	Water Heating	Water Heater Blanket	MH	All	Retrofit	3,460.0	2%	79.0	0.009	0.009	0.00	0	5.0	5.0	$35	0.42
12016	Water Heating	Water Heater Pipe Wrap	MH	All	Retrofit	3,460.0	4%	134.0	0.015	0.015	0.00	0	15.0	15.0	$45	1.40
12017	Water Heating	Heat Pump Water Heater (resistance heat)	MH	All	MO	3,460.0	14%	499.0	0.197	0.197	0.00	0	10.0	10.0	$700	0.21

EKPC DSM **Measure Assumptions**

Measure #	End-Use	Measure Name	Home Type	Income Type	Replacement Type	Base Annual Electric	% Elec Savings	Per Unit Elec Savings	Per Unit Summer NCP kW	Per Unit Winter NCP kW	Per unit NG Saving	Per Unit Water Savings	RC EUL	EE EUL	Initial Measure Cost	TRC Ratio
12018	Water Heating	Heat Pump Water Heater (ASHP heat)	MH	All	MO	3,460.0	37%	1,297.0	0.512	0.512	0.00	0	10.0	10.0	$700	0.54
12019	Water Heating	Heat Pump Water Heater (non-electric heat)	MH	All	MO	3,460.0	60%	2,076.0	0.820	0.820	-7.38	0	10.0	10.0	$700	0.71
12020	Water Heating	CO2 Heat Pump Water Heater	MH	All	MO	3,460.0	66%	2,283.6	0.902	0.902	0.00	0	10.0	10.0	$3,800	0.18
12021	Water Heating	Solar Water Heating	MH	All	MO	3,460.0	64%	2,207.0	1.833	1.833	0.00	0	10.0	20.0	$9,506	0.14
12022	Water Heating	Drain Water Heat Recovery	MH	All	Retrofit	3,460.0	6%	208.0	0.033	0.033	0.00	0	20.0	20.0	$1,022	0.10
12023	Water Heating	Low Flow Faucet Aerators	SF	All	NC	3,460.0	1%	29.7	0.012	0.012	0.00	469	10.0	10.0	$2	26.62
12024	Water Heating	Low Flow Showerhead	SF	All	NC	3,460.0	5%	168.4	0.067	0.067	0.00	1,641	10.0	10.0	$19	11.02
12025	Water Heating	Thermostatic Restriction Valve	SF	All	NC	3,460.0	2%	80.1	0.032	0.032	0.00	859	10.0	10.0	$50	2.17
12026	Water Heating	Water Heater Blanket	SF	All	NC	3,460.0	2%	79.0	0.009	0.009	0.00	0	5.0	5.0	$35	0.42
12027	Water Heating	Water Heater Pipe Wrap	SF	All	NC	3,460.0	4%	134.0	0.015	0.015	0.00	0	15.0	15.0	$45	1.40
12028	Water Heating	Heat Pump Water Heater (resistance heat)	SF	All	NC	3,460.0	14%	499.0	0.197	0.197	0.00	0	10.0	10.0	$700	0.21
12029	Water Heating	Heat Pump Water Heater (ASHP heat)	SF	All	NC	3,460.0	37%	1,297.0	0.512	0.512	0.00	0	10.0	10.0	$700	0.54
12030	Water Heating	Heat Pump Water Heater (non-electric heat)	SF	All	NC	3,460.0	60%	2,076.0	0.820	0.820	-7.38	0	10.0	10.0	$700	0.71
12031	Water Heating	CO2 Heat Pump Water Heater	SF	All	NC	3,460.0	66%	2,283.6	0.902	0.902	0.00	0	10.0	10.0	$3,800	0.18
12032	Water Heating	Solar Water Heating	SF	All	NC	3,460.0	64%	2,207.0	1.833	1.833	0.00	0	10.0	20.0	$9,506	0.14
12033	Water Heating	Drain Water Heat Recovery	SF	All	NC	3,460.0	6%	208.0	0.033	0.033	0.00	0	20.0	20.0	$1,022	0.10
12034	Water Heating	Low Flow Faucet Aerators	MH	All	NC	3,460.0	1%	29.7	0.012	0.012	0.00	469	10.0	10.0	$2	26.62
12035	Water Heating	Low Flow Showerhead	MH	All	NC	3,460.0	5%	168.4	0.067	0.067	0.00	1,641	10.0	10.0	$19	11.02
12036	Water Heating	Thermostatic Restriction Valve	MH	All	NC	3,460.0	2%	80.1	0.032	0.032	0.00	859	10.0	10.0	$50	2.17
12037	Water Heating	Water Heater Blanket	MH	All	NC	3,460.0	2%	79.0	0.009	0.009	0.00	0	5.0	5.0	$35	0.42
12038	Water Heating	Water Heater Pipe Wrap	MH	All	NC	3,460.0	4%	134.0	0.015	0.015	0.00	0	15.0	15.0	$45	1.40
12039	Water Heating	Heat Pump Water Heater (resistance heat)	MH	All	NC	3,460.0	14%	499.0	0.197	0.197	0.00	0	10.0	10.0	$700	0.21
12040	Water Heating	Heat Pump Water Heater (ASHP heat)	MH	All	NC	3,460.0	37%	1,297.0	0.512	0.512	0.00	0	10.0	10.0	$700	0.54
12041	Water Heating	Heat Pump Water Heater (non-electric heat)	MH	All	NC	3,460.0	60%	2,076.0	0.820	0.820	-7.38	0	10.0	10.0	$700	0.71
12042	Water Heating	CO2 Heat Pump Water Heater	MH	All	NC	3,460.0	66%	2,283.6	0.902	0.902	0.00	0	10.0	10.0	$3,800	0.18
12043	Water Heating	Solar Water Heating	MH	All	NC	3,460.0	64%	2,207.0	1.833	1.833	0.00	0	10.0	20.0	$9,506	0.14
12044	Water Heating	Drain Water Heat Recovery	MH	All	NC	3,460.0	6%	208.0	0.033	0.033	0.00	0	20.0	20.0	$1,022	0.10

APPENDIX C. Commercial Measure Detail

Measure Number	End Use	Measure Name	Annual kWh Saved	Percent Savings (kWh)	Summer KW Savings	Incremental Cost	Measure Useful Life	TRC
1	Interior Lighting	Compact Fluorescent	199	68%	0.036	$1	2	21.18
2	Interior Lighting	LED Exit Sign	89	82%	0.012	$30	16	3.37
3	Interior Lighting	High Performance T8 (vs T8) 4ft	46	17%	0.009	$18	15	2.25
4	Interior Lighting	Wall Mounted Occupancy Sensor	335	24%	0.068	$51	8	1.43
5	Interior Lighting	Fixture Mounted Occupancy Sensor	198	24%	0.040	$92	8	0.47
6	Interior Lighting	Remote Mounted Occupancy Sensor	568	24%	0.116	$101	8	1.23
7	Interior Lighting	High Bay 4 lamp HPT8 vs (Metal Halide 250W)	677	50%	0.138	$200	15	1.74
8	Interior Lighting	High Bay 8 lamp HPT8 vs (Metal Halide 400W)	1,492	53%	0.304	$250	15	3.07
9	Interior Lighting	High performance T5 (replacing T8)	238	22%	0.048	$100	15	1.23
10	Interior Lighting	CFL Hard Wired Fixture	199	69%	0.041	$38	12	2.26
11	Interior Lighting	CFL High Wattage 31-115	383	55%	0.078	$21	3	2.72
12	Interior Lighting	CFL High Wattage 150-199	1,088	58%	0.221	$57	3	2.60
13	Interior Lighting	Low Bay LED (vs T8HO)	306	42%	0.062	$331	15	0.48
14	Interior Lighting	High Bay LED (vs T8HO)	472	35%	0.096	$482	15	0.50
22	Interior Lighting	Switching Controls for Multi-Level Lighting	8,155	20%	1.407	$274	8	13.63
23	Interior Lighting	Central Lighting Controls	4,077	10%	0.704	$103	8	12.08
17	Interior Lighting	LED Screw-In Bulb	254	64%	0.043	$1	15	103.08
18	Interior Lighting	LED Downlight Fixtures	168	68%	0.034	$27	15	3.21
19	Interior Lighting	LED Linear Replacement Lamps	68	44%	0.014	$24	15	1.47
20	Interior Lighting	Light Tube	250	10%	0.000	$500	10	0.23
21	Interior Lighting	Lighting Power Density Reduction (NC)	2,669	10%	0.490	$220	15	9.09
15	Exterior Lighting	Outdoor LED (vs 100W Metal Halide)	348	63%	0.000	$190	15	2.48
16	Exterior Lighting	Outdoor LED (vs 250W Metal Halide)	792	57%	0.000	$355	15	1.73
24	Space Cooling - Unitary / Split	Split AC (14 SEER to 14.5 SEER), 5 ton	174	3%	0.109	$315	15	0.51
25	Space Cooling - Unitary / Split	Split AC (14 SEER to 15 SEER), 5 ton	337	7%	0.211	$315	15	0.98
26	Space Cooling - Unitary / Split	Split AC (14 SEER to 16 SEER), 5 ton	632	13%	0.396	$635	15	0.91
27	Space Cooling - Unitary / Split	Split AC (11.4 IEER to 13 IEER), 8.3 ton	1,274	12%	0.799	$523	15	2.24
28	Space Cooling - Unitary / Split	Split AC (11.4 IEER to 14 IEER), 8.3 ton	1,922	19%	1.206	$1,054	15	1.67
29	Space Cooling - Unitary / Split	Split AC (11.4 IEER to 15 IEER), 8.3 ton	2,484	24%	1.558	$1,054	15	2.16
30	Space Cooling - Unitary / Split	DX Packaged System (CEE Tier 2), 10 ton	2,382	19%	1.494	$1,270	15	1.72
31	Space Cooling - Unitary / Split	DX Packaged System (CEE Tier 2), < 20 ton	2,971	15%	1.863	$1,905	15	1.43
32	Space Cooling - Unitary / Split	DX Packaged System (CEE Tier 2), > 20 ton	7,802	18%	4.893	$3,810	15	1.88
51	Space Cooling - Unitary / Split	Integrated Building Design - Cooling	54,634	30%	12.834	$29,640	15	0.63
52	Space Cooling - Unitary / Split	Commercial Window Film - Cooling	143	5%	0.034	$67	10	0.53
35	Space Cooling - Unitary / Split	PTAC, 1/2 ton	200	23%	0.082	$42	15	3.42
36	Space Cooling - Unitary / Split	PTAC, 3/4 ton	254	22%	0.103	$63	15	2.88
37	Space Cooling - Unitary / Split	PTAC, 1 ton	359	23%	0.146	$84	15	2.75
38	Space Cooling - Unitary / Split	PTAC, 1 1/4 ton	422	20%	0.172	$105	15	1.87
39	Space Cooling - Unitary / Split	HVAC Tune-up, 5 Ton	354	7%	0.222	$175	3	0.37
40	Space Cooling - Unitary / Split	Ground Source Heat Pump, 5 Ton - Cooling	23	5%	0.014	$375	15	0.06
41	Space Cooling - Unitary / Split	Water Source Heat Pump, 5 Ton - Cooling	50	11%	0.031	$375	15	0.12
53	Space Cooling - Unitary / Split	High Performance Glazing - Cooling	1	6%	0.047	$14	20	0.04
43	Space Cooling - Unitary / Split	High Efficiency Pumps	201	8%	0.043	$68	15	1.55
44	Space Cooling - Unitary / Split	Cool Roof - Cooling	181	15%	0.091	$499	20	0.16
45	Space Cooling - Unitary / Split	Roof Insulation - Cooling	0	2%	0.000	$1	20	0.03
46	Space Cooling - Unitary / Split	Programable Thermostats - Cooling	960	10%	0.000	$45	4	2.51
47	Space Cooling - Unitary / Split	Hotel Guest Room Occupancy Control System - Cool	30	30%	0.015	$65	15	0.16
48	Space Cooling - Unitary / Split	EMS Installation - Michigan - Cooling	211	10%	0.011	$2	15	40.74
49	Space Cooling - Unitary / Split	Retrocommisioning - Cooling	1	9%	0.000	$0	15	7.85
50	Space Cooling - Unitary / Split	Commissioning - Cooling	2	9%	0.000	$0	15	3.58
33	Space Cooling - Chillers	Air Cooled Chiller, 20 ton	5,761	13%	2.428	$2,540	20	2.14
34	Space Cooling - Chillers	Air Cooled Chiller, 100 ton	28,806	13%	12.140	$12,700	20	2.14
42	Space Cooling - Chillers	Chiller Tune-up/Diagnostics, 100 Ton	16,193	8%	15.403	$283	5	22.10
140	Space Cooling - Chillers	Water Cooled Screw Chiller, 200 ton	69,518	9%	3.658	$7,952	20	8.25
141	Space Cooling - Chillers	Water Cooled Screw Chiller, 1000 ton	668,164	20%	74.215	$55,870	20	11.28
142	Space Cooling - Chillers	Water-Side Economizer - 200 Tons	209,500	70%	0.000	$10,000	15	7.14
54	Space Heating	PTHP, 1/2 ton	1,065	51%	0.057	$42	15	3.20
55	Space Heating	PTHP, 3/4 ton	1,299	49%	0.063	$63	15	7.48
56	Space Heating	PTHP, 1 ton	1,782	49%	0.099	$84	15	7.72
57	Space Heating	PTHP, 1 1/4 ton	2,144	46%	0.112	$105	15	7.42
58	Space Heating	Ground Source Heat Pump - Heating	329	0%	0.206	$375	15	0.36
59	Space Heating	Water Source Heat Pump - Heating	29	0%	0.018	$375	15	0.03
60	Space Heating	Cool Roof - Heating	91	15%	0.062	$499	20	0.08
61	Space Heating	Roof Insulation - Heating	0	2%	0.000	$1	20	0.02
62	Space Heating	Programable Thermostats - Heating	1,439	10%	0.000	$136	4	1.31
63	Space Heating	Hotel Guest Room Occupancy Control System - Heating	45	30%	0.022	$195	15	0.08
64	Space Heating	EMS Installation - Heating	106	10%	0.005	$2	15	7.38
65	Space Heating	Retrocommisioning - Heating	1	9%	0.000	$0	15	1.42
66	Space Heating	Commissioning - Heating	3	9%	0.000	$0	15	2.49
67	Space Heating	Integrated Building Design - Heating	81,891	30%	19.237	$111,149	15	0.26

Measure Number	End Use	Measure Name	Annual kWh Saved	Percent Savings (kWh)	Summer KW Savings	Incremental Cost	Measure Useful Life	TRC
68	Space Heating	Commercial Window Film - Heating	214	5%	0.051	$200	10	0.28
69	Space Heating	High Performance Glazing - Heating	2	6%	0.071	$41	20	0.02
70	Ventilation	VFD Supply and Return Fans, < 2 HP	2,497	30%	0.369	$1,330	15	0.67
71	Ventilation	VFD Supply and Return Fans, <3 to 10 HP	6,242	30%	0.922	$1,622	15	1.36
72	Ventilation	VFD Supply and Return Fans, 11 to 50 HP	37,450	30%	5.530	$3,059	15	4.34
73	Ventilation	Enthalpy Economizer	3,500	20%	0.000	$400	10	2.26
74	Ventilation	Improved Duct Sealing	70	23%	0.000	$108	18	0.47
75	Ventilation	Electronically-Commutated Permanent Magnet Motors	50,342	65%	0.000	$3,059	15	5.83
76	Ventilation	Destratification Fans	758	50%	0.000	$133	10	1.48
77	Ventilation	Demand Controlled Ventilation	718	1%	0.200	$115	15	232.94
78	Water Heating	High Efficiency Storage (tank)	9	0%	0.000	$70	15	0.04
79	Water Heating	Pre-Rinse Sprayer, Low flow, Commercial Application re	1,284	20%	0.000	$93	5	2.07
80	Water Heating	On Demand (tankless)	7,905	7%	0.000	$1,050	5	1.12
81	Water Heating	Tank Insulation	468	91%	0.053	$2	15	74.96
82	Water Heating	Heat Pump Water Heater	2,124	59%	0.000	$433	10	1.27
83	Refrigeration	Glass Door Freezer, <15-49 cu ft, Energy Star	3,595	43%	0.000	$166	12	6.39
84	Refrigeration	Glass Door Freezer, 50+ cu ft, Energy Star	9,804	45%	0.000	$407	12	7.10
85	Refrigeration	Solid Door Freezer, <15-49 cu ft, Energy Star	1,489	36%	0.000	$166	12	2.65
86	Refrigeration	Solid Door Freezer, 50+ cu ft, Energy Star	5,322	46%	0.000	$407	12	3.86
87	Refrigeration	Glass Door Refrigerator, <15 - 49 cu ft, Energy Star	828	36%	0.000	$164	12	1.49
88	Refrigeration	Glass Door Refrigerator, 50+ cu ft, Energy Star	1,577	35%	0.000	$249	12	1.87
89	Refrigeration	Solid Door Refrigerator, <15-49 cu ft, Energy Star	635	38%	0.000	$164	12	1.14
90	Refrigeration	Solid Door Refrigerator, 50+ cu ft, Energy Star	1,675	48%	0.000	$249	12	1.98
91	Refrigeration	Commercial Refrigeration Tune-Up, Medium Temp ,not	537	7%	0.099	$75	1	0.24
92	Refrigeration	Commercial Refrigeration Tune-Up, Low Temp, not self	1,388	7%	0.191	$75	1	0.63
93	Refrigeration	Anti-sweat heater controls on freezers	2,557	75%	0.000	$200	12	3.77
94	Refrigeration	Anti-sweat heater controls, on refrigerators	1,082	67%	0.000	$200	12	1.60
95	Refrigeration	Vending Miser, Cold Beverage	1,612	46%	0.000	$216	5	1.11
96	Refrigeration	Brushless DC Motors (ECM) for freezers and coolers	1,064	9%	0.121	$177	15	2.11
97	Refrigeration	Humidity Door Heater Controls for freezers and coolers	1,820	71%	0.000	$200	12	2.68
98	Refrigeration	Refrigerated Case Covers	945	9%	0.000	$252	5	0.55
99	Refrigeration	Zero Energy Doors for freezers and coolers	1,360	20%	0.131	$290	10	1.20
100	Refrigeration	Evaporator Coil Defrost Control	197	30%	0.405	$500	10	0.10
101	Refrigeration	Evaporator Fan Motor Control for freezers and coolers	1,524	36%	0.174	$291	16	1.94
102	Refrigeration	Ice Machine, Energy Star, Self-Contained	263	7%	0.041	$56	9	1.11
103	Refrigeration	LED Case Lighting (retrofit)	437	45%	0.000	$250	8	0.38
104	Refrigeration	Efficient Refrigeration Condenser	120	2%	0.000	$35	15	1.20
105	Refrigeration	Efficient low-temp compressor	875	1%	0.000	$552	13	0.50
106	Cooking	High Efficiency Combination Oven	6,368	35%	0.000	$10	12	189.87
107	Cooking	Induction Cooktop	784	20%	0.000	$3,000	11	0.07
108	Cooking	Electric Energy Star Fryers	3,126	17%	0.000	$276	12	3.38
109	Cooking	Electric Energy Star Steamers,3-6 pan	9,967	57%	0.000	$3,400	12	0.87
110	Cooking	Energy Star Convection Ovens	1,937	16%	0.000	$388	12	1.49
111	Cooking	Energy Star Griddles	1,909	12%	0.000	$860	12	0.66
112	Cooking	Energy Star Hot Food Holding Cabinet	1,730	53%	0.000	$902	12	0.57
113	Compressed Air	Automatic Drains	2,097	0%	0.000	$355	5	0.93
114	Compressed Air	Cycling and High Efficiency Dryers	4	35%	0.000	$6	10	0.18
115	Compressed Air	Efficient Air Compressors	914	18%	0.000	$250	15	1.36
116	Compressed Air	Low Pressure Drop-Filters	65	3%	0.000	$22	10	0.80
117	Compressed Air	Receiver Capacity Addition	9,159	10%	0.000	$2,000	10	1.24
118	Compressed Air	Engineered Nozzles for blow-off	22,230	71%	0.000	$14	15	590.56
119	Compressed Air	Compressed Air Leak Survey and Repair	496	50%	0.000	$6	1	2.96
120	Motors	VFD on Chilled Water Pump, 5 HP	28,580	15%	3.258	$1,330	15	7.08
121	Motors	VFD on Chilled Water Pump, 7.5 HP	42,870	15%	4.888	$1,622	15	8.70
122	Motors	VFD on Chilled Water Pump, 20 HP	171,480	15%	19.550	$3,059	15	18.46
123	Office Equipment	Commercial Plug Load - Smart Strip Outlets	23	15%	0.000	$15	8	0.34
124	Office Equipment	Plug Load Occupancy Sensor	169	15%	0.000	$70	8	0.52
125	Office Equipment	Energy Star Compliant Refrigerator	120	20%	0.000	$30	17	1.55
126	Office Equipment	Energy Star Computers	81	43%	0.000	$5	4	1.96
127	Office Equipment	Computer Power Management Software	161	46%	0.000	$29	5	0.82
128	Office Equipment	Energy Star UPS	105	11%	0.000	$1,303	10	0.02
129	Office Equipment	High Efficiency Hand Dryer	965	71%	0.000	$450	10	0.55
130	Office Equipment	Electrically Commutated Plug Fans in data centers	1,445	33%	0.000	$718	15	0.71
131	Office Equipment	High Efficiency CRAC unit	162	30%	0.000	$63	15	0.91
132	Office Equipment	Computer Room Air Conditioner Economizer	358	47%	0.000	$82	15	1.53
133	Office Equipment	Computer Room Hot Aisle Cold Aisle Configuration	125	13%	0.000	$156	15	0.28
134	Office Equipment	Computer Room Air Side Economizer	440	0%	0.000	$25	10	4.50
135	Office Equipment	VFD for Process Fans -CRAC units	2,279	78%	0.000	$200	15	4.19
136	Office Equipment	Vending Miser for Non-Refrig Equip	343	46%	0.000	$108	5	0.40
137	Pools	Heat Pump Pool Heater	5,732	61%	0.000	$4,000	10	0.37
138	Pools	High efficiency spas/hot tubs	375	15%	0.000	$300	10	0.32
139	Pools	VFD Retrofit on Pool Circulation Pump	1,425	35%	0.000	$200	12	2.10

APPENDIX D. Industrial Measure Detail

Measure Number	End Use	Measure Name	Annual kWh Saved	Percent Savings (kWh)	Summer KW Savings	Incremental Cost	Measure Useful Life	TRC
1	Computers & Office Equipment	Energy Star Compliant Single Door Refrigerator	120 0	20.0%	0.000	$30 00	17	1 6
2	Computers & Office Equipment	Energy Star computers	80.5	43.0%	0.000	$5.00	4	2 0
3	Computers & Office Equipment	High Efficiency CRAC Unit	162 3	30.0%	0.020	$62 50	15	0 9
4	Computers & Office Equipment	PC Network Energy Management Controls replacing no	161 0	46.0%	0.000	$29 00	5	0 8
5	Computers & Office Equipment	Energy Efficient "Smart" Power Strip for PC/Monitor/Pri	23.4	15.0%	0.000	$15 00	8	0 3
6	Computers & Office Equipment	Energy Star UPS	104 8	10.5%	0.000	$1,303 35	10	0 0
7	Water Heating	Tank Insulation (electric)	468 0	91.0%	0.000	$2.22	15	75.0
8	Water Heating	Process Cooling Condenser Heat Recovery	5,720.0	33.0%	1.205	$254.00	15	13.2
9	Water Heating	Heat Pump Water Heater	2,123.7	58.8%	0.000	$433.00	10	1 3
10	Water Heating	Electric Tankless Water Heater	7,905.0	7.4%	0.000	$1,050 00	5	1.1
11	Water Heating	Drain Water Heat Recovery Water Heater	546 0	25.0%	4.490	$631.00	25	0.7
12	Water Heating	High Efficiency Storage (tank)	8.6	0 2%	0.000	$70 00	15	0 0
13	Ventilation	VFD supply and return fans, 11 to 50 hp	37,450.0	30.0%	5.530	$3,059 00	15	4 3
14	Ventilation	Engineered CKV Hood	727 2	42.8%	0.288	$11 00	15	3 6
15	Ventilation	EMS for Manufacturing HVAC Fan	2,197.0	44.0%	0.250	$400.00	15	2.7
16	Ventilation	VFD supply and return fans, <3 to 10 hp	6,241.7	30.0%	0.922	$1,622 00	15	1.4
17	Ventilation	Destratification Fan (HVLS)	758 2	50.0%	0.000	$132.50	10	1 5
18	Ventilation	Economizer	136.600	0.120	0.001	123.000	12.500	0.241
19	Space Cooling - Chillers	EMS install	211 3	10.0%	0.011	$1.77	15	40.7
20	Space Cooling - Chillers	Retrocommissioning	0.9	9 0%	0.000	$0.04	15	1.4
21	Space Cooling - Chillers	Water Side Economizer	1,047.5	10.0%	0.000	$50 00	15	7.1
22	Space Cooling - Chillers	Chiller Tune Up	16,192.8	8 0%	15.403	$283.00	5	22.1
23	Space Cooling - Chillers	Water-Cooled Chiller > 1000 ton	######	19.5%	74.215	$55,870.00	20	11.3
24	Space Cooling - Chillers	Water-Cooled Chiller > 200 ton	69,518.0	9 2%	3.658	$7,952 00	20	8 3
25	Space Cooling - Chillers	Programmable Thermostats	960 0	10.0%	0.000	$45 25	4	2 5
26	Space Cooling - Chillers	Air-Cooled Chiller, 20 ton	5,761.2	13.1%	2.428	$2,540 00	20	2.1
27	Space Cooling - Chillers	Ceiling Insulation	65.5	8 0%	0.024	$47.16	20	1.7
28	Space Cooling - Chillers	Integrated Building Design	54,634.0	40.0%	12.830	$29,639.71	15	0 6
29	Space Cooling - Chillers	Energy Efficient Windows	170.4	13.9%	0.022	$272.96	25	0 5
30	Space Cooling - Chillers	Economizer	136 6	12.0%	0.001	$123.00	13	0 2
31	Space Cooling - Chillers	Roof Insulation	22.1	0 8%	0.014	$54 88	20	0 6
32	Space Cooling - Chillers	Improved Duct Sealing	37.6	1.4%	0.019	$107.91	18	0.4
33	Space Cooling - Chillers	Window Improvements	85.3	0.7%	0.033	$286.16	15	0 2
34	Space Cooling - Chillers	Cool Roofing	51.250	0.150	0.028	332.440	20.000	0.130
35	ace Cooling - Unitary and Split A	EMS install	211 3	10.0%	0.011	$1.77	15	40.7
36	ace Cooling - Unitary and Split A	Retrocommissioning	0.9	9 0%	0.000	$0.04	15	1.4
37	ace Cooling - Unitary and Split A	Programmable Thermostats	960 0	10.0%	0.000	$45 25	4	2 5
38	ace Cooling - Unitary and Split A	Split AC (11.4 to 13 IEER), 8.3 ton	1274.000	0.123	0.799	522.900	15.000	2.240
39	ace Cooling - Unitary and Split A	Ceiling Insulation	65.5	8 0%	0.024	$47.16	20	1.7
40	ace Cooling - Unitary and Split A	DX Packaged Sysytem >20 tons	7,801.9	18.2%	4.893	$3,810 00	15	1 9
41	ace Cooling - Unitary and Split A	Integrated Building Design	54,634.0	40.0%	12.830	$29,639.71	15	0 6
42	ace Cooling - Unitary and Split A	Economizer	136.600	0.120	0.001	123.000	12.500	0.241
43	ace Cooling - Unitary and Split A	Energy Efficient Windows	170.4	13.9%	0.022	$272.96	25	0 5
44	ace Cooling - Unitary and Split A	Roof Insulation	22.1	0 8%	0.014	$54 88	20	0 6
45	ace Cooling - Unitary and Split A	Improved Duct Sealing	37.6	1.4%	0.019	$107.91	18	0.4
46	ace Cooling - Unitary and Split A	HVAC Tune-up	58.600	0.068	0.079	32.400	3.000	0.370
47	ace Cooling - Unitary and Split A	Window Improvements	85.3	0.7%	0.033	$286.16	15	0 2
48	ace Cooling - Unitary and Split A	Cool Roofing	51.3	15.0%	0.028	$332.44	20	0.1
49	ace Cooling - Unitary and Split A	Water Loop Heat Pump (WLHP) - Cooling	49.8	11.5%	0.031	$375.00	15	0.1
50	ace Cooling - Unitary and Split A	Ground Source Heat Pump - Cooling	22.7	4 9%	0.014	$375.00	15	0.1
51	Lighting	LED Screw In Bulb	253.500	0.639	0.043	1 200	15.000	1.790
52	Lighting	Compact Fluorescent	198 8	67.8%	0.036	$1.20	2	21.2
53	Lighting	Central Lighting Control	4,077.3	10.0%	0.704	$103.00	8	12.1
54	Lighting	Switching Controls for Multilevel Lighting (Non-HID)	8,154.6	20.0%	1.407	$274.00	8	13.6
55	Lighting	Lighting Power Density - Interior	2,669.0	10.0%	0.490	$220.00	15	9.1
56	Lighting	LED Downlight	168.1	66.2%	0.034	$27 00	15	103.1
57	Lighting	CFL Hard Wired Fixture	199.000	0.690	0.041	37.500	12.000	2.260
58	Lighting	Occupancy Sensor	335 0	24.0%	0.068	$51 00	8	1.4
59	Lighting	High bay 4 lamp HPT8 vs (Metal halide 250 W)	677 0	50.1%	0.138	$200.00	15	1.7
60	Lighting	LED Exit Sign	88.6	81.8%	0.012	$30 00	16	3.4
61	Lighting	LED Linear Replacement Lamps	68.3	44.3%	0.014	$24 00	15	1 5
62	Lighting	Lamp & Ballast Retrofit (HPT8 Replacing Standard T8)	45.8	17.2%	0.009	$18 00	15	2 3
63	Lighting	High performance T5 (replacing T8)	238 2	22.4%	0.048	$100.00	15	1 2
64	Lighting	Exterior HID replaced with LED	792 3	56.9%	0.000	$355.00	15	1.7
65	Lighting	LED High Bay Lighting	471 8	35.0%	0.096	$482.00	15	0 5
66	Lighting	LED Low Bay Lighting	305 0	42.5%	0.062	$331.00	15	0 5
67	Lighting	Light Tube	250 0	10.0%	0.000	$500.00	10	0 2
68	Space Heating	EMS install	211 3	10.0%	0.011	$1.77	15	40.7
69	Space Heating	Retrocommissioning	0.9	9 0%	0.000	$0.04	15	1.4
70	Space Heating	Destratification Fan (HVLS)	758 2	50.0%	0.000	$132.50	10	1 5

Measure Number	End Use	Measure Name	Annual kWh Saved	Percent Savings (kWh)	Summer KW Savings	Incremental Cost	Measure Useful Life	TRC
71	Space Heating	Programmable Thermostats	960 0	10.0%	0.000	$45 25	4	2 5
72	Space Heating	PTHP, 1 ton	358 9	23.2%	0.146	$84 00	15	7.7
73	Space Heating	Ceiling Insulation	65.5	8 0%	0.024	$47.16	20	1.7
74	Space Heating	Integrated Building Design	54,634.0	40.0%	12.830	$29,639.71	15	0 6
75	Space Heating	Energy Efficient Windows	170.4	13.9%	0.022	$272.96	25	0 5
76	Space Heating	Economizer	136 6	12.0%	0.001	$123.00	13	0 2
77	Space Heating	Roof Insulation	22.1	0 8%	0.014	$54 88	20	0 6
78	Space Heating	Improved Duct Sealing	37.600	0.014	0.019	107.910	18.000	0.400
79	Space Heating	Window Improvements	85.3	0.7%	0.033	$286.16	15	0 2
80	Space Heating	Cool Roofing	51.3	15.0%	0.028	$332.44	20	0.1
81	Space Heating	Water Loop Heat Pump (WLHP) - Heating	49.785	0.115	0.031	375.000	15.000	0.030
82	Space Heating	Ground Source Heat Pump - Heating	22.7	4 9%	0.014	$375.00	15	0.4
83	Other	Engine Block Heater Timer	576 0	64.0%	0.800	$50 00	5	7.7
84	Other	Parking Garage Exhaust Fan CO Control	2,413.0	48.0%	0.275	$900.00	15	2 2
85	Other	High Efficiency Transformer, three-phase	0.4	2 5%	0.000	$0.44	30	2 0
86	Other	NEMA Premium Transformer, three-phase	0.2	2 5%	0.000	$0.18	30	0 8
87	Other	High Efficiency Transformer, single-phase	0.4	2 5%	0.000	$0.46	30	1 0
88	Other	NEMA Premium Transformer, single-phase	0.2	2 5%	0.000	$0.24	30	1 3
89	Other	Optimized Snow and Ice Melt Controls	0.1	92.0%	0.000	$15.15	15	0 3
90	Machine Drive	Compressed Air Low Pressure Drop Filters	64.7	1 3%	0.010	$22 00	10	1 2
91	Machine Drive	Efficient Air Compressors	957 6	18.0%	0.130	$177.78	14	2 0
92	Machine Drive	Compressed Air Pressure Flow Controller	73.0	1 5%	0.010	$25 00	15	1.7
93	Machine Drive	Compressed Air Nozzles	21,142.0	7 5%	6.340	$76.75	20	5.7
94	Machine Drive	Compressed Air Storage Tank	423 0	8 5%	0.059	$36 00	20	8.7
95	Machine Drive	VFD for Process Fans	707 0	28.0%	0.000	$46 00	15	10.0
96	Machine Drive	VFD for Process Pumps	1,082.0	29.0%	0.000	$94 00	15	7 6
97	Machine Drive	Compressed Air replacement with Air Blowers	5,587.7	8 5%	4.180	$620.00	15	14.0
98	Machine Drive	Pump System Efficiency Improvements	1.0	16.4%	0.000	$0.01	15	7 5
99	Machine Drive	Motor System Optimization (Including ASD)	1.0	19.0%	0.000	$0.01	15	6.7
100	Machine Drive	Compressed Air Automatic Drains	2,097.0	2 2%	0.332	$100.00	5	1 3
101	Machine Drive	Electric Supply System Improvements	1.0	3 0%	0.000	$0.01	15	6 3
102	Machine Drive	High Efficiency Pumps	201 0	7.4%	0.000	$31 00	15	7 2
103	Machine Drive	Sensors & Controls	1.0	3.0%	0.000	$0.01	15	4 5
104	Machine Drive	Compressed Air High Efficiency Dryers	48.0	1.0%	0.000	$10 00	15	3.1
105	Machine Drive	Compressed Air Audits and Leak Repair	496.1	8.0%	0.069	$8.00	1	3.1
106	Machine Drive	Industrial Motor Management	1.0	1.0%	0.000	$0.02	5	3 2
107	Machine Drive	Fan System Improvements	1.0	6.0%	0.000	$0.02	15	2 6
108	Machine Drive	Advanced Efficient Motors	1.0	2.3%	0.000	$0.04	20	2 0
109	Machine Drive	Compressed Air Outdoor Air Intake	109.8	2.2%	0.015	$5.00	20	16.3
110	Process Cooling & Refrigeration	Improved Refrigeration	1.0	10.0%	0.000	$0.00	15	19.2
111	Process Cooling & Refrigeration	Electric Supply System Improvements	1.0	3 0%	0.000	$0.01	15	6 2
112	Process Cooling & Refrigeration	Sensors & Controls	1.0	3 0%	0.000	$0.01	15	4 5
113	Process Cooling & Refrigeration	Energy Information System	1.0	1 0%	0.000	$0.06	15	1 0
114	Process Heating	Decrease Oven Exhaust Flow	399 0	60.0%	0.087	$1.00	20	24.9
115	Process Heating	Electric Supply System Improvements	1.0	3 0%	0.000	$0.01	15	6 2
116	Process Heating	Sensors & Controls	1.0	3 0%	0.000	$0.01	15	4 5
117	Process Heating	Energy Information System	1.0	1.0%	0.000	$0.06	15	1 0
118	Industrial Other	Barrel Insulation - Inj. Molding (plastics)	1,210.0	18.0%	0.291	$80 00	10	7 9
119	Industrial Other	High Efficiency Welders	761.0	12.0%	0.390	$200.00	20	8.7
120	Industrial Other	Dewpoint Sensor Control for Dessicant Plastic Dryer	565.0	8.5%	0.100	$150.00	15	1 2
121	Industrial Other	Pellet Dryer Insulation (plastics)	185.0	17.0%	0.100	$40 00	10	2 3
122	Industrial Other	3 Phase High Eff Battery Charger	2,595.0	8.0%	0.289	$872.50	20	2.1
123	Industrial Other	Injection Molding Machine - efficient (plastics)	223.0	51.0%	0.050	$125.00	20	1 6
124	Industrial Other	Fiber Laser Replacing CO2 laser (auto industry)	32,562.0	78.0%	5.000	$60,000.00	20	0.4
125	Agriculture	Fan Thermostat Controller	1,586.0	53.4%	0.000	$50 00	15	20.7
126	Agriculture	Evaporator Fan Motor Controls Ag	537.1	35.4%	0.270	$30.13	20	2 6
127	Agriculture	VFD for Process Fans - Agriculture	520 0	23.0%	0.000	$46 00	15	7.4
128	Agriculture	Milk Pre-Cooler Heat Exchanger	1.0	50.0%	0.000	$0.15	15	4.4
129	Agriculture	VFD for Process Pumps - Agriculture	290 0	43.0%	0.000	$46 00	15	4.1
130	Agriculture	Low Pressure Sprinkler Nozzles	5.0	15.0%	0.000	$1.00	15	3 3
131	Agriculture	Long Daylighting Dairy	6.2	30.0%	0.001	$1.79	16	1.7
132	Agriculture	VFD for Process Pumps - Irrigation	195 0	43.0%	0.000	$46 00	10	2 0
133	Agriculture	LED Poultry Lights	5.8	57.4%	0.001	$1.53	9	1 9
134	Agriculture	Variable Speed Drives for Dairy Vacuum Pumps	598 0	34.8%	0.000	$250.00	10	1.1
135	Agriculture	Grain Storage Temperature and Moisture Management (	349 0	49.0%	0.000	$233.00	15	1 0
136	Agriculture	Other Industrial -Low-Energy Livestock Waterer	1,593.0	47.7%	1.000	$788.00	10	0 9
137	Agriculture	Greenhouse Environmental Controls	98.0	10.0%	0.000	$125.00	15	0 5
138	Agriculture	Other Industrial -Dairy Refrigerator Tune-Up	0.1	4 0%	0.000	$0.05	5	0 5
139	Agriculture	Variable Speed Drive withHeat Exchanger, Milk	878 0	15.0%	0.000	$2,725 00	15	0 2
140	Agriculture	Scroll Compressor with Heat Exchanger for Dairy Refrig	190 0	10.5%	0.000	$1,500 00	15	0.1

APPENDIX E. Global Assumptions

GENERAL MODELING ASSUMPTIONS		
Analysis Start Year	2019	
Length of Analysis	15	Years
Nominal Discount Rate	7.00%	
Inflation Rate	2.20%	
Reserve Margin Multiplier	3.00%	

	Avoided Costs (Nominal Dollars)								Retail Rates (Nominal Dollars)
Data Year	Natural Gas Wholesale Forecast $/MMBTU	Winter Peak Energy $/kWh	Winter Off-Peak Energy $/kWh	Summer Peak Energy $/kWh	Summer Off-Peak Energy $/kWh	Summer Capacity $/kW-yr	Winter Capacity $/kW-yr	Avoided T&D Capacity $/kW-yr	Water $/gallon
2019	$2.86	$0.035	$0.028	$0.033	$0.023	$27.93	$0.00	$19.89	$0.013
2020	$2.87	$0.035	$0.028	$0.033	$0.022	$42.73	$0.00	$20.34	$0.013
2021	$2.90	$0.035	$0.027	$0.033	$0.022	$44.43	$0.00	$20.81	$0.013
2022	$2.94	$0.036	$0.027	$0.034	$0.022	$47.48	$0.00	$21.29	$0.013
2023	$2.99	$0.035	$0.028	$0.034	$0.023	$55.47	$0.00	$21.78	$0.013
2024	$3.03	$0.035	$0.027	$0.035	$0.023	$58.37	$0.00	$22.28	$0.013
2025	$3.08	$0.035	$0.028	$0.035	$0.022	$73.28	$0.00	$22.79	$0.013
2026	$3.13	$0.035	$0.028	$0.034	$0.023	$83.62	$0.00	$23.32	$0.013
2027	$3.19	$0.036	$0.030	$0.034	$0.022	$100.54	$0.00	$23.85	$0.013
2028	$3.26	$0.038	$0.032	$0.036	$0.024	$106.44	$0.00	$24.40	$0.013
2029	$3.34	$0.040	$0.033	$0.038	$0.026	$114.52	$0.00	$24.96	$0.013
2030	$3.53	$0.042	$0.035	$0.040	$0.027	$122.37	$0.00	$25.54	$0.013
2031	$3.75	$0.043	$0.037	$0.042	$0.029	$126.89	$0.00	$26.13	$0.013
2032	$3.99	$0.046	$0.039	$0.044	$0.031	$134.16	$0.00	$26.73	$0.013
2033	$4.30	$0.049	$0.042	$0.047	$0.034	$132.55	$0.00	$27.34	$0.013
2034	$4.63	$0.053	$0.045	$0.051	$0.037	$144.50	$0.00	$27.97	$0.013
2035	$5.04	$0.057	$0.050	$0.055	$0.041	$140.69	$0.00	$28.61	$0.013
2036	$5.50	$0.062	$0.054	$0.060	$0.046	$145.79	$0.00	$29.27	$0.013
2037	$6.03	$0.069	$0.061	$0.066	$0.052	$147.54	$0.00	$29.95	$0.013
2038	$6.71	$0.076	$0.068	$0.073	$0.059	$148.12	$0.00	$30.63	$0.013
2039	$7.36	$0.084	$0.076	$0.081	$0.067	$151.08	$0.00	$31.34	$0.013
2040	$7.98	$0.087	$0.079	$0.088	$0.075	$154.11	$0.00	$32.06	$0.013
2041	$8.15	$0.089	$0.081	$0.090	$0.077	$157.19	$0.00	$32.80	$0.013
2042	$8.33	$0.091	$0.083	$0.092	$0.078	$160.33	$0.00	$33.55	$0.013
2043	$8.52	$0.093	$0.085	$0.094	$0.080	$163.54	$0.00	$34.32	$0.013
2044	$8.71	$0.095	$0.087	$0.097	$0.082	$166.81	$0.00	$35.11	$0.013
2045	$8.91	$0.098	$0.088	$0.099	$0.084	$170.14	$0.00	$35.92	$0.013
2046	$9.12	$0.100	$0.090	$0.101	$0.085	$173.55	$0.00	$36.75	$0.013
2047	$9.33	$0.102	$0.092	$0.103	$0.087	$177.02	$0.00	$37.59	$0.013

	Electric Line Losses				Demand Line Losses		
	Winter On Peak	Winter Off Peak	Summer On Peak	Summer Off Peak	Winter Gen.	Summer Gen.	T&D Capacity
Residential	1.076	1.076	1.076	1.076	1.076	1.076	1.076
C&I	1.076	1.076	1.076	1.076	1.076	1.076	1.076

APPENDIX F. Demand Response Methodology

1.1 DEMAND RESPONSE PROGRAM OPTIONS

Table F-1 provides a brief description of the demand response program options considered and identifies the eligible customer segment for each demand response program that was considered in this study.

Table F-1 // DEMAND RESPONSE PROGRAM OPTIONS AND ELIGIBLE MARKETS

DR Program Option	Program Description	Eligible Markets
DLC AC (Switch)	The compressor of the air conditioner is remotely shut off (cycled) by the system operator for periods that may range from 7 ½ to 15 minutes during every 30-minute period (i.e., 25%-50% duty cycle)	Residential and Small Non-Residential Customers
DLC AC (Thermostat)	The system operator can remotely raise the AC's thermostat set point during peak load conditions, lowering AC load.	Residential and Small Non-Residential Customers
DLC Pool Pumps	The swimming pool pump is remotely shut off by the system operator for periods normally ranging from 2 to 4 hours.	Residential Customers
DLC Water Heaters	The water heater is remotely shut off by the system operator for periods normally ranging from 2 to 8 hours.	Residential and Small Non-Residential Customers
DLC Agricultural Irrigation	The irrigation pump is remotely shut off by the system operator for periods normally ranging from 2 to 4 hours.	Farms
Interruptible Rate	A discounted rate is offered to the customer for agreeing to interrupt or curtail load during peak period. The interruption is mandatory. No buy-through options are available.	Large Non-Residential Customers
Large C&I Behavioral	Participants are required to be available to curtail their load any non-holiday weekday during peak hours. Each event typically lasts 4 hours in duration.	Large Non-Residential Customers
Demand Buyback	A year-round, flexible, Internet-based bidding program that offers business customers credits for voluntarily reducing power when an event is called.	Large Non-Residential Customers

DR Program Option	Program Description	Eligible Markets
Critical Peak Pricing with Enabling Technology	A retail rate in which an extra-high price for electricity is provided during a limited number of critical periods (e.g. 100 hours) of the year. Market-based prices are typically provided on a day-ahead basis, or an hour-ahead basis. Includes enabling technology that connects technologies within building. Only for customers with AC.	Residential and Non-Residential Customers
Critical Peak Pricing without Enabling Technology	A retail rate in which an extra-high price for electricity is provided during a limited number of critical periods (e.g. 100 hours) of the year. Market-based prices are typically provided on a day-ahead basis, or an hour-ahead basis.	Residential and Non-Residential Customers
PEV Charging	Special rate service for electric vehicles that charge off-peak	Residential and Non-Residential Customers

1.2 DEMAND RESPONSE POTENTIAL ASSESSMENT APPROACH

The analysis for this study was conducted using the GDS DR Model. The GDS DR Model is an Excel spreadsheet tool that allows the user to determine the achievable potential for a demand response program based on the following two basic equations that can be chosen to be the model user.

TECHNICAL POTENTIAL • All technically feasible demand reductions are incorporated to provide a measure of the theoretical maximum demand response potential. This assumes 100% of eligible customers will participate in all programs regardless of cost-effectiveness.

ECONOMIC POTENTIAL • Economic potential is a subset of technical potential. Only cost-effective demand response program options are included in the economic potential. The cost-effectiveness test applied in this study is the TRC test. Only programs whose net present value of benefits exceed its costs will pass the economic screening.

ACHIEVABLE POTENTIAL • The cost-effective demand response potential that can practically be attained in a real-world program delivery scenario, if a certain level of market penetration can be attained are included in this scenario. Achievable potential takes into account real-world barriers to convincing customers to participate in cost-effective demand response programs. Achievable savings potential savings is a subset of economic potential.

If the model user chooses to base the estimated potential demand reduction on a per customer CP load reduction value, then:

$$\textit{Achievable DR Potential} = \textit{Potentially Eligible Customers} \times \textit{Eligible Customer Participation Rate} \times \textit{CP kW Load Reduction Per Participant}$$

The framework for assessing the cost-effectiveness of demand response programs is based *on A Framework for Evaluating the Cost-Effectiveness of Demand Response, prepared for the National Forum on the National Action Plan (NAPA) on Demand Response*.[1] Additionally, GDS reviewed the May 2017 National Standard Practice Manual published by the National Efficiency Screening Project.[2] GDS utilized this guide to define avoided ancillary services and energy and/or capacity price suppression benefits. Appendix A contains a table from the report summarizing the energy efficiency cost and benefits including in all five major benefit cost tests.

The GDS Demand Response Model determines the estimated savings for each demand response program by performing an extensive review of all benefits and cost associated with each program. GDS developed the model such that the value of future programs could be determined and to help facilitate demand response program planning strategies. The model contains approximately 50 required inputs for each program including: expected life, CP kW load reductions, proposed rebate levels, program related expenses such as vendor service fees, marketing and evaluation cost and on-going O&M expenses. This model and future program planning features can be used to standardize the cost-effectiveness screening process between EKPC departments interested in the deployment of demand response resources.

For this study, the Total Cost Resource Cost (TRC) test was used to determine the cost-effectiveness of each demand response program. Benefits are based on avoided demand, energy (including load shifting), wholesale cost reductions and T&D costs. Costs include incremental program equipment costs (such as control switches or smart thermostats), fixed program capital costs (such as the cost of a central controller), program administrative, marketing, and evaluation costs. Incremental equipment program costs are included for both new and replacement units (such as control switches) to account for units that are replaced at the end of their useful life.

Achievable potential is broken into maximum and realistic achievable potential in this study:

MAP represents an estimate of the maximum cost-effective demand response potential that can be achieved over the 20-year study period. For this study, this is defined as customer participation in demand response program options that reflect a "best practices" estimate of what could eventually be achieved. MAP assumes no barriers to effective delivery of programs.

RAP represents an estimate of the amount of demand response potential that can be realistically achieved over the 20-year study period. For this study, this is defined as achieving customer participation in demand response program options that reflect a realistic estimate of what could eventually be achieved assuming typical or "average" industry experience. RAP is a discounted MAP, by considering program barriers that limit participation, therefore reducing savings that could be achieved.

This potential study evaluated DR potential for two achievable potential scenarios:

1) Switch Scenario: The switch scenario assumes that all cost-effective DR programs will be implemented by EKPC and load switches will be used to control central air conditioning. No utility spending caps are placed on the achievable potential for this scenario.

[1] Study was prepared by Synapse Energy Economics and the Regulatory Assistance Project, February 2013.
[2] National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, May 18, 2017, Prepared by The National Efficiency Screening Project

2) Smart Thermostat Scenario: The smart thermostat scenario also assumes that all cost-effective DR programs will be implemented, but in this scenario controllable smart thermostats will be used to control central air conditioning. As in the switch scenario, no spending caps are placed on the achievable potential for this scenario.

1.3 AVOIDED COSTS AND OTHER ECONOMIC ASSUMPTIONS

The avoided costs used to determine utility benefits were provided by East Kentucky. Avoided electric generation capacity refers to the demand response program benefit resulting from a reduction in the need for new peaking generation capacity. Demand response can also produce energy related benefits. If the demand response option is considered "load shifting", such as direct load control of electric water heating, the consumption of energy is shifted from the control period to the period immediately following the period of control. For this study, GDS assumed that the energy is shifted with no loss of energy. For power suppliers, this shift in the timing of energy use can produce benefits from either the production of energy from lower cost resources or the purchase of energy at a lower rate. If the program is not considered to be "load shifting" the measure is turned off during peak control hours, and the energy is saved altogether. Demand response programs can also potentially delay the construction of new transmission and distribution lines and facilities, which is reflected in avoided T&D costs.

The discount rate used in this study is 7.0%. A peak demand line loss factor of 7.6% and a reserve margin of 3.0 % (for firm load reduction such as direct load control) were also applied to demand reductions at the customer meter. These values were provided by East Kentucky.

The useful life of a smart thermostat is assumed to be 15 years[3]. Load control switches have a useful life of 15 years[4]. This life was used for all direct load control measures in this study.

The number of control units per participant was assumed to be 1 for all direct load control programs using switches (such as water heaters and air conditioning switches), because load control switches can control up to two units. However, for controllable thermostats, some participants have more than one thermostat. The average number of residential thermostats per single family home was assumed to be 1.72[5].

1.4 CUSTOMER PARTICIPATION

The assumed level of customer participation for each demand response program option is a key driver of achievable demand response potential estimates. Customer participation rates reflect the total number of eligible customers that are likely to participate in a demand response program. An eligible customer is defined as a customer that is eligible to participate in a demand response program. For DLC programs, eligibility is determined by whether a customer has the end use equipment that will be controlled[6]. Each sector (residential and non-residential) was broken into sub-sectors. These sub-sectors include single family and multifamily for residential, and small, medium, and large non-residential. The eligible customers for each program is shown in Table F-2 and Table F-3.

[3] Indiana TRM
[4] Provided by Comverge
[5] EIA RECS table HC6.1

Table F-1 // ELIGIBLE RESIDENTIAL CUSTOMERS IN EACH DEMAND RESPONSE PROGRAM OPTION

DR Program Option	Saturation	Source / Description
DLC AC (Switch)	77% of residential customers	EKPC 2016 End Use Survey Data - % of residential homes with central AC
DLC AC (Thermostat)	17% of residential customers	77% of homes have central AC * 22.4% of homes have WiFi
DLC Pool Pumps	6% of residential customers	EKPC 2016 End Use Survey Data - % of residential homes with pools
DLC Water Heaters	87% of residential customers	EKPC 2016 End Use Survey Data - % of residential homes with electric water heaters
Critical Peak Pricing with Enabling Technology	77% of residential customers	EKPC 2016 End Use Survey Data - % of residential homes with central AC
Critical Peak Pricing without Enabling Technology	100% of residential customers	GDS Assumption
PEV Charging	100% of PEVs	GDS Assumption

Table F-2 // ELIGIBLE NON-RESIDENTIAL CUSTOMERS IN EACH DEMAND RESPONSE PROGRAM OPTION

DR Program Option	Saturation	Source / Description
DLC AC (Switch)	89% of small C&I customers	EKPC 2016 End Use Survey Data - % of businesses with central AC
DLC AC (Thermostat)	89% of small C&I customers	EKPC 2016 End Use Survey Data - % of businesses with central AC
DLC Water Heaters	59% of small C&I customers	CBECS 2012 - % of commercial customers in East South Central region with electric water heaters
DLC Agricultural Irrigation	100% of farms	GDS Assumption
Interruptible Rate	100% of large C&I customers	GDS Assumption
Large C&I Behavioral	100% of large C&I customers	GDS Assumption
Demand Buyback	100% of large C&I customers	GDS Assumption
Critical Peak Pricing with Enabling Technology	89% of C&I customers	EKPC 2016 End Use Survey Data - % of businesses with central AC
Critical Peak Pricing without Enabling Technology	100% of C&I customers	GDS Assumption

1.4.1 Existing Demand Response Programs

East Kentucky and its owner-member cooperatives have offered their Direct Load Control program since

2008. This program offers incentives to members who enroll central AC and electric water heaters. As of 2018, 20,298 switches had been installed. EKPC also has an existing interruptible rate program. Seven large customers had bid 140 MW at the time of this study.

1.4.2 Hierarchy

Double-counting savings from demand response programs that affect the same end uses is a common issue that must be addressed when calculating the demand response savings potential. For example, a direct load control program of air conditioning and a rate program both assume load reduction of the customers' air conditioners. For this reason, it is typically assumed that customers cannot participate in programs that affect the same end uses. This hierarchy where direct load control programs come before rate programs was chosen by East Kentucky. The order of the rest of the programs is based on savings. Programs with higher savings per customer are ranked as higher in the hierarchy.

Table F-3 // Demand Response Hierarchy

DR Program Option	Applicable Sector
DLC Programs	Residential, Small C&I
Interruptible Rate	Large C&I
Large C&I Behavioral Program	Large C&I
Demand Buyback	Large C&I
CPP with Enabling Technology	Residential, Small C&I, Large C&I
CPP without Enabling Technology	Residential, Small C&I, Large C&I

1.4.3 Participation Rates

The assumed "steady state" participation rates used in this potential study and the sources upon which each assumption is based are shown in Table F-4 for residential and non-residential customers, respectively. The steady state participation rate represents the enrollment rate once the fully achievable participation has been reached. Participation rates are expressed as a percentage of eligible customers. Program participation and impacts (demand reductions) are assumed to begin in 2018. The main sources of participant rates are several studies completed by the Brattle Group. Additional detail about participation rates and sources are shown in Appendix B.

Table F-4 // STEADY STATE PARTICIPATION RATES FOR DEMAND RESPONSE PROGRAM OPTIONS

DR Program Options	MAP Steady State Participation Rate	RAP Steady State Participation Rate	Source
RESIDENTIAL			
DLC AC (Switch)	31%	20%	GDS Survey of 20 Utilities (75th percentile for MAP, 50th percentile for RAP)
DLC AC (Thermostat)	36%	25%	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (Participation in BYOD programs is estimated to be 5% higher than in DLC programs.

DR Program Options	MAP Steady State Participation Rate	RAP Steady State Participation Rate	Source
DLC Pool Pumps	38%	19%	Pool Pump Demand Response Potential, Design & Engineering Services Customer Service Business Unit Southern California Edison, June 2008 (76% of survey respondents expressed and interest in an incentive-based pool pump demand response program). For RAP it is assumed that 25% of interested customers will participate. For MAP it is assumed that 50% of interested customers will participate.
DLC Water Heaters	36%	23%	RAP: Assumed an additional 5% participation compared to DLC AC. Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. Applied ratio of RAP to MAP for DLC- Central Air Conditioning.
Critical Peak Pricing with Enabling Technology	91%	22%	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (Opt-Out for MAP, Opt-In for RAP)
Critical Peak Pricing without Enabling Technology	82%	17%	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (Opt-Out for MAP, Opt-In for RAP)
PEV Charging	94%	57%	MAP: Used TOU with enabling technology take rate as most electric cars are equipped with a built-in technology that allows the vehicle to charge at specific times. (Opt-Out); RAP: Plug-in Electric Vehicle and Infrastructure Analysis September 2015, Prepared for the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy by Idaho National Lab. (Opt-In)
NON-RESIDENTIAL			
DLC AC (Switch)	14%	3%	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (PacifiCorp 2014 Study, FERC 75th percentile MAP, FERC 50th percentile RAP)
DLC AC (Thermostat)	19%	8%	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (Participation in BYOD programs is estimated to be 5% higher than in DLC programs.

DR Program Options	MAP Steady State Participation Rate	RAP Steady State Participation Rate	Source
DLC Water Heaters	16%	7%	FERC 2012 DR Survey Data (75th percentile for MAP, 50th percentile for RAP)
DLC Agricultural Irrigation	30%	15%	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (Average of Range for MAP, Low End of Range for RAP)
Interruptible Rate	21%	12%	FERC 2012 DR Survey Data- 75th percentile for MAP; EKPC Input for RAP that they would realistically gain 1 new participant per year
Large C&I Behavioral	21%	3%	FERC 2012 DR Survey Data (75th percentile for MAP, 50th percentile for RAP)
Demand Buyback	9%	1%	MAP: Demand Response Market Potential in Xcel Energy's Northern States Power Service Territory, The Brattle Group, April 2014. Avg of Small/medium and large. RAP: 2015–2025 Demand Response Portfolio of Southern California Edison Company April 1, 2015 and 2013, 2014, and 2015 Load Impact of California Statewide Demand Bidding Programs for Non-Res Customers by Christensen Associates Energy Consulting and FERC 2012 Demand Response Study.
Critical Peak Pricing with Enabling Technology	69%	20%	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (Opt-Out for MAP, Opt-In for RAP)
Critical Peak Pricing without Enabling Technology	63%	18%	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (Opt-Out for MAP, Opt-In for RAP)

Customer participation in new demand response programs is assumed to reach the steady state take rate over a five-year period. The path to steady state customer participation follows an "S-shaped" curve, in which participation growth accelerates over the first half of the five-year period, and then slows over the second half of the period (see **FIGURE** F-1). Existing programs have already gone through this ramp-up period, so they were escalated linearly to the final participation rate.

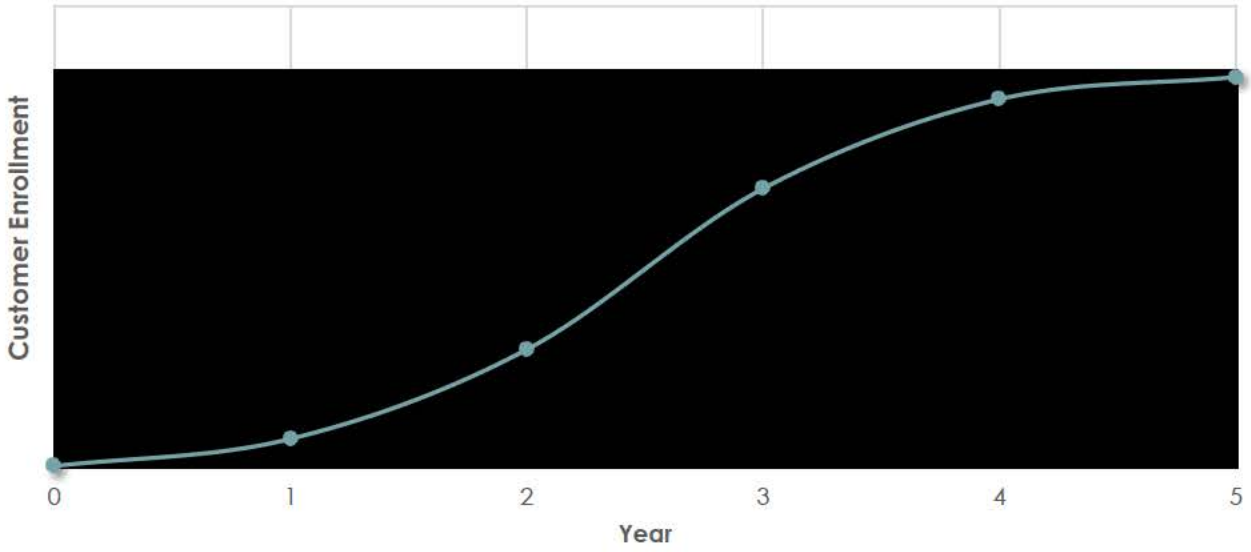


FIGURE F-1 // ILLUSTRATION OF S-SHAPED MARKET ADOPTION CURVE

1.5 LOAD REDUCTION ASSUMPTIONS

Table F-6 presents the residential and non-residential per participant CP demand reduction impact assumptions for each demand response program option at the customer meter. Demand reductions were based on load reductions found in East Kentucky's existing demand response programs, and various secondary data sources including the FERC and other industry reports, including demand response potential studies.

Table F-5 // PER PARTICIPANT CP DEMAND REDUCTION ASSUMPTIONS

DR Program Options	Per Participant CP Demand Reduction	Source
RESIDENTIAL		
DLC AC (Switch)	1 kW	EKPC 2016 Annual Report
DLC AC (Thermostat)	0.87 kW	87% of Load Switch Control. Sources: Smart Thermostats: An Alternative to Load Control Switches? Trends and Strategic Options to Consider for Residential Load Control Programs; 2016 Demand Response Potential Study Conducted by GDS for several Michigan utilities (Confidential pilot program report)
DLC Pool Pumps	1.36 kW	Southern California Edison Pool Pump Demand Response Potential Report, 2008.
DLC Water Heaters	0.37 kW Summer, 0.52 kW Winter	EKPC 2016 Annual Report
Critical Peak Pricing with Enabling Technology	31% of coincident peak load	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016.

DR Program Options	Per Participant CP Demand Reduction	Source
Critical Peak Pricing without Enabling Technology	11.7% of coincident peak load	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016.
PEV Charging	3.02 kW	GDS Calculation based on EIA Annual Energy Outlook PEV stock forecast; share state allocated to EKPC based on statewide customers in EKPC service area; DEPLOYMENT ROLLOUT ESTIMATE OF ELECTRIC VEHICLES, 2011-2015; DTE Energy Plug-In Electric Vehicles and Infrastructure Hawk Asgeirsson; Plug-in Electric Vehicle and Infrastructure Analysis September 2015
NON-RESIDENTIAL		
DLC AC (Switch)	1.6 kW	2012 FERC Demand Response Survey Data (Reported realized savings data for 14 utility programs, adjusted to account for peak summer temperature differences using NOAA Normal Max Summer Temperature Data, 1981-2010)
DLC AC (Thermostat)	1.39 kW	87% of Load Switch Control. Sources: Smart Thermostats: An Alternative to Load Control Switches? Trends and Strategic Options to Consider for Residential Load Control Programs; 2016 Demand Response Potential Study Conducted by GDS for several Michigan utilities (Confidential pilot program report)
DLC Water Heaters	1.2 kW Summer, 0.8 kW Winter	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016.
DLC Agricultural Irrigation	44 kW	2012 FERC Demand Response Survey Data (Reported realized savings data for 17 utility programs)
Interruptible Rate	3 MW for RAP, 2.5 MW for MAP	EKPC Input, GDS assumed for MAP case, there would be more small customers, bringing the average load down
Large C&I Behavioral	35 kW	Assumptions for C&I DR 2015 IRP (Included in EKPC Data Response)
Demand Buyback	7% of coincident peak load	Average taken from: 2013, 2014, and 2015 Load Impact of California Statewide Demand Bidding Programs for Non-Res Customers by Christensen Associates Energy Consulting and FERC 2012 Demand Response Study.

DR Program Options	Per Participant CP Demand Reduction	Source
Critical Peak Pricing with Enabling Technology	21.5% of coincident peak load	Dynamic Pricing: Transitioning from Experiments to Full Scale Deployments, Michigan Retreat on Peak Shaving to Reduce Wasted Energy, The Brattle Group, August 06, 2014.
Critical Peak Pricing without Enabling Technology	4.2% of coincident peak load	Demand Response Market Research: Portland General Electric, 2016 to 2035, The Brattle Group, January 2016. (average of small, med, large C&I)

1.6 PROGRAM COSTS

Table F-7 shows the program costs that were assumed for each demand response program option. One-time program development costs included in the first year of the analysis for new programs. No program development costs are assumed for programs that already exist. It was assumed that there would be a cost of $50[7] per new participant for marketing for residential and small C&I programs. Large C&I programs require a higher marketing costs due to more time spent to acquire a participant, including potential site visits. Marketing costs are assumed to be 33.3% higher for MAP. There was assumed to be an annual administrative cost of $5,000 per program[8]. All program costs were escalated each year by the general rate of inflation assumed for this study.[9] Table F-8 shows the equipment cost assumptions.

Table F-6 // PROGRAM COST ASSUMPTIONS

DR Program Option	Program Development Cost	MAP Marketing Cost	RAP Marketing Cost
Residential			
DLC AC (Switch)	$0	$67 / new customer	$50 / new customer
DLC AC (Thermostat)	$0	$67 / new customer	$50 / new customer
DLC Swimming Pool Pumps	$0	$67 / new customer	$50 / new customer
DLC Water Heating	$0	$67 / new customer	$50 / new customer
Critical Peak Pricing with Enabling Technology	$100,000	$67 / new customer	$50 / new customer
Critical Peak Pricing without Enabling Technology	$100,000	$67 / new customer	$50 / new customer
PEV Charging	$133,333	$67 / new customer	$50 / new customer
Non-Residential			
DLC AC (Switch)	$0	$67 / new customer	$50 / new customer
DLC AC (Thermostat)	$0	$67 / new customer	$50 / new customer

[7] TVA Potential Study Volume III: Demand Response Potential, Global Energy Partners, December 2011
[8] Based on Input from EKPC.
[9] The general rate of inflation used for this study was 2.8%. This was provided by EKPC.

DR Program Option	Program Development Cost	MAP Marketing Cost	RAP Marketing Cost
DLC Water Heaters	$0	$67 / new customer	$50 / new customer
DLC Agricultural Irrigation	$100,000	$67 / new customer	$50 / new customer
Interruptible Rate	$0	$665 / new customer	$500 / new customer
Large C&I Behavioral	$133,333	$665 / new customer	$500 / new customer
Demand Buyback	$133,333	$665 / new customer	$500 / new customer
Critical Peak Pricing with Enabling Technology	$100,000	$67 / new customer	$50 / new customer
Critical Peak Pricing without Enabling Technology	$100,000	$67 / new customer	$50 / new customer

Table F-7 // EQUIPMENT COST ASSUMPTIONS

Device	Cost	Applicable DR Programs	Source
Two-way communicating load control switch using Wi-Fi	95	DLC programs controlled by switches	Comverge
Load control switch installation	200	All DLC programs controlled by switches	Comverge
Smart controllable thermostat (such as Nest or Ecobee)	249	DLC AC Thermostat	Nest / Ecobee

APPENDIX G. Annual Achievable Potential by Sector

Residential Sector

Cumulative Annual MWh	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Max Achievable															
Appliances	6,043	8,263	11,222	15,104	20,093	26,338	33,899	42,698	46,431	54,528	61,887	67,780	71,589	72,907	71,589
Behavioral	106,338	104,660	103,983	104,240	104,087	104,463	105,585	107,121	109,133	111,302	113,327	115,638	117,670	119,454	120,753
Bundles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clothes Washer/ Dryer	1,907	4,263	7,079	10,337	14,022	18,098	22,514	27,212	32,132	37,230	42,426	47,708	53,063	58,403	62,005
Dishwasher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electronics	23,632	47,642	71,857	95,968	120,037	144,111	146,160	147,947	149,529	151,123	152,613	154,065	155,519	156,925	158,273
HVAC Shell	25,302	77,773	126,342	169,130	205,206	234,268	256,741	273,541	285,647	293,865	307,591	312,465	315,772	320,942	327,975
HVAC Equipment	13,365	33,737	55,628	79,070	102,407	128,351	155,524	183,691	212,559	244,631	274,577	305,004	335,815	367,035	398,293
Lighting	35,313	80,662	75,983	34,820	48,900	59,217	69,917	80,632	91,015	100,806	109,792	107,776	110,893	112,991	114,266
New Construction	3,078	6,967	11,480	16,319	21,580	27,347	33,582	40,247	47,217	54,486	61,460	68,389	75,368	82,153	88,678
Pool/Spa	624	1,278	1,955	2,649	3,356	4,074	4,791	5,508	6,225	6,942	7,036	7,101	7,142	7,166	7,177
Water Heating	4,661	15,157	25,175	34,741	43,949	53,625	62,413	73,595	82,688	92,171	100,315	104,533	110,157	116,927	125,569
Total	**220,263**	**380,402**	**490,703**	**562,378**	**683,638**	**799,891**	**891,126**	**982,192**	**1,062,574**	**1,147,083**	**1,231,023**	**1,290,460**	**1,352,988**	**1,414,902**	**1,474,578**
Realistic Achievable															
Appliances	4,287	5,862	7,961	10,715	14,255	18,685	24,050	30,292	32,940	38,685	43,906	48,087	50,789	51,724	50,789
Behavioral	35,184	34,775	34,734	34,971	35,097	35,400	35,951	36,639	37,479	38,338	39,226	40,143	40,948	41,653	42,196
Bundles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clothes Washer/ Dryer	1,958	4,249	6,844	9,696	12,776	16,050	19,482	23,037	26,685	30,404	34,151	37,889	41,627	45,355	47,305
Dishwasher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electronics	22,195	44,763	67,537	90,213	112,851	135,492	137,442	139,128	140,610	142,103	143,498	144,858	146,219	147,536	148,798
HVAC Shell	11,695	42,336	68,056	88,840	105,142	117,537	126,354	131,935	135,925	145,514	149,020	153,394	159,320	167,111	176,882
HVAC Equipment	11,341	28,448	45,761	63,167	78,952	95,872	112,684	130,315	146,953	165,179	181,767	198,303	214,739	231,338	248,261
Lighting	36,518	81,340	71,978	33,398	45,728	53,275	60,732	67,901	74,630	80,837	86,410	83,420	84,711	85,461	85,714
New Construction	2,711	6,113	10,036	14,218	18,738	23,669	28,976	34,623	40,506	46,620	52,468	58,251	64,068	69,717	75,144
Pool/Spa	485	970	1,455	1,940	2,425	2,909	3,394	3,879	4,364	4,849	4,850	4,851	4,852	4,853	4,853
Water Heating	4,437	14,666	24,392	33,660	42,555	51,901	60,342	71,158	79,868	88,951	96,709	100,539	105,765	112,143	120,405
Total	**130,810**	**263,521**	**338,754**	**380,818**	**468,518**	**550,790**	**609,407**	**668,908**	**719,960**	**781,480**	**832,005**	**869,735**	**913,038**	**956,889**	**1,000,348**

Residential Sector

Cumulative Annual Summer MW	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Max Achievable															
Appliances	0.9	1.2	1.6	2.2	2.9	3.8	4.9	6.2	6.7	7.9	8.9	9.8	10.3	10.5	10.3
Behavioral	10.7	10.5	10.4	10.4	10.3	10.3	10.4	10.4	10.5	10.7	10.8	10.9	11.0	11.2	11.2
Bundles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clothes Washer/ Dryer	0.2	0.5	0.9	1.3	1.8	2.3	2.9	3.5	4.1	4.8	5.5	6.1	6.8	7.5	8.0
Dishwasher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electronics	4.3	8.7	13.2	17.6	22.1	26.5	26.9	27.3	27.5	27.8	28.1	28.4	28.6	28.9	29.1
HVAC Shell	4.6	13.3	21.3	28.3	34.1	38.8	42.4	45.1	47.0	48.2	50.7	51.5	52.1	53.2	54.6
HVAC Equipment	1.8	3.2	4.8	6.8	7.9	10.1	12.4	14.8	17.2	19.5	21.4	23.1	24.4	25.3	25.9
Lighting	4.3	9.8	8.2	4.2	5.9	7.1	8.4	9.6	10.9	12.0	13.1	12.8	13.1	13.4	13.5
New Construction	0.2	0.5	0.9	1.3	1.7	2.2	2.7	3.2	3.7	4.3	4.9	5.4	6.0	6.5	7.0
Pool/Spa	0.9	1.8	2.7	3.7	4.6	5.6	6.6	7.6	8.6	9.6	9.7	9.8	9.9	9.9	9.9
Water Heating	0.3	0.8	1.4	2.0	2.6	3.3	4.0	4.7	5.3	6.0	6.5	7.0	7.4	7.8	8.2
Total	**28.3**	**50.4**	**65.5**	**77.7**	**94.0**	**110.1**	**121.5**	**132.4**	**141.7**	**150.8**	**159.6**	**164.7**	**169.7**	**174.1**	**177.8**
Realistic Achievable															
Appliances	0.6	0.8	1.1	1.5	2.1	2.7	3.5	4.4	4.8	5.6	6.3	6.9	7.3	7.5	7.3
Behavioral	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.6	3.6	3.7	3.7	3.8	3.8	3.9	3.9
Bundles	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Clothes Washer/ Dryer	0.3	0.5	0.9	1.2	1.6	2.1	2.5	3.0	3.4	3.9	4.4	4.9	5.4	5.8	6.1
Dishwasher	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electronics	4.3	8.6	13.0	17.4	21.8	26.1	26.5	26.9	27.1	27.4	27.7	27.9	28.2	28.4	28.7
HVAC Shell	2.2	7.7	12.3	16.0	19.0	21.2	22.8	23.9	24.6	26.5	27.1	28.0	29.1	30.6	32.4
HVAC Equipment	1.6	2.7	4.0	5.5	6.1	7.6	9.2	10.9	12.5	14.0	15.2	16.1	16.5	16.6	16.5
Lighting	4.5	9.9	7.8	4.1	5.6	6.5	7.4	8.2	9.0	9.7	10.4	10.0	10.1	10.2	10.2
New Construction	0.2	0.5	0.8	1.1	1.5	1.9	2.3	2.7	3.2	3.7	4.1	4.6	5.0	5.5	5.9
Pool/Spa	0.7	1.3	2.0	2.7	3.4	4.0	4.7	5.4	6.0	6.7	6.7	6.7	6.7	6.7	6.7
Water Heating	0.3	0.8	1.3	2.0	2.6	3.3	3.9	4.6	5.3	5.9	6.4	6.8	7.2	7.6	8.0
Total	**18.1**	**36.4**	**46.8**	**55.0**	**67.0**	**78.8**	**86.3**	**93.4**	**99.6**	**107.0**	**112.1**	**115.7**	**119.4**	**122.8**	**125.8**

Commercial Sector

Cumulative Annual MWh	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Max Achievable															
Lighting	4,454,018	8,908,036	13,362,054	17,816,072	22,270,090	26,724,108	31,178,126	35,632,143	40,086,161	44,540,179	48,994,197	53,448,215	57,902,233	62,356,251	66,810,269
Space Cooling - Chillers	1,698,693	3,397,386	5,096,079	6,794,772	8,493,465	10,192,158	11,890,851	13,589,544	15,288,237	16,986,930	18,685,623	20,384,316	22,083,009	23,781,701	25,480,394
Space Cooling - Unitary / Split	2,684,255	5,368,510	8,052,765	10,737,020	13,421,275	16,105,530	18,789,785	21,474,041	24,158,296	26,842,551	29,526,806	32,211,061	34,895,316	37,579,571	40,263,826
Space Heating	222,964	445,929	668,893	891,858	1,114,822	1,337,787	1,560,751	1,783,715	2,006,680	2,229,644	2,452,609	2,675,573	2,898,538	3,121,502	3,344,466
Ventilation	2,835,692	5,671,384	8,507,077	11,342,769	14,178,461	17,014,153	19,849,846	22,685,538	25,521,230	28,356,922	31,192,615	34,028,307	36,863,999	39,699,691	42,535,384
Motors	579,195	1,158,390	1,737,586	2,316,781	2,895,976	3,475,171	4,054,366	4,633,562	5,212,757	5,791,952	6,371,147	6,950,343	7,529,538	8,108,733	8,687,928
Water Heating	10,711	21,422	32,134	42,845	53,556	64,267	74,978	85,689	96,401	107,112	117,823	128,534	139,245	149,957	160,668
Cooking	77,116	154,232	231,347	308,463	385,579	462,695	539,811	616,926	694,042	771,158	848,274	925,389	1,002,505	1,079,621	1,156,737
Refrigeration	5,872,523	11,745,047	17,617,570	23,490,094	29,362,617	35,235,141	41,107,664	46,980,188	52,852,711	58,725,234	64,597,758	70,470,281	76,342,805	82,215,328	88,087,852
Office Equipment	174,122	348,244	522,366	696,488	870,611	1,044,733	1,218,855	1,392,977	1,567,099	1,741,221	1,915,343	2,089,465	2,263,587	2,437,710	2,611,832
Compressed Air	1,719,516	3,478,207	5,276,075	7,113,117	8,989,336	10,904,730	12,859,301	14,853,046	16,885,968	18,958,065	21,069,338	23,219,787	25,409,411	27,638,211	29,906,187
Pools	303,976	607,953	911,929	1,215,906	1,519,882	1,823,858	2,127,835	2,431,811	2,735,788	3,039,764	3,343,740	3,647,717	3,951,693	4,255,670	4,559,646
Total	**20,632,783**	**41,304,741**	**62,015,875**	**82,766,185**	**103,555,670**	**124,384,331**	**145,252,168**	**166,159,181**	**187,105,369**	**208,090,733**	**229,115,273**	**250,178,988**	**271,281,879**	**292,423,946**	**313,605,189**
Realistic Achievable															
Lighting	1,596,145	3,192,290	4,788,435	6,384,580	7,980,725	9,576,870	11,173,015	12,769,161	14,365,306	15,961,451	17,557,596	19,153,741	20,749,886	22,346,031	23,942,176
Space Cooling - Chillers	1,222,901	2,445,802	3,668,704	4,891,605	6,114,506	7,337,407	8,560,308	9,783,209	11,006,111	12,229,012	13,451,913	14,674,814	15,897,715	17,120,617	18,343,518
Space Cooling - Unitary / Split	1,920,476	3,840,951	5,761,427	7,681,903	9,602,379	11,522,854	13,443,330	15,363,806	17,284,281	19,204,757	21,125,233	23,045,709	24,966,184	26,886,660	28,807,136
Space Heating	146,568	293,137	439,705	586,273	732,841	879,410	1,025,978	1,172,546	1,319,115	1,465,683	1,612,251	1,758,820	1,905,388	2,051,956	2,198,524
Ventilation	2,010,915	4,021,829	6,032,744	8,043,658	10,054,573	12,065,487	14,076,402	16,087,316	18,098,231	20,109,145	22,120,060	24,130,974	26,141,889	28,152,803	30,163,718
Motors	419,260	838,520	1,257,780	1,677,040	2,096,300	2,515,560	2,934,820	3,354,080	3,773,340	4,192,600	4,611,860	5,031,120	5,450,380	5,869,639	6,288,899
Water Heating	7,403	14,806	22,209	29,612	37,015	44,419	51,822	59,225	66,628	74,031	81,434	88,837	96,240	103,643	111,046
Cooking	52,914	105,829	158,743	211,658	264,572	317,486	370,401	423,315	476,230	529,144	582,058	634,973	687,887	740,802	793,716
Refrigeration	5,212,260	10,424,520	15,636,780	20,849,040	26,061,300	31,273,560	36,485,820	41,698,080	46,910,339	52,122,599	57,334,859	62,547,119	67,759,379	72,971,639	78,183,899
Office Equipment	135,925	271,850	407,776	543,701	679,626	815,551	951,477	1,087,402	1,223,327	1,359,252	1,495,177	1,631,103	1,767,028	1,902,953	2,038,878
Compressed Air	1,190,658	2,406,957	3,648,898	4,916,480	6,209,704	7,528,569	8,873,075	10,243,223	11,639,012	13,060,443	14,507,515	15,980,228	17,478,583	19,002,579	20,552,217
Pools	192,202	384,403	576,605	768,807	961,009	1,153,210	1,345,412	1,537,614	1,729,816	1,922,017	2,114,219	2,306,421	2,498,623	2,690,824	2,883,026
Total	**14,107,627**	**28,240,896**	**42,399,805**	**56,584,357**	**70,794,549**	**85,030,384**	**99,291,859**	**113,578,976**	**127,891,734**	**142,230,134**	**156,594,175**	**170,983,858**	**185,399,182**	**199,840,147**	**214,306,754**

Commercial Sector

Cumulative Annual Summer MW	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Max Achievable															
Lighting	782.4	1,564.8	2,347.2	3,129.6	3,912.0	4,694.4	5,476.8	6,259.2	7,041.6	7,824.0	8,606.4	9,388.8	10,171.2	10,953.6	11,736.0
Space Cooling - Chillers	165.0	330.0	495.0	660.0	825.0	990.1	1,155.1	1,320.1	1,485.1	1,650.1	1,815.1	1,980.1	2,145.1	2,310.1	2,475.1
Space Cooling - Unitary / Split	1,294.8	2,589.5	3,884.3	5,179.1	6,473.9	7,768.6	9,063.4	10,358.2	11,653.0	12,947.7	14,242.5	15,537.3	16,832.1	18,126.8	19,421.6
Space Heating	11.2	22.5	33.7	44.9	56.1	67.4	78.6	89.8	101.0	112.3	123.5	134.7	145.9	157.2	168.4
Ventilation	175.8	351.6	527.4	703.1	878.9	1,054.7	1,230.5	1,406.3	1,582.1	1,757.8	1,933.6	2,109.4	2,285.2	2,461.0	2,636.8
Motors	66.0	132.1	198.1	264.1	330.2	396.2	462.2	528.3	594.3	660.3	726.4	792.4	858.4	924.5	990.5
Water Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cooking	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigeration	330.6	661.2	991.8	1,322.4	1,653.0	1,983.6	2,314.2	2,644.7	2,975.3	3,305.9	3,636.5	3,967.1	4,297.7	4,628.3	4,958.9
Office Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compressed Air	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pools	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**2,825.8**	**5,651.7**	**8,477.5**	**11,303.3**	**14,129.1**	**16,955.0**	**19,780.8**	**22,606.6**	**25,432.4**	**28,258.3**	**31,084.1**	**33,909.9**	**36,735.7**	**39,561.6**	**42,387.4**
Realistic Achievable															
Lighting	302.3	604.7	907.0	1,209.4	1,511.7	1,814.1	2,116.4	2,418.8	2,721.1	3,023.5	3,325.8	3,628.2	3,930.5	4,232.9	4,535.2
Space Cooling - Chillers	113.0	226.1	339.1	452.2	565.2	678.3	791.3	904.4	1,017.4	1,130.5	1,243.5	1,356.6	1,469.6	1,582.7	1,695.7
Space Cooling - Unitary / Split	936.8	1,873.5	2,810.3	3,747.0	4,683.8	5,620.5	6,557.3	7,494.0	8,430.8	9,367.5	10,304.3	11,241.0	12,177.8	13,114.5	14,051.3
Space Heating	7.4	14.8	22.2	29.6	37.0	44.4	51.8	59.2	66.6	74.0	81.4	88.8	96.2	103.6	111.0
Ventilation	119.0	237.9	356.9	475.8	594.8	713.8	832.7	951.7	1,070.7	1,189.6	1,308.6	1,427.5	1,546.5	1,665.5	1,784.4
Motors	47.8	95.6	143.4	191.2	239.0	286.8	334.6	382.4	430.2	478.0	525.8	573.6	621.4	669.2	717.0
Water Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cooking	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refrigeration	300.9	601.8	902.7	1,203.6	1,504.5	1,805.5	2,106.4	2,407.3	2,708.2	3,009.1	3,310.0	3,610.9	3,911.8	4,212.7	4,513.6
Office Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compressed Air	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pools	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**1,827.2**	**3,654.4**	**5,481.6**	**7,308.9**	**9,136.1**	**10,963.3**	**12,790.5**	**14,617.7**	**16,444.9**	**18,272.2**	**20,099.4**	**21,926.6**	**23,753.8**	**25,581.0**	**27,408.2**

Industrial Sector

Cumulative Annual MWh	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Max Achievable															
Machine Drive	17,823	35,646	53,469	71,293	89,116	106,939	124,762	142,585	160,408	178,232	196,055	213,878	231,701	249,524	267,347
Lighting	10,677	21,353	32,030	42,706	53,383	64,059	74,736	85,412	96,089	106,765	117,442	128,118	138,795	149,471	160,148
Space Cooling	1,634	3,267	4,901	6,534	8,167	9,800	11,434	13,060	14,687	16,314	16,688	17,062	17,437	17,811	18,185
Ventilation	2,670	5,340	8,010	10,680	13,350	16,019	18,689	21,359	24,029	26,699	29,369	32,039	34,709	37,379	40,049
Process Heating and Cooling	3,789	7,578	11,367	15,156	18,946	22,735	26,524	30,313	34,102	37,891	41,680	45,469	49,259	53,048	56,837
Space Heating	1,181	2,363	3,544	4,726	5,907	7,089	8,270	9,452	10,633	11,814	12,733	13,652	14,571	15,490	16,409
Other	77	154	231	308	385	462	539	616	693	770	848	925	1,002	1,079	1,156
Agriculture	364	729	1,093	1,457	1,822	2,186	2,551	2,915	3,279	3,644	4,008	4,372	4,737	5,101	5,465
Water Heating	16	32	48	63	79	95	111	127	143	159	175	190	206	222	238
Computers & Office Equipmen	28	56	84	112	140	167	195	223	251	279	307	335	363	391	419
Total	**38,259**	**76,518**	**114,777**	**153,036**	**191,294**	**229,553**	**267,811**	**306,063**	**344,315**	**382,567**	**419,304**	**456,041**	**492,779**	**529,516**	**566,253**
Realistic Achievable															
Machine Drive	13,852	27,703	41,555	55,407	69,258	83,110	96,962	110,813	124,665	138,517	152,368	166,220	180,072	193,923	207,775
Lighting	5,232	10,465	15,697	20,930	26,162	31,395	36,627	41,860	47,092	52,324	57,557	62,789	68,022	73,254	78,487
Space Cooling	1,265	2,530	3,795	5,059	6,324	7,588	8,852	10,112	11,372	12,631	12,938	13,244	13,551	13,858	14,164
Ventilation	2,263	4,526	6,789	9,052	11,315	13,578	15,840	18,103	20,366	22,629	24,892	27,155	29,418	31,681	33,944
Process Heating and Cooling	2,662	5,325	7,987	10,649	13,312	15,974	18,636	21,299	23,961	26,623	29,286	31,948	34,610	37,273	39,935
Space Heating	862	1,725	2,587	3,450	4,312	5,174	6,037	6,899	7,761	8,624	9,313	10,002	10,691	11,380	12,069
Other	70	140	210	280	350	420	490	560	630	700	770	840	910	980	1,050
Agriculture	331	663	994	1,325	1,657	1,988	2,319	2,651	2,982	3,314	3,645	3,976	4,308	4,639	4,970
Water Heating	13	26	39	51	64	77	90	103	116	128	141	154	167	180	193
Computers & Office Equipmen	18	35	53	70	88	105	123	140	158	175	193	210	228	245	263
Total	**26,568**	**53,137**	**79,705**	**106,273**	**132,841**	**159,409**	**185,977**	**212,540**	**239,103**	**265,666**	**291,103**	**316,539**	**341,976**	**367,413**	**392,850**

Industrial Sector

Cumulative Annual Summer MW	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Max Achievable															
Machine Drive	3.4	6.9	10.3	13.8	17.2	20.7	24.1	27.6	31.0	34.4	37.9	41.3	44.7	48.2	51.6
Lighting	1.9	3.8	5.7	7.6	9.5	11.3	13.2	15.1	17.0	18.9	20.8	22.7	24.6	26.5	28.4
Space Cooling	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8	0.9	0.9
Ventilation	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
Process Heating and Cooling	0.6	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.8	8.4	9.1	9.7
Space Heating	0.0	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6
Other	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7
Agriculture	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.1
Water Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Computers & Office Equipmen	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
Total	**6.4**	**12.8**	**19.3**	**25.7**	**32.1**	**38.5**	**45.0**	**51.4**	**57.8**	**64.2**	**70.6**	**77.0**	**83.4**	**89.8**	**96.2**
Realistic Achievable															
Machine Drive	2.7	5.4	8.0	10.7	13.4	16.1	18.7	21.4	24.1	26.8	29.4	32.1	34.8	37.4	40.1
Lighting	1.9	3.8	5.7	7.6	9.5	11.3	13.2	15.1	17.0	18.9	20.8	22.7	24.6	26.5	28.4
Space Cooling	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8
Ventilation	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
Process Heating and Cooling	0.5	0.9	1.4	1.8	2.3	2.8	3.2	3.7	4.1	4.6	5.1	5.5	6.0	6.5	6.9
Space Heating	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4
Other	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7
Agriculture	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0
Water Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Computers & Office Equipmen	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
Total	**5.4**	**10.9**	**16.3**	**21.8**	**27.2**	**32.7**	**38.1**	**43.5**	**49.0**	**54.4**	**59.9**	**65.3**	**70.7**	**76.1**	**81.5**

Exhibit DSM-2

2014 -2017
Annual Reports for DSM

DSM

Demand Side Management

2014 Annual Report

Targeting Energy Savings

EAST KENTUCKY POWER COOPERATIVE

A Touchstone Energy Cooperative

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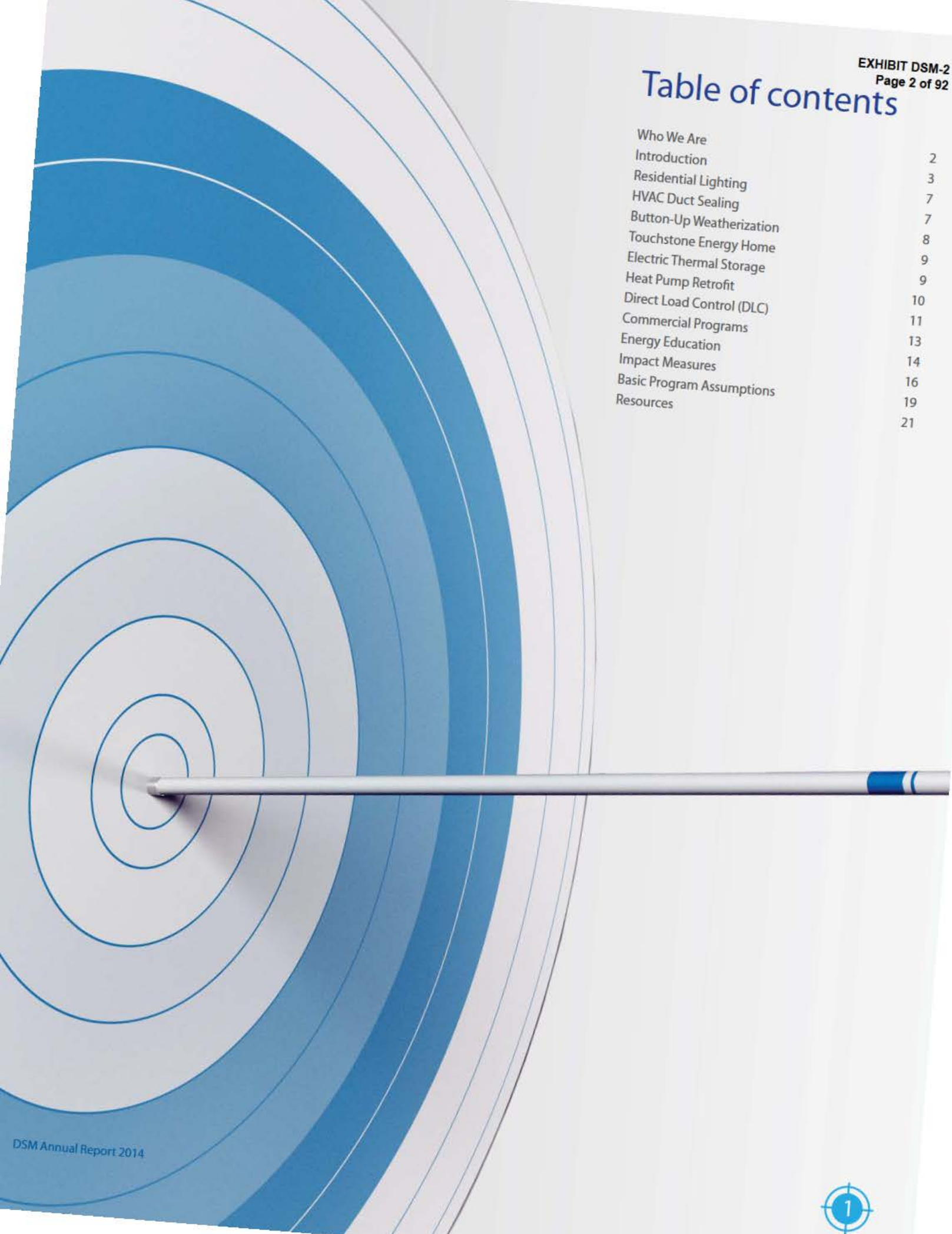


Who We Are

East Kentucky Power Cooperative (EKPC) is owned by 16 electric distribution cooperatives located in Central and Eastern Kentucky. Those cooperatives provide electric service to more than 1 million Kentuckians.

EKPC's role is to provide electric power to its 16 owner-members. EKPC owns and operates four major power plants totaling nearly 3,000 megawatts in capacity, as well as more than 2,900 miles of high-voltage transmission lines. EKPC has provided this service for more than 70 years.

EKPC and each of its 16 owner-member cooperatives is owned and democratically governed by the people who use their energy and services. All are not-for-profit organizations.

More than 520,000 homes and businesses in 87 Kentucky counties depend on EKPC and its 16 owner-member cooperatives for safe, reliable, affordable electric power.

Together, EKPC and its 16 owner-member cooperatives are known as Kentucky's Touchstone Energy Cooperatives.

Targeting Participation

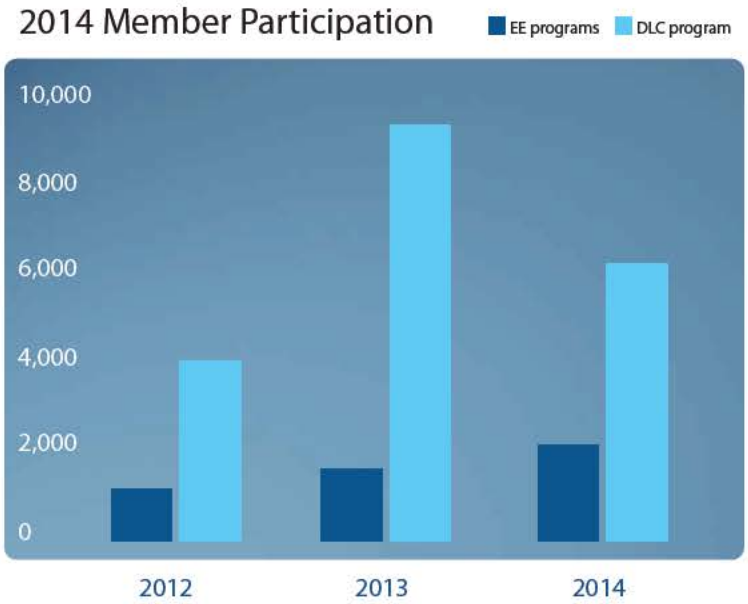
EKPC and its owner-member cooperatives are committed to helping members identify opportunities to improve the energy efficiency of their homes and businesses, and offer a variety of options to achieve that goal. For more than 30 years, EKPC and its 16 owner-member cooperatives have been leaders in developing demand-side management (DSM) programs for Kentuckians.

The cooperatives have steadily built a portfolio of programs that is practical and cost-effective for the members. Each program is evaluated using industry-standard practices, and is shown to be a "win-win-win" situation. Successful programs are beneficial to the member at the end of the line by helping them save money and live more comfortably. The cooperative owner-member systems and EKPC find benefits by avoiding cost of new generation. By working together, energy-efficiency solutions can be more easily achieved.

Collectively, the system employs 29 energy advisors, most of whom have advanced certifications such as RESNET Accredited Home Energy Raters (HERS) and Building Performance Institute (BPI) Building Analysts. They play a vital role by conducting free in-home energy assessments, resulting in thousands of energy audits each year. These visits provide opportunities to direct cooperative members to the most appropriate programs to help reduce energy usage and make their monthly bill more manageable.

Since 2005, EKPC's portfolio has achieved average annual energy reductions of 80 million kilowatt (KW) hours (kWh), and average annual peak reductions of almost 79 megawatts (MW).

In 2014, participation and savings stayed on track. Overall, energy-efficiency program participation increased more than 33 percent over 2013. These measures will result in a lifetime savings of 181,352 MWh and 362,704,666 pounds of carbon dioxide emissions.

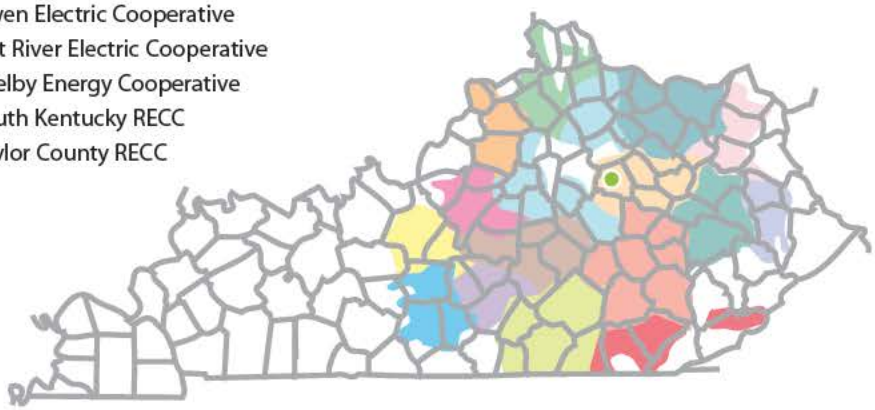


EKPC and its Owner-Members

Sixteen distribution cooperatives, which are called the member systems, own EKPC. The 16 co-ops include:

- Big Sandy RECC
- Blue Grass Energy Cooperative
- Clark Energy Cooperative
- Cumberland Valley Electric
- Farmers RECC
- Fleming-Mason Energy Cooperative
- Grayson RECC
- Inter-County Energy
- Jackson Energy Cooperative
- Licking Valley RECC
- Nolin RECC
- Owen Electric Cooperative
- Salt River Electric Cooperative
- Shelby Energy Cooperative
- South Kentucky RECC
- Taylor County RECC

- EKPC headquarters



East Kentucky Power Cooperative Generation

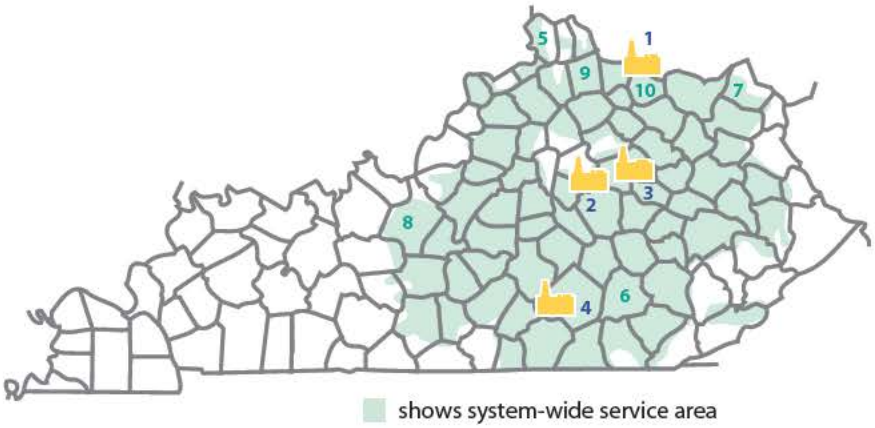
1	Spurlock	1,346 net MW
2	Dale	195 net MW
3	Smith Combustion Turbine Units	Summer 784 net MW Winter 1,032 net MW
4	Cooper	341 net MW

Landfill Gas Plants

5	Bavarian	3.0 net MW
6	Laurel Ridge	3.0 net MW
7	Green Valley	2.3 net MW
8	Pearl Hollow	2.3 net MW
9	Pendleton	3.0 net MW
10	Mason	0.8 net MW*

Southeastern Power Adm. (SEPA), hydro power	170 MW

** Mason will be officially closed in 2015*



Building the future, together

In 2014, EKPC took new steps into preparing for the DSM future. EKPC utilized GDS Associates to conduct a DSM program potential study. GDS identified numerous potential DSM programs, and the DSM Steering Committee (comprised of owner-member cooperative representatives and EKPC staff) took on the task of evaluating new programs to be included in EKPC's 2015 Integrated Resources Plan (IRP).

Once new DSM programs were selected, working groups were formed to establish guidelines for four new DSM programs in 2014: ENERGY STAR Appliance Rebate, Appliance Recycling, ENERGY STAR Manufactured Home and a low-income, energy-efficiency program called Community Assistance Resources for Energy Savings (CARES). EKPC filed tariffs for three of those four programs in late 2014, and received approval. Details of the CARES program were not finalized until 2015.

EKPC also incorporated the DSM/Renewable Energy Collaborative's recommendations for DSM options. The Collaborative, which met for more than two years, was made up of representatives of EKPC and the 16 owner-member cooperatives, three environmental advocacy organizations and other interested stakeholders.

"During the more than two years that the original collaborative met, numerous DSM recommendations were passed on to EKPC management for implementation. The success of that collaborative has prompted EKPC and public interest groups to negotiate a charter for continued collaboration going forward," said Steve Wilkins, member of Kentuckians for the Commonwealth.

EKPC and its owner-member cooperatives unveiled a new tool in 2014 called Billing*Insights*™, that provides cooperative members with the ability to perform free, online energy audits to access their energy usage and receive recommendations for improvements. Powered by Apogee Interactive, this application uses recent actual local weather and energy rates to accurately analyze a home's energy use and costs with some commonly-known inputs from the member.

A new platform for tracking DSM program participation was implemented in 2014. EKPC contracted with ESG, a Direct Technology Company, to use Energy Efficiency Collaboration Platform (EECP). This unified tracking system helps EKPC facilitate standard processes such as reporting and tracking, as well as providing data integrity and security.

In 2014, six of EKPC's owner-member cooperatives and Mountain Association for Community Economic Development (MACED) continued efforts to make an on-bill, energy-efficiency financing program called "How$martKY" available to members. MACED assists with home-energy evaluations and provides loan capital, while EKPC and its owner-member cooperatives provide qualifying rebates and program marketing materials.

"EKPC and its member cooperatives have been dedicated partners in the 'How$martKY' program which provides on-bill financing for residential retrofits," said Peter Hille, President of MACED. "Co-op members save money on their utility bills while enjoying greater comfort in their homes through affordable energy efficiency. We look forward to extending this benefit to more Kentuckians as this program grows."

EKPC and its owner-member cooperatives continued working with Kentucky's affordable housing builders, including Frontier Housing, Peoples' Self Help Housing, Partnership Housing, Southern Tier Housing and local Habitat for Humanities in 2014 to further low-income, energy-efficiency efforts.

As new and emerging technologies develop, EKPC and its owner-member cooperatives will continue to evaluate potential programs into the future.

Residential Lighting:

Providing more than 945,000 CFLs to members

Since 2003, EKPC and its owner-member cooperatives have provided more than 945,000 compact fluorescent lights (CFL) bulbs to members. This program provides CFLs at the annual meetings held by the distribution cooperatives each year. Each registered member receives a two-pack of CFLs that replace two incandescent light bulbs, targeting all residential end-consumers.

In 2014, cooperatives distributed more than 65,000 20-watt cool white CFLs that are expected to result in a lifetime savings of 10,952 MWh and 21,903,840 pounds of carbon dioxide emissions.

In 2014, EKPC provided 5,000 light-emitting diode (LED) bulbs to its owner-member cooperatives for distribution in an effort to better gauge member opinions on the product.

HVAC Duct Sealing:

Addressing the big usage issues

Since the 1990s, EKPC and its owner-member cooperatives have offered this program to reduce the energy loss through a home's HVAC duct system. This program provides incentives to members who seal ductwork through traditional mastic sealers. Duct loss measurement requires the use of a blower door test (before and after the duct sealing work is performed). Duct leakage per system must be reduced to below 10 percent of the fan's rated capacity. All joints in the duct system must be sealed with foil tape and mastic. This program is targeted to single-family homes using electric furnaces or electric heat pumps. All participating homes must have duct systems that are at least two years old to qualify for the incentive . The program is offered only to homes that have centrally-ducted heating systems in unconditioned areas.

In 2014, 248 HVAC Duct Sealing rebates were provided to members, resulting in a lifetime savings of 4,030 MWh and 8,059,008 pounds of carbon dioxide emissions. From 2013 to 2014, participation increased by 8 percent.

Button-Up Weatherization:

Improving homes' energy efficiency

Since the early 1990s, EKPC and its owner-member cooperatives have offered this program to improve a home's energy efficiency, comfort, and reduce energy use. This program offers incentives to members who add insulation materials or use other weatherization techniques to reduce heat loss in the home. Any member who resides in a site-built or manufactured home that is at least two years old and uses electricity as their primary source of heat is eligible.

This program offers a whole-house approach with multiple levels.

Button-Up Weatherization with Air Sealing:
This version of the Button-Up encourages members to air seal the envelope of their home in addition to the regular Button-Up improvements. A blower door test is required to demonstrate the impact in kW demand reduction, and an added incentive is paid based on that reduction.

Advanced Weatherization Level 2:
Level 2 encourages homeowners to address all of their home's inefficiencies at one time. The resulting BTUh savings can be as much as 150 percent of Button- Up Level I. Achieving this level of savings results in a greater incentive.

Advanced Weatherization Level 3:
This version represents the highest level. Level 3 also encourages homeowners to address all of their home's inefficiencies at one time. The resulting BTUh savings can be as much as 200 percent of Button-Up Level I. Achieving this level of savings results in an even greater incentive.

Levels 2 and 3 of this program are targeted to members who currently heat their home with electricity, particularly homes with unfinished basements, homes that have partition walls separating a crawl space or garage, and Cape Cod style homes (1.5 stories).

In 2014, 805 Button-Up rebates were provided to members, resulting in a lifetime savings of 22,200 MWh and 44,399,610 pounds of carbon dioxide emissions. From 2013 to 2014, participation increased by 21 percent.

Touchstone Energy Home:

Building the home of your dreams

Since 2003, EKPC and its owner-member cooperatives have offered this program to increase energy efficiency in new-home construction. This program is designed to encourage new homes to be built to higher standards for thermal integrity and equipment efficiency, as well as to choose a geothermal or an air-source heat pump, rather than less efficient forms of heating and cooling. Homes built to Touchstone Energy Home standards typically use 30 percent less energy than the same home built to typical construction standards. Plans are submitted before the home is built, a pre-drywall inspection is made, and a blower door test is administered after the home is built to verify that the home meets the standard.

This program is targeted towards the residential new construction market and members who are constructing new site-built homes.

In 2014, 346 Touchstone Energy Home rebates were provided to members, resulting in a lifetime savings of 17,576 MWh and 35,152,320 pounds of carbon dioxide emissions. From 2013 to 2014, participation increased by 64 percent.

EKPC's owner-members have also used this program to partner with Kentucky's affordable housing builders. Relationships with these organizations have led to improved efficiency in affordable housing and lower monthly energy costs for recipients of these homes.

Electric Thermal Storage:

Using power off-peak

Since the 1980s, EKPC and its owner-member cooperatives have offered this program to incentivize off-peak heating. This program promotes members to utilize off-peak heating equipment by providing a discounted energy rate.

This program is targeted primarily to members who currently use electric resistance heat (baseboard or ceiling cable) as their primary source for space heating.

In 2014, 15 ETS rebates were provided to members. After re-evalution of this program, EKPC filed a tariff to discontinue this offering as a DSM program. The PSC approved this request.

Heat Pump Retrofit:

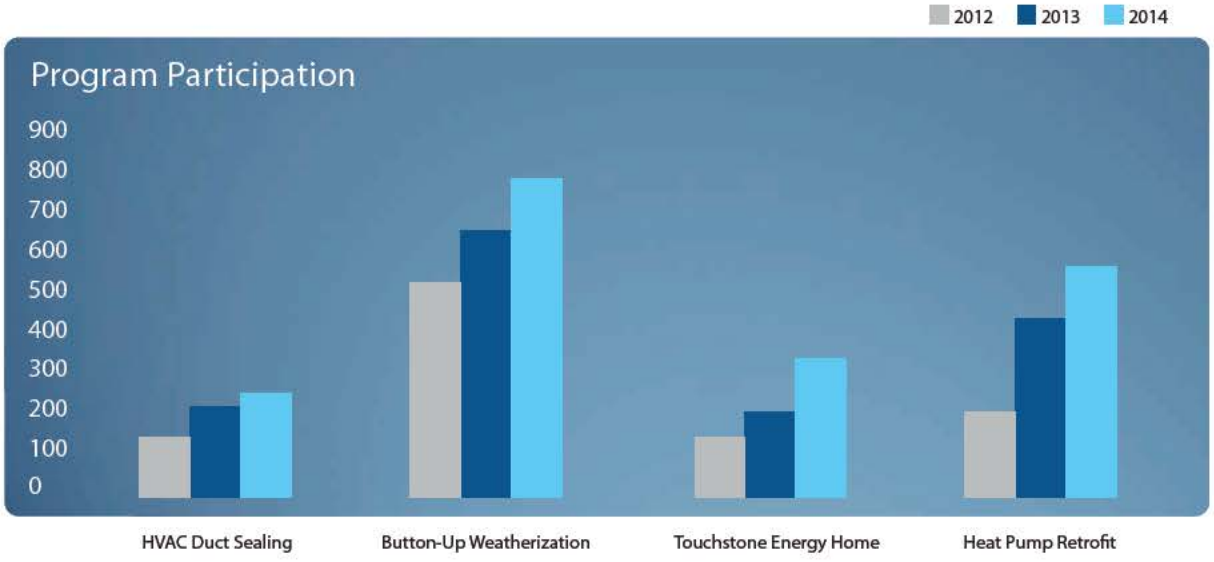
Replacing resistance heat sources

For decades, EKPC and its owner-member cooperatives have offered this program to lower the cost of heating homes and increase comfort. This program provides incentives for members to replace their existing resistance heat source with a high-efficiency heat pump through three levels of rebates.

Level 1 offers a rebate for a 13 SEER/7.5 HSPF heat pump. Level 2 offers a rebate for a 14 SEER/8.0 HSPF heat pump. Level 3 offers a rebate for a 15 SEER/8.5 HSPF or higher heat pump. The existing heating system must be two years or older to qualify for incentives unless the heat pump is being installed in a new manufactured home. New manufactured homeowners who install a heat pump qualify based on the levels above.

The program is targeted to members who currently use a resistance heat source. Incentives are offered when the homeowner's primary source of heat is an electric resistance furnace, ceiling cable heat, or baseboard heat in both site-built and manufactured homes.

In 2014, 576 Heat Pump Retrofit rebates were provided to members, resulting in a lifetime savings of 85,964 MWh and 171,926,880 pounds of carbon dioxide emissions. The incentives to members for this program were doubled in 2013 to increase participation. From 2013 to 2014, participation increased by 30 percent.



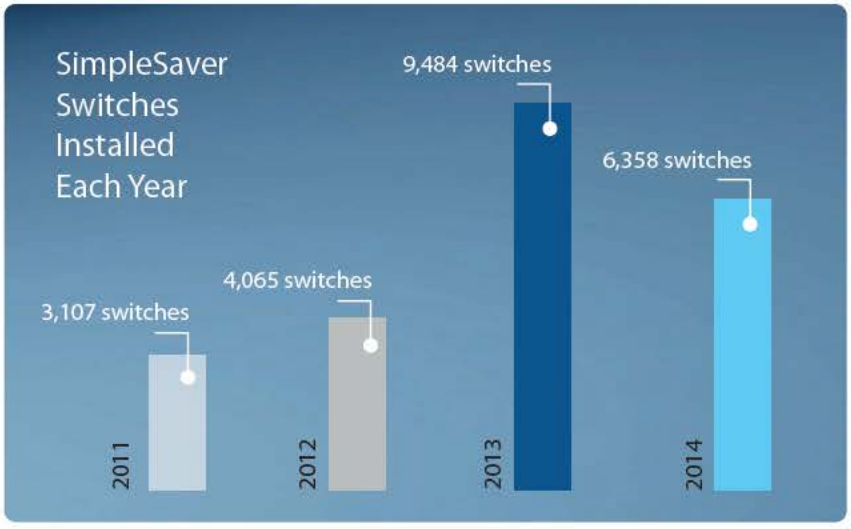
Direct Load Control:

Making saving simple

Since 2008, EKPC and its owner-member cooperatives have offered this program to manage peak usage. This program offers incentives to members who enroll central air-conditioners and electric water heaters. Switches are installed and, during periods of high demand, the utility briefly cycles the appliance off in order to reduce system peaks and save on costs for peak power. Although EKPC's system typically peaks in winter, member's heating appliances are not interrupted to lower peak. Member comfort and safety are top priority.

This program is targeted to any member with central air-conditioning, heat pump or electric tank water heaters, 40 gallons or greater.

In 2014, 6,358 switches were installed, resulting in a reduction of 4.776 MW during the summer months and 1.306 MW in the winter.



Commercial Programs:

Commercial & Industrial Advanced Lighting

For several years, EKPC and its owner-member cooperatives have offered this program to improve lighting in commercial or industrial facilities. This program offers incentives to install high-efficiency lamps and ballasts, including, but not limited to, LED exit signs, T-5 fluorescent fixtures and advanced controls.

This program is targeted to any existing commercial or industrial facility in the service territory of a distribution cooperative. The facility and its lighting must have been in service for at least two years.

In 2014, 172 C&I Advanced Lighting rebates were provided to members, resulting in a lifetime savings of 39,970 MWh and 79,939,360 pounds of carbon dioxide emissions.

Industrial Compressed-Air

For several years, EKPC and its owner-member cooperatives have offered this program to refund the cost of a leak-detection audit. This program is designed to reduce electricity consumption through detecting and repairing compressed-air leaks. Compressed-air production and distribution represents one of the primary electricity costs in many industrial plants. Both the supply side (compressors and conditioning equipment) and the demand side (distribution and end use) can be targeted to significantly improve energy efficiency.

This program is targeted to any existing commercial or industrial facility that uses electricity compressed air applications.

Energy Education:

Getting the message out

Collectively, EKPC and its owner-member cooperatives reached audiences through multiple forms of media including direct mail pieces, bill inserts, newspapers, television, billboards, radio, magazines, web, brochures, social media and through personal interaction. Several campaigns were utilized to encourage member participation in DSM programs and general energy-efficiency measures.

In 2014, the SAVE IT! campaign was used for a second year to promote DSM programs by featuring local cooperative members. The strategy of this effort is to create a dialogue between the owner-member cooperative and the member. More than 50 variations of this campaign were produced and provided to the owner-member cooperatives.

Several new concepts for promoting the SimpleSaver (DLC) program were created in 2014 to increase participation. In order to attract as many audiences as possible, campaigns focused on different topics of benefit – environmental, bill credits, delay of new power plant construction and the ease of the program. The outbound calling project continued in 2014, as well. More than half of new participants were added due to this effort.

New campaigns were created in 2014 for the new offerings, including ENERGY STAR Appliance Rebate, Appliance Recycling and Billing*Insights*™. To promote the use of Billing*Insights*, the concept of providing a Philips Slimstyle LED bulb to participants was introduced in late 2014.

Impact Measures:

System summary of 2014 DSM program savings

DSM program totals for installed measures in 2014

All programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Lifetime energy savings (MWh)	Cost of demand saved ($/kW)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
All DSM programs	73,711	12,515	6.539	4.385	$5,541,412	181,352	$639	$0.014	362,704,666

Residential Lighting

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
CFLs	65,190	1,369	0.137	0.228	$41,814	8	10,952	$0.004	21,903,840

HVAC Duct Seal

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
HVAC Duct Sealing	248	336	0.099	0.265	$105,750	12	4,030	$0.026	8,059,008

Button-Up Weatherization

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Button up level 1	796	1,447	0.317	1.041	$489,688	15	21,705	$0.023	43,410,000
Button up level 2	6	14	0.003	0.011	$3,992	15	215	$0.019	430,560
Button up level 3	3	19	0.004	0.014	$5,046	15	280	$0.018	559,050

Touchstone Energy Home

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
TSE Home Prescriptive	97	249	0.064	0.241	$105,107	20	4,982	$0.021	9,963,840
TSE Home HERS 79 or better	237	609	0.156	0.588	$315,779	20	12,172	$0.026	24,344,640
TSE Home HERS 80-85	12	21	0.005	0.020	$10,065	20	422	$0.024	843,840

Electric Thermal Storage

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Electric Thermal Storage	15	-9	0.000	0.102	$6,000	20	(190)	$(0.032)	(379,200)

Heat Pump Retrofit

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Heat Pump 13 SEER	324	2,324	0.049	0.000	$457,999	20	46,488	$0.010	92,975,040
Heat Pump 14 SEER	51	381	0.015	0.000	$73,041	20	7,626	$0.010	15,252,440
Heat Pump 15 SEER or higher	201	1,592	0.089	0.000	$384,957	20	31,850	$0.012	63,699,400

Direct Load Control

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Cost of Demand saved ($/KW)
DLC Air Conditioner	3847	19	3.847	0.000	$1,84,354	$480
DLC Water Heater	2511	25	0.929	1.306	$1,205,146	$1,297
DLC total	6358	44	4.776	1.306	$3,051,500	$639

Commercial and Industrial

C&I programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2014 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Commercial Lighting	172	3,997	0.799	0.432	$484,563	10	39,970	$0.012	79,939,360
Compressed Air	1	122	0.024	0.010	$6,120	7	851	$0.007	1,702,848
Total	173	4,119	0.823	0.442	$490,683		40,821	$0.012	81,642,208

2014 Basic Program Assumptions [1]

Weatherization Programs

Measure: Button Up Level 1

Annual kWh Saved:	2,205
Winter Demand Savings:	1.71
Summer Demand Savings:	0.52
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC: [3]	1.45

Measure: Button Up Level 2

Annual kWh Saved:	4,567
Winter Demand Savings:	3.53
Summer Demand Savings:	1.07
Lifetime of Savings:	15 years
(Weighted mix of measures)	
Installation Rate:	100%
TRC:	1.52

Measure: Button Up Level 3

Annual kWh Saved:	6,090
Winter Demand Savings:	4.71
Summer Demand Savings:	1.43
Lifetime of Savings:	15 years
(Weighted mix of measures)	
Installation Rate:	100%
TRC:	1.56

Measure: Button Up w/Air Seal

Annual kWh Saved:	3,045
Winter Demand Savings:	2.35
Summer Demand Savings:	0.720
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	1.44

Equipment Efficiency

Measure: HVAC Maintenance Program

For a typical heat pump in typical residence to same home reduced by 12% savings

Annual kWh Saved:	1,354
Winter Demand Savings:	1.07
Summer Demand Savings:	0.40
Lifetime of Savings:	12 years
Installation Rate:	100%
TRC:	1.15

Measure: Heat Pump SEER 13

From Electric Furnace and Central Air to ENERGY STAR SEER 13, HSPF 7.5

Annual kWh Saved:	7,174
Winter Demand Savings:	0
Summer Demand Savings:	0 .15
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.52

Measure: Heat Pump SEER 14

From Electric Furnace and Central Air to ENERGY STAR SEER 14, HSPF 8.0

Annual kWh Saved:	7,533
Winter Demand Savings:	0
Summer Demand Savings:	0.32
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.32

Measure: Heat Pump SEER 15

From Electric Furnace and Central Air to ENERGY STAR SEER 15, HSPF 8.5

Annual kWh Saved:	7,978
Winter Demand Savings:	0
Summer Demand Savings:	0.45
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.08

Measure: Electric Thermal Storage
Designed as a Demand Response program

Annual kWh Saved:	(632)
Winter Demand Savings:	6.79
Summer Demand Savings:	0
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	0.28

New Home Construction

Measure: Touchstone Energy Home
Prescriptive and Performance Level #2 – Encourages new homes to be built to a standard of at least SEER 14.5, HSPF 8.2; HERS Rating of 79 and below

Annual kWh Saved:	2,568
Winter Demand Savings:	2.48
Summer Demand Savings:	0.66
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.98

Measure: Touchstone Energy Home
Performance Level #1 – Encourages new homes to be built to a standard of at least SEER 14.5, HSPF 8.2; HERS rating of 80-85

Annual kWh Saved:	1,758
Winter Demand Savings:	1.7
Summer Demand Savings:	0.45
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	2.06

Residential Lighting [2]

Measure: CFLs

Annual kWh Saved:	21
Winter Demand Savings:	0.0035
Summer Demand Savings:	0.0021
Lifetime of Savings:	8 years
Installation Rate:	70%
TRC:	2.62

C&I Energy Efficiency Program

Measure: Commercial Advanced Lighting
Unit is 1 kW connected load savings

Annual kWh Saved:	4,252
Winter Demand Savings:	0.45
Summer Demand Savings:	0.85
Lifetime of Savings:	10 years
Installation Rate:	100%
TRC:	2.22

Measure: Industrial Compressed Air

Annual kWh Saved:	3,800
Winter Demand Savings:	0.30
Summer Demand Savings:	0.75
Lifetime of Savings:	7 years
Installation Rate:	0
TRC:	1.62

Load Control Program

Measure: Water Heater >40 gals

Annual kWh Saved:	10
Winter Demand Savings:	0.52
Summer Demand Savings:	0.37
Lifetime of Savings:	20 years
Installation Rate:	100%

Measure: Central Air Conditioning

Annual kWh Saved:	5
Winter Demand Savings:	0.0
Summer Demand Savings:	1.0
Lifetime of Savings:	20 years
Installation Rate:	100%

TRC for Load Control Program	2.68

1 Savings numbers are "ex ante" or as planned gross savings except where noted.
2 Reported savings for CFLs are adjusted by the install rate of 70%.
3 Total Resource Cost (TRC) is an overall program benefits/costs analysts ratio.

Resources

Big Sandy RECC	bigsandyrecc.com
Blue Grass Energy	bgenergy.com
Clark Energy	clarkenergy.com
Cumberland Valley Electric	cumberlandvalley.coop
East Kentucky Power Cooperative	ekpc.coop togetherwesaveky.com simplesaver.coop
Farmers RECC	farmersrecc.com
Fleming-Mason Energy	fme.coop
Grayson RECC	graysonrecc.com
Inter-County Energy	intercountyenergy.net
Jackson Energy	jacksonenergy.com
Licking Valley RECC	lvrecc.com
Nolin RECC	nolinrecc.com
Owen Electric	owenelectric.com
Salt River Electric	srelectric.com
Shelby Energy	shelbyenergy.com
South Kentucky RECC	skrecc.com
Taylor County RECC	tcrecc.com
Touchstone Energy	touchstonenergy.com togetherwesave.com

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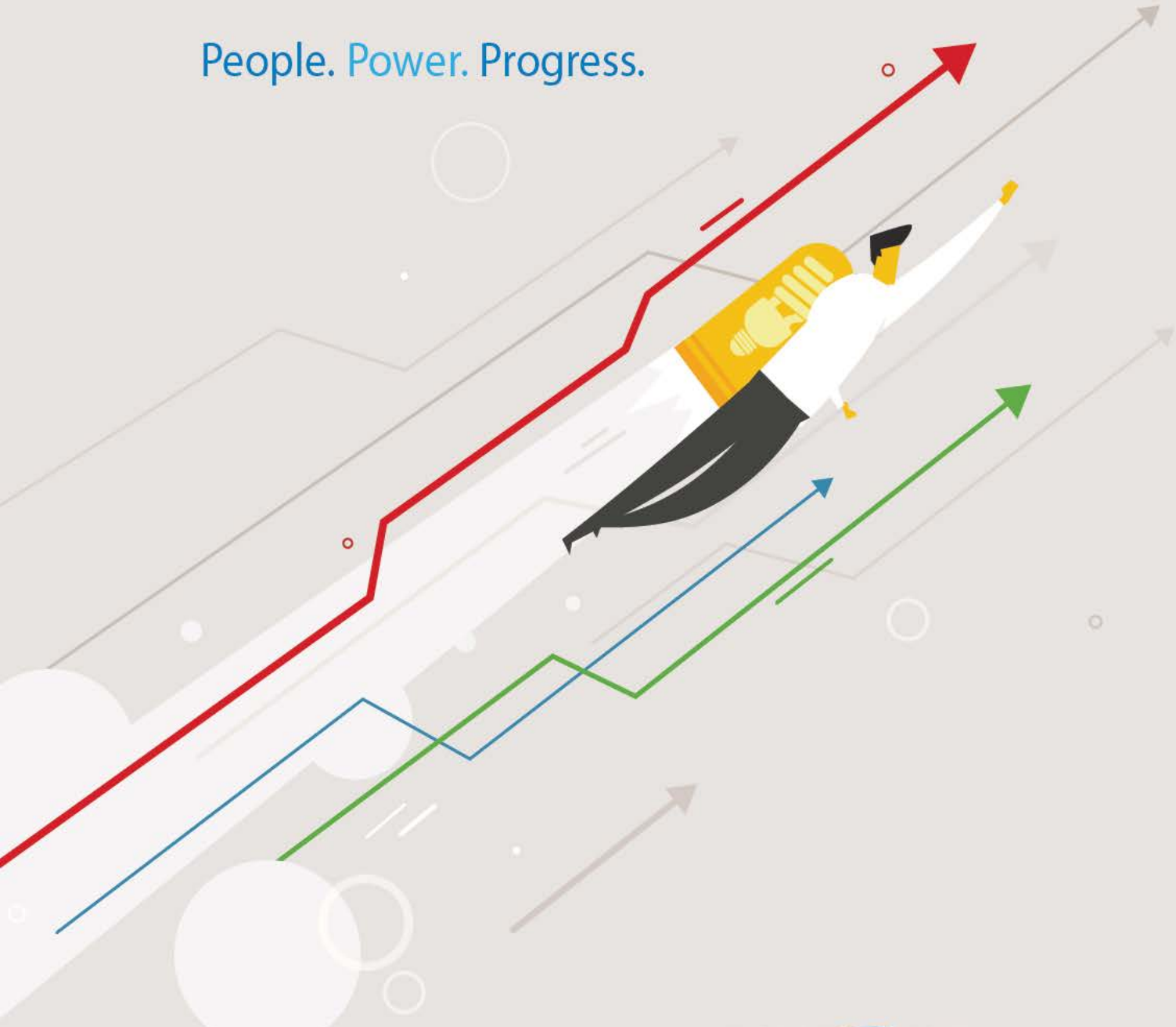
DSM

Demand Side Management

2015 Annual Report

People. Power. Progress.



EAST KENTUCKY POWER COOPERATIVE

A Touchstone Energy Cooperative

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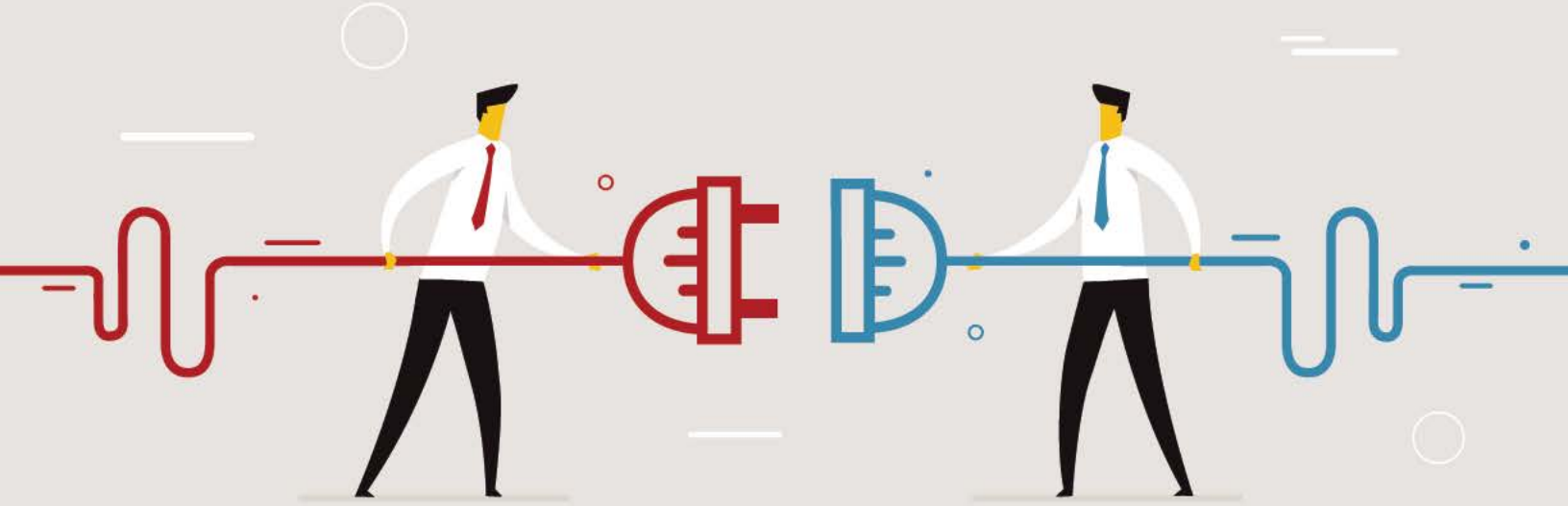


Who We Are

Located in the heart of the Bluegrass state, East Kentucky Power Cooperative is a not-for-profit generation and transmission (G&T) electric utility with headquarters in Winchester, Ky. Our cooperative has a vital mission: to safely generate and deliver affordable, reliable electric power to 16 owner-member cooperatives serving more than one million Kentuckians.

Together, with our 16 owner-members, we're known as Kentucky's Touchstone Energy Cooperatives. The member co-ops distribute energy to 530,168 Kentucky homes, farms, businesses and industries across 87 counties. We're leaders in energy efficiency and environmental stewardship. And we're committed to providing power to improve the lives of people in Kentucky.

Targeting Participation

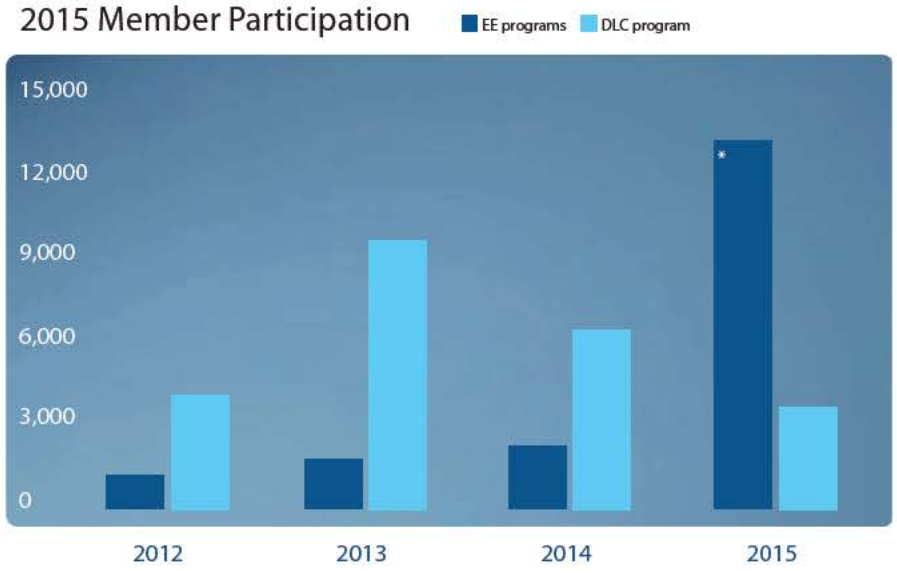
EKPC and its owner-member cooperatives are committed to helping members identify opportunities to improve the energy efficiency of their homes and businesses and offer a variety of options to achieve that goal. For more than 30 years, EKPC and its 16 owner-member cooperatives have been leaders in developing demand-side management (DSM) programs for Kentuckians.

The cooperatives have steadily built a portfolio of programs that is practical and cost-effective for the members. Each program is evaluated using industry-standard practices, and is shown to be a "win-win-win" situation. Successful programs are beneficial to the member at the end of the line by helping them save money and live more comfortably. The cooperative owner-member systems and EKPC find benefits by avoiding cost of new generation. By working together, energy-efficiency solutions can be more easily achieved.

Collectively, the system employs 29 energy advisors, most of whom have advanced certifications such as RESNET Accredited Home Energy Raters (HERS) and Building Performance Institute (BPI) Building Analysts. They play a vital role by conducting free in-home energy assessments, resulting in thousands of energy audits each year. These visits provide opportunities to direct cooperative members to the most appropriate programs to help reduce energy usage and make their monthly bill more manageable.

Since 2005, EKPC's portfolio has achieved average annual energy reductions of nearly 160 million kilowatt (KW) hours (kWh), and average annual peak reductions of almost 100 megawatts (MW).

In 2015, participation and savings stayed on track. Overall, energy-efficiency program participation increased more than 793 percent over 2014. These measures will result in a lifetime savings of 320,263 MWh and 640,525,545 pounds of carbon dioxide emissions.

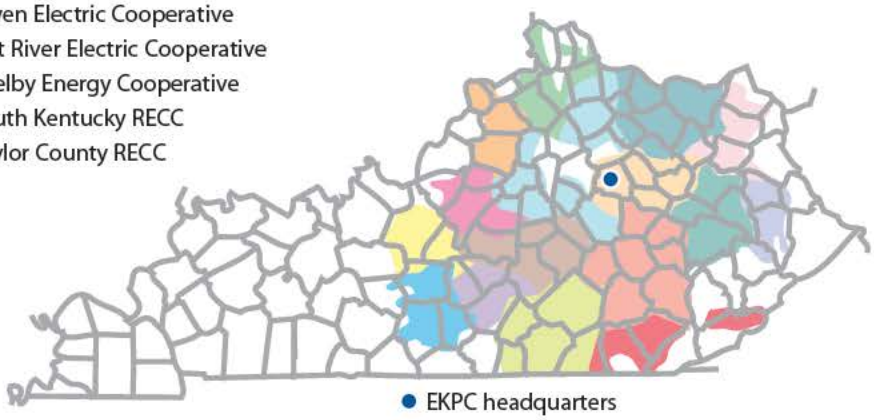


* Excludes CFLs and LEDs.

EKPC and its Owner-Members

Sixteen distribution cooperatives, which are called the member systems, own EKPC. The 16 co-ops include:

- Big Sandy RECC
- Blue Grass Energy Cooperative
- Clark Energy Cooperative
- Cumberland Valley Electric
- Farmers RECC
- Fleming-Mason Energy Cooperative
- Grayson RECC
- Inter-County Energy
- Jackson Energy Cooperative
- Licking Valley RECC
- Nolin RECC
- Owen Electric Cooperative
- Salt River Electric Cooperative
- Shelby Energy Cooperative
- South Kentucky RECC
- Taylor County RECC



East Kentucky Power Generation

Coal	Generation
Spurlock	1,346 new MW
Dale*	149 net MW
Cooper	341 net MW
Total	**1,836 net MW**

Natural Gas	Generation
Smith	Summer
Combustion	753 net MW
Turbine	Winter
Units	989 net MW
Bluegrass**	Summer
Combustion	501 net MW
Turbine	Winter
Units	567 net MW
Total Natural Gas Summer	**1,254 net MW**
Total Natural Gas Winter	**1,556 net MW**

Landfill	Generation
Bavarian	3.0 net MW
Laurel Ridge	3.0 net MW
Green Valley	2.3 net MW
Pearl Hollow	2.3 net MW
Pendleton	3.0 net MW
Glasgow***	1.0 net MW
Total Landfill	**14.6 net MW**

Hydro	Generation
Southeastern Power Adm. (SEPA)	170 MW

* Dale Station was retired in April 2016 due to the cost to comply with new, more-stringent federal regulations.

** Under an existing agreement, which continues until April 2019, a third party receives the output of one Bluegrass Generating Station unit.

*** Under an existing agreement, a third party receives the output of Glasgow in a 10-year power purchase agreement.

Building the future, together

In 2015, EKPC and its owner-members were very focused on promotion and implementation of the newly-expanded DSM portfolio. With the rollout of three programs in late 2014 (ENERGY STAR Appliance Rebate, Appliance Recycling and ENERGY STAR Manufactured Home) and a low-income program called Community Assistance Resources for Energy Savings or CARES in 2015, the challenge was set to educate and gain participation.

In fact, that desire to increase participation in all DSM programs drove the reconstitution of the DSM and Renewable Energy Collaborative group. The Collaborative, which met for more than two years (beginning in 2013), is a joint project of EKPC, its 16 owner-member distribution cooperatives, environmental advocacy organizations and other interested stakeholders. The group's first recommendations on expanding the DSM portfolio were used to develop the newest programs. Collaborative 2.0 will continue those efforts in 2016.

Under the name of the Collaborative 2.0, the group was given a new task in 2015 – to increase participation in DSM/energy efficiency and renewable energy programs. The first and only meeting of 2015 was held in September and consisted of introductions and background discussion.

EKPC and its owner-members also partner with other organizations to expand DSM efforts, including Mountain Association for Community Economic Development (MACED). In 2015, six of EKPC's owner-member cooperatives continued to offer an on-bill, energy-efficiency financing program called "How$martKY" available to members. MACED assists with home-energy evaluations and provides loan capital, while EKPC and its owner-member cooperatives provide quality rebates and program marketing materials. Work also continued with Kentucky's affordable housing builders, including Frontier Housing, Peoples' Self Help Housing, Partnership Housing, Southern Tier Housing and local Habitat for Humanities to further low-income energy efficiency efforts.

EKPC grew its relationship with the Midwest Energy Efficiency Alliance (MEEA) in 2015, by having an employee elected to the organization's Board of Directors. The Midwest Energy Efficiency Alliance is a collaborative network advancing energy efficiency in the Midwest for sustainable economic development and environmental stewardship. EKPC has been a member of MEEA for several years, and has hosted meetings where ideas and concepts were shared with other stakeholders.

"It's apparent that EKPC and its owner-member cooperatives are committed to energy efficiency efforts," said MEEA's Executive Director Stacey Paradis. "Their DSM programs are great for the state and for their members and they are always looking for more opportunities to benefit their members through saving energy and saving money."

As new and emerging technologies develop, EKPC and its owner-member cooperatives will continue to evaluate potential programs into the future.

Residential Lighting:

Providing more than 9 million CFLs & LEDs to members

Since 2003, EKPC and its owner-member cooperatives have provided more than one million compact fluorescent lights (CFL) and light-emitting diodes (LED) to members.

In 2015, cooperatives distributed more than 61,500 20-watt cool white CFLs that are expected to result in a lifetime savings of 10,337 MWh and 20,674,752 pounds of carbon dioxide emissions. This program provides CFLs at the annual meetings held by the distribution cooperatives each year. Each registered member in attendance receives a two-pack of CFLs that replace two incandescent light bulbs, targeting all residential end-consumers.

In 2015, cooperatives provided more than 5,900 LEDs to its members. Each member who participated in a free, online energy audit called Billing*Insights*™ received an LED. These LEDs that are expected to result in a lifetime savings of 1,134MWh and 2,267,904 pounds of carbon dioxide emissions.

HVAC Duct Sealing:

Addressing the big usage issues

Since the 1990s, EKPC and its owner-member cooperatives have offered this program to reduce the energy loss through a home's HVAC duct system. This program provides incentives to members who seal ductwork through traditional mastic sealers. Duct loss measurement requires the use of a blower door test (before and after the duct sealing work is performed). Duct leakage per system must be reduced to below 10 percent of the fan's rated capacity. All joints in the duct system must be sealed with foil tape and mastic. This program is targeted to single-family homes using electric furnaces or electric heat pumps. All participating homes must have duct systems that are at least two years old to qualify for the incentive. The program is offered only to homes that have centrally-ducted heating systems in unconditioned areas.

In 2015, 266 HVAC Duct Sealing rebates were provided to members, resulting in a lifetime savings of 3,313 MWh and 6,626,592 pounds of carbon dioxide emissions. From 2014 to 2015, participation increased by 7 percent.

Button-Up Weatherization:

Improving homes' energy efficiency

Since the early 1990s, EKPC and its owner-member cooperatives have offered this program to improve a home's energy efficiency, comfort, and reduce energy use. This program offers incentives to members who add insulation materials or use other weatherization techniques to reduce heat loss in the home. Any member who resides in a site-built or manufactured home that is at least two years old and uses electricity as their primary source of heat is eligible.

This program offers a whole-house approach with multiple levels.

Button-Up Weatherization with Air Sealing:
This version of the Button-Up encourages members to air seal the envelope of their home in addition to the regular Button-Up improvements. A blower door test is required to demonstrate the impact in kW demand reduction, and an added incentive is paid based on that reduction.

Advanced Weatherization Level 2:
Level 2 encourages homeowners to address all of their home's inefficiencies at one time. The resulting BTUh savings can be as much as 150 percent of Button- Up Level I. Achieving this level of savings results in a greater incentive.

Advanced Weatherization Level 3:
This version represents the highest level. Level 3 also encourages homeowners to address all of their home's inefficiencies at one time. The resulting BTUh savings can be as much as 200 percent of Button-Up Level I. Achieving this level of savings results in an even greater incentive.

Levels 2 and 3 of this program are targeted to members who currently heat their home with electricity, particularly homes with unfinished basements, homes that have partition walls separating a crawl space or garage, and Cape Cod style homes (1.5 stories).

In 2015, 1,101 Button-Up rebates were provided to members, resulting in a lifetime savings of 25,682 MWh and 51,362,463 pounds of carbon dioxide emissions. From 2014 to 2015, participation increased by 37 percent.

Touchstone Energy Home:

Building the home of your dreams

Since 2003, EKPC and its owner-member cooperatives have offered this program to increase energy efficiency in new-home construction. This program is designed to encourage new homes to be built to higher standards for thermal integrity and equipment efficiency, as well as to choose a geothermal or an air-source heat pump, rather than less efficient forms of heating and cooling. Homes built to Touchstone Energy Home standards typically use 30 percent less energy than the same home built to typical construction standards. Plans are submitted before the home is built, a pre-drywall inspection is made, and a blower door test is administered after the home is built to verify that the home meets the standard.

This program is targeted towards the residential new construction market and members who are constructing new site-built homes.

In 2015, 435 Touchstone Energy Home rebates were provided to members, resulting in a lifetime savings of 22,342 MWh and 44,683,200 pounds of carbon dioxide emissions. From 2014 to 2015, participation increased by 26 percent.

EKPC's owner-members have also used this program to partner with Kentucky's affordable housing builders. Relationships with these organizations have led to improved efficiency in affordable housing and lower monthly energy costs for recipients of these homes.

CARES

Community Assistance Resources for Energy Savings

The Community Assistance Resources for Energy Savings (CARES) program began in early 2015, and provides an incentive to enhance the weatherization and energy efficiency services provided to the end-use members by the Kentucky Community Action Agencies (CAA) network. EKPC and its owner-members provide an incentive to the CAA implementing the project on behalf of the end-use member.

This program is available to end-use members who qualify for weatherization and energy-efficiency services through their local CAA in all service territories of participating cooperatives. The maximum incentive possible per household is $2,000, which can be reached by using any combination of the following improvements not to exceed their individual maximums through heat pump upgrade and/or weatherization improvements.

In 2015, one CARES incentive was provided, resulting in a lifetime savings of 71 MWh and 141,930 pounds of carbon dioxide emissions.

Heat Pump Retrofit:

Replacing resistance heat sources

For decades, EKPC and its owner-member cooperatives have offered this program to lower the cost of heating homes and increase comfort. This program provides incentives for members to replace their existing resistance heat source with a high-efficiency heat pump through three levels of rebates.

Level 1 offers a rebate for a 13 SEER/7.5 HSPF heat pump. Level 2 offers a rebate for a 14 SEER/8.0 HSPF heat pump. Level 3 offers a rebate for a 15 SEER/8.5 HSPF or higher heat pump. The existing heating system must be two years or older to qualify for incentives unless the heat pump is being installed in a new manufactured home. New manufactured homeowners who install a heat pump qualify based on the levels above.

The program is targeted to members who currently use a resistance heat source. Incentives are offered when the homeowner's primary source of heat is an electric resistance furnace, ceiling cable heat, or baseboard heat in both site-built and manufactured homes.

In 2015, 823 Heat Pump Retrofit rebates were provided to members, resulting in a lifetime savings of 124,561 MWh and 249,121,720 pounds of carbon dioxide emissions. From 2014 to 2015, participation increased by 43 percent.

Direct Load Control:

Making saving simple

Since 2008, EKPC and its owner-member cooperatives have offered this program to manage peak usage. This program offers incentives to members who enroll central air-conditioners and electric water heaters. Switches are installed and, during periods of high demand, the utility briefly cycles the appliance off in order to reduce system peaks and save on costs for peak power. Although EKPC's system typically peaks in winter, member's heating appliances are not interrupted to lower peak. Member comfort and safety are top priority.

This program is targeted to any member with central air-conditioning, heat pump or electric tank water heaters, 40 gallons or greater.

In 2015, 3,649 switches were installed, resulting in a reduction of 2.8 MW during the summer months and 0.701 MW in the winter.

Appliance Recycling

You call, we haul

The Appliance Recycling program began in 2014 in an effort to encourage members to recycle old, inefficient refrigerators and freezers. Members receive a $50 incentive for recycling refrigerators and/or freezers that meet qualifying conditions. The appliances must be in working condition, plugged in and running at scheduled pick-up, between 7.75 and 30 cubic feet, and empty and defrosted with water lines disconnected.

EKPC and its owner-member cooperatives partner with Appliance Recycling Centers of America, Inc. (ARCA) for proper recycling procedures that meet all federal and state requirements.

This program is available to all end-use members who qualify.

In 2015, 1,144 incentives were provided to members, resulting in a lifetime savings of 5,574 MWh and 11,147,136 pounds of carbon dioxide emissions.

ENERGY STAR Appliance Rebate:

Get paid to upgrade

The ENERGY STAR Appliance Rebate program began in 2014 in an effort to encourage members to purchase new, energy-efficient appliances. EKPC and its owner-member cooperatives provides the incentives to members who purchase and install the ENERGY STAR certified appliances listed in the table.

This program is available to all end-use members who qualify.

In 2015, 5,936 rebates were provided to members, resulting in a lifetime savings of 22,664 MWh and 45,329,514 pounds of carbon dioxide emissions.

ENERGY STAR Appliances	Rebate
Refrigerator	$100
Freezer	$50
Dishwasher	$50
Clothes Washer	$75
Heat Pump Water Heater	$300
Heat Pump	$300
Central Air Conditioning	$300

ENERGY STAR Manufactured Home:

Get paid to upgrade

The ENERGY STAR Manufactured Home program began in 2014. An upstream program, EKPC works directly with the manufacturer to automatically upgrade the home to ENERGY STAR certified standards. EKPC utilizes a third-party administrator, Systems Building Research Alliance (SBRA), to verify information and ensure quality control.

Once the installation address is verified to be on a participating cooperative's service lines, the member will automatically receive the upgrade. An ENERGY STAR certified manufactured home is a home that has been designed, produced and installed by the home manufacturer to meet ENERGY STAR requirements for energy efficiency. These manufactured homes feature efficient heating and cooling equipment, high-efficiency water heaters, properly installed insulation, high-performance windows, tight construction and sealed ducts.

This program is available to all end-use members who qualify.

In 2015, two rebates were provided to members, resulting in a lifetime savings of 358 MWh and 716,820 pounds of carbon dioxide emissions.

Commercial Programs:

Commercial & Industrial Advanced Lighting

For several years, EKPC and its owner-member cooperatives have offered this program to improve lighting in commercial or industrial facilities. This program offers incentives to install high-efficiency lamps and ballasts, including, but not limited to, LED exit signs, T-5 fluorescent fixtures and advanced controls.

This program is targeted to any existing commercial or industrial facility in the service territory of a distribution cooperative. The facility and its lighting must have been in service for at least two years.

In 2015, 130 C&I Advanced Lighting rebates were provided to members, resulting in a lifetime savings of 91,108 MWh and 182,216,880 pounds of carbon dioxide emissions.

Industrial Compressed-Air

For several years, EKPC and its owner-member cooperatives have offered this program to refund the cost of a leak-detection audit. This program is designed to reduce electricity consumption through detecting and repairing compressed-air leaks. Compressed-air production and distribution represents one of the primary electricity costs in many industrial plants. Both the supply side (compressors and conditioning equipment) and the demand side (distribution and end use) can be targeted to significantly improve energy efficiency.

This program is targeted to any existing commercial or industrial facility that uses electricity compressed air applications.

In 2015, one compressed air rebate was provided, resulting in a lifetime savings of 3,870 MWh and 7,739,444 pounds of carbon dioxide emissions.

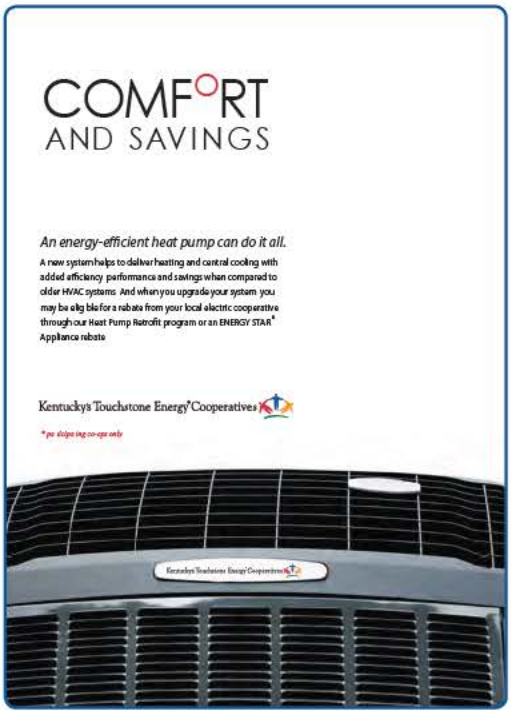
Energy Education:

Getting the message out

In 2015, campaigns for the newest DSM programs were featured in all of EKPC and its owner-member cooperatives' mediums including direct mail, bill inserts, newspapers, television, billboards, radio, magazines, digital, brochures, social media and through personal interaction. An emphasis on digital (online) advertising began in 2015. The ability to track and measure digital advertising in a precise manner makes it an attractive and efficient venue.

New campaigns to promote each of the DSM programs were introduced in 2015, adding to the large increase of participation in 2015.

Non-traditional forms of advertising were used in two of the newest programs. Various items, such as yard signs and retail lot flags, were provided to increase education on the ENERGY STAR Manufactured Home program. Appliance adhesives and single-panel brochures were provided to retail stores to promote the ENERGY STAR Appliance Rebate program.



Impact Measures:

System summary of 2015 DSM program savings

DSM program totals for installed measures in 2015

All programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Lifetime energy savings (MWh)	Cost of demand saved ($/kW)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
All DSM Programs	84,503	24,834	6.796	5.468	$9,514,844*	320,263	$881	$0.022	640,525,545

Appliance Recycling

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Appliance Recycling	1,144	796	0.114	0.080	$272,432	7	5,574	$0.049	11,147,136

Button-Up Weatherization

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Button-Up level 1	1,099	1,639	0.386	1.268	$696,270	15	24,589	$0.028	49,178,079
Button-Up level 2	1	9	0.002	0.007	$2,085	15	142	$0.015	283,323
Button-Up level 3	1	63	0.015	0.049	$2,625	15	951	$0.003	1,901,061

CARES

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
CARES	1	5	0.001	0.001	$1,700	15	71	$0.024	141,930

* Includes $1,325,639 program administration and promotional expenses.

Commercial and Industrial

C&I programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Commercial Lighting	130	9,111	1.822	0.984	$823,529	10	91,108	$0.009	182,216,880
Compressed Air	1	553	0.109	0.044	$15,000	7	3,870	$0.004	7,739,444
Total	131	9,664	1.931	1.028	$838,592		94,978	$0.009	189,956,324

Direct Load Control

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Cost of Demand saved ($/KW)
DLC Air Conditioner	2,301	12	2.301	0.000	$1,553,986	$675
DLC Water Heater	1,348	13	0.499	0.701	$912,658	$1,830
DLC total	3,649	25	2.800	0.701	$2,466,644	$881

Energy Audits

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
In-home	22	14	0.003	0.004	$818	8	114	$0.007	228,800
Online	3,555	1,827	0.391	0.569	$132,175	5	9,134	$0.014	18,268,390

ENERGY STAR® Appliance Rebate

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
ES Appliance Rebate	5,936	1,713	0.390	0.179	$1,221,100	10-15	22,665	$0.0538	45,329,514

ENERGY STAR® Manufactured Home

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
ES Manufactured Home	2	24	0.001	0.006	$8,600	15	358	$0.024	716,820

Heat Pump Retrofit

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Heat Pump 13 SEER	295	2,116	0.044	0.000	$491,175	20	42,327	$0.012	84,653,200
Heat Pump 14 SEER	216	1,626	0.068	0.000	$420,120	20	32,514	$0.013	65,027,680
Heat Pump 15 SEER or higher	312	2,486	0.139	0.000	$699,192	20	49,720	$0.014	99,440,840

HVAC Duct Seal

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
HVAC Duct Sealing	266	276	0.080	0.258	$133,000	12	3,313	$0.040	6,626,592

Residential Lighting

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
CFLs & LEDs	67,438	1,434	0.143	0.239	$143,741	8	11,471	$0.012	22,942,656

Touchstone Energy Home

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2015 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
TSE Home Prescriptive	108	277	0.071	0.268	$151,200	20	5,547	$0.027	11,093,760
TSE Home HERS 79 or better	327	840	0.216	0.811	$457,800	20	16,795	$0.027	33,589,440
TSE Home HERS 80-85	0	0	0	0	$0	20	0	$0	0

2015 Basic Program Assumptions [1]

Measure: Button-Up Level 1

Annual kWh Saved:	2,205
Winter Demand Savings:	1.71
Summer Demand Savings:	0.52
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC: [3]	1.45

Measure: Button-Up Level 2

Annual kWh Saved:	4,567
Winter Demand Savings:	3.53
Summer Demand Savings:	1.07
Lifetime of Savings:	15 years
(Weighted mix of measures)	
Installation Rate:	100%
TRC:	1.52

Measure: Button-Up Level 3

Annual kWh Saved:	6,090
Winter Demand Savings:	4.71
Summer Demand Savings:	1.43
Lifetime of Savings:	15 years
(Weighted mix of measures)	
Installation Rate:	100%
TRC:	1.56

Measure: Button-Up w/Air Seal

Annual kWh Saved:	3,045
Winter Demand Savings:	2.35
Summer Demand Savings:	0.720
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	1.44

Measure: HVAC Maintenance Program

For a typical heat pump in typical residence to same home reduced by 12% savings

Annual kWh Saved:	1,354
Winter Demand Savings:	1.07
Summer Demand Savings:	0.40
Lifetime of Savings:	12 years
Installation Rate:	100%
TRC:	1.15

Measure: Heat Pump SEER 13

From Electric Furnace and Central Air to ENERGY STAR SEER 13, HSPF 7.5

Annual kWh Saved:	7,174
Winter Demand Savings:	0
Summer Demand Savings:	0 .15
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.52

Measure: Heat Pump SEER 14

From Electric Furnace and Central Air to ENERGY STAR SEER 14, HSPF 8.0

Annual kWh Saved:	7,533
Winter Demand Savings:	0
Summer Demand Savings:	0.32
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.32

Measure: Heat Pump SEER 15

From Electric Furnace and Central Air to ENERGY STAR SEER 15, HSPF 8.5

Annual kWh Saved:	7,978
Winter Demand Savings:	0
Summer Demand Savings:	0.45
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.08

Measure: Touchstone Energy Home

Prescriptive and Performance Level #2 – Encourages new homes to be built to a standard of at least SEER 14.5, HSPF 8.2; HERS Rating of 79 and below

Annual kWh Saved:	2,568
Winter Demand Savings:	2.48
Summer Demand Savings:	0.66
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.98

Measure: Touchstone Energy Home

Performance Level #1 – Encourages new homes to be built to a standard of at least SEER 14.5, HSPF 8.2; HERS rating of 80-85

Annual kWh Saved:	1,758
Winter Demand Savings:	1.7
Summer Demand Savings:	0.45
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	2.06

Measure: CFLs [2]

Annual kWh Saved:	21
Winter Demand Savings:	0.0035
Summer Demand Savings:	0.0021
Lifetime of Savings:	8 years
Installation Rate:	70%
TRC:	2.62

Measure: LEDs

Annual kWh Saved:	24
Winter Demand Savings:	0.0040
Summer Demand Savings:	0.0024
Lifetime of Savings:	8 years
Installation Rate:	80%
TRC:	2.13

Measure: Commercial Advanced Lighting

Unit is 1 kW connected load savings

Annual kWh Saved:	4,252
Winter Demand Savings:	0.45
Summer Demand Savings:	0.85
Lifetime of Savings:	10 years
Installation Rate:	100%
TRC:	2.22

Measure: Industrial Compressed Air

Annual kWh Saved:	3,800
Winter Demand Savings:	0.30
Summer Demand Savings:	0.75
Lifetime of Savings:	7 years
Installation Rate:	0
TRC:	1.62

Measure: Water Heater >40 gals

Annual kWh Saved:	10
Winter Demand Savings:	0.52
Summer Demand Savings:	0.37
Lifetime of Savings:	20 years
Installation Rate:	100%

Measure: Central Air Conditioning

Annual kWh Saved:	5
Winter Demand Savings:	0.0
Summer Demand Savings:	1.0
Lifetime of Savings:	20 years
Installation Rate:	100%

TRC for Load Control Program	2.68

1 Savings numbers are "ex ante" or as planned gross savings except where noted.
2 Reported savings for CFLs are adjusted by the install rate of 70%.
3 Total Resource Cost (TRC) is an overall program benefits/costs analysts ratio.

Measure: ENERGY STAR® Appliances

TRC:	1.49 in aggregate

Measure: ENERGY STAR® Heat Pump

Annual kWh Saved:	804
Winter Demand Savings:	0.00
Summer Demand Savings:	0.30
Lifetime of Savings:	20 years
Installation Rate:	100%

Measure: ENERGY STAR® Central Air

Annual kWh Saved:	529
Winter Demand Savings:	0.00
Summer Demand Savings:	0.52
Lifetime of Savings:	15 years
Installation Rate:	100%

Measure: ENERGY STAR® Clothes Washer

Annual kWh Saved:	350
Winter Demand Savings:	0.07
Summer Demand Savings:	0.03
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Dish Washer

Annual kWh Saved:	79
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	10 years
Installation Rate:	100%

Measure: ENERGY STAR® Freezer

Annual kWh Saved:	67
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Refrigerator

Annual kWh Saved:	100
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Heat Pump Water Heater

Annual kWh Saved:	2,200
Winter Demand Savings:	0.51
Summer Demand Savings:	0.20
Lifetime of Savings:	13 years
Installation Rate:	100%

Measure: Appliance Recycling

Annual kWh Saved:	696
Winter Demand Savings:	0.07
Summer Demand Savings:	0.10
Lifetime of Savings:	7 years
Installation Rate:	100%
TRC:	2.01

Measure: CARES

Annual kWh Saved:	4,731
Winter Demand Savings:	1.44
Summer Demand Savings:	0.72
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	1.34

Measure: ENERGY STAR® Manufactured Home

Annual kWh Saved:	11,947
Winter Demand Savings:	2.88
Summer Demand Savings:	0.51
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	4.09

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DSM

Demand Side Management
2016 Annual Report

EAST KENTUCKY POWER COOPERATIVE

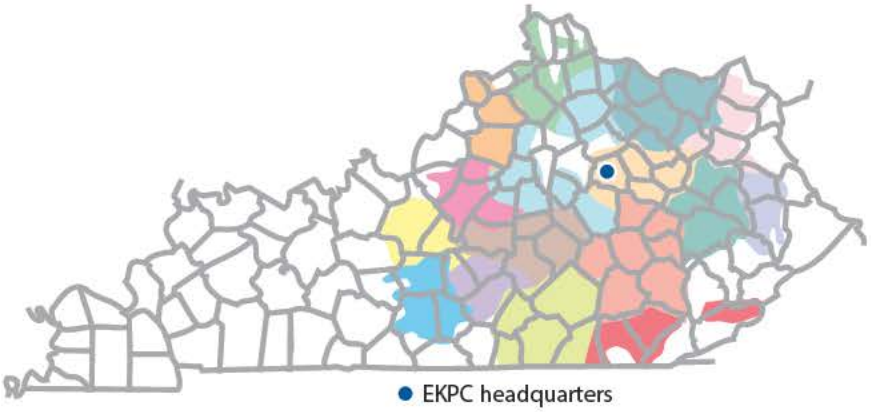
A Touchstone Energy Cooperative

Table of Contents

Who We Are

Located in the heart of the Bluegrass state, East Kentucky Power Cooperative is a not-for-profit generation and transmission (G&T) electric utility with headquarters in Winchester, Ky. Our cooperative has a vital mission: to safely generate and deliver affordable, reliable electric power to 16 owner-member cooperatives serving more than one million Kentuckians.

Together, with our 16 owner-members, we're known as Kentucky's Touchstone Energy Cooperatives. The member co-ops distribute energy to over 530,000 Kentucky homes, farms, businesses and industries across 87 counties. We're leaders in energy efficiency and environmental stewardship. And we're committed to providing power to improve the lives of people in Kentucky.



Sixteen distribution cooperatives, which are called the member systems, own EKPC. The 16 co-ops include:

- Big Sandy RECC
- Blue Grass Energy Cooperative
- Clark Energy Cooperative
- Cumberland Valley Electric
- Farmers RECC
- Fleming-Mason Energy Cooperative
- Grayson RECC
- Inter-County Energy
- Jackson Energy Cooperative
- Licking Valley RECC
- Nolin RECC
- Owen Electric Cooperative
- Salt River Electric Cooperative
- Shelby Energy Cooperative
- South Kentucky RECC
- Taylor County RECC

East Kentucky Power Generation

Coal	Generation
Spurlock	1,346 new MW
Cooper	341 net
MW	
Total	**1,687 net MW**

Hydro	Generation
Southeastern Power Adm. (SEPA)	170 MW

Natural Gas	Generation
Smith Combustion Turbine Units	Summer 753 net MW Winter 989 net MW
Bluegrass** Combustion Turbine Units	Summer 501 net MW Winter 567 net MW
Total Natural Gas Summer	**1,254 net MW**
Total Natural Gas Winter	**1,556 net MW**

Landfill	Generation
Bavarian	4.6 net MW
Laurel Ridge	3.0 net MW
Green Valley	2.3 net MW
Pearl Hollow	2.3 net MW
Pendleton	3.0 net MW
Glasgow***	0.8 net MW
Total Landfill	**16.0 net MW**

** Under an existing agreement, which continues until April 2019, a third party receives the output of one Bluegrass Generating Station unit.
*** Under an existing agreement, a third party receives the output of Glasgow in a 10-year power purchase agreement.

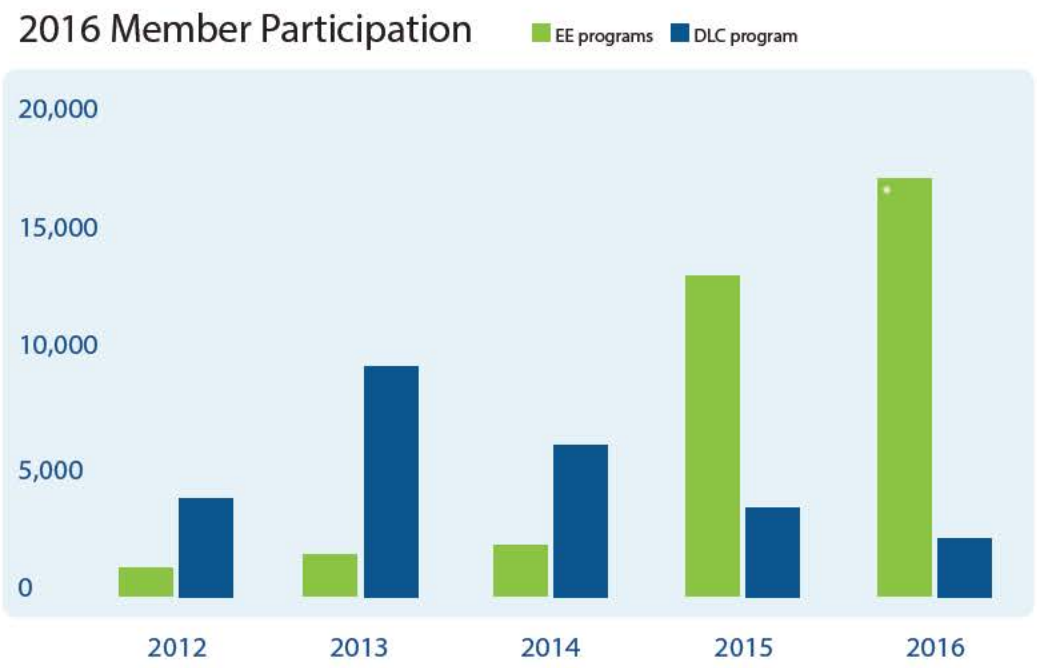
Reaching new heights in savings

For more than 30 years, EKPC and its 16 owner-member cooperatives have been leaders in developing demand-side management (DSM) programs for Kentuckians. Over the past three years, the cooperatives doubled the number of energy-efficiency programs for members. Through the growing portfolio and active marketing efforts, the energy savings in 2016 was the largest in that 30-year history.

The cooperatives have steadily built a portfolio of programs that is practical and cost-effective for members. Each program is evaluated using-industry standard practices, and is shown to be a "win-win-win" situation. Successful programs are beneficial to the member at the end of the line by helping them save money and live more comfortably. The cooperative owner-member systems and EKPC find benefits by avoiding cost of new generation. By working together, energy-efficiency solutions can be more easily achieved.

"EKPC's approach to energy efficiency programs is very unique, and would make an excellent model for others across the country," said the National Rural Electric Cooperative Association's (NRECA) Program and Product Line Manager-Energy Utilization/Delivery/Energy Efficiency Brian Sloboda. "The collaboration between EKPC and its owner-member cooperatives to serve end-use members' needs is outstanding. They continue to stay up-to-date and engaged with industry trends in order to provide the best offerings to members."

Collectively, the system employs approximately 29 energy advisors, some of who have advanced certificates such as RESNET Accredited Energy Raters (HERS) and Building Performance Institute (BPI) Building Analysts. They play a vital role by conducting free in-home energy assessments, resulting in thousands of energy audits. These visits provide opportunities to direct cooperative members to the most appropriate programs to help reduce energy usage and make their monthly bill more manageable.



* Excludes CFLs and LEDs.

In 2016, the DSM and Renewable Energy Collaborative group, called the Collaborative 2.0, continued to meet. With more than eight meetings in 2016, the group, consisting of EKPC, its 16 owner-member distribution cooperatives, environmental advocacy organizations and other interested stakeholders worked towards increasing program participation.

> Since 2015, the DSM portfolio has achieved average annual energy reductions of nearly 194 million kilowatt (KW) hours (kWh), and average annual peak reductions of almost 107 megawatts (MW).

EKPC and its owner-members also partner with many other organizations to expand DSM efforts, including Mountain Association for Community Economic Development (MACED). In 2016, six of EKPC's owner-member cooperatives continued to offer an on-bill, energy-efficiency financing program called "How$martKY" available to members. MACED assists with home-energy evaluations and provides loan capital, while EKPC and its owner-member cooperatives provide quality rebates and program marketing materials.

Work also continued with Kentucky's affordable housing builders, including Frontier Housing, Peoples' Self Help Housing, Partnership Housing, Southern Tier Housing and local Habitat for Humanities to further low-income energy efficiency efforts. EKPC is also a member of the Midwest Energy Efficiency Alliance (MEEA), and one of its employees continues to serve on the organization's Board of Directors.

In 2016, participation and savings reached new heights. Overall, energy-efficiency program participation increased more than 3.4 percent over 2016. These measures will result in a lifetime savings of 459,391 MWh and 918,781,098 pounds of carbon dioxide emissions.


Touchstone Energy®
Cooperatives

Residential Lighting:

Providing more than 1 million CFLs & LEDs to members

Since 2003, EKPC and its owner-member cooperatives have provided more than one million compact fluorescent lights (CFL) and light-emitting diodes (LED) bulbs to members.

In 2016, cooperatives distributed more than 58,200 20-watt cool white CFLs that are expected to result in a lifetime savings of 9,778 MWh and 19,555,200 pounds of carbon dioxide emissions. This program provides CFLs at the annual meetings held by the distribution cooperatives each year. Each registered member in attendance typically receives a two-pack of CFLs that replace two incandescent light bulbs, targeting all residential end-consumers.

In 2016, cooperatives provided more than 7,878 LEDs to its members. Each member who participated in a free, online energy audit called BillingInsights™ received an LED. These LEDs that are expected to result in a lifetime savings of 1,513 MWh and 3,025,152 pounds of carbon dioxide emissions.

HVAC Duct Sealing:

Addressing the big usage issues

Since the 1990s, EKPC and its owner-member cooperatives have offered this program to reduce the energy loss through a home's HVAC duct system. This program provides incentives to members who seal ductwork through traditional mastic sealers. Duct loss measurement requires the use of a blower door test (before and after the duct sealing work is performed). Duct leakage per system must be reduced to below 10 percent of the fan's rated capacity. All joints in the duct system must be sealed with foil tape and mastic. This program is targeted to single-family homes using electric furnaces or electric heat pumps. All participating homes must have duct systems that are at least two years old to qualify for the incentive. The program is offered only to homes that have centrally-ducted heating systems in unconditioned areas.

In 2016, 186 HVAC Duct Sealing rebates were provided to members, resulting in a lifetime savings of 2,317 MWh and 4,633,632 pounds of carbon dioxide emissions.

Button-Up Weatherization:

Improving homes' energy efficiency

Since the early 1990s, EKPC and its owner-member cooperatives have offered this program to improve a home's energy efficiency, comfort, and reduce energy use. This program offers incentives to members who add insulation materials or use other weatherization techniques to reduce heat loss in the home. Any member who resides in a site-built or manufactured home that is at least two years old and uses electricity as their primary source of heat is eligible.

This program offers a whole-house approach with multiple levels.

Button-Up Weatherization with Air Sealing:
This version of the Button-Up encourages members to air seal the envelope of their home in addition to the regular Button-Up improvements. A blower door test is required to demonstrate the impact in kW demand reduction, and an added incentive is paid based on that reduction.

Advanced Weatherization Level 2:
Level 2 encourages homeowners to address all of their home's inefficiencies at one time. The resulting BTUh savings can be as much as 150 percent of Button- Up Level I. Achieving this level of savings results in a greater incentive.

Advanced Weatherization Level 3:
This version represents the highest level. Level 3 also encourages homeowners to address all of their home's inefficiencies at one time. The resulting BTUh savings can be as much as 200 percent of Button-Up Level I. Achieving this level of savings results in an even greater incentive.

Levels 2 and 3 of this program are targeted to members who currently heat their home with electricity, particularly homes with unfinished basements, homes that have partition walls separating a crawl space or garage, and Cape Cod style homes (1.5 stories).

In 2016, 1,136 Button-Up rebates were provided to members, resulting in a lifetime savings of 23,254 MWh and 46,506,877 pounds of carbon dioxide emissions. From 2015 to 2016, participation increased by 3.2 percent.

Touchstone Energy Home:

Building the home of your dreams

Since 2003, EKPC and its owner-member cooperatives have offered this program to increase energy efficiency in new-home construction. This program is designed to encourage new homes to be built to higher standards for thermal integrity and equipment efficiency, as well as to choose a geothermal or an air-source heat pump, rather than less efficient forms of heating and cooling. Homes built to Touchstone Energy Home standards typically use 30 percent less energy than the same home built to typical construction standards. Plans are submitted before the home is built, a pre-drywall inspection is made, and a blower door test is administered after the home is built to verify that the home meets the standard.

This program is targeted towards the residential new construction market and members who are constructing new site-built homes.

In 2016, 517 Touchstone Energy Home rebates were provided to members, resulting in a lifetime savings of 26,472 MWh and 52,944,240 pounds of carbon dioxide emissions. From 2015 to 2016, participation increased by 19 percent.

EKPC's owner-members have also used this program to partner with Kentucky's affordable housing builders. Relationships with these organizations have led to improved efficiency in affordable housing and lower monthly energy costs for recipients of these homes.

CARES

Community Assistance Resources for Energy Savings

The Community Assistance Resources for Energy Savings (CARES) program began in early 2015, and provides an incentive to enhance the weatherization and energy efficiency services provided to the end-use members by the Kentucky Community Action Agencies (CAA) network. EKPC and its owner-members provide an incentive to the CAA implementing the project on behalf of the end-use member.

This program is available to end-use members who qualify for weatherization and energy-efficiency services through their local CAA in all service territories of participating cooperatives. The maximum incentive possible per household is $2,000.

In 2016, 34 CARES incentive were provided, resulting in a lifetime savings of 2,413 MWh and 4,825,620 pounds of carbon dioxide emissions.

Heat Pump Retrofit:

Replacing resistance heat sources

For decades, EKPC and its owner-member cooperatives have offered this program to lower the cost of heating homes and increase comfort. This program provides incentives for members to replace their existing resistance heat source with a high-efficiency heat pump through three levels of rebates.

Level 1 offers a rebate for a 13 SEER/7.5 HSPF heat pump. Level 2 offers a rebate for a 14 SEER/8.0 HSPF heat pump. Level 3 offers a rebate for a 15 SEER/8.5 HSPF or higher heat pump. The existing heating system must be two years or older to qualify for incentives unless the heat pump is being installed in a new manufactured home. New manufactured homeowners who install a heat pump qualify based on the levels above.

The program is targeted to members who currently use a resistance heat source. Incentives are offered when the homeowner's primary source of heat is an electric resistance furnace, ceiling cable heat, or baseboard heat in both site-built and manufactured homes.

In 2016, 1,209 Heat Pump Retrofit rebates were provided to members, resulting in a lifetime savings of 187,432 MWh and 374,864,480 pounds of carbon dioxide emissions. From 2015 to 2016, participation increased by 47 percent.

Direct Load Control:

Making saving simple

Since 2008, EKPC and its owner-member cooperatives have offered this program to manage peak usage. This program offers incentives to members who enroll central air-conditioners and electric water heaters. Switches are installed and, during periods of high demand, the utility briefly cycles the appliance off in order to reduce system peaks and save on costs for peak power. Although EKPC's system typically peaks in winter, member's heating appliances are not interrupted to lower peak. Member comfort and safety are top priority.

This program is targeted to any member with central air-conditioning, heat pump or electric tank water heaters, 40 gallons or greater.

In 2016, 2,336 switches were installed, resulting in a reduction of 1.8 MW during the summer months and 0.45 MW in the winter.

Appliance Recycling

You call, we haul

The Appliance Recycling program began in 2014 in an effort to encourage members to recycle old, inefficient refrigerators and freezers. Members receive a $50 incentive for recycling refrigerators and/or freezers that meet qualifying conditions. The appliances must be in working condition, plugged in and running at scheduled pick-up, between 7.75 and 30 cubic feet, and empty and defrosted with water lines disconnected.

EKPC and its owner-member cooperatives partner with Appliance Recycling Centers of America, Inc. (ARCA) for proper recycling procedures that meet all federal and state requirements.

This program is available to all end-use members who qualify.

In 2016, 1,686 incentives were provided to members, resulting in a lifetime savings of 8,214 MWh and 16,428,384 pounds of carbon dioxide emissions.

ENERGY STAR Appliance Rebate:

Get paid to upgrade

The ENERGY STAR Appliance Rebate program began in 2014 in an effort to encourage members to purchase new, energy-efficient appliances. EKPC and its owner-member cooperatives provide the incentives to members who purchase and install the ENERGY STAR certified appliances listed in the table.

This program is available to all end-use members who qualify.

In 2016, 10,636 rebates were provided to members, resulting in a lifetime savings of 38,936 MWh and 77,871,992 pounds of carbon dioxide emissions. From 2015 to 2016, participation increased by 79 percent.

ENERGY STAR Appliances	Rebate
Refrigerator	$100
Freezer	$50
Dishwasher	$50
Clothes Washer	$75
Heat Pump Water Heater	$300
Heat Pump	$300
Central Air Conditioning	$300

ENERGY STAR Manufactured Home:

Get paid to upgrade

The ENERGY STAR Manufactured Home program began in 2014. An upstream program, EKPC works directly with the manufacturer to automatically upgrade the home to ENERGY STAR certified standards. EKPC utilizes a third-party administrator, Systems Building Research Alliance (SBRA), to verify information and ensure quality control.

Once the installation address is verified to be on a participating cooperative's service lines, the member will automatically receive the upgrade. An ENERGY STAR certified manufactured home is a home that has been designed, produced and installed by the home manufacturer to meet ENERGY STAR requirements for energy efficiency. These manufactured homes feature efficient heating and cooling equipment, high-efficiency water heaters, properly installed insulation, high-performance windows, tight construction and sealed ducts.

This program is available to all end-use members who qualify.

In 2016, 38 rebates were provided to members, resulting in a lifetime savings of 6,810 MWh and 13,619,580 pounds of carbon dioxide emissions.

Commercial Programs:

Commercial & Industrial Advanced Lighting

For several years, EKPC and its owner-member cooperatives have offered this program to improve lighting in commercial or industrial facilities. This program offers incentives to install high-efficiency lamps and ballasts, including, but not limited to, LED exit signs, T-5 fluorescent fixtures and advanced controls.

This program is targeted to any existing commercial or industrial facility in the service territory of a distribution cooperative. The facility and its lighting must have been in service for at least two years.

In 2016, 207 C&I Advanced Lighting rebates were provided to members, resulting in a lifetime savings of 146,653 MWh and 293,305,856 pounds of carbon dioxide emissions. From 2015 to 2016, participation increased by 59 percent.

Industrial Compressed-Air

For several years, EKPC and its owner-member cooperatives have offered this program to refund the cost of a leak-detection audit. This program is designed to reduce electricity consumption through detecting and repairing compressed-air leaks. Compressed-air production and distribution represents one of the primary electricity costs in many industrial plants. Both the supply side (compressors and conditioning equipment) and the demand side (distribution and end use) can be targeted to significantly improve energy efficiency.

This program is targeted to any existing commercial or industrial facility that uses electricity compressed air applications.

In 2016, one compressed air rebate was provided, resulting in a lifetime savings of 477 MWh and 953,595 pounds of carbon dioxide emissions.


ENERGYGUIDE
$32
270
$23

Impact Measures:

System summary of 2016 DSM program savings

DSM program totals for installed measures in 2016

All programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Lifetime energy savings (MWh)	Cost of demand saved ($/kW)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
All DSM Programs	85,924	34,320	7.223	6.039	$10,900,700*	459,391	$656	$0.021	918,781,098

Appliance Recycling

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Appliance Recycling	1,686	1,173	0.169	0.118	$369,637	7	8,214	$0.045	16,428,384

Button-Up Weatherization

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Button-Up level 1	1,129	1,475	0.347	1.141	$632,245	15	22,130	$0.029	44,259,130
Button-Up level 2	1	5	0.001	0.004	$2,085	15	76	$0.027	152,634
Button-Up level 3	6	70	0.016	0.054	$15,750	15	1,048	$0.015	2,095,113

CARES

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
CARES	34	161	0.024	0.049	$78,043	15	2,413	$0.032	4,825,620

* Includes $1,255,049 program administration and promotional expenses.

Commercial and Industrial

C&I programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Commercial Lighting	207	14,665	2.852	1.841	$1,712,888	10	146,653	$0.012	293,305,856
Compressed Air	1	68	0.013	0.005	$3,288	7	477	$0.007	953,595
Total	208	14,733	2.866	1.847	$1,716,176		147,130	$0.012	294,259,451

Direct Load Control

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Cost of Demand saved ($/KW)
DLC Air Conditioner	1,471	7	1.471	0.000	$740,139	$503
DLC Water Heater	865	9	0.320	0.450	$434,685	$1,358
DLC total	2,336	16	1.791	0.450	$1,174,824	$656

Energy Audits

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
In-home	161	103	0.032	0.023	$11,512	8	827	$0.014	1,653,600
Online	1,699	859	0.272	0.187	$121,488	5	4,296	$0.028	8,592,890

ENERGY STAR® Appliance Rebate

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
ES Heat Pump	1,180	949	0.354	0.000	$798,965	15	14,231	$0.056	28,461,600
ES Central Air Conditioner	330	175	0.172	0.033	$134,525	15	2,619	$0.051	5,237,100
ES Clother Washer	2,527	884	0.076	0.177	$329,825	12	10,613	$0.031	21,226,800
ES Dishwasher	2,927	231	0.029	0.029	$184,970	10	2,312	$0.080	4,624,660
ES Freezer	379	25	0.004	0.002	$22,655	12	305	$0.074	609,432
ES Heat Pump Water Heater	179	394	0.036	0.091	$97,675	13	5,119	$0.019	10,238,800
ES Refrigerator	3,114	311	0.016	0.031	$367,490	12	3,737	$0.098	7,473,600
ES Total	10,636	2,970	0.686	0.364	$1,936,105	—	38,936	$0.050	77,871,992

ENERGY STAR® Manufactured Home

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
ES Manufactured Home	38	454	0.019	0.109	$163,400	15	6,810	$0.024	13,619,580

Heat Pump Retrofit

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Heat Pump 13 SEER	38	273	0.006	0.000	$63,270	20	5,452	$0.012	10,904,480
Heat Pump 14 SEER	496	3,734	0.158	0.000	$964,720	20	74,680	$0.013	149,360,000
Heat Pump 15 SEER or higher	675	5,365	0.298	0.000	$1,496,154	20	107,300	$0.014	214,600,000

HVAC Duct Seal

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
HVAC Duct Sealing	186	193	0.056	0.180	$93,000	12	2,317	$0.040	4,633,632

Residential Lighting

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
CFLs	58,200	1,222	0.122	0.204	$52,380	8	9,778	$0.005	19,555,200
LED	7,878	189	0.019	0.032	$34,261	8	1,513	$0.023	3,025,152

Touchstone Energy Home

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2016 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
TSE Home Prescriptive	133	340	0.088	0.328	$185,440	20	6,796	$0.027	13,591,440
TSE Home HERS 79 or better	379	982	0.252	0.948	$534,400	20	19,641	$0.027	39,282,480
TSE Home HERS 80-85	5	2	0.000	0.002	$760	20	35	$0.022	70,320

2016 Basic Program Assumptions [1]

Measure: Button-Up Level 1

Annual kWh Saved:	2,205
Winter Demand Savings:	1.71
Summer Demand Savings:	0.52
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC: [3]	1.45

Measure: Button-Up Level 2

Annual kWh Saved:	4,567
Winter Demand Savings:	3.53
Summer Demand Savings:	1.07
Lifetime of Savings:	15 years
(Weighted mix of measures)	
Installation Rate:	100%
TRC:	1.52

Measure: Button-Up Level 3

Annual kWh Saved:	6,090
Winter Demand Savings:	4.71
Summer Demand Savings:	1.43
Lifetime of Savings:	15 years
(Weighted mix of measures)	
Installation Rate:	100%
TRC:	1.56

Measure: Button-Up w/Air Seal

Annual kWh Saved:	3,045
Winter Demand Savings:	2.35
Summer Demand Savings:	0.720
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	1.44

Measure: HVAC Maintenance Program

For a typical heat pump in typical residence to same home reduced by 12% savings

Annual kWh Saved:	1,354
Winter Demand Savings:	1.07
Summer Demand Savings:	0.40
Lifetime of Savings:	12 years
Installation Rate:	100%
TRC:	1.15

Measure: Heat Pump SEER 13

From Electric Furnace and Central Air to ENERGY STAR SEER 13, HSPF 7.5

Annual kWh Saved:	7,174
Winter Demand Savings:	0
Summer Demand Savings:	0 .15
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.52

Measure: Heat Pump SEER 14

From Electric Furnace and Central Air to ENERGY STAR SEER 14, HSPF 8.0

Annual kWh Saved:	7,533
Winter Demand Savings:	0
Summer Demand Savings:	0.32
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.32

Measure: Heat Pump SEER 15

From Electric Furnace and Central Air to ENERGY STAR SEER 15, HSPF 8.5

Annual kWh Saved:	7,978
Winter Demand Savings:	0
Summer Demand Savings:	0.45
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.08

Measure: Touchstone Energy Home

Prescriptive and Performance Level #2 – Encourages new homes to be built to a standard of at least SEER 14.5, HSPF 8.2; HERS Rating of 79 and below

Annual kWh Saved:	2,568
Winter Demand Savings:	2.48
Summer Demand Savings:	0.66
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.98

Measure: Touchstone Energy Home

Performance Level #1 – Encourages new homes to be built to a standard of at least SEER 14.5, HSPF 8.2; HERS rating of 80-85

Annual kWh Saved:	1,758
Winter Demand Savings:	1.7
Summer Demand Savings:	0.45
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	2.06

Measure: CFLs [2]

Annual kWh Saved:	21
Winter Demand Savings:	0.0035
Summer Demand Savings:	0.0021
Lifetime of Savings:	8 years
Installation Rate:	70%
TRC:	2.62

Measure: LEDs

Annual kWh Saved:	24
Winter Demand Savings:	0.0040
Summer Demand Savings:	0.0024
Lifetime of Savings:	8 years
Installation Rate:	80%
TRC:	2.13

Measure: Commercial Advanced Lighting

Unit is 1 kW connected load savings

Annual kWh Saved:	4,252
Winter Demand Savings:	0.45
Summer Demand Savings:	0.85
Lifetime of Savings:	10 years
Installation Rate:	100%
TRC:	2.22

Measure: Industrial Compressed Air

Annual kWh Saved:	3,800
Winter Demand Savings:	0.30
Summer Demand Savings:	0.75
Lifetime of Savings:	7 years
Installation Rate:	0
TRC:	1.62

Measure: Water Heater >40 gals

Annual kWh Saved:	10
Winter Demand Savings:	0.52
Summer Demand Savings:	0.37
Lifetime of Savings:	20 years
Installation Rate:	100%

Measure: Central Air Conditioning

Annual kWh Saved:	5
Winter Demand Savings:	0.0
Summer Demand Savings:	1.0
Lifetime of Savings:	20 years
Installation Rate:	100%

TRC for Load Control Program	2.68

Measure: ENERGY STAR® Appliances

TRC:	1.49 in aggregate

Measure: ENERGY STAR® Heat Pump

Annual kWh Saved:	804
Winter Demand Savings:	0.00
Summer Demand Savings:	0.30
Lifetime of Savings:	20 years
Installation Rate:	100%

Measure: ENERGY STAR® Central Air

Annual kWh Saved:	529
Winter Demand Savings:	0.00
Summer Demand Savings:	0.52
Lifetime of Savings:	15 years
Installation Rate:	100%

Measure: ENERGY STAR® Clothes Washer

Annual kWh Saved:	350
Winter Demand Savings:	0.07
Summer Demand Savings:	0.03
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Dish Washer

Annual kWh Saved:	79
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	10 years
Installation Rate:	100%

Measure: ENERGY STAR® Freezer

Annual kWh Saved:	67
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Refrigerator

Annual kWh Saved:	100
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Heat Pump Water Heater

Annual kWh Saved:	2,200
Winter Demand Savings:	0.51
Summer Demand Savings:	0.20
Lifetime of Savings:	13 years
Installation Rate:	100%

Measure: Appliance Recycling

Annual kWh Saved:	696
Winter Demand Savings:	0.07
Summer Demand Savings:	0.10
Lifetime of Savings:	7 years
Installation Rate:	100%
TRC:	2.01

Measure: CARES

Annual kWh Saved:	4,731
Winter Demand Savings:	1.44
Summer Demand Savings:	0.72
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	1.34

Measure: ENERGY STAR® Manufactured Home

Annual kWh Saved:	11,947
Winter Demand Savings:	2.88
Summer Demand Savings:	0.51
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	4.09

1 Savings numbers are "ex ante" or as planned gross savings except where noted.
2 Reported savings for CFLs are adjusted by the install rate of 70%.
3 Total Resource Cost (TRC) is an overall program benefits/costs analysts ratio.

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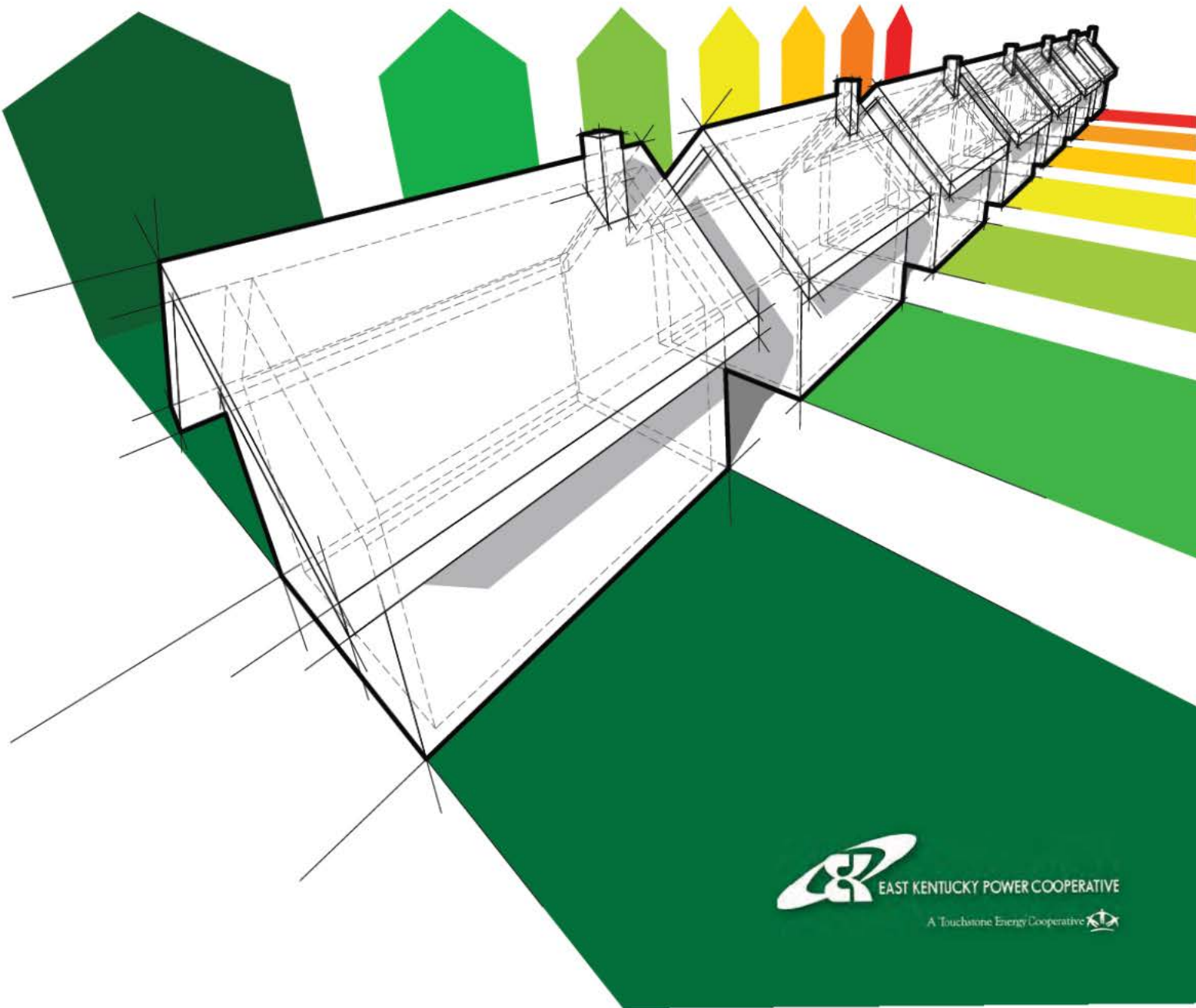
DSM

Demand Side Management
2017 Annual Report



EAST KENTUCKY POWER COOPERATIVE

A Touchstone Energy Cooperative

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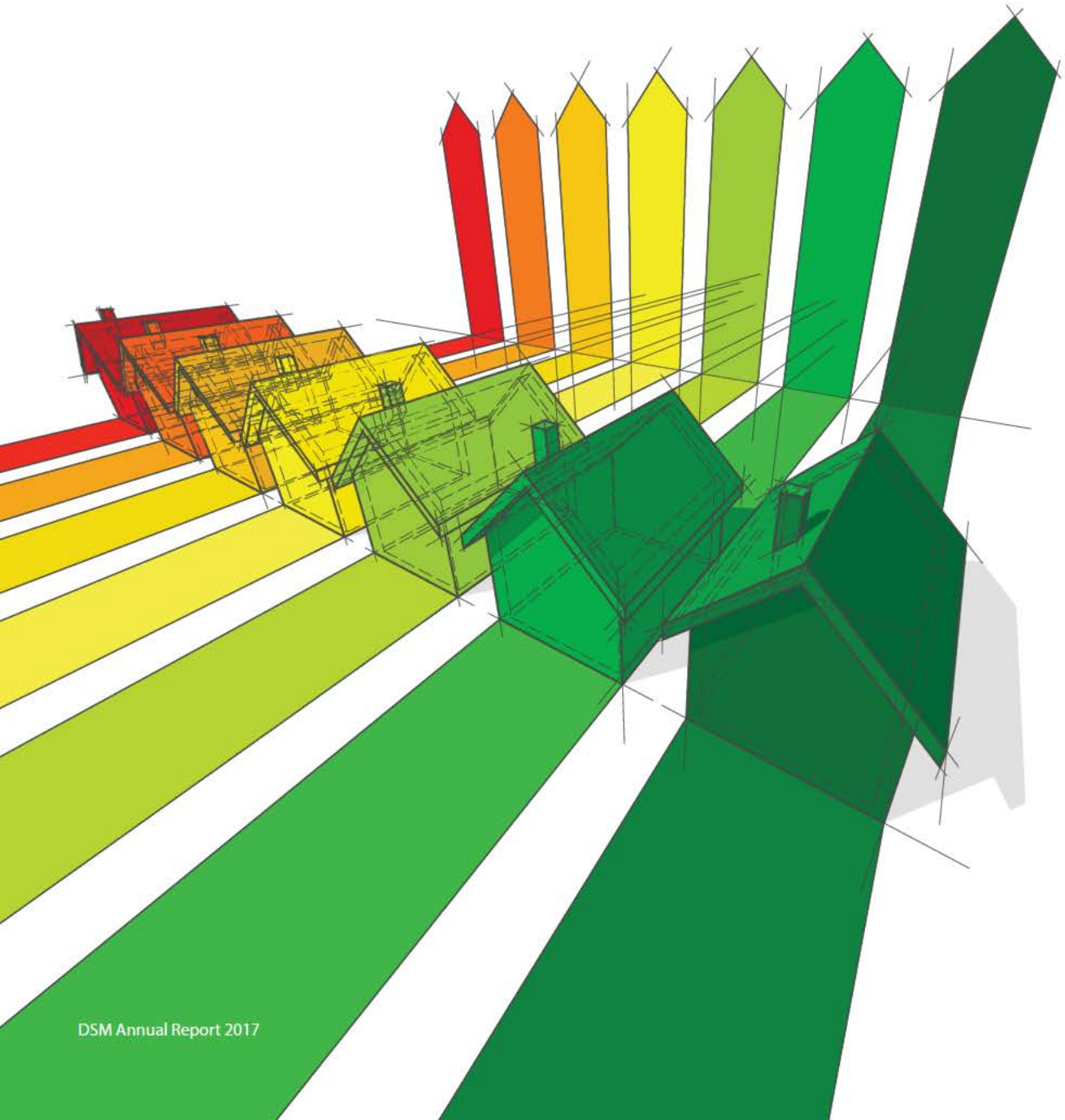
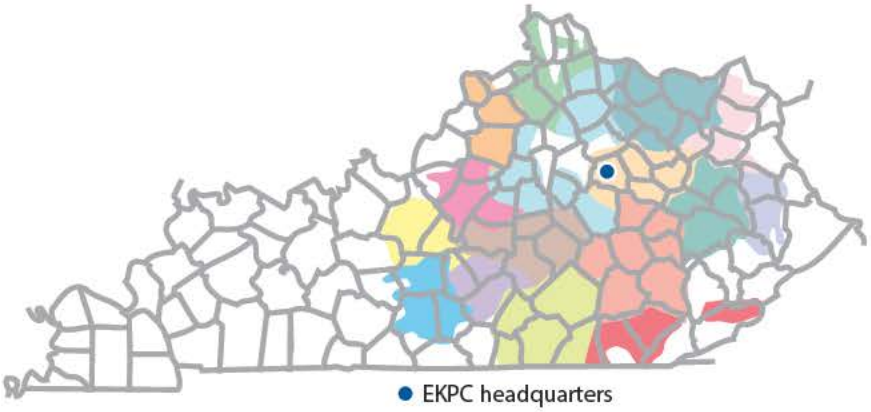


Who We Are

Located in the heart of the Bluegrass state, East Kentucky Power Cooperative is a not-for-profit generation and transmission (G&T) electric utility with headquarters in Winchester, Ky. Our cooperative has a vital mission: to safely generate and deliver affordable, reliable electric power to 16 owner-member cooperatives serving more than one million Kentuckians.

Together, with our 16 owner-members, we're known as Kentucky's Touchstone Energy Cooperatives. The member co-ops distribute energy to over 530,000 Kentucky homes, farms, businesses and industries across 87 counties. We're leaders in energy efficiency and environmental stewardship. And we're committed to providing power to improve the lives of people in Kentucky.



Sixteen distribution cooperatives, which are called the member systems, own EKPC. The 16 co-ops include:

- Big Sandy RECC
- Blue Grass Energy Cooperative
- Clark Energy Cooperative
- Cumberland Valley Electric
- Farmers RECC
- Fleming-Mason Energy Cooperative
- Grayson RECC
- Inter-County Energy
- Jackson Energy Cooperative
- Licking Valley RECC
- Nolin RECC
- Owen Electric Cooperative
- Salt River Electric Cooperative
- Shelby Energy Cooperative
- South Kentucky RECC
- Taylor County RECC

East Kentucky Power Generation

Coal	Generation
Spurlock	1,346 new MW
Cooper	341 net
MW	
Total	**1,687 net MW**

Hydro	Generation
Southeastern Power Adm. (SEPA)	170 MW

Natural Gas	Generation
Smith Combustion Turbine Units	Summer 753 net MW Winter 989 net MW
Bluegrass** Combustion Turbine Units	Summer 501 net MW Winter 567 net MW
Total Natural Gas Summer	**1,254 net MW**
Total Natural Gas Winter	**1,556 net MW**

Landfill	Generation
Bavarian	4.6 net MW
Laurel Ridge	3.0 net MW
Green Valley	2.3 net MW
Pearl Hollow	2.3 net MW
Pendleton	3.0 net MW
Glasgow***	0.8 net MW
Total Landfill	**16.0 net MW**

** Under an existing agreement, which continues until April 2019, a third party receives the output of one Bluegrass Generating Station unit.
*** Under an existing agreement, a third party receives the output of Glasgow in a 10-year power purchase agreement.

Residential Lighting:

Since 2003, EKPC and its owner-member cooperatives have provided more than one million compact fluorescent lights (CFL) and light-emitting diodes (LED) bulbs to members.

In 2017, cooperatives distributed more than 14,950 20-watt cool white CFLs that are expected to result in a lifetime savings of 2,870 MWh and 5,740,800 pounds of carbon dioxide emissions. This program provides CFLs at the annual meetings held by the distribution cooperatives each year.

In 2017, cooperatives provided more than 22,352 LEDs to its members. Each member who participated in a free, online energy audit called BillingInsights™ received an LED. These LEDs are expected to result in a lifetime savings of 6,330 MWh and 12,660,096 pounds of carbon dioxide emissions.

HVAC Duct Sealing:

Since the 1990s, EKPC and its owner-member cooperatives have offered this program to reduce the energy loss through a home's HVAC duct system. This program provides incentives to members who seal ductwork through traditional mastic sealers. Duct loss measurement requires the use of a blower door test (before and after the duct sealing work is performed). Duct leakage per system must be reduced to below 10 percent of the fan's rated capacity. All joints in the duct system must be sealed with foil tape and mastic. This program is targeted to single-family homes using electric furnaces or electric heat pumps. All participating homes must have duct systems that are at least two years old to qualify for the incentive. The program is offered only to homes that have centrally-ducted heating systems in unconditioned areas.

In 2017, 61 HVAC Duct Sealing rebates were provided to members, resulting in a lifetime savings of 922 MWh and 1,843,488 pounds of carbon dioxide emissions.

Button-Up Weatherization:

Since the early 1990s, EKPC and its owner-member cooperatives have offered this program to improve a home's energy efficiency, comfort, and reduce energy use. This program offers incentives to members who add insulation materials or use other weatherization techniques to reduce heat loss in the home. Any member who resides in a site-built or manufactured home that is at least two years old and uses electricity as their primary source of heat is eligible.

This program offers a whole-house approach with multiple levels.

Button-Up Weatherization with Air Sealing:
This version of the Button-Up encourages members to air seal the envelope of their home in addition to the regular Button-Up improvements. A blower door test is required to demonstrate the impact in kW demand reduction, and an added incentive is paid based on that reduction.

Advanced Weatherization Level 2:
Level 2 encourages homeowners to address all of their home's inefficiencies at one time. The resulting BTUh savings can be as much as 150 percent of Button- Up Level I. Achieving this level of savings results in a greater incentive.

Advanced Weatherization Level 3:
This version represents the highest level. Level 3 also encourages homeowners to address all of their home's inefficiencies at one time. The resulting BTUh savings can be as much as 200 percent of Button-Up Level I. Achieving this level of savings results in an even greater incentive.

Levels 2 and 3 of this program are targeted to members who currently heat their home with electricity, particularly homes with unfinished basements, homes that have partition walls separating a crawl space or garage, and Cape Cod style homes (1.5 stories).

In 2017, 786 Button-Up rebates were provided to members, resulting in a lifetime savings of 18,118 MWh and 36,236,189 pounds of carbon dioxide emissions.

Touchstone Energy Home:

Since 2003, EKPC and its owner-member cooperatives have offered this program to increase energy efficiency in new-home construction. This program is designed to encourage new homes to be built to higher standards for thermal integrity and equipment efficiency, as well as to choose a geothermal or an air-source heat pump, rather than less efficient forms of heating and cooling. Homes built to Touchstone Energy Home standards typically use 30 percent less energy than the same home built to typical construction standards. Plans are submitted before the home is built, a pre-drywall inspection is made, and a blower door test is administered after the home is built to verify that the home meets the standard.

This program is targeted towards the residential new construction market and members who are constructing new site-built homes.

In 2017, 538 Touchstone Energy Home rebates were provided to members, resulting in a lifetime savings of 27,615 MWh and 55,230,960 pounds of carbon dioxide emissions.

EKPC's owner-members have also used this program to partner with Kentucky's affordable housing builders. Relationships with these organizations have led to improved efficiency in affordable housing and lower monthly energy costs for recipients of these homes.

CARES:

The Community Assistance Resources for Energy Savings (CARES) program began in early 2015, and provides an incentive to enhance the weatherization and energy efficiency services provided to the end-use members by the Kentucky Community Action Agencies (CAA) network. EKPC and its owner-members provide an incentive to the CAA implementing the project on behalf of the end-use member.

This program is available to end-use members who qualify for weatherization and energy-efficiency services through their local CAA in all service territories of participating cooperatives. The maximum incentive possible per household is $2,000.

In 2017, 64 CARES incentives were provided, resulting in a lifetime savings of 4,542 MWh and 9,083,520 pounds of carbon dioxide emissions.

Heat Pump Retrofit:

For decades, EKPC and its owner-member cooperatives have offered this program to lower the cost of heating homes and increase comfort. This program provides incentives for members to replace their existing resistance heat source with a high-efficiency heat pump through three levels of rebates.

Level 1 offers a rebate for a 13 SEER/7.5 HSPF heat pump. Level 2 offers a rebate for a 14 SEER/8.0 HSPF heat pump. Level 3 offers a rebate for a 15 SEER/8.5 HSPF or higher heat pump. The existing heating system must be two years or older to qualify for incentives unless the heat pump is being installed in a new manufactured home. New manufactured homeowners who install a heat pump qualify based on the levels above.

The program is targeted to members who currently use a resistance heat source. Incentives are offered when the homeowner's primary source of heat is an electric resistance furnace, ceiling cable heat, or baseboard heat in both site-built and manufactured homes.

In 2017, 986 Heat Pump Retrofit rebates were provided to members, resulting in a lifetime savings of 180,722 MWh and 361,444,120 pounds of carbon dioxide emissions.

Direct Load Control:

Since 2008, EKPC and its owner-member cooperatives have offered this program to manage peak usage. This program offers incentives to members who enroll central air-conditioners and electric water heaters. Switches are installed and, during periods of high demand, the utility briefly cycles the appliance off in order to reduce system peaks and save on costs for peak power. Although EKPC's system typically peaks in winter, member's heating appliances are not interrupted to lower peak. Member comfort and safety are top priority.

This program is targeted to any member with central air-conditioning, heat pump or electric tank water heaters, 40 gallons or greater.

In 2017, 715 switches were installed, resulting in a reduction of 0.563 MW during the summer months and 0.126 MW in the winter.

Appliance Recycling:

The Appliance Recycling program began in 2014 in an effort to encourage members to recycle old, inefficient refrigerators and freezers. Members receive a $50 incentive for recycling refrigerators and/or freezers that meet qualifying conditions. The appliances must be in working condition, plugged in and running at scheduled pick-up, between 7.75 and 30 cubic feet, and empty and defrosted with water lines disconnected.

EKPC and its owner-member cooperatives partner with Appliance Recycling Centers of America, Inc. (ARCA) for proper recycling procedures that meet all federal and state requirements.

This program is available to all end-use members who qualify.

In 2017, 1,506 incentives were provided to members, resulting in a lifetime savings of 8,229 MWh and 16,457,616 pounds of carbon dioxide emissions.

ENERGY STAR Appliance Rebate:

The ENERGY STAR Appliance Rebate program began in 2014 in an effort to encourage members to purchase new, energy-efficient appliances. EKPC and its owner-member cooperatives provide the incentives to members who purchase and install the ENERGY STAR certified appliances listed in the table.

This program is available to all end-use members who qualify.

In 2017, 11,962 rebates were provided to members, resulting in a lifetime savings of 44,145 MWh and 88,290,728 pounds of carbon dioxide emissions.

ENERGY STAR Appliances	Rebate
Refrigerator	$100
Freezer	$50
Dishwasher	$50
Clothes Washer	$75
Heat Pump Water Heater	$300
Heat Pump	$300
Central Air Conditioning	$300

ENERGY STAR Manufactured Home:

The ENERGY STAR Manufactured Home program began in 2014. An upstream program, EKPC works directly with the manufacturer to automatically upgrade the home to ENERGY STAR certified standards. EKPC utilizes a third-party administrator, Systems Building Research Alliance (SBRA), to verify information and ensure quality control.

Once the installation address is verified to be on a participating cooperative's service lines, the member will automatically receive the upgrade. An ENERGY STAR certified manufactured home is a home that has been designed, produced and installed by the home manufacturer to meet ENERGY STAR requirements for energy efficiency. These manufactured homes feature efficient heating and cooling equipment, high-efficiency water heaters, properly installed insulation, high-performance windows, tight construction and sealed ducts.

This program is available to all end-use members who qualify.

In 2017, 21 rebates were provided to members, resulting in a lifetime savings of 3,763 MWh and 7,526,610 pounds of carbon dioxide emissions.

Commercial Programs:

Commercial & Industrial Advanced Lighting

For several years, EKPC and its owner-member cooperatives have offered this program to improve lighting in commercial or industrial facilities. This program offers incentives to install high-efficiency lamps and ballasts, including, but not limited to, LED exit signs, T-5 fluorescent fixtures and advanced controls.

This program is targeted to any existing commercial or industrial facility in the service territory of a distribution cooperative. The facility and its lighting must have been in service for at least two years.

In 2017, 240 C&I Advanced Lighting rebates were provided to members, resulting in a lifetime savings of 207,403 MWh and 414,806,387 pounds of carbon dioxide emissions.

Industrial Compressed-Air

For several years, EKPC and its owner-member cooperatives have offered this program to refund the cost of a leak-detection audit. This program is designed to reduce electricity consumption through detecting and repairing compressed-air leaks. Compressed-air production and distribution represents one of the primary electricity costs in many industrial plants. Both the supply side (compressors and conditioning equipment) and the demand side (distribution and end use) can be targeted to significantly improve energy efficiency.

This program is targeted to any existing commercial or industrial facility that uses electricity compressed air applications.

In 2017, three compressed air rebates were provided, resulting in a lifetime savings of 2,548 MWh and 5,095,241 pounds of carbon dioxide emissions.

Impact Measures:

System summary of 2017 DSM program savings

DSM program totals for installed measures in 2017

All programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Lifetime energy savings (MWh)	Cost of demand saved ($/kW)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
All DSM Programs	54,661	39,218	6.164	5.392	$10,549,337*	508,365	$1,129	$0.020	1,016,730,424

Appliance Recycling

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Appliance Recycling	1,506	1,176	0.169	0.118	$374,031	7	8,229	$0.045	16,457,616

Button-Up Weatherization

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Button-Up level 1	779	1,152	0.271	0.891	$503,836	15	17,274	$0.029	34,548,297
Button-Up level 2	0	0	0	0	0	0	0	0	0
Button-Up level 3	7	56	0.013	0.044	$18,375	15	844	$0.022	1,687,892

CARES

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
CARES	64	303	0.046	0.092	$140,646	15	4,542	$0.031	9,083,520

* Includes $1,351,443 program administration and promotional expenses.

Commercial and Industrial

C&I programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Commercial Lighting	240	20,740	3.240	2.121	$1,719,237	10	207,403	$0.008	414,806,387
Compressed Air	3	364	0.072	0.029	$18,113	7	2,548	$0.007	5,095,241
Total	243	21,104	3.312	2.150	$1,737,349		209,951	$0.008	419,901,627

Direct Load Control

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Cost of Demand saved ($/KW)
DLC Air Conditioner	473	2.365	0.473	0.000	$420,221	$888
DLC Water Heater	242	2.42	0.090	0.126	$214,996	$2,401
DLC total	715	4.785	0.563	0.126	$635,217	$1,129

Energy Audits

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
In-home	42	24	0.000	0.000	$11,711	8	192	$0.061	384,800
Online	435	193	0.000	0.000	$121,289	5	965	$0.126	1,929,870

ENERGY STAR® Appliance Rebate

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
ES Heat Pump	1,606	1,348	0.503	0.000	$1,001,145	15	20,213	$0.050	40,425,120
ES Central Air Conditioner	355	172	0.170	0.000	$131,750	15	2,587	$0.050	5,173,620
ES Clother Washer	2,686	862	0.074	0.172	$293,725	12	10,349	$0.028	20,697,600
ES Dishwasher	3,067	239	0.030	0.030	$185,925	10	2,388	$0.078	4,776,340
ES Freezer	466	27	0.004	0.002	$25,715	12	326	$0.079	652,848
ES Heat Pump Water Heater	217	328	0.030	0.076	$76,215	13	4,261	$0.018	8,522,800
ES Refrigerator	3,565	335	0.017	0.034	$561,100	12	4,021	$0.140	8,042,400
ES Total	11,962	3,311	0.827	0.315	$2,275,575	—	44,145	$0.052	88,290,728

ENERGY STAR® Manufactured Home

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
ES Manufactured Home	21	251	0.011	0.060	$90,300	15	3,763	$0.024	7,526,610

Heat Pump Retrofit

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Heat Pump	986	9,036	0.0460	0.000	$2,457,327	20	180,722	$0.014	361,444,120

HVAC Duct Seal

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
HVAC Duct Sealing	61	77	0.022	0.072	$37,000	12	922	$0.040	1,843,488

Residential Lighting

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
CFLs	14,950	359	0.036	0.060	$13,455	8	2,870	$0.005	5,740,800
LEDs	22,352	791	0.079	0.132	$29,222	8	6,330	$0.005	12,660,096

Touchstone Energy Home

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2017 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
TSE Home Prescriptive	229	588	0.151	0.568	$320,600	20	11,761	$0.027	23,522,880
TSE Home Performance	309	793	0.204	0.766	$431,960	20	15,854	$0.027	31,708,880

2017 Basic Program Assumptions [1]

Measure: Button-Up Level 1

Annual kWh Saved:	2,205
Winter Demand Savings:	1.71
Summer Demand Savings:	0.52
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC: [3]	1.45

Measure: Button-Up Level 2

Annual kWh Saved:	4,567
Winter Demand Savings:	3.53
Summer Demand Savings:	1.07
Lifetime of Savings:	15 years
(Weighted mix of measures)	
Installation Rate:	100%
TRC:	1.52

Measure: Button-Up Level 3

Annual kWh Saved:	6,090
Winter Demand Savings:	4.71
Summer Demand Savings:	1.43
Lifetime of Savings:	15 years
(Weighted mix of measures)	
Installation Rate:	100%
TRC:	1.56

Measure: Button-Up w/Air Seal

Annual kWh Saved:	3,045
Winter Demand Savings:	2.35
Summer Demand Savings:	0.720
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	1.44

Measure: HVAC Maintenance Program

For a typical heat pump in typical residence to same home reduced by 12% savings

Annual kWh Saved:	1,354
Winter Demand Savings:	1.07
Summer Demand Savings:	0.40
Lifetime of Savings:	12 years
Installation Rate:	100%
TRC:	1.15

Measure: Heat Pump SEER 13

From Electric Furnace and Central Air to ENERGY STAR SEER 13, HSPF 7.5

Annual kWh Saved:	7,174
Winter Demand Savings:	0
Summer Demand Savings:	0 .15
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.52

Measure: Heat Pump SEER 14

From Electric Furnace and Central Air to ENERGY STAR SEER 14, HSPF 8.0

Annual kWh Saved:	7,533
Winter Demand Savings:	0
Summer Demand Savings:	0.32
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.32

Measure: Heat Pump SEER 15

From Electric Furnace and Central Air to ENERGY STAR SEER 15, HSPF 8.5

Annual kWh Saved:	7,978
Winter Demand Savings:	0
Summer Demand Savings:	0.45
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.08

Measure: Touchstone Energy Home

Prescriptive and Performance Level #2 – Encourages new homes to be built to a standard of at least SEER 14.5, HSPF 8.2; HERS Rating of 79 and below

Annual kWh Saved:	2,568
Winter Demand Savings:	2.48
Summer Demand Savings:	0.66
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	1.98

Measure: Touchstone Energy Home

Performance Level #1 – Encourages new homes to be built to a standard of at least SEER 14.5, HSPF 8.2; HERS rating of 80-85

Annual kWh Saved:	1,758
Winter Demand Savings:	1.7
Summer Demand Savings:	0.45
Lifetime of Savings:	20 years
Installation Rate:	100%
TRC:	2.06

Measure: CFLs [2]

Annual kWh Saved:	21
Winter Demand Savings:	0.0035
Summer Demand Savings:	0.0021
Lifetime of Savings:	8 years
Installation Rate:	70%
TRC:	2.62

Measure: LEDs

Annual kWh Saved:	24
Winter Demand Savings:	0.0040
Summer Demand Savings:	0.0024
Lifetime of Savings:	8 years
Installation Rate:	80%
TRC:	2.13

Measure: Commercial Advanced Lighting

Unit is 1 kW connected load savings

Annual kWh Saved:	4,252
Winter Demand Savings:	0.45
Summer Demand Savings:	0.85
Lifetime of Savings:	10 years
Installation Rate:	100%
TRC:	2.22

Measure: Industrial Compressed Air

Annual kWh Saved:	3,800
Winter Demand Savings:	0.30
Summer Demand Savings:	0.75
Lifetime of Savings:	7 years
Installation Rate:	0
TRC:	1.62

Measure: Water Heater >40 gals

Annual kWh Saved:	10
Winter Demand Savings:	0.52
Summer Demand Savings:	0.37
Lifetime of Savings:	20 years
Installation Rate:	100%

Measure: Central Air Conditioning

Annual kWh Saved:	5
Winter Demand Savings:	0.0
Summer Demand Savings:	1.0
Lifetime of Savings:	20 years
Installation Rate:	100%

TRC for Load Control Program	2.68

Measure: ENERGY STAR® Appliances

TRC:	1.49 in aggregate

Measure: ENERGY STAR® Heat Pump

Annual kWh Saved:	804
Winter Demand Savings:	0.00
Summer Demand Savings:	0.30
Lifetime of Savings:	20 years
Installation Rate:	100%

Measure: ENERGY STAR® Central Air

Annual kWh Saved:	529
Winter Demand Savings:	0.00
Summer Demand Savings:	0.52
Lifetime of Savings:	15 years
Installation Rate:	100%

Measure: ENERGY STAR® Clothes Washer

Annual kWh Saved:	350
Winter Demand Savings:	0.07
Summer Demand Savings:	0.03
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Dish Washer

Annual kWh Saved:	79
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	10 years
Installation Rate:	100%

Measure: ENERGY STAR® Freezer

Annual kWh Saved:	67
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Refrigerator

Annual kWh Saved:	100
Winter Demand Savings:	0.01
Summer Demand Savings:	0.01
Lifetime of Savings:	12 years
Installation Rate:	100%

Measure: ENERGY STAR® Heat Pump Water Heater

Annual kWh Saved:	2,200
Winter Demand Savings:	0.51
Summer Demand Savings:	0.20
Lifetime of Savings:	13 years
Installation Rate:	100%

Measure: Appliance Recycling

Annual kWh Saved:	696
Winter Demand Savings:	0.07
Summer Demand Savings:	0.10
Lifetime of Savings:	7 years
Installation Rate:	100%
TRC:	2.01

Measure: CARES

Annual kWh Saved:	4,731
Winter Demand Savings:	1.44
Summer Demand Savings:	0.72
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	1.34

Measure: ENERGY STAR® Manufactured Home

Annual kWh Saved:	11,947
Winter Demand Savings:	2.88
Summer Demand Savings:	0.51
Lifetime of Savings:	15 years
Installation Rate:	100%
TRC:	4.09

1 Savings numbers are "ex ante" or as planned gross savings except where noted.
2 Reported savings for CFLs are adjusted by the install rate of 70%.
3 Total Resource Cost (TRC) is an overall program benefits/costs analysts ratio.

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Exhibit DSM-3

New Program Assumption Sheets

2019 IRP

Residential Energy Audit Program:
On-Line Track

15 years of participation Year 1 is 2019

Assumption	***Source***
Load Impacts Before Participant *14,136 kWh, 4.29 kW (coincident with winter peak), 3.06 kW (summer)* *Savings =* ***523*** *kWh* After Participant *13,613 kWh, 4.13 kW (coincident with winter system peak), 2.95 kW (summer)*	Typical residential customer Typical customer with 3.7 % savings applied. Source: Apogee 2012 evaluation report
Lifetime of savings	5 Years. Source: RI TRM
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $ 63 per audit. 2% escalation	Savings not tied to measures in eval, but typical measures include a set of O&M tasks, plus programmable thermostats, insulation, air sealing, and CFLs. Using same cost per kWh as the Home Performance with Energy Star program ($0.40 per 1st year kWh) for 30% of savings, no cost for 70% of savings, for blended cost of $0.12 per 1st year kWH)
Administrative Cost EK **$75,000** fixed annual **$0** per participant Co-op **$ 0** per new participant	based on 5 year workplan no administrative costs for the member cooperatives with the On-Line track
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation 2019: 400. 2020-2033: 750 per year. 0% free riders	Based on 5 year workplan. No free riders because impact evaluation results used are net savings
Rebates Co-op to Participant **$0** EK to Co-op **$0**	No financial incentive. Information and service offered free of charge. None. Member coops are providing this as a customer service.

For 2019 IRP

Residential Energy Audit Program:
In-Home track

15 years of participation Year 1 is 2019

Assumption	***Source***
Load Impacts Before Participant *14,136 kWh, 4.29 kW (coincident with winter peak), 3.06 kW (summer)* *Savings: **650** kWh* After Participant *13,486 kWh, 4.09 kW (coincident with winter system peak), 2.92 kW (summer)*	Typical residential customer Typical customer with 4.6% savings applied. Source: SCE 2002 evaluation report
Lifetime of savings	**8** Years. Source: RI TRM
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $ 78 per audit. **2**% escalation	Savings not tied to measures in eval, but typical measures include a set of O&M tasks, plus programmable thermostats, insulation, air sealing, and CFLs. Using same cost per kWh as the Home Performance with Energy Star program ($0.40 per 1st year kWh) for 30% of savings, no cost for 70% of savings, for blended cost of $0.12 per 1st year kWH)
Administrative Cost EK **$75,000** fixed annual **$0** per participant Co-op $0 per new participant	based on 5 year workplan. Based on 2016. Energy advisors use the audit on high-bill visits that they do anyway.
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation - **2019:100. 2020-2033: 200.** 0% free riders	Based on 5 year workplan. No free riders because impact evaluation results used are net savings
Rebates Co-op to Participant **$0** EK to Co-op **$0**	No financial incentive. Information and service offered free of charge. None. Member coops are providing this as a customer service.

DSM for 2019 IRP

updated participation

15 years of participation **Year 1 is 2019**

Button-Up Weatherization Program

The Button-Up Weatherization Program offers an incentive for reducing the heat loss of a home. Only **ceiling insulation and air sealing** based on GDS measure TRCs

Assumption	***Source***
Load Impacts Before Participant *10,500 kWh, 8.12 kW (coinc. with winter system peak), 2.47 kW (summer)* ***Savings: 3,987 kWh*** After Participant *6,513 kWh, 5.56 kW (winter peak), 1.82 (summer peak)*	Mix of Furnace/Central AC and air source heat pump weighted according to saturation in existing single family homes. 70% heat pump, 30% furnace/CAC. GDS savings for ceiling insulation and air sealing, weighted across heat pump and furnace/CAC
Lifetime of savings	**15** Years
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $2,107	GDS costs weighted across heat pump and furnace/CAC
Administrative Cost EK **$5,000** per year (2019-**2033**), 2% escalation Co-op **$316** per new participant	Program admin estimate of $4,300 provided by EKPC Marketing/Communications, October 2010 updated to 2018. Also includes $0 advertising budget. Labor costs are $116. (2 hours times $58 per hour). Plus $200 for pre and post blower door test.
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation - **2019: 222; 2020-2033: 67** 10% free riders	Based on DSM 5 year workplam. Free riders based on Frontier Assoc study for LG&E/KU
Rebates Co-op to Participant **$ 750** EK to Co-op **$ 1,545**	**Cap for program** **Full incentive according to the tariff. Reimburse for rebate, 50% of admin costs, plus compensation for net lost revenues.**

DSM for 2019 IRP
updated costs , partic, lost rev

15 years of participation Year 1 is 2019

Heat Pump Retrofit Program - SEER 14

This program encourages residential members to convert their primary heat source from electric resistance heat to an efficient air source heat pump

Assumption	***Source***
Load Impacts Before Participant *14,843 kWh, 8.12 kW (coinc. with winter system peak), 2.25 kW (summer)* *Savings:* ***7,533*** *kWh* After Participant *7,310 kWh, 8.12 kW (coinc. with winter system peak), 1.93 kW (summer)*	Electric Furnace and Central A.C. ENERGY STAR® efficiency new heat pump: SEER 14, HSPF 8.0
Lifetime of savings	**20** Years
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $2,648. 2% esc.	GDS cost for SEER 16, scaled back to SEER 14 using Indiana TRM, version 2.2
Administrative Cost EK **$5,000** fixed annual (2019-**2033**). 2% esc Co-op $177 per new participant. 2% esc.	Program admin based on 5 year workplan. No advertising Cost information provided by various coops in September 2011 survey of hours and rates.
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation - **2019-2033: 300. 0%** Free Riders	based on DSM 5 year workplan
Rebates Co-op to Participant **$ 500**, 2% esc EK to Co-op **$1,695,** 2% esc	**two tiers: SEER 14 is $500, SEER 15+ is $750. modeling SEER 14** **Planned transfer payment for 5 year marketing plan. Reimburse for rebate, 50% of admin costs, plus compensation for a share of net lost revenues.**

2019 IRP **updated costs , partic, lost rev** **15 years of participation Year 1 is 2019**	Heat Pump Retrofit Program - SEER 15 This program encourages residential members to convert their primary heat source from electric resistance heat to an efficient air source heat pump
Assumption	***Source***
Load Impacts Before Participant *14,843 kWh, 8.12 kW (coinc. with winter system peak), 2.25 kW (summer)* *Savings:* ***7,978*** *kWh* After Participant *6,865 kWh, 8.12 kW (coinc. with winter system peak), 1.80 kW (summer)*	Electric Furnace and Central A.C. ENERGY STAR® efficiency new heat pump: SEER 15, HSPF 8.0
Lifetime of savings	**20** Years
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $3,059. 2% esc.	GDS cost for SEER 16, scaled back to SEER 15 using Indiana TRM, version 2.2
Administrative Cost EK **$5,000** fixed annual (2019-**2033**). 2% esc	Program admin based on 5 year workplan. No advertising
Co-op $177 per new participant. 2% esc.	Cost information provided by various coops in September 2011 survey of hours and rates.
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation - **2019: 400; 2020-2033: 300. 0%** Free Riders	based on 5 year workplan
Rebates Co-op to Participant **$ 750 ,** 2% esc EK to Co-op **$1,991,** 2% esc	**two tiers: SEER 14 is $500, SEER 15+ is $750. modeling SEER 15** **Planned transfer payment for 5 year marketing plan. Reimburse for rebate, 50% of admin costs, plus compensation for a share of net lost revenues.**

DSM for 2019 IRP
updated savings, costs , lost rev

15 years of participation Year 1 is 2019

CARES Program (Low income)

EKPC provides an incentive to enhance the weatherization and energy efficiency services provided to its low income residential members by the Kentucky Community Action network of community action agencies (CAAs). Heat pump eligible homes receive a new SEER 14 heat pump as well as weatherization measures. Other homes receive only weatherization measures.

Assumption	***Source***
Load Impacts Before Participant *11,286 kWh, 8.81 kW (coincident with winter system peak), 3.45 kW (summer), 750 therms* *Savings:* ***4,731*** *kWh,* ***59*** *therms* After Participant ***6,555*** *kWh,* ***7.37*** *kW (coincident with winter system peak),* ***2.73*** *kW (summer),* ***691*** *therms*	HVAC loads for a typical heat pump in typical residence. Note: the program savings are based on a mix of homes with different primary heating systems: electric furnace, wood, heat pump, and other non-electric heat. Plus gas furnace. HVAC loads for a typical heat pump home reduced by **4,731** kWh. Savings estimate is a weighted average based on measure packages and baseline HVAC consumption of the different participation categories. Weighted gas savings of **59** therms.
Lifetime of savings	**15** years
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Avoided Gas Commodity Costs - **$3.02** per Mcf in 2018	DSMore scenario **2.** Based on Dominion fuel forecast for Henry Hub in 2017 IRP. TCO Appalachian TCO Pool Hub spot price has been close to Henry Hub. Currently trading at negative basis to Henry Hub.
Participant Costs $ 1,232	This is the Kentucky Housing share of measure costs, modeled to calculate a true TRC
Administrative Cost EK $20,000 fixed annual (2019-**2033**) 2% esc.	0.1 FTE for implementation admin, plus M&V
Co-op **$2,100** per new participant	This includes the rebate to the CAA (avg will be $2,000) but since it does not go to the consumer it is treated as a program cost. Plus coop admin cost ($100 per participant).
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968**	Current rates in effect as of August, 2017
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect as of August, 2017
Natural gas delivery rate is **$ 5.113** per Mcf in 2018 (**$0.511** per ccf for DSMore units)	Current rates as of August 2017. From Columbia Gas of KY GSR rate. Sum of base rate charge and gas cost demand. DSMore adds in the commodity portion using the market forecast.
Participation - **2019: 69; 2020-2033:75.** **0%** Free Riders	Based on DSM 5 year workplan
Rebates Co-op to Participant **$0**	Direct installation program - no participant out of pocket costs
EK to Co-op **$2,691**	100% reimbursement of program costs plus 5 years net lost revenue

2019 IRP	ENERGY STAR® Manufactured Home
15 years of participation Year 1 is 2019	All Electric manufactured home built to ENERGY STAR® standards with a SEER 14 ASHP
Assumption	***Source***
Load Impacts Before Participant *17,194 kWh, 9.58 kW (coincident with winter system peak), 3.06 kW (summer)*	Heating & cooling electricity loads for a standard efficiency manufactured home with an electric furnace
*Savings = **4,060** kWh* After Participant *13,134 kWh, 8.65 kW (coincident with winter system peak), 2.59 kW (summer)*	Heating & Cooling loads for a Manufactured home built to ENERGY STAR® standards with a SEER 14 ASHP . kWh and kW savings based on GDS assumptions as adjusted for Josh model run
Lifetime of savings	**15** Years - TVA assumption
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $ 1,150	Price premium for ENERGY STAR® Manufactured Home upgrades. $750 for heat pump and $400 for building shell upgrades.
Administrative Cost EK **$10,000** fixed annual, plus **$150** per home	Fixed annual allocated administrative costs ($3,000) plus M&V ($7,000).
Co-op **$50** per new participant	$50 for rebate processing and tracking
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation -2019:175. 2020-2033: 150. **0%** Free Riders projected because of nature of program	Based on 5 year workplan
Rebates Co-op to Participant **$1,150** per home	Incentive to owner-member who purchases the home.
EK to Co-op **$ 2,050**	Reimbursement for incentive, 100% of coop admin, plus 10 years estimated net lost revenue (adjusted for lower savings estimate).

2019 IRP

Heat Pump Retrofit program: Ductlesss Mini-Split

10 years of participation **Year 1 is 2024**

This program encourages residential members to convert their primary heat source from electric resistance heat to a ductless mini-split system

Assumption	***Source***
Load Impacts Before Participant *14,843 kWh, 8.12 kW (coinc. with winter system peak), 2.25 kW (summer)* *Savings:* ***9,060*** *kWh* After Participant *5,783 kWh, 8.12 kW (coinc. with winter system peak), 1.74 kW (summer)*	Electric Furnace and Central A.C. 3-head mini-split based on GDS savings %: SEER 16, HSPF 9.0
Lifetime of savings	**20** Years
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $4,768. 2% esc.	GDS measure cost for Ductless Mini-split measure
Administrative Cost EK **$5,000** fixed annual (**2024-2033**). 2% esc Co-op $177 per new participant. 2% esc.	Program admin based on estimates provided by EKPC Marketing/Communications, October 2010. No advertising Cost information provided by various coops in September 2011 survey of hours and rates.
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation - **2024-2033:93.** **0%** Free Riders	based on 5 year DSM workplan. 1,2, and 3-head participants combined , scaled to 3-head as weighted by kWh savings
Rebates Co-op to Participant **$ 750 ,** 2% esc EK to Co-op **$2,143,** 2% esc	**three tiers: 1-head is $250, 2-head is $500, 3-head is $750. modeling 3-head** **Planned transfer payment for 5 year marketing plan. Reimburse for rebate, 50% of admin costs, plus compensation for a share of net lost revenues.**

2019 IRP

Residential Efficient Lighting Program

To transform the residential lighting market by facilitating a shift in consumer purchasing decisions from market baseline efficiency to higher efficiency lighting products. Partnership with retailer.

15 years of participation Year 1 is 2019

Assumption	***Source***
Load Impacts Before Participant *392 kWh, 0.065 kW (coincident with winter system peak), 0.039 kW summer* *savings:* ***262*** *kWh (gross savings)* After Participant *130 kWh, 0.020 kW (coincident with winter system peak), 0.012 kW summer*	10 EISA compliant Halogen light bulbs, 43 watts each portfolio of 10 CFL and LED light bulbs providing equivalent lumens. These are gross savings (before free riders)
Lifetime of savings	**8** Years. 9,000 hour rated life, 20% attrition (removals)
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $ 30	Price premium to purchase the package of CFLs and LEDs versus Halogen light bulbs. Imputed based on the incentive cost being 50% of total participant cost
Administrative Cost EK $ **5,000** fixed annual (**2019-2033**) Co-op $0 per new participant	Based on 5 year workplan EKPC pays for all program costs
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation - **2019-2033**: **5500.** Unit is ten(10) light bulbs for ease of modeling. **20%** free riders	Based on 5 year workplan. Free rider estimate is from review of several studies. Free rider is defined as a program participant who would have installed the measure anyway even without the program.
Rebates Co-op to Participant **$9** EK to Co-op **$9**	Pass through to customer Rebate paid by EKPC

2019 IRP Direct Load Control Program-Residential Air Conditioners - **"Bring your own thermostat"**

15 years of participation **Year 1 is 2019** Reduce peak demand and energy usage through smart thermostat control

Assumption	***Source***
Load Impacts Air Conditioner savings ***5*** *kWh,* ***0.00 kW (****coincident with winter system peak),* ***0.95*** *kW (summer)*	Based on M&V data for the existing residential DLC program.Temperature of 98 degrees.
Lifetime of savings 15 Years.	Effective life given program history of the need for changeouts.
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $ 0	The participant will have already purchased and installed their own thermostat
Administrative Cost **EK $25k one time setup fee to each new vendor that joins the program, plus $10k one time integration costs per new vendor; plus $20 per thermostat per year as an annual maintenance fee to the vendor, plus $10k per year fixed annual EKPC admin. escalates at 2% per year.** Co-op $0 per new participant	Vendor costs are based on the NEST Pilot. Integration costs based on previous project. EKPC fixed annual administrative costs include program oversight, and M&V. The assumption is that one new vendor joins the program in 2018, three new vendors will join the program in 2019, followed by 1 addiitional new vendor in 2020.
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
New Participation - **2019: 250; 2020-2033: 500 new per year.**	based on 5 year workplan
Rebates Co-op to Participant: **annual incentive of $25 per thermostat, 2% escalation rate** EKPC to Co-op: **annual incentive of $25 per thermostat, 2% escalation rate**	Program as currently designed. Based on 2018 DSM Budget forecast. Program as currently designed. Based on 2018 DSM Budget forecast.

2019 IRP Direct Load Control program - Residential: **Air Conditioner switches**

15 years of participation Year 1 is 2019

Reduce peak demand and energy usage through the installation of load control devices on air conditioners .

Assumption	***Source***
Load Impacts Air Conditioner savings ***5*** *kWh,* ***0.00 kW (****coincident with winter system peak),* ***0.95*** *kW (summer)*	Based on M&V data for the program.Temperature of 98 degrees.
Lifetime of savings 15 Years.	Effective life given program history of the need for changeouts.
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $ 0	
Administrative Cost **EK $350 per new switch installed; plus $10k fixed annual admin.; plus $0 legacy rebate payments per year; escalates at 2% per year.** Co-op $0 per new participant	Includes(a) per switch costs: device costs, installation, transportation, scheduling, enrollment, recruitment, and servicing; and (b) fixed annual costs: general admin, M&V. No legacy rebates included because legacy savings are not included
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
New Participation - 2019: 250; 2020-2033: 500 new per year.	based on 5 year workplan
Rebates Co-op to Participant **$20 per switch per year. 2% escalation rate** EK to Co-op **$20 per switch per year. 2% escalation rate**	Program as filed Program as filed

2019 IRP	Touchstone Energy Home program
15 years of participation; Year 1 is 2019	Encourages new homes to be built to higher standards for thermal integrity and equipment efficiency and high efficient heat pump systems. Measures include air sealing and insulation equivalent to 2009 IECC standards, with specific focus on completing the Thermal Bypass Checklist. **HERS <=75 (30% savings)**
Assumption	***Source***
Load Impacts Before Participant *10,574 kWh, 8.69 kW (coincident with winter system peak), 2.35 kW (summer)*	Typical practice heat pump: SEER 13, HSPF 7.7, 1700 square foot home, built to 2006 IECC standards. Standard electric hot water heater (2007 update to kWh).
*Savings = **3,172** kWh* After Participant *7,402 kWh, 6.08 kW (coincident with winter system peak), 1.64 kW (summer)*	Efficient air source heat pump: SEER 14.5, HSPF 8.2 , 1700 square foot home, built to Touchstone Energy Home standards, with continuous insulation, R-38 in attic, air barrier, sealed duct work, and completed thermal bypass checklist. Efficient electric hot water heater. Savings come from GDS 2018 Potential study
Lifetime of savings	**20** Years
Generation Capacity Cost -PJM Market, 100% summer **$29.20** per kW-year in 2018	**PJM market forecast** in **BlueGrass transmission econ analysis** (1/2018). **Updated escalators to match.** 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market Medium **DSMore scenario 1 scaled to ACES forward prices**	based on Feb 13, 2018 ACES Forward prices for AEP_Dayton hub. DSMore **Scenario 1, 0.540 esc in 2018**
Participant Costs $1,522	Includes (1) costs associated with bringing standard built Kentucky home to enhanced Touchstone Energy standards (2009 IECC); (2) savings from equipment resizing (1/2 ton reduction); (3) incremental cost of an efficient water heater. KY tax credit no longer applied because of inability for builders to claim given legal structure (per Josh, Sept 2011). Costs come from GDS 2018 Potential study.
Administrative Cost EK $**5,000** fixed annual 2% esc	Includes direct program administration only. From 5 year workplan
Co-op **$ 430** per new participant	Costs of rating and inspection. Based on typical hours and labor rates
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg **$14.18,** Energy Rate **$.08968** **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect as of August, 2017 Current rates in effect as of August, 2017
Participation - **2019: 485. 2020-2033: 470. 5%** Free Riders	Based on 2019 budget . Free riders based on Frontier Assoc study for LG&E/KU
Rebates Co-op to Participant **$ 750** EK to Co-op **$ 1,450**	**recommended incentive according to tariff. Customer also receives free ENERGY STAR® rating ($500 value).** **Reimburse for rebate, 50% of admin costs, plus compensation for net lost revenues.**

Exhibit DSM-4

Summary Sheets for New DSM Projects

Residential Energy Audit Program:In-Home Audit, 2019 IRP, 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 645,891	Revenue Declines	($873,591)
Rebates From EK	$0	Administrative Costs	$0
		Rebates Paid To Consumers	$0
Total Benefits	$645,891	Total Costs	($873,591)

Benefit / Cost Ratio: 0.74

Participant Benefits		Participant Costs	
Electric Bill Declines	$531,900	Up Front Investment	($117,969)
Rebates From Distribution System	$ -		
Reductions in O&M costs	$0		
Total Benefits	$531,900	Total Costs	($117,969)

Benefit / Cost Ratio: 4.51

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$337,324	Up Front Customer Investment	($163,191)
Avoided Gen Capacity Costs	$166,742	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$32,775	EK Administrative Costs	($822,074)
Reduced Customer O&M costs	$0		
Total Benefits	$536,840	Total Costs	($985,265)

Benefit / Cost Ratio: 0.54

EK Benefits		EK Costs	
Avoided Energy Costs	$337,324	Decrease In Revenue	($645,891)
Avoided Gen Capacity Costs	$166,742	Rebates Paid	$0
Avoided Transmission Expense	$32,775	Administrative Costs	($822,074)
Total Benefits	$536,840	Total Costs	($1,467,965)

Benefit / Cost Ratio: 0.37

Societal Benefits		Societal Costs	
Avoided Energy Costs	$409,497	Up Front Customer Investment	($184,727)
Avoided Gen Capacity Costs	$205,887	Utility Admin Costs	($925,613)
Avoided Transmission Expense	$39,532		
Environmental Externalities	$0		
Total Benefits	$654,916	Total Costs	($1,110,340)

Benefit / Cost Ratio: 0.59

Combined RIM:			
Benefits:	$536,840	Costs:	($1,695,664)

Benefit / Cost Ratio: 0.32

Residential Energy Audit Program:On-Line. 2019 IRP, 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 1,303,784	Revenue Declines	($1,763,415)
Rebates From EK	$0	Administrative Costs	$0
		Rebates Paid To Consumers	$0
Total Benefits	$1,303,784	Total Costs	($1,763,415)
	Benefit / Cost Ratio: 0.74		

Participant Benefits		Participant Costs	
Electric Bill Declines	$1,152,935	Up Front Investment	($358,885)
Rebates From Distribution System	$ -		
Reductions in O&M costs	$0		
Total Benefits	$1,152,935	Total Costs	($358,885)
	Benefit / Cost Ratio: 3.21		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$665,948	Up Front Customer Investment	($495,856)
Avoided Gen Capacity Costs	$311,147	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$66,083	EK Administrative Costs	($822,074)
Reduced Customer O&M costs	$0		
Total Benefits	$1,043,178	Total Costs	($1,317,930)
	Benefit / Cost Ratio: 0.79		

EK Benefits		EK Costs	
Avoided Energy Costs	$665,948	Decrease In Revenue	($1,303,784)
Avoided Gen Capacity Costs	$311,147	Rebates Paid	$0
Avoided Transmission Expense	$66,083	Administrative Costs	($822,074)
Total Benefits	$1,043,178	Total Costs	($2,125,858)
	Benefit / Cost Ratio: 0.49		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$783,613	Up Front Customer Investment	($561,086)
Avoided Gen Capacity Costs	$375,022	Utility Admin Costs	($925,613)
Avoided Transmission Expense	$77,623		
Environmental Externalities	$0		
Total Benefits	$1,236,258	Total Costs	($1,486,699)
	Benefit / Cost Ratio: 0.83		

Combined RIM:			
Benefits:	$1,043,178	Costs:	($2,585,488)
	Benefit / Cost Ratio: 0.40		

Button Up Weatherization program for 2019 IRP: 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 2,634,274	Revenue Declines	($3,323,228)
Rebates From EK	$1,374,101	Administrative Costs	($281,046)
		Rebates Paid To Consumers	($667,039)
Total Benefits	$4,008,375	Total Costs	($4,271,313)
	Benefit / Cost Ratio: 0.94		

Participant Benefits		Participant Costs	
Electric Bill Declines	$2,114,930	Up Front Investment	($1,464,706)
Rebates From Distribution System	$ 521,372		
Reductions in O&M costs	$0		
Total Benefits	$2,636,302	Total Costs	($1,464,706)
	Benefit / Cost Ratio: 1.80		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$1,403,572	Up Front Customer Investment	($1,686,542)
Avoided Gen Capacity Costs	$589,434	Distribution System Admin. Costs	($281,046)
Avoided Transmission Expense	$287,410	EK Administrative Costs	($54,805)
Reduced Customer O&M costs	$0		
Total Benefits	$2,280,417	Total Costs	($2,022,393)
	Benefit / Cost Ratio: 1.13		

EK Benefits		EK Costs	
Avoided Energy Costs	$1,403,572	Decrease In Revenue	($2,634,274)
Avoided Gen Capacity Costs	$589,434	Rebates Paid	($1,374,101)
Avoided Transmission Expense	$287,410	Administrative Costs	($54,805)
Total Benefits	$2,280,417	Total Costs	($4,063,180)
	Benefit / Cost Ratio: 0.56		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$1,783,070	Up Front Customer Investment	($1,861,940)
Avoided Gen Capacity Costs	$755,196	Utility Admin Costs	($371,982)
Avoided Transmission Expense	$357,989		
Environmental Externalities	$0		
Total Benefits	$2,896,256	Total Costs	($2,233,922)
	Benefit / Cost Ratio: 1.30		

Combined RIM:

Benefits:	$2,280,417	Costs:	($4,326,118)
	Benefit / Cost Ratio: 0.53		

Heat Pump Retrofit program - SEER 14 for 2019 IRP

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 21,696,054	Revenue Declines	($31,217,223)
Rebates From EK	$5,573,659	Administrative Costs	($582,028)
		Rebates Paid To Consumers	($1,644,147)
Total Benefits	$27,269,713	Total Costs	($33,443,398)
	Benefit / Cost Ratio: 0.82		

Participant Benefits		Participant Costs	
Electric Bill Declines	$15,488,947	Up Front Investment	($6,404,548)
Rebates From Distribution System	$ 1,209,318		
Reductions in O&M costs	$0		
Total Benefits	$16,698,265	Total Costs	($6,404,548)
	Benefit / Cost Ratio: 2.61		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$14,475,884	Up Front Customer Investment	($8,707,403)
Avoided Gen Capacity Costs	$1,297,870	Distribution System Admin. Costs	($582,028)
Avoided Transmission Expense	$0	EK Administrative Costs	($54,805)
Reduced Customer O&M costs	$0		
Total Benefits	$15,773,753	Total Costs	($9,344,236)
	Benefit / Cost Ratio: 1.69		

EK Benefits		EK Costs	
Avoided Energy Costs	$14,475,884	Decrease In Revenue	($21,696,054)
Avoided Gen Capacity Costs	$1,297,870	Rebates Paid	($5,573,659)
Avoided Transmission Expense	$0	Administrative Costs	($54,805)
Total Benefits	$15,773,753	Total Costs	($27,324,518)
	Benefit / Cost Ratio: 0.58		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$19,723,859	Up Front Customer Investment	($9,804,088)
Avoided Gen Capacity Costs	$1,748,398	Utility Admin Costs	($717,041)
Avoided Transmission Expense	$0		
Environmental Externalities	$0		
Total Benefits	$21,472,257	Total Costs	($10,521,130)
	Benefit / Cost Ratio: 2.04		

Combined RIM:			
Benefits:	$15,773,753	Costs:	($33,498,203)
	Benefit / Cost Ratio: 0.47		

Heat Pump Retrofit Program - SEER 15 for 2019. 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 23,846,842	Revenue Declines	($34,061,213)
Rebates From EK	$6,746,094	Administrative Costs	($599,728)
		Rebates Paid To Consumers	($2,541,221)
Total Benefits	$30,592,936	Total Costs	($37,202,162)
	Benefit / Cost Ratio: 0.82		

Participant Benefits		Participant Costs	
Electric Bill Declines	$17,081,391	Up Front Investment	($7,704,507)
Rebates From Distribution System	$ 1,888,977		
Reductions in O&M costs	$0		
Total Benefits	$18,970,368	Total Costs	($7,704,507)
	Benefit / Cost Ratio: 2.46		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$15,723,058	Up Front Customer Investment	($10,364,792)
Avoided Gen Capacity Costs	$1,868,167	Distribution System Admin. Costs	($599,728)
Avoided Transmission Expense	$0	EK Administrative Costs	($54,805)
Reduced Customer O&M costs	$0		
Total Benefits	$17,591,225	Total Costs	($11,019,325)
	Benefit / Cost Ratio: 1.60		

EK Benefits		EK Costs	
Avoided Energy Costs	$15,723,058	Decrease In Revenue	($23,846,842)
Avoided Gen Capacity Costs	$1,868,167	Rebates Paid	($6,746,094)
Avoided Transmission Expense	$0	Administrative Costs	($54,805)
Total Benefits	$17,591,225	Total Costs	($30,647,741)
	Benefit / Cost Ratio: 0.57		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$21,350,548	Up Front Customer Investment	($11,631,696)
Avoided Gen Capacity Costs	$2,511,090	Utility Admin Costs	($734,741)
Avoided Transmission Expense	$0		
Environmental Externalities	$0		
Total Benefits	$23,861,639	Total Costs	($12,366,437)
	Benefit / Cost Ratio: 1.93		

Combined RIM:			
Benefits:	$17,591,225	Costs:	($37,256,967)
	Benefit / Cost Ratio: 0.47		

CARES program (Low income) for 2019 IRP: 15 years participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 3,035,021	Revenue Declines	($4,026,140)
Rebates From EK	$2,196,054	Administrative Costs	($1,713,755)
		Rebates Paid To Consumers	$0
Total Benefits	$5,231,075	Total Costs	($5,739,894)
	Benefit / Cost Ratio: 0.91		

Participant Benefits		Participant Costs	
Electric Bill Declines	$2,162,518	Up Front Investment	($737,548)
Rebates From Distribution System	$ -		
Reductions in Gas bill	$218,081		
Total Benefits	$2,380,600	Total Costs	($737,548)
	Benefit / Cost Ratio: 3.23		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$1,724,258	Up Front Customer Investment	($1,005,403)
Avoided Gen Capacity Costs	$584,776	Distribution System Admin. Costs	($1,713,755)
Avoided Transmission Expense	$213,345	EK Administrative Costs	($219,220)
Reduced Nat Gas Costs	$301,989		
Total Benefits	$2,824,368	Total Costs	($2,938,377)
	Benefit / Cost Ratio: 0.96		

EK Benefits		EK Costs	
Avoided Energy Costs	$1,724,258	Decrease In Revenue	($3,035,021)
Avoided Gen Capacity Costs	$584,776	Rebates Paid	($2,196,054)
Avoided Transmission Expense	$213,345	Administrative Costs	($219,220)
Total Benefits	$2,522,379	Total Costs	($5,450,294)
	Benefit / Cost Ratio: 0.46		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$2,238,682	Up Front Customer Investment	($1,132,963)
Avoided Gen Capacity Costs	$760,059	Utility Admin Costs	($2,178,016)
Avoided Transmission Expense	$271,198		
Environmental Externalities	$0		
Reduced Gas Costs	$ 387,171		
Total Benefits	$3,657,110	Total Costs	($3,310,979)
	Benefit / Cost Ratio: 1.10		

Combined RIM:			
Benefits:	$2,522,379	Costs:	($5,959,114)
	Benefit / Cost Ratio: 0.42		

ENERGY STAR® Manufactured Home Program for 2019 IRP: 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 4,920,278	Revenue Declines	($7,066,098)
Rebates From EK	$3,421,752	Administrative Costs	($83,457)
		Rebates Paid To Consumers	($1,919,519)
Total Benefits	$8,342,030	Total Costs	($9,069,075)
	Benefit / Cost Ratio: 0.92		

Participant Benefits		Participant Costs	
Electric Bill Declines	$3,826,267	Up Front Investment	($1,419,466)
Rebates From Distribution System	$ 1,419,466		
Reductions in O&M costs	$0		
Total Benefits	$5,245,732	Total Costs	($1,419,466)
	Benefit / Cost Ratio: 3.70		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$3,034,829	Up Front Customer Investment	($1,919,519)
Avoided Gen Capacity Costs	$777,071	Distribution System Admin. Costs	($83,457)
Avoided Transmission Expense	$218,327	EK Administrative Costs	($359,982)
Reduced Customer O&M costs	$0		
Total Benefits	$4,030,227	Total Costs	($2,362,958)
	Benefit / Cost Ratio: 1.71		

EK Benefits		EK Costs	
Avoided Energy Costs	$3,034,829	Decrease In Revenue	($4,920,278)
Avoided Gen Capacity Costs	$777,071	Rebates Paid	($3,421,752)
Avoided Transmission Expense	$218,327	Administrative Costs	($359,982)
Total Benefits	$4,030,227	Total Costs	($8,702,011)
	Benefit / Cost Ratio: 0.46		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$3,930,032	Up Front Customer Investment	($2,157,659)
Avoided Gen Capacity Costs	$1,008,303	Utility Admin Costs	($498,660)
Avoided Transmission Expense	$276,846		
Environmental Externalities	$0		
Total Benefits	$5,215,182	Total Costs	($2,656,319)
	Benefit / Cost Ratio: 1.96		

Combined RIM:			
Benefits:	$4,030,227	Costs:	($9,429,057)
	Benefit / Cost Ratio: 0.43		

Heat Pump Retrofit program: Ductless Mini-Split for 2019 IRP. 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 7,817,332	Revenue Declines	($11,141,772)
Rebates From EK	$2,094,507	Administrative Costs	($172,995)
		Rebates Paid To Consumers	($733,028)
Total Benefits	$9,911,838	Total Costs	($12,047,795)
	Benefit / Cost Ratio: 0.82		

Participant Benefits		Participant Costs	
Electric Bill Declines	$5,441,866	Up Front Investment	($3,374,681)
Rebates From Distribution System	$ 530,833		
Reductions in O&M costs	$0		
Total Benefits	$5,972,698	Total Costs	($3,374,681)
	Benefit / Cost Ratio: 1.77		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$5,211,883	Up Front Customer Investment	($4,660,106)
Avoided Gen Capacity Costs	$621,997	Distribution System Admin. Costs	($172,995)
Avoided Transmission Expense	$0	EK Administrative Costs	($54,805)
Reduced Customer O&M costs	$0		
Total Benefits	$5,833,880	Total Costs	($4,887,906)
	Benefit / Cost Ratio: 1.19		

EK Benefits		EK Costs	
Avoided Energy Costs	$5,211,883	Decrease In Revenue	($7,817,332)
Avoided Gen Capacity Costs	$621,997	Rebates Paid	($2,094,507)
Avoided Transmission Expense	$0	Administrative Costs	($54,805)
Total Benefits	$5,833,880	Total Costs	($9,966,643)
	Benefit / Cost Ratio: 0.59		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$7,135,999	Up Front Customer Investment	($5,272,262)
Avoided Gen Capacity Costs	$840,567	Utility Admin Costs	($257,427)
Avoided Transmission Expense	$0		
Environmental Externalities	$0		
Total Benefits	$7,976,567	Total Costs	($5,529,689)
	Benefit / Cost Ratio: 1.44		

Combined RIM:			
Benefits:	$5,833,880	Costs:	($12,102,600)
	Benefit / Cost Ratio: 0.48		

Residential Efficient Lighting for 2019 IRP; 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 5,432,197	Revenue Declines	($8,128,424)
Rebates From EK	$542,569	Administrative Costs	$0
		Rebates Paid To Consumers	($542,569)
Total Benefits	$5,974,766	Total Costs	($8,670,993)
	Benefit / Cost Ratio: 0.69		

Participant Benefits		Participant Costs	
Electric Bill Declines	$6,296,066	Up Front Investment	($1,330,250)
Rebates From Distribution System	$ 399,075		
Reductions in O&M costs	$0		
Total Benefits	$6,695,141	Total Costs	($1,330,250)
	Benefit / Cost Ratio: 5.03		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$3,116,428	Up Front Customer Investment	($1,446,850)
Avoided Gen Capacity Costs	$799,336	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$251,503	EK Administrative Costs	($54,805)
Reduced Customer O&M costs	$0		
Total Benefits	$4,167,267	Total Costs	($1,501,654)
	Benefit / Cost Ratio: 2.78		

EK Benefits		EK Costs	
Avoided Energy Costs	$3,116,428	Decrease In Revenue	($5,432,197)
Avoided Gen Capacity Costs	$799,336	Rebates Paid	($542,569)
Avoided Transmission Expense	$251,503	Administrative Costs	($54,805)
Total Benefits	$4,167,267	Total Costs	($6,029,571)
	Benefit / Cost Ratio: 0.69		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$3,762,130	Up Front Customer Investment	($1,629,078)
Avoided Gen Capacity Costs	$983,720	Utility Admin Costs	($61,708)
Avoided Transmission Expense	$301,759		
Environmental Externalities	$0		
Total Benefits	$5,047,609	Total Costs	($1,690,786)
	Benefit / Cost Ratio: 2.99		

Combined RIM:			
Benefits:	$4,167,267	Costs:	($8,725,798)
	Benefit / Cost Ratio: 0.48		

Direct Load Control- Residential: Air Conditioners - Bring Your Own Thermostat. For 2019 IRP. 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 1,625,538	Revenue Declines	($155,516)
Rebates From EK	$1,464,352	Administrative Costs	$0
		Rebates Paid To Consumers	($1,464,352)
Total Benefits	$3,089,891	Total Costs	($1,619,868)

Benefit / Cost Ratio: 1.91

Participant Benefits		Participant Costs	
Electric Bill Declines	$82,298	Up Front Investment	$0
Rebates From Distribution System	$ 769,235		
Reductions in O&M costs	$0		
Total Benefits	$851,533	Total Costs	$0

Benefit / Cost Ratio: NA

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$71,045	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$5,009,831	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$592,906	EK Administrative Costs	($1,433,989)
Reduced Customer O&M costs	$0		
Total Benefits	$5,673,783	Total Costs	($1,433,989)

Benefit / Cost Ratio: 3.96

EK Benefits		EK Costs	
Avoided Energy Costs	$71,045	Decrease In Revenue	($1,625,538)
Avoided Gen Capacity Costs	$5,009,831	Rebates Paid	($1,464,352)
Avoided Transmission Expense	$592,906	Administrative Costs	($1,433,989)
Total Benefits	$5,673,783	Total Costs	($4,523,879)

Benefit / Cost Ratio: 1.25

Societal Benefits		Societal Costs	
Avoided Energy Costs	$92,671	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$6,530,876	Utility Admin Costs	($1,870,905)
Avoided Transmission Expense	$757,055		
Environmental Externalities	$0		
Total Benefits	$7,380,602	Total Costs	($1,870,905)

Benefit / Cost Ratio: 3.94

Combined RIM:			
Benefits:	$5,673,783	Costs:	($3,053,857)

Benefit / Cost Ratio: 1.86

Direct Load Control Program - Residential: Air Conditioner Switches. For 2019 IRP. 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 1,625,538	Revenue Declines	($155,516)
Rebates From EK	$1,171,482	Administrative Costs	$0
		Rebates Paid To Consumers	($1,171,482)
Total Benefits	$2,797,020	Total Costs	($1,326,997)

Benefit / Cost Ratio: 2.11

Participant Benefits		Participant Costs	
Electric Bill Declines	$82,298	Up Front Investment	$0
Rebates From Distribution System	$ 615,388		
Reductions in O&M costs	$0		
Total Benefits	$697,686	Total Costs	$0

Benefit / Cost Ratio: NA

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$71,045	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$5,009,831	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$592,906	EK Administrative Costs	($1,940,282)
Reduced Customer O&M costs	$0		
Total Benefits	$5,673,783	Total Costs	($1,940,282)

Benefit / Cost Ratio: 2.92

EK Benefits		EK Costs	
Avoided Energy Costs	$71,045	Decrease In Revenue	($1,625,538)
Avoided Gen Capacity Costs	$5,009,831	Rebates Paid	($1,171,482)
Avoided Transmission Expense	$592,906	Administrative Costs	($1,940,282)
Total Benefits	$5,673,783	Total Costs	($4,737,302)

Benefit / Cost Ratio: 1.20

Societal Benefits		Societal Costs	
Avoided Energy Costs	$92,671	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$6,530,876	Utility Admin Costs	($2,195,678)
Avoided Transmission Expense	$757,055		
Environmental Externalities	$0		
Total Benefits	$7,380,602	Total Costs	($2,195,678)

Benefit / Cost Ratio: 3.36

Combined RIM:			
Benefits:	$5,673,783	Costs:	($3,267,279)

Benefit / Cost Ratio: 1.74

Touchstone Energy Home program for 2019 IRP: 15 years of participation

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 16,444,012	Revenue Declines	($19,623,090)
Rebates From EK	$7,491,659	Administrative Costs	($2,221,664)
		Rebates Paid To Consumers	($3,874,996)
Total Benefits	$23,935,670	Total Costs	($25,719,751)
	Benefit / Cost Ratio: 0.93		

Participant Benefits		Participant Costs	
Electric Bill Declines	$10,259,578	Up Front Investment	($5,789,987)
Rebates From Distribution System	$ 2,853,147		
Reductions in O&M costs	$0		
Total Benefits	$13,112,726	Total Costs	($5,789,987)
	Benefit / Cost Ratio: 2.26		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$9,195,507	Up Front Customer Investment	($7,470,475)
Avoided Gen Capacity Costs	$4,295,553	Distribution System Admin. Costs	($2,221,664)
Avoided Transmission Expense	$2,139,251	EK Administrative Costs	($54,805)
Reduced Customer O&M costs	$0		
Total Benefits	$15,630,312	Total Costs	($9,746,944)
	Benefit / Cost Ratio: 1.60		

EK Benefits		EK Costs	
Avoided Energy Costs	$9,195,507	Decrease In Revenue	($16,444,012)
Avoided Gen Capacity Costs	$4,295,553	Rebates Paid	($7,491,659)
Avoided Transmission Expense	$2,139,251	Administrative Costs	($54,805)
Total Benefits	$15,630,312	Total Costs	($23,990,475)
	Benefit / Cost Ratio: 0.65		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$12,525,016	Up Front Customer Investment	($8,408,639)
Avoided Gen Capacity Costs	$5,785,411	Utility Admin Costs	($2,562,375)
Avoided Transmission Expense	$2,819,136		
Environmental Externalities	$0		
Total Benefits	$21,129,564	Total Costs	($10,971,014)
	Benefit / Cost Ratio: 1.93		

Combined RIM:			
Benefits:	$15,630,312	Costs:	($25,774,555)
	Benefit / Cost Ratio: 0.61		

Exhibit DSM-5

Program Descriptions for Existing DSM Programs

Program Descriptions for Demand Side Management (DSM) Programs

Introduction

For over 25 years, East Kentucky Power Cooperative, Inc. (EKPC) and its 16 Owner-Member Cooperatives (owner-member) have promoted the cost-effective use of energy by offering energy efficiency and demand response to the End-Use Retail Member (retail member). These programs have been designed to meet the needs of the retail members, to delay the need for additional generating capacity, and secure the most cost-effective energy resources.

This document describes the existing DSM programs. These programs are implemented and administered by EKPC and its owner-members. EKPC supports the owner-members with analysis, administrative, promotion, incentives, and other support services. EKPC considers the programs as part of its overall supply portfolio, with the understanding that the programs impact EKPC indirectly, through its owner-members.

The DSM programs in this IRP are listed below and described in this exhibit:

- Button-Up Weatherization Program (Residential)
- CARES Low-Income Weatherization (Residential)
- Heat Pump Retrofit Program (Residential)
- Touchstone Energy Program (Residential)
- ENERGY STAR® Manufactured Home Program (Residential)
- Energy Audit (Residential)
- Residential Efficient Lighting (Residential)
- Direct Load Control of Air Conditioners: Switches and Bring Your Own Thermostat (BYOT) (Residential)

Button-Up Weatherization Program

Program Description

The Button-Up Weatherization (Button-Up) Program is designed to incentivize retail members with poor energy-performing homes to improve the energy efficiency of the home's shell. The Button-up program is an important program to assist retail members with high bills caused by excessive heat losses. Air-sealing and attic insulation are the most cost-effective measures to improve home energy performance.

Button-Up offers an incentive for reducing the heat loss of a home. The incentive is paid based on heat loss reduction measured in British Thermal Units per hour (BTUH). Heat loss calculations in BTUH are based on the winter design temperature. The retail member may qualify for this incentive by reducing the air leakage of their home and/or adding insulation in the attic.

Air-sealing actions reduce air infiltration by sealing air leaks in the shell walls, floors or ceiling. Electrical and plumbing protrusions as well as window and door seals are typical places where air leaks cause the home to lose heat in the winter

Typical air sealing measures caulking, improved weather stripping, and sealing attic accesses. To receive this incentive either an EKPC approved contractor or a owner-member representative must perform a "pre" and "post" blower door test to measure actual BTUH reduced.

The attic insulation portion of the Button Up incentive will also promote the reduction of energy usage on the part of the retail members. Heat loss calculation of BTUH reduced will be made by using either the Manual J 8th Edition or through other methods approved by EKPC. In order to receive an incentive for attic insulation, an air seal must also be completed.

Target Markets

This program is targeted at older single-family, multi-family or manufactured dwellings. Eligibility requirements are:

- Home must be 2 years old or older to qualify for the incentive.
- Primary source of heat must be electricity.

CARES Low-Income Weatherization Program

Program Description

EKPC's Community Assistance Resources for Energy Savings (CARES) Low Income Program provides an incentive to enhance the weatherization and energy efficiency services provided to its residential retail members by the Kentucky Community Action Agency's (CAA) network of not for profit community action agencies.

EKPC and its owner-members provide an incentive to the CAA implementing the project on behalf of the retail member.

EKPC's program has two primary objectives. First, EKPC's incentive will enable the CAA to install more measures in each home. Second, the additional incentive from EKPC will assist CAA in weatherizing more homes.

Two types of homes are eligible for incentives:

Heat Pump Eligible Homes are single family or multi-family residential dwellings that use electricity for their primary source of heat. The EKPC incentive can be used to upgrade the home to an air source heat pump as well as to install weatherization improvements including insulation, air sealing, duct sealing, and a water heater blanket.

Heat Pump ineligible homes are single family or multi-family residential dwellings that do not use electricity for their primary source of heat, but do cool their home with central or window unit air conditioners. The EKPC incentive can be used to install weatherization improvements.

The maximum incentive per household is $2,000.

Target Market

The homeowner must be a residential retail member of one of EKPC's 16 owner-members.

The household must qualify for weatherization and energy efficiency services according to the guidelines of the Weatherization Assistance Program administered by the local CAA. Household income cannot exceed the designated poverty guidelines established by the CAA.

Heat Pump Retrofit Program

Program Description

The Heat Pump Retrofit Program provides incentives for residential members to replace their existing resistance heat source heat (electric furnace, ceiling cable heat, baseboard heat, or electric thermal storage) with a more efficient heat pump.

Most high bill complaints are from retail members with homes that are heated with electric resistive heat instead of a heat pump. Installing an electric heat pump lowers electric bills significantly for those retail members.

The program provides incentives for both centrally ducted systems and mini-split systems.

Since the previous IRP was prepared, the Federal Department of Energy (DOE) has raised the minimum efficiencies of air source heat pumps. This program now provides incentives for two efficiency levels of centrally ducted heat pump systems: DOE minimum standard 14 Seasonal Energy Efficiency Ratio (SEER) and ENERGY STAR® rated 15 SEER.

In recent years, EKPC and the owner-members have seen a sizable increase in mini-split heat pump systems. This heat pump technology is highly efficient and new to the US market. This program provides incentives to install mini-split heat pump systems that replace resistance heat units. These installations must be ENERGY STAR® rated. The rebate will be paid per indoor head unit up to a maximum of three rebates.

Homeowners replacing their existing resistance heat source with a heat pump will qualify for the following incentive based on the equipment type:

Equipment Type	**Rebate**
Centrally Ducted Systems:	
Current Energy Conservation Standard established by the DOE	$500
Current ENERGY STAR® level equipment or greater	$750
Mini Split Systems:	
Ducted or Ductless Mini-Splits ENERGY STAR® level equipment or greater (per indoor head unit – max 3)	$250

When Federal efficiency standards increase the required SEER and Heating Season Performance Factor (HSPF) for heat pumps, these targets will be adjusted upward accordingly.

Target Markets

This program is targeted to retail members who currently heat their home with a resistance heat source; this program is targeted to site built homes, manufactured homes, and multi-family dwellings.

Eligibility requirements are:

- Incentive only applies when homeowner's primary source of heat is an electric resistance heat furnace, ceiling cable heat, baseboard heat, electric thermal storage.
- Existing heat source must be at least 2 years old.
- New manufactured homes are eligible for the incentive.
- Two (2) maximum incentive payments per location, per lifetime for centrally ducted systems.
- Ducted and Ductless mini-splits applying for the incentive will be incentivized at a rate of $250 per indoor head unit up to a maximum of three head units per location, per lifetime.
- Participants in the Heat Pump Retrofit Program are not eligible for participation in the ENERGY STAR® Manufactured Home Program.

Touchstone Energy Home

Program Description

In an effort to improve new residential home energy performance, EKPC has designed the Touchstone Energy Home Program. The program is designed to encourage new homes to be built to higher standards for thermal integrity and equipment efficiency, as well as to choose a geothermal or an air source heat pump rather than less efficient forms of heating and cooling.

This program provides guidance during the building process to guarantee a home that is ≥25-30% more efficient than the Kentucky standard built home.

The typical home built in rural Kentucky scores a 105 on the Home Energy Rating System ("HERS") Index. The HERS testing and rating system is the industry accepted standard for evaluating the energy efficiency of a new home. Therefore, EKPC and the owner-members will provide the incentive for a home that either scores a HERS of 75 or better for the Performance Path or completes a Prescriptive Path check list of energy saving measures that assure the home performs equivalently to a 75 HERS tested home.

Plans are submitted before the home is built, a pre-drywall inspection is made, and a blower door test is administered after the home is built to verify that the home meets the standard.

To qualify as a Touchstone Energy Home under EKPC's program, the participating home must be located in the service territory of a participating Owner-Member System and must meet the program guidelines following one of the two available paths of approval.

All homes must receive a pre-drywall inspection and pass EKPC's pre-drywall checklist. Homes must also receive a final inspection and pass a whole house air leakage and duct leakage test.

All homes must be heated with an Air Source or Geothermal Heat Pump. The air source heat pump must meet or exceed the current ENERGY STAR® specifications for SEER and HSPF.

Water heaters must be an electric storage tank water heater that meets or exceeds current Energy and Water Conservation standards established by the DOE.

In addition:

Prescriptive Path:

- Home must meet each prescriptive value on EKPC's Touchstone Energy Home Specifications.

Performance Path:

- Home must receive a HERS Index score of ≤75
- Home must pass 2009 International Energy Conservation Code performance path.

Target Markets

This program is designed to serve the residential new construction market. The incentives are available to any residential retail member of participating EKPC owner-members. The primary market consists of retail members who are constructing new stick-built homes. Multi-family dwellings pre-approved by EKPC may be eligible.

ENERGY STAR® Manufactured Home

Program Description

The ENERGY STAR® Manufactured Home Program is designed to ensure that our residential retail members purchase an energy efficient manufactured home. EKPC will accomplish this by providing an incentive to purchase and install a new ENERGY STAR® certified manufactured home instead of a Housing and Urban Development (HUD) minimum standard home. The incentive is paid to the retail member who purchases the ENERGY STAR® manufactured home.

In February 2018, the United States Environmental Protection Agency (EPA) changed the ENERGY STAR® requirements for ESMF. Effectively, EPA lessened the efficiency requirements for the home's shell. The changes allow the manufacturers to achieve ENERGY STAR® certification while spending less on improving the home's shell. Therefore, EKPC is lowering the incentive to a more appropriate level to offset these lower costs.

Through the program, EKPC will pay incentives in the form of rebates for electrically heated manufactured homes that qualify for the ENERGY STAR® label. Such homes use a combination of structural envelope and equipment measures that, in combination, result energy consumption that is significantly lower than comparable factory-built homes produced in accordance with the HUD code.

To be eligible for an incentive under this program, new manufactured homes must meet the following criteria:

- ENERGY STAR® certified according to the EPA and Systems Building Research Alliance guidelines
- Primary source of heat must be a heat pump.
- Home must be all electric
- Home must be installed by or on behalf of the member on lines served by one of EKPC's 16 owner-members
- Participants in the ESMF are not eligible to participate in the Heat Pump Retrofit Program.

Target Markets

This program is available to all residential retail members who purchase an ENERGY STAR® certified manufactured home.

Residential Energy Audit Program

Program Description

This program uses targeted information on home energy use to help retail members manage their energy use and save energy. The program is designed to offer two kinds of information delivery: An in-home audit and an online audit.

EKPC uses the Billing*Insights* tool from Apogee Interactive to analyze energy usage and make recommendations to lower energy consumption.

Retail members who complete the online Billing*Insights* analysis receive a free light-emitting diode light bulbs (LED).

The in-home audit is available for retail members who want a more thorough assessment of their electricity usage. An energy advisor from one of our owner-members will visit the home to conduct an energy audit by inspecting the appliances, building shell, heating and cooling systems, ductwork, appliances, and other sources of energy consumption and energy losses. The energy advisors have access to blower doors and infrared cameras if needed to identify air leakage and other heat losses.

The audit report will include simple low cost improvements that the homeowners can do themselves. The homeowner will also be made aware of any recommendations that are eligible for a rebate under our other energy efficiency programs.

Target Market

The program is available for all residential retail members but specifically targets households with higher than average electricity usage.

Residential Efficient Lighting Program

Program Description

The purpose of this program is to improve the efficiency of residential lighting by subsidizing the cost of higher efficiency lighting products. EKPC and its owner-members distribute compact fluorescent light bulbs (CFLs) and LEDs to retail members.

The program provides CFLs at the annual meetings held by the owner-members. In addition, each retail member who completes an online energy audit receives and LED light bulb.

Target Markets

The program is targeted to all residential members.

Direct Load Control Program: Residential Air Conditioners

Program Description

The Direct Load Control Program is designed to shift loads during peak times to off-peak times in order to reduce EKPC's capacity payments to PJM.

The objective of the program is to reduce peak demand and energy usage through the installation of load control devices on residential central air conditioners and heat pumps. The peak load reduction lowers EKPC's capacity obligations and payments to PJM.

EKPC's peak load contributions and resulting capacity obligations and payments to PJM are determined by the top five highest system peak hours for PJM during the summer months. EKPC controls switches during these extreme peak hours and days each year to lower air conditioning load during PJM peaks.

Water heater load control is no longer cost-effective. As a result, the program no longer installs new switches on water heaters. Existing water heaters will continue to be controlled and rebates for those water heaters will continue to be paid.

Peak demand reduction is accomplished by cycling equipment on and off according to a predetermined control strategy. Central air conditioning and heat pump units are cycled on and off, while water heater loads are curtailed. The typical control duration is between four and six hours. Participating retail members receive an annual incentive.

EKPC has added a BYOT offering. This BYOT option allows retail members to use their existing or newly installed Wi-Fi-enabled thermostats to participate in the DLC program.

EKPC plans to continue to rely on a third party administrator to provide enrollment, installation, service calls, and measurement & verification services.

EKPC offers an incentive of $10 per year for each water heater under control, and $20 per year for each air conditioner being controlled by a switch or a thermostat.

Target Markets

The program targets homes with central air conditioning (including heat pumps). The incentive is available to any residential retail member of a participating EKPC owner-member who has a qualifying central air conditioner or heat pump.

Exhibit DSM-6

Load Impacts
by Program

Load Impacts of DSM Programs

Button-Up Weatherization Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	222	-797	-0.5	-0.2
2020	289	-1,037	-0.7	-0.2
2021	356	-1,277	-0.8	-0.2
2022	423	-1,518	-1.0	-0.3
2023	490	-1,758	-1.1	-0.3
2024	557	-1,999	-1.3	-0.4
2025	624	-2,239	-1.4	-0.4
2026	691	-2,480	-1.6	-0.5
2027	758	-2,720	-1.7	-0.5
2028	825	-2,960	-1.9	-0.6
2029	892	-3,201	-2.1	-0.6
2030	959	-3,441	-2.2	-0.7
2031	1,026	-3,682	-2.4	-0.7
2032	1,093	-3,922	-2.5	-0.8
2033	1,160	-4,162	-2.7	-0.8

CARES-Low Income program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	69	-326	-0.1	0.0
2020	144	-681	-0.2	-0.1
2021	219	-1,036	-0.3	-0.2
2022	294	-1,391	-0.4	-0.2
2023	369	-1,746	-0.5	-0.3
2024	444	-2,100	-0.6	-0.3
2025	519	-2,455	-0.7	-0.4
2026	594	-2,810	-0.9	-0.4
2027	669	-3,165	-1.0	-0.5
2028	744	-3,520	-1.1	-0.5
2029	819	-3,874	-1.2	-0.6
2030	894	-4,229	-1.3	-0.6
2031	969	-4,584	-1.4	-0.7
2032	1,044	-4,939	-1.5	-0.8
2033	1,119	-5,294	-1.6	-0.8

Heat Pump Retrofit program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	751	-5,913	0.0	-0.3
2020	1,444	-11,408	0.0	-0.6
2021	2,137	-16,904	0.0	-0.9
2022	2,830	-22,400	0.0	-1.1
2023	3,523	-27,895	0.0	-1.4
2024	4,216	-33,391	0.0	-1.7
2025	4,909	-38,886	0.0	-2.0
2026	5,602	-44,382	0.0	-2.3
2027	6,295	-49,878	0.0	-2.5
2028	6,988	-55,373	0.0	-2.8
2029	7,681	-60,869	0.0	-3.1
2030	8,374	-66,364	0.0	-3.4
2031	9,067	-71,860	0.0	-3.6
2032	9,760	-77,355	0.0	-3.9
2033	10,453	-82,851	0.0	-4.2

Touchstone Energy Home

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	485	-1,461	-1.2	-0.3
2020	955	-2,878	-2.4	-0.6
2021	1,425	-4,294	-3.5	-1.0
2022	1,895	-5,710	-4.7	-1.3
2023	2,365	-7,127	-5.9	-1.6
2024	2,835	-8,543	-7.0	-1.9
2025	3,305	-9,959	-8.2	-2.2
2026	3,775	-11,376	-9.4	-2.5
2027	4,245	-12,792	-10.5	-2.9
2028	4,715	-14,208	-11.7	-3.2
2029	5,185	-15,624	-12.9	-3.5
2030	5,655	-17,041	-14.0	-3.8
2031	6,125	-18,457	-15.2	-4.1
2032	6,595	-19,873	-16.4	-4.4
2033	7,065	-21,290	-17.5	-4.8

ENERGY STAR® Manufactured Home Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	175	-711	-0.2	-0.1
2020	325	-1,320	-0.3	-0.2
2021	475	-1,929	-0.4	-0.2
2022	625	-2,538	-0.6	-0.3
2023	775	-3,147	-0.7	-0.4
2024	925	-3,756	-0.9	-0.4
2025	1,075	-4,365	-1.0	-0.5
2026	1,225	-4,974	-1.1	-0.6
2027	1,375	-5,583	-1.3	-0.6
2028	1,525	-6,192	-1.4	-0.7
2029	1,675	-6,801	-1.6	-0.8
2030	1,825	-7,410	-1.7	-0.9
2031	1,975	-8,019	-1.8	-0.9
2032	2,125	-8,628	-2.0	-1.0
2033	2,275	-9,237	-2.1	-1.1

Residential Energy Audit Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	500	-274	-0.1	-0.1
2020	1,450	-797	-0.2	-0.2
2021	2,400	-1,319	-0.4	-0.3
2022	3,350	-1,841	-0.6	-0.4
2023	4,300	-2,364	-0.7	-0.5
2024	4,850	-2,677	-0.8	-0.6
2025	5,050	-2,807	-0.9	-0.6
2026	5,250	-2,937	-0.9	-0.6
2027	5,350	-3,002	-0.9	-0.7
2028	5,350	-3,002	-0.9	-0.7
2029	5,350	-3,002	-0.9	-0.7
2030	5,350	-3,002	-0.9	-0.7
2031	5,350	-3,002	-0.9	-0.7
2032	5,350	-3,002	-0.9	-0.7
2033	5,350	-3,002	-0.9	-0.7

Residential Lighting Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	5,500	-1,155	-0.2	-0.1
2020	11,000	-2,310	-0.4	-0.3
2021	16,500	-3,465	-0.5	-0.4
2022	22,000	-4,620	-0.7	-0.5
2023	27,500	-5,775	-0.9	-0.7
2024	33,000	-6,930	-1.1	-0.8
2025	38,500	-8,085	-1.3	-0.9
2026	44,000	-9,240	-1.4	-1.1
2027	44,000	-9,240	-1.4	-1.1
2028	44,000	-9,240	-1.4	-1.1
2029	44,000	-9,240	-1.4	-1.1
2030	44,000	-9,240	-1.4	-1.1
2031	44,000	-9,240	-1.4	-1.1
2032	44,000	-9,240	-1.4	-1.1
2033	44,000	-9,240	-1.4	-1.1

Direct Load Control: Residential Air Conditioner - Switches

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	250	-7	0.0	-0.2
2020	750	-21	0.0	-0.7
2021	1,250	-36	0.0	-1.2
2022	1,750	-50	0.0	-1.7
2023	2,250	-64	0.0	-2.1
2024	2,750	-78	0.0	-2.6
2025	3,250	-93	0.0	-3.1
2026	3,750	-107	0.0	-3.6
2027	4,250	-121	0.0	-4.0
2028	4,750	-135	0.0	-4.5
2029	5,250	-150	0.0	-5.0
2030	5,750	-164	0.0	-5.5
2031	6,250	-178	0.0	-5.9
2032	6,750	-192	0.0	-6.4
2033	7,250	-207	0.0	-6.9

Direct Load Control: Residential Air Conditioner – Bring Your Own Thermostat

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2019	250	-7	0.0	-0.2
2020	750	-21	0.0	-0.7
2021	1,250	-36	0.0	-1.2
2022	1,750	-50	0.0	-1.7
2023	2,250	-64	0.0	-2.1
2024	2,750	-78	0.0	-2.6
2025	3,250	-93	0.0	-3.1
2026	3,750	-107	0.0	-3.6
2027	4,250	-121	0.0	-4.0
2028	4,750	-135	0.0	-4.5
2029	5,250	-150	0.0	-5.0
2030	5,750	-164	0.0	-5.5
2031	6,250	-178	0.0	-5.9
2032	6,750	-192	0.0	-6.4
2033	7,250	-207	0.0	-6.9

Exhibit DSM-7

DSM Program Tables

Remaining DSM program tables that are required by Section 8 of the regulations

8.(3)(e)(1). Targeted classes and end-uses;

The following table provides the targeted classes and end-uses for the DSM programs included in the plan. More detailed program descriptions can be found in Exhibit DSM-5 in the DSM Technical Appendix.

Table 8.(3)(e)(1)
Existing Programs

Program Name	Class	End-uses
Button-Up Weatherization	Residential	Space Heating, Space Cooling
CARES – Low Income	Residential	Space Heating, Space Cooling, Water Heating, Lighting
Heat Pump Retrofit	Residential	Space Heating, Space Cooling
Touchstone Energy (TSE) Home	Residential	Space Heating, Space Cooling, Water Heating
ENERGY STAR® Manufactured Home	Residential	Space Heating, Space Cooling
Residential Energy Audit	Residential	Space Heating, Space Cooling, Water Heating, Lighting
Residential Efficient Lighting	Residential	Lighting
Direct Load Control-Residential: AC switches	Residential	Space Cooling
Direct Load Control-Residential: AC Bring Your Own Thermostat	Residential	Space Cooling

8.(3)(e)(2). Expected duration of the program;

Expected Duration of the Program

The following table provides the expected duration of each program. For each program, the number of years that new participants are served is given as well as the lifetime of the measure savings:

Table 8.(3)(e)(2)-1
Existing Programs – Duration

Program Name	New Participants	Savings Lifetime
Button-Up Weatherization	15 years	15 years
CARES – Low Income	15 years	15 years
Heat Pump Retrofit	15 years	20 years
Touchstone Energy (TSE) Home	15 years	20 years
ENERGY STAR® Manufactured Home	15 years	15 years
Residential Energy Audit	15 years	5 years
Residential Efficient Lighting	15 years	8 years
Direct Load Control-Residential: AC switches	15 years	15 years
Direct Load Control-Residential: AC Bring Your Own Thermostat	15 years	15 years

8.(3)(e)(3). Projected energy changes by season, and summer and winter peak demand changes;

The following tables provide the projected annual energy, summer peak demand and winter peak demand changes for each Existing and New DSM program included in the plan:

See Exhibit DSM-6

8.(3)(e)(4). Projected cost, including any incentive payments and program administrative costs;

The projected costs for each DSM program are shown below in Table 8.(3)(e)(4). Cost values are the present value of the future stream of costs for that element using a 7 percent discount rate.

Distribution system rebates are paid to program participants. More details on program costs and cost-effectiveness can be found in Exhibits DSM-3 and DSM-4.

Table 8.(3)(e)(4)
DSM Program Costs

Program	Program costs	present value, 2019 $ using a 7% discount rate		Customer Investment
	Distribution System Admin	EKPC Admin	Rebates	
Button-Up Weatherization	$281,046	$54,805	$667,039	$1,686,542
CARES Low Income	$1,713,755	$219,220	$2,196,054	$1,005,403[1]
Heat Pump Retrofit	$1,354,751	$164,415	$4,918,396	$23,732,302
Touchstone Energy (TSE) Home	$2,221,664	$54,805	$3,874,996	$7,470,475
ENERGY STAR® Manufactured Home	$83,457	$359,982	$1,919,519	$1,919,519
Residential Energy Audit	$0	$1,644,147	$0	$659,048
Residential Efficient Lighting	$0	$54,805	$542,569	$1,446,850
Direct Load Control - Residential: AC switches	$0	$1,940,282	$1,171,482	$0
Direct Load Control - Residential: AC Bring Your Own Thermostat	$0	$1,433,989	$1,464,352	$0
Totals	**$5,654,673**	**$5,926,450**	**$16,754,407**	**$37,920,139**

[1] The participant costs for the CARES Low Income represent the Kentucky Housing share of measure costs. This is included (along with gas savings) in order to calculate the correct TRC for the program.

8.(3)(e)(5). Projected cost savings, including savings in utility's generation, transmission and distribution costs.

The projected cost savings for each DSM program are shown below in Table 8.(3)(e)(5). Values shown are the benefits in the Total Resource Cost test. Cost values are the present value of the future stream of costs for that element using a 7 percent discount rate.

Table 8.(3)(e)(5)
DSM Program Cost Savings

Program		present value, 2019 $ Projected Cost Savings
Button-Up Weatherization		$2,280,417
CARES – Low Income		$2,824,368[2]
Heat Pump Retrofit		$39,198,858
Touchstone Energy (TSE) Home		$15,630,312
ENERGY STAR® Manufactured Home		$4,030,227
Residential Energy Audit		$1,580,018
Residential Efficient Lighting		$4,167,267
Direct Load Control-Residential: AC switches		$5,673,783
Direct Load Control-Residential: AC Bring Your Own Thermostat		$5,673,783
Totals		**$81,059,033**

The Total Resource Cost test for the entire portfolio yields a benefit-cost ratio of **1.64.**

[2] Includes gas cost savings

8.(4)(a) On total resource capacity available at the winter and summer peak:

6. Reductions or increases in peak demand from new conservation and load management or other demand-side programs;

See Table DSM-3 in the main report titled "DEMAND SIDE MANAGEMENT ANALYSIS".

8.(4)(b) On planned annual generation:

5. Reductions or increases in energy from new conservation and load management or other demand-side programs;

See Table DSM-3 in the main report titled "DEMAND SIDE MANAGEMENT ANALYSIS".

8.(5)(c) Criteria (for example, present value of revenue requirements, capital requirements, environmental impacts, flexibility, diversity) used to screen each resource alternative including demand-side programs, and criteria used to select the final mix of resources presented in the acquisition plan.

Please see pages 7-8 and 15-16 in the main report titled "DEMAND SIDE MANAGEMENT ANALYSIS".

All DSM programs are evaluated based on the standard California tests.

Exhibit DSM-8

DSM and Renewable Energy Collaborative Discussion and Materials

Collaborative Section discussion and materials

In 2015, EKPC worked with potential DSM and Renewable Energy stakeholders to develop a new DSM and Renewable Energy Collaborative. EKPC and stakeholders agreed to a charter that established the new "Collaborative 2.0."

Participants in Collaborative 2.0 are:

- EKPC
- EKPC's 16 owner-members
- Kentuckians for the Commonwealth
- COAP, Inc.
- Kentucky Association of Manufacturers
- Kentucky Environmental Foundation
- KIUC
- MACED
- Next Step
- Nucor
- Office of the Attorney General

The first Collaborative 2.0 meeting date was Sept. 29, 2015. See the agenda below. The first meeting was a review of Collaborative 1.0 results and updates from EKPC on DSM and Renewable Energy programs.

A second meeting was held on Feb. 2, 2016. See the agenda below. During this meeting, the Collaborative decided to create sub-teams focused on growing DSM programs. Three (3) sub-teams were created, sub-team leaders were identified, and Collaborative members were assigned. The three (3) sub-teams were:

- Residential DSM Programs
- Commercial & Industrial DSM Programs
- Marketing DSM Programs

These three (3) sub-teams met and reported back to the whole Collaborative at the 3rd Collaborative 2.0 meeting on June 27, 2017. See the agenda below. Some possible DSM program enhancements were identified.

EKPC noticed sub-team attendance and participation declining. Near the same time, EKPC noticed other factors important to DSM programs including lower energy and capacity avoided costs, increased cost-effectiveness scrutiny from the Commission, and the Clean Power Program essentially placed on hold. Also, it was time for EKPC to start a complete evaluation of all DSM programs for the IRP. Therefore, Collaborative 2.0 and its mission to grow DSM programs were halted until EKPC had current DSM program cost-effectiveness evaluations and reviews by EKPC executive staff and the owner-member CEOs.

EKPC hired GDS Associates to complete a potential study for energy efficiency and demand response measures for the EKPC service territory. That study is included in this IRP. From that cost-effectiveness study and additional DSM program information, EKPC and the owner-member CEOs determined the future energy efficiency and demand response programs to provide to the membership.

At the December 2018 Collaborative 2.0 meeting, EKPC reviewed the cost-effective measures, and the programs that EKPC and the owner-members planned to request the Commission to discontinue or change.

No Collaborative 2.0 report(s) have been created at this time.

Demand Side Management & Renewable Energy
COLLABORATIVE 2.0

Meeting Agenda

Tuesday, September 29, 2015

Marriott Griffin Gate – Terrace Ballroom

1:00 pm	Welcome	*David Crews/Steve Wilkins*
1:03 pm	Safety Moment	*David Crews*
1:05 pm	Ground Rules	*Steve Wilkins*
1:10 pm	Participant & Organization intros	*David Crews (roundtable)*
1:35 pm	Collaborative 2.0 Bingo	*Steve Wilkins*
2:00 pm	Break	
2:05 pm	Collaborative 2.0 (History, Objectives, Charter)	*David Crews/Steve Wilkins*
2:30 pm	Collaborative "1.0" (Recommendations & Status)	*Scott Drake*
2:45 pm	EKPC programs	*Joe Settles*
3:15 pm	Break	
3:30 pm	Increasing Program Participation (Break-out, Report-out & Discussion)	*David Crews/Steve Wilkins*
4:00 pm	Scheduling next meeting	*David Crews*
4:05 pm	Public comments	*Open*
4:15 pm	Adjourn	

Demand Side Management & Renewable Energy
COLLABORATIVE 2.0

Meeting Agenda

Tuesday, February 2, 2016

Hampton Inn – Frankfort, KY

9:00 am to 12:00 p.m. EST

Welcome	*David Crews/Steve Wilkins*
Safety Moment	*David Crews*
Ice Breaker	*Sara Pennington*
Market Research Refresher/Q&A	*Bruce Barlow*
Sub-team Organization Discussion	*David Crews/Steve Wilkins*
Sub-team Break Out Session	*All Participants*
Solar Project Update	*David Crews*
Public comments	*Open*
Adjourn	

Demand Side Management & Renewable Energy
COLLABORATIVE 2.0

Meeting Agenda

Tuesday, June 27, 2017

Marriott Griffin Gate – Terrace Ballroom

9:30 a.m.	Welcome & Safety Moment	*David Crews*
9:40 a.m.	Public Comments	*Open*
9:50 a.m.	Ice Breaker	*David Crews*
10:00 a.m.	Work Group Reports *(15 mins each)*	
	Marketing *(Chairs: Epperson/Sharp)*	
	Programs *(Chairs: Coomes/Stallons)*	
	Commercial & Industrial *(Chairs: Higdon/Williams)*	
10:45 a.m.	Break	
11:00 a.m.	Electric Vehicle Tariff (Discussion)	*Scott Drake*
11:20 a.m.	Cooperative Solar Project Update	*Joe Settles*
11:35 a.m.	Public Comments	*Open*
11:45 a.m.	Adjourn	

Exhibit DSM-9

Demand Response Bids in PJM

EKPC Demand Response Bids in PJM

Each year EKPC bids Demand Response (DR) capacity into the appropriate PJM Market. The following are the bids.

PJM Year (June-May)	MWs
2015-2016	131.6
2016-2017	141.7
2017-2018	118.0 See Note 1
2018-2019	118.8 See Note 2
2019-2020	120.3
2020-2021	121.8
2021-2022	[redacted] ee Note 3

Note 1: PJM began requiring market participants EKPC to include the calculation for the Winter Peak Load contribution as well as Summer Peak Load contributions for all DR assets being bid in the market. The new PJM market rules required EKPC to bid the lower of the two calculations. For EKPC, the winter contribution is the lower contributions resulting in a lower bid in 2017-2018 when compared to 2016-2017.

Note 2: PJM implemented a new market called Capacity Performance (CP). The new CP market has new rules. One rule is that all assets must be able to reduce the load up to 12 hours when PJM calls for a demand response of the participating assets. EKPC and its owner-members knows that controlling air conditioning and water heating for 12 hours will cause issues with participating members of the DLC program. Therefore, EKPC did not bid DLC switches in the market for 2018-2019 and after. However, EKPC and its owner-members are still reaping the benefits for DLC switches. EKPC's annual load payments to PJM is determined by EKPC contribution to the PJM 5 coincident peaks during the summer months. EKPC is predicting those 5 coincident peaks and managing DLC switches accordingly to minimize EKPC's payments to the PJM capacity market.

Note 3: [redacted]

Energy Efficiency Peak Savings

EKPC evaluated bidding energy efficiency into the DR market under the PJM rules for bidding energy efficiency. PJM has stringent measurement and verification requirements for participating program to prove performance. The cost for EKPC to measure and verify energy efficiency programs would outweigh the benefits or payments received from PJM. Therefore, EKPC has not yet bid energy efficiency programs in the market, but will continue to evaluate that option.