Integrated Resource Plan

Technical Appendix

Volume 2

Demand Side Management

EAST KENTUCKY
POWER COOPERATIVE
A Touchstone Energy Cooperative

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 customer 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 customer 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 2015 IRP, EKPC has significantly enhanced its DSM planning capabilities by undertaking a comprehensive study of energy efficiency (EE) savings potential.

For the EE potential study, GDS Associates (GDS) conducted a cost-effectiveness screening of a comprehensive set of measures using the Total Resource Cost 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 IRP.

EKPC evaluated 207 DSM measures for the 2015 Integrated Resource Plan. These include 54 residential energy efficiency measures, 82 commercial efficiency measures, and 66 industrial measures, plus 5 demand response programs.

For more details on the energy efficiency measures and the results of the economic screening of those measures, please see the GDS Energy Efficiency Potential report. All five of the demand response programs are included as resources in this plan.

Individual energy efficiency measures were then bundled together according to program categories, both existing and new. EKPC then prepared cost and participation estimates for all of the DSM programs, and conducted a final cost-effectiveness analysis for each DSM program using the DSMore software tool.

For three programs, cost-effectiveness analysis was done for individual measures in that program as well: Direct Load Control of Air Conditioners and Water Heaters (2 measures), ENERGY STAR® Appliances (7 measures), and Commercial & Industrial Equipment Rebate (5 measures). All of the programs were shown to be cost-effective using the TRC test.

All programs that were implemented in 2014, plus any additional programs in the tariff approval process, are considered "Existing" for the purposes of this IRP. "New" programs target measures with significant potential that are not included in Existing programs.

For this 2015 IRP, EKPC has fine-tuned its DSM modeling projects to close the gap between its theoretical and actual peak demand and energy savings. In order to close this gap, EKPC established a ramp-up period of six years (2015-2020) during which time it plans to steadily increase its investment in DSM resources so that EKPC attain its goal of 1% of annual retail savings by the year 2020.

The DSM portfolio for the 2015 IRP includes fourteen (14) Existing programs, and eleven (11) New programs.

EKPC presents the following DSM Program Portfolio for the 2015 IRP:

Table DSM-1
Existing Programs[1]

Program Name	Class	Summer Peak Demand Impact in 2029 (MW)	Annual Energy Impact in 2029 (MWh)	Total Resource Cost Test Benefit/ Cost Ratio
Button-Up Tiered Weatherization	Residential	20.2	85,739	1.15
Heat Pump Retrofit	Residential	6.1	142,905	1.34
Direct Load Control of AC & WH	Residential	49.7	1,806	2.29
Residential Lighting	Residential	4.5	40,745	2.13
Touchstone Energy (TSE) Home	Residential	2.0	7,619	1.36
ENERGY STAR® Manufactured Home	Residential	1.0	23,894	4.27
Tune-Up HVAC w/ Duct Sealing	Residential	2.2	7,585	2.25
Low Income with Community Action	Residential	1.2	7,569	1.34
ENERGY STAR® Appliances	Residential	17.6	55,886	1.36
Appliance Recycling	Residential	3.1	21,583	2.31
Commercial Lighting	Commercial	26.6	133,053	1.93
Compressed Air	Industrial	0.0	0	1.84
Large Interruptible	Industrial	85.0	30,600	NA
Other Interruptible	Industrial	24.0	8,640	NA

[1] All impacts are cumulative incremental starting with 2015 new participation except for the Interruptible programs. All impacts represent net savings at the customer meter.

Table DSM-2
New Programs [2]

Program Name	Class	Summer Peak Demand Impact in 2029 (MW)	Annual Energy Impact in 2029 (MWh)	Total Resource Cost Test Benefit/ Cost Ratio
Consumer Electronics	Residential	5.3	33,882	2.07
Exterior Lighting	Residential	0.0	15,442	3.06
Water Heater Conservation	Residential	1.9	25,902	4.97
Smart Thermostat	Residential	15.5	66,114	3.48
Home Energy Information	Residential	16.3	76,486	1.41
C&I Demand Response	Commercial, Industrial	18.2	5,250	4.39
Industrial Process	Industrial	5.1	25,840	1.43
Industrial Machine Drive	Industrial	14.1	131,066	2.97
DLC for Commercial Central AC	Commercial	12.0	691	7.06
C&I Equipment Rebate	Commercial	27.2	108,492	2.54
C&I New Construction	Commercial, Industrial	6.5	24,944	3.57

This portfolio of existing and new DSM programs is projected to produce $820 million of benefits and $400 million of net benefits (2015 $) on a total resource basis over the lifetime of the cost-effectiveness study (25 years). They will require an investment of $420 million (2015 $) by EKPC, its member cooperatives, and participating customers in order to produce these savings.

[2] All impacts are cumulative incremental starting with 2015 new participation. All impacts represent net savings at the customer meter.

Major Enhancements Since Last IRP

EKPC has made several improvements to its DSM planning since the 2012 IRP. They include:

1. Sponsored GDS Associates to prepare an Energy Efficiency Potential Study for EKPC (see **Exhibit DSM-1**). The project scope included a detailed energy efficiency potential study for residential and commercial/industrial customers. This resulted in evaluating a more comprehensive set of DSM measures in preparing DSM projections in this IRP.
2. EKPC is now implementing several new programs that were proposed in the 2012 IRP. These include Button-Up Tiered Weatherization, the ENERGY STAR® Manufactured Home, Low Income, ENERGY STAR® Appliances, and the Appliance Recycling program.
3. Adapted a DSM planning approach and avoided cost values to match participation as a member in the PJM market.
4. Currently participating in the PJM capacity market auctions, bidding in demand response resources.
5. Cost-benefit analysis performed on a greater number of DSM measures by incorporating cost-benefit analysis into the energy efficiency potential study.
6. More ambitious targets for energy (MWh) savings established, to align DSM portfolio with changing resource needs and to enhance the use of DSM as an environmental compliance option.
7. Commissioned a comprehensive Assessment of Evaluation, Measurement and Verification ("EM&V) for DSM Programs which was conducted by KEMA in 2013.
8. Procured and implemented a DSM Tracking software system provided by Direct Technology to improve data collection and program administration and reporting capabilities for DSM programs.
9. Sponsored Quarterly DSM Collaborative meetings over the two-year life of that organization, and submitted two annual reports on the findings of the collaborative.
10. Prepared and submitted DSM Annual Report for 2013 (see **Exhibit DSM-2**); 2014 is now in progress.
11. Updated avoided costs for capacity to match current plans for transmission, distribution, and generation investment (including environmental compliance costs).
12. Enhanced program designs to incorporate lessons learned in the field as well as best practice in the industry.

Introduction

East Kentucky Power Cooperative (EKPC) evaluates the future electric service requirements for its member cooperatives with balanced consideration of demand-side and supply-side resource options. The purpose of this section is to describe the evaluation of demand-side management (DSM) resources for inclusion in the integrated analysis portion of the 2015 Integrated Resource Plan (IRP).

DSM resources consist of customer energy programs that seek to change the power consumption of customer facilities in a way that meets planning objectives. They include conservation, load management, demand response, and other demand-side programs.

EKPC's DSM analysis is conducted on an aggregate basis, with all member cooperatives combined, rather than on an individual cooperative basis.

Screening Criteria

EKPC analyzes DSM measures and programs using both qualitative and quantitative criteria. These criteria include customer 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 Measure/Program Screening and Evaluation

EKPC has used an enhanced process to screen and evaluate DSM resources for inclusion in this plan.

For the 2015 IRP, EKPC has significantly enhanced its DSM planning capabilities by undertaking a comprehensive study of energy efficiency (EE) savings potential. In the summer of 2014, EKPC selected GDS Associates as its contractor to conduct this energy efficiency potential study.

The residential class results from that study were available at the time EKPC conducted its analysis of DSM programs and therefore have been directly incorporated into the projections of DSM resources for this 2015 IRP. The residential class accounts for approximately 60% of the retail load served by EKPC.

In addition, GDS made available high level results for the industrial class, and EKPC supplemented these with findings from neighbor utilities regarding the commercial class.

For the EE potential study, GDS conducted a cost-effectiveness screening of a comprehensive set of measures using the Total Resource Cost 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 IRP.
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 Potential Study submitted by GDS. That report can be found in **Exhibit DSM-1.**

EKPC reviewed the findings of the potential study with its member cooperatives. At that point, a small number of measures were screened out because they had very low savings potential. However, this set of measures represented only 2% of the achievable potential in the residential class, and 3% of the industrial potential.

EKPC evaluated 207 DSM measures for the 2015 Integrated Resource Plan. These include 54 residential energy efficiency measures, 82 commercial efficiency measures, and 66 industrial measures, plus 5 demand response programs.

DSM Program Bundling and Final Cost-Effectiveness Analysis

Individual energy efficiency measures were then bundled together according to program categories, both existing and new. EKPC then prepared cost and participation estimates for all of the DSM programs, and conducted a final cost-effectiveness analysis for each DSM program using the DSMore software tool.

For three programs, cost-effectiveness analysis was done for individual measures in that program as well: Direct Load Control of Air Conditioners and Water Heaters (2 measures), ENERGY STAR® Appliances (7 measures), and Commercial & Industrial Equipment Rebate (5 measures). All of the programs were shown to be cost-effective using the TRC test.

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 Demand Side Management Option Risk Evaluator ("*DSMore*") is a financial analysis tool designed to evaluate the costs, benefits, and risk profile of demand side management 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 of the standard DSM cost-effectiveness tests can be calculated using this tool: the Total Resource Cost test, the Utility Cost test, the Participant Cost test, the Ratepayer Impact Test, and the Societal Test. *DSMore* provides the results of those tests for both energy efficiency and demand response programs. This tool is one of the few packages 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 utilities and their customers. 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 the electric system and its customers.

DSMore determines the cost-effectiveness of DSM programs by reporting results according to the cost-benefit tests established in the California Standard Practice Manual for Economic Analysis of Demand Side Programs[3].

EKPC uses these tests to examine cost-effectiveness from three major perspectives: participant cost (PC), ratepayer impact measure (RIM), and total resource cost (TRC). A fourth perspective, the societal cost (SC), is treated as a variation on the TRC test.

The results of each perspective 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 Participant Cost 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.

This multi-perspective approach will require reviewers to consider tradeoffs between the various tests. The use of multiple tests helps ensure that the resulting portfolio of DSM programs attracts participants, results in the wise use of resource, and limits cross-subsidization.

EKPC is a full requirements Generation and Transmission provider for its 16 member cooperatives. Each cooperative is an independent non-profit corporation and operates distinct from EKPC.

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[3] California Public Utilities Commission and California Energy Commission, "Standard Practice Manual for Economic Analysis of Demand-Side Management Programs," Document Number P400-87-006, December 1987.

As a result, it is necessary to examine the impacts of DSM programs separately for EKPC and for the typical distribution cooperative. EKPC uses a customized version of DSMore to separately report the RIM test for EKPC and for the distribution cooperative.

Each of the 25 DSM programs was modeled in detail with *DSMore*. The model includes for each DSM program:

- Typical participant electricity savings (kWh and kW)
- Lifetime of the measure savings
- Incremental measure costs (participant costs)
- EKPC and distribution cooperative administrative costs
- Rebates to customers, and from EKPC to the cooperative
- Detailed retail and wholesale rate schedules
- Customer 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, incl. seasonal allocation)
- Fossil fuel (natural gas & propane) costs (by year)
- Environmental externality costs (costs not internalized in energy or capacity costs; chiefly carbon related)

Existing and New Programs

All programs that were implemented in 2014, plus any additional programs in the tariff approval process, are considered "Existing" for the purposes of this IRP. Savings from Existing programs are included in the Load Forecast. This includes future participation for the period 2015 through 2019.

In most cases, the potential study identified additional savings beyond those in the load forecast for Existing program measures. These additional savings for additional participation in the years 2020 through 2029 have been modeled as New resources in this IRP. However, in order to avoid confusion, these additional savings are reported with the same Existing program category in the program impact tables.

Theoretical versus Actual: Closing the Gap

For this 2015 IRP, EKPC has fine-tuned its DSM modeling projects to close the gap between its theoretical and actual peak demand and energy savings. EKPC has set the goal of achieving the equivalent of 1% of annual retail sales in new DSM annual kWh savings each year. The findings from the potential study show that this goal is achievable in the medium and long term. However, the levels of activity and spending far outstrip current performance and budgeting. In fact, EKPC is currently producing 0.2% of annual retail sales in new DSM annual kWh.

In order to close this gap, EKPC has established a ramp-up period of six years (2015-2020) during which time it plans to steadily increase investment in DSM resources so that EKPC can attain its goal of 1% of annual retail savings by the year 2020. Participation projections reflect this steady increase in the years 2015-2020 then leveling off at participation levels that consistently achieve the 1% goal thereafter (from 2020-2029).

Descriptions of the Existing and New DSM Programs

Exhibit DSM-3 provides assumptions sheets for each DSM program. For three programs, separate analysis was performed for individual measures and then aggregated. Separate assumptions sheets were completed for each measure for those programs: Direct Load Control of Air Conditioners and Water Heaters (2 measures), ENERGY STAR® Appliances (5 measures), and the Commercial & Industrial Rebate Program (5 measures).

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 existing programs, while **Exhibit DSM-6** provides program descriptions for each of the new programs.

Recommendations

Coming out of the Quantitative Screening and review, 11 New DSM programs along with 14 Existing DSM programs comprise the DSM portfolio and were passed on to the integrated analysis portion of the IRP. The integrated analysis determines the direction that EKPC should take in meeting the future needs of its member cooperatives and their customers.

EKPC presents the following DSM Program Portfolio for the 2015 Integrated Resource Plan:

Table DSM-3
Existing Programs[4]

Program Name	Class	Summer Peak Demand Impact in 2029 (MW)	Annual Energy Impact in 2029 (MWh)	Total Resource Cost Test Benefit/ Cost Ratio
Button-Up Tiered Weatherization	Residential	20.2	85,739	1.15
Heat Pump Retrofit	Residential	6.1	142,905	1.34
Direct Load Control of AC & WH	Residential	49.7	1,806	2.29
Residential Lighting	Residential	4.5	40,745	2.13
Touchstone Energy (TSE) Home	Residential	2.0	7,619	1.36
ENERGY STAR® Manufactured Home	Residential	1.0	23,894	4.27
Tune-Up HVAC w/ Duct Sealing	Residential	2.2	7,585	2.25
Low Income with Community Action	Residential	1.2	7,569	1.34
ENERGY STAR® Appliances	Residential	17.6	55,886	1.36
Appliance Recycling	Residential	3.1	21,583	2.31
Commercial Lighting	Commercial	26.6	133,053	1.93
Compressed Air	Industrial	0.0	0	1.84
Large Interruptible	Industrial	85.0	30,600	NA
Other Interruptible	Industrial	24.0	8,640	NA
Total for Existing Programs		243.2	567,624	-

[4] All impacts are cumulative incremental starting with 2015 new participation except for the Interruptible programs. All impacts represent net savings at the customer meter.

Table DSM-4
New Programs [5]

Program Name	Class	Summer Peak Demand Impact in 2029 (MW)	Annual Energy Impact in 2029 (MWh)	Total Resource Cost Test Benefit/ Cost Ratio
Consumer Electronics	Residential	5.3	33,882	2.07
Exterior Lighting	Residential	0.0	15,442	3.06
Water Heater Conservation	Residential	1.9	25,902	4.97
Smart Thermostat	Residential	15.5	66,114	3.48
Home Energy Information	Residential	16.3	76,486	1.41
C&I Demand Response	Commercial, Industrial	18.2	5,250	4.39
Industrial Process	Industrial	5.1	25,840	1.43
Industrial Machine Drive	Industrial	14.1	131,066	2.97
DLC for Commercial Central AC	Commercial	12.0	691	7.06
C&I Equipment Rebate	Commercial	27.2	108,492	2.54
C&I New Construction	Commercial, Industrial	6.5	24,944	3.57
Total for New Programs		122.1	514,109	-

This portfolio of existing and new DSM programs is projected to produce $ 820 million of benefits and $400 million of net benefits (2015 $) on a total resource basis over the lifetime of the cost-effectiveness study (25 years). They will require an investment of $420 million (2015 $) by EKPC, its member cooperatives, and participating customers in order to produce these savings.

[5] All impacts are cumulative incremental starting with 2015 new participation. All impacts represent net savings at the customer meter.

DSM program design and implementation are complex and dynamic undertakings. It is possible that DSM programs that are selected through this evaluation process may not be implemented as they have been described in this document. DSM programs that are ultimately launched will first be subjected to a much more rigorous program design effort. In certain cases, a demonstration or pilot project may precede full-scale implementation to test the validity of the program concept. This could mean that certain program concepts are modified, and some may not ultimately be implemented.

Estimated Impacts

This section provides the estimated impacts of both the Existing and New DSM programs in utility sales and coincident peak demands. Impacts for Existing DSM programs are accounted for in the load forecast. Impacts for New DSM programs are accounted for in the integrated resource plan.

The following table provides the forecasted impacts of the Existing DSM programs. Negative values denote reductions in load requirements while positive values denote increases in load requirements.

Table DSM-5
Load Impacts of Existing Programs

(negative value= reduction in load)

Year	Impact on Energy Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	-67,218	-122.8	-141.9
2016	-96,372	-130.7	-152.4
2017	-130,904	-139.4	-163.9
2018	-168,432	-148.4	-176.1
2019	-207,943	-157.6	-188.6
2020	-252,601	-167.5	-195.8
2021	-297,290	-177.2	-202.8
2022	-339,206	-186.4	-209.3
2023	-379,428	-195.2	-215.5
2024	-418,582	-203.7	-221.3
2025	-454,088	-211.9	-226.4
2026	-490,201	-220.1	-231.6
2027	-523,942	-227.5	-236.5
2028	-546,687	-233.2	-239.9
2029	-567,623	-238.6	-243.0

The following table provides the projected estimated impacts of the New DSM programs. Negative values denote reductions in load requirements while positive values denote increases in load requirements.

Table DSM-6
Load Impacts of New Programs

(negative value = reduction in load)

Year	Impact on Energy Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	-7,000	-6.0	-9.0
2016	-16,152	-14.1	-20.2
2017	-26,536	-20.5	-30.1
2018	-67,134	-31.4	-40.3
2019	-121,212	-46.5	-52.9
2020	-192,681	-65.5	-65.9
2021	-246,597	-78.4	-75.1
2022	-290,724	-88.0	-82.8
2023	-328,525	-95.3	-89.3
2024	-362,816	-102.5	-95.3
2025	-395,312	-109.6	-101.0
2026	-426,559	-116.7	-106.5
2027	-457,351	-123.8	-111.9
2028	-487,053	-130.8	-117.1
2029	-514,111	-137.4	-122.1

Year by year impacts for each individual program are provided in **Exhibit DSM-7**.

Other Exhibits

Exhibit DSM-8 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-9 contains the two Annual Reports produced by the DSM Collaborative.

Exhibit DSM-10 contains a table that shows the amount of demand response 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) the cost of purchasing allowances; (2) the capital costs of compliance at power plants; and (3) externality 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
Externalities	Externality adder	Used in Societal Cost test; value is set to $0/MWh. Value based on current assessment of likely value placed on carbon dioxide over the 15 year planning period.

Exhibit DSM-1

EE Potential Report

Exhibit DSM -1

GDS Associates, Inc.
Engineers and Consultants

EAST KENTUCKY POWER COOPERATIVE
ENERGY EFFICIENCY POTENTIAL STUDY

Prepared for:

EAST KENTUCKY POWER COOPERATIVE

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GDS ASSOCIATES, INC.
1850 PARKWAY PLACE
SUITE 800
MARIETTA, GA 30067
770.425.8100
770.426.0303 (FAX)
WWW.GDSASSOCIATES.COM

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1 EXECUTIVE SUMMARY

1.1 BACKGROUND

This energy efficiency potential for the East Kentucky Power Cooperative (EKPC) study provides a roadmap and identifies the energy efficiency 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. For this study, GDS Associates, the consulting firm retained to conduct this study, produced the following estimates of energy efficiency potential:

- Technical potential
- Economic potential
- Achievable potential

Definitions of the types of energy efficiency potential are provided below.

1. **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. It is often estimated as a "snapshot" in time assuming immediate implementation of all technologically feasible energy saving measures, with additional efficiency opportunities assumed as they arise from activities such as new construction.

2. **ECONOMIC POTENTIAL** refers to the subset of the technical potential that is economically cost-effective as compared to conventional supply-side energy resources. Both technical and economic potential are theoretical numbers that assume immediate implementation of 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 efficiency. Finally, they only consider the costs of efficiency measures themselves, ignoring any programmatic costs (e.g., marketing, analysis, administration) that would be necessary to capture them.

3. **ACHIEVABLE POTENTIAL** is the amount of energy use that efficiency can realistically be expected to displace assuming different market penetration scenarios for cost effective energy efficiency measures. An aggressive scenario, for example, could, provide program participants with payments for the entire incremental cost of more energy efficient equipment). This is often referred to as "maximum achievable potential". Achievable potential takes into account real-world barriers to convincing end-users to adopt cost effective energy efficiency measures, the non-measure costs of delivering programs (for administration, marketing, tracking systems, monitoring and evaluation, etc.), and the capability of programs and administrators to ramp up program activity over time.[1] Achievable savings potential savings is a subset of economic potential.

This potential study evaluates achievable potential represented by the amount of energy use that efficiency can realistically be expected to displace assuming transfer payments (incentives and cost recovery) equal to 48% of the incremental measure cost and no spending cap. Cost effectiveness of measures was determined with the Total Resource Cost (TRC) Test.

[1] These definitions are from the November 2007 National Action Plan for Energy Efficiency "Guide for Conducting Energy Efficiency Potential Studies"

The purpose of this energy efficiency potential study is to provide a foundation for the continuation of EKPC's energy efficiency programs and to determine the remaining opportunities for cost-effective energy efficiency savings. This detailed report presents results of the technical, economic, and achievable potential for electric efficiency measures for the following time period:

- The ten-year period from January 1, 2015 through December 31, 2024

All results were developed using customized residential, commercial and industrial sector-level potential assessment analytic models and Kentucky-specific cost effectiveness criteria including the most recent EKPC-specific avoided cost projections for electricity and natural gas. To help inform these energy efficiency potential models, up-to-date energy efficiency measure data were primarily obtained from the following recent studies and reports:

1) EKPC measures list)
2) Energy efficiency baseline studies conducted by EKPC
3) 2009 EIA Residential Energy Consumption Survey (RECS)
4) 2007 American Housing Survey (AHS)
5) 2003 EIA Commercial Building Energy Consumption Survey (CBECS)[2]
6) Indiana Technical Reference Manual
7) Mid- Atlantic Technical Reference Manual

The above data sources provided valuable information regarding the current saturation, costs, savings and useful lives of electric and natural gas energy efficiency measures considered in this study.

The results of this study provide detailed information on energy efficiency measures that are the most cost effective and have the greatest potential electric savings for EKPC. The data used for 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.

1.2 STUDY SCOPE

The study examines the potential to reduce electric consumption and peak demand and natural gas consumption through the implementation of energy efficiency technologies and practices in residential, commercial, and industrial facilities in EKPC member service territories. This study assesses electric energy efficiency potential over ten years, from 2015 through 2024.

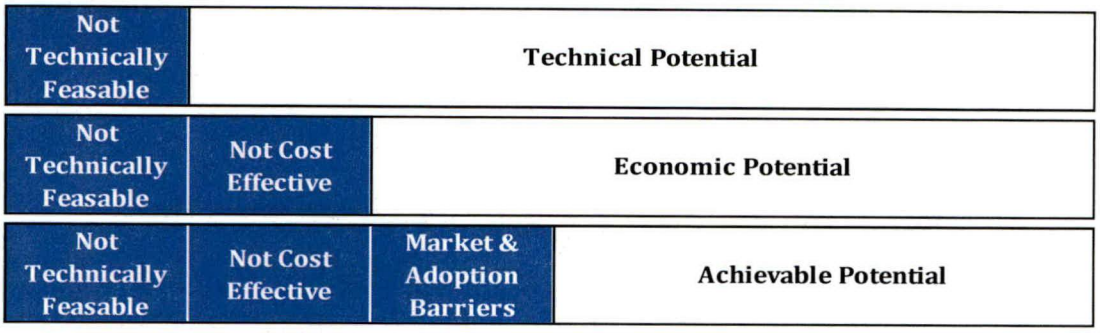
The study had the following main objectives:

- Evaluate the electric energy efficiency technical, economic and achievable potential savings for EKPC;
- Calculate the economic and achievable potential energy efficiency savings based upon cost effectiveness screening with the TRC benefit/cost ratios.

As noted above, the scope of this study distinguishes among three types of energy efficiency potential; (1) technical, (2) economic, and (3) achievable potential. The definitions used in this study for energy efficiency potential estimates were obtained directly from a 2007 National Action Plan for Energy Efficiency (NAPEE) report. Figure 1-1 below provides a graphical representation of the relationship of the various definitions of energy efficiency potential.

[2] This is the latest publicly available CBECS data released by the Energy Information Administration (EIA).

Figure 1-1: Types of Energy Efficiency Potential[3]



Limitations to the scope of study: As with any assessment of energy efficiency potential, this study necessarily builds on a large number of assumptions and data sources, including the following:

- Energy efficiency measure lives, measure savings and measure costs
- The discount rate for determining the net present value of future savings
- Projected penetration rates for energy efficiency measures
- Projections of EKPC specific electric avoided costs
- Future changes to current energy efficiency codes and standards for buildings and equipment

While the GDS Team has sought to use the best and most current available data, there are many assumptions where there may be reasonable alternative assumptions that would yield somewhat different results. Furthermore, while the lists of energy efficiency measures examined in this study represent most commercially available measures, these measure lists are not exhaustive.

Finally there was no attempt to place a dollar value on some difficult to quantify benefits arising from installation of some measures, such as increased comfort or increased safety, which may in turn support some personal choices to implement particular measures that may otherwise not be cost-effective or only marginally so.

1.3 SUMMARY OF RESULTS

This study examined 407 electric energy efficiency measures in the residential, commercial and industrial sectors combined.

Figure 1-2 below shows that cost effective electric energy efficiency resources can play a significantly expanded role in EKPC energy resource mix over the next ten years. For the EKPC, the achievable potential for electricity savings based on the TRC in 2024 is 8.5% of forecast MWh sales for 2024.

[3] Reproduced from "Guide to Resource Planning with Energy Efficiency" November 2007. US EPA. Figure 2-1.

Figure 1-2: Electric Energy Efficiency Potential Savings Summary

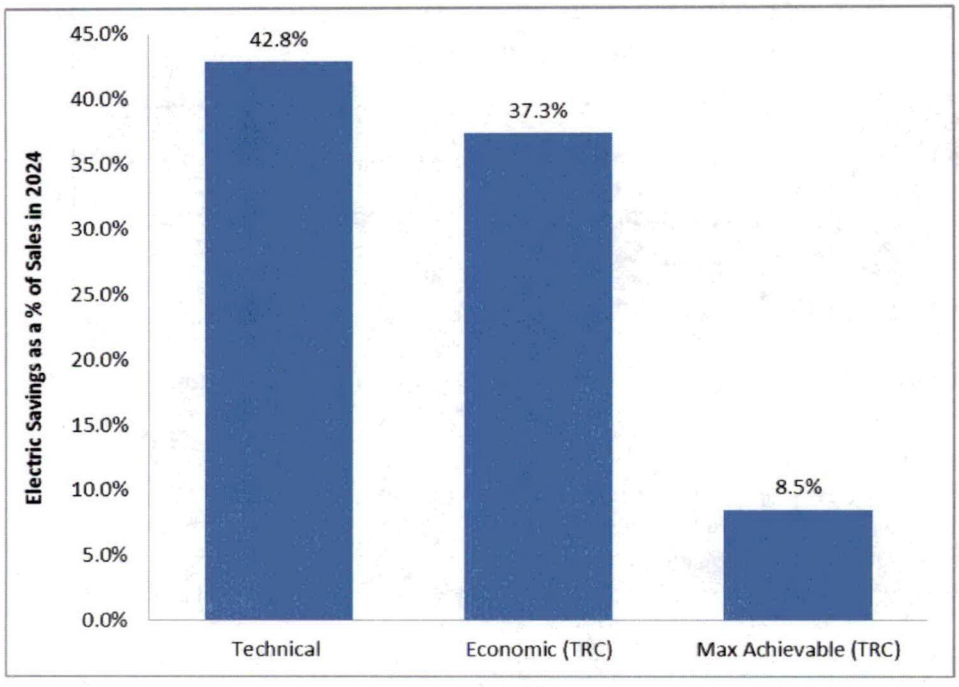


Table 1-1 presents additional detail, providing the energy efficiency savings potential for all scenarios over a period 10 years.

Table 1-1: Summary of Technical, Economic and Achievable Electric Energy Savings for 2024

END USE	TECHNICAL POTENTIAL	ECONOMIC POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (TRC)
Electric Sales MWh			
Savings % - Residential	57.50%	50.50%	9.10%
Savings % - Commercial	29.90%	28.30%	8.80%
Savings % - Industrial	22.20%	17.20%	7.00%
Savings % - Total	**42.84%**	**37.32%**	**8.47%**
Savings mWh - Residential	4,559,451	4,006,425	724,790
Savings mWh - Commercial	671,288	636,670	196,736
Savings mWh - Industrial	863,024	666,015	283,812
Savings mWh - Total	**6,093,763**	**5,309,110**	**1,205,338**

END USE	TECHNICAL POTENTIAL	ECONOMIC POTENTIAL (TRC)	ACHIEVABLE POTENTIAL (TRC)
Electric Demand MW			
Savings % - Residential	23%	18%	4%
Savings % - Commercial	21%	19%	7%
Savings % - Industrial	19%	15%	6%
Savings % - Total	**22%**	**17%**	**5%**
Savings MW - Residential	475	366	80.2
Savings MW - Commercial	95	88	32.4
Savings MW - Industrial	160.9	124.1	52.9
Savings MW - Total	**730.9**	**578.1**	**165.5**

Table 1-2 presents the annual utility budgets in total and by sector required to achieve the savings levels in each achievable potential scenario.

Table 1-2: Annual Program Budgets Associated with the Maximum Achievable TRC Scenario

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Residential	$21,161,766	$23,851,062	$26,072,192	$27,949,945	$29,607,024	$31,102,128	$32,626,531	$34,050,500	$35,487,444	$36,748,485
Commercial	$4,283,301	$4,283,905	$4,284,513	$4,324,691	$4,335,192	$4,358,833	$4,391,097	$4,635,577	$4,682,010	$4,718,626
Industrial	$3,255,539	$3,868,445	$4,151,869	$4,181,598	$3,657,061	$3,719,921	$3,455,122	$3,493,481	$3,613,002	$3,928,857
Total Budgets	**$28,700,606**	**$32,003,412**	**$34,508,574**	**$36,456,234**	**$37,599,277**	**$39,180,882**	**$40,472,750**	**$42,179,558**	**$43,782,456**	**$45,395,968**

1.4 ENERGY EFFICIENCY POTENTIAL SAVINGS DETAIL BY SECTOR

Note that Sections 6, 7 and 8 of this report include additional detail about the electric energy efficiency savings potential for EKPC by 2024.

1.5 COST EFFECTIVENESS FINDINGS

This study examines economic potential scenario using the Total Resource Cost (TRC) test. This energy efficiency potential study concludes that significant cost effective electric energy efficiency potential remains for EKPC. Table 1-3 show the preliminary present value benefits, costs and benefit-cost ratios for the Maximum Achievable Potential scenario examined in this study.

Table 1-3: Benefit-Cost Ratios for Achievable Potential Scenarios For 2015 to 2024 Time Period

ACHIEVABLE POTENTIAL SCENARIOS	NPV $ BENEFITS	NPV $ COSTS	BENEFIT/COST RATIO	NET BENEFITS
Achievable TRC	$1,114,326,815	$527,373,703	3.10	$1,105,280,447

In addition, GDS did calculate TRC benefit/cost ratios for each energy efficiency measure considered in this study. Only measures that had a benefit/cost ratio greater than or equal to 1.0 were retained in the economic and achievable potential savings estimates.

1.6 REPORT ORGANIZATION

The remainder of this report is organized as follows:

Section 2: Glossary of Terms defines key terminology used in the report.

Section 3: Introduction highlights the purpose of this study and the importance of energy efficiency.

Section 4: Characterization of Electric Energy Consumption provides an overview of the economic/demographic characteristics a brief discussion of the historical and forecasted electric energy sales by sector as well as electric peak demand.

Section 5: Potential Study Methodology details the approach used to develop the estimates of technical, economic and achievable potential savings for electric and natural gas energy efficiency savings.

Section 6: Residential Electric Energy Efficiency Potential Estimates provides a breakdown of the technical, economic, and achievable energy efficiency savings potential in the residential sector.

Section 7: Commercial Sector Electric Energy Efficiency Potential Estimates provides a breakdown of the technical, economic, and achievable energy efficiency savings potential in the commercial sector.

Section 8: Industrial Sector Electric Efficiency Potential Estimates provides a breakdown of the technical, economic, and achievable energy efficiency savings potential in the industrial sector.

2 GLOSSARY OF TERMS[4]

The following list defines many of the key energy efficiency terms used throughout this energy efficiency potential study.

ACHIEVABLE POTENTIAL: The November 2007 National Action Plan for Energy Efficiency "Guide for Conducting Energy Efficiency Potential Studies" defines achievable potential as the amount of energy use that energy 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). This is often referred to as maximum achievable potential. Achievable potential takes into account real-world barriers to convincing end-users to adopt efficiency measures, the non-measure costs of delivering programs (for administration, marketing, tracking systems, monitoring and evaluation, etc.), and the capability of programs and administrators to ramp up program activity over time.

APPLICABILITY FACTOR: The fraction of the applicable housing units or businesses that is technically feasible for conversion to the efficient technology from an engineering perspective (e.g., it may not be possible to install CFLs in all light sockets in a home because the CFLs may not fit in every socket in a home).

AVOIDED COSTS: For purposes of this report, the electric avoided costs are defined as the generation, transmission and distribution costs that can be avoided in the future if the consumption of electricity or natural gas can be reduced with energy efficiency or demand response programs. For a natural gas utility, the avoided costs include the cost of the natural gas commodity and any other natural gas infrastructure costs that can be reduced with energy efficiency programs.

BASE ACHIEVABLE POTENTIAL: For purposes of this study, an achievable potential scenario which assumes incentives are set to 48% of the incremental or full measure cost.

BASE CASE EQUIPMENT END-USE INTENSITY: The electricity or natural gas used per customer per year by each base-case technology in each market segment. This is the consumption of the electric or natural gas energy using equipment that the efficient technology replaces or affects. For example, if the efficient measure is a high efficiency light bulb (CFL), the base end-use intensity would be the annual kWh use per bulb per household associated with an incandescent or halogen light bulb that provides equivalent lumens to the CFL.

BASE CASE FACTOR: The fraction of the market that is applicable for the efficient technology in a given market segment. For example, for the residential electric clothes washer measure, this would be the fraction of all residential customers that have an electric clothes washer in their household.

CAPITAL RECOVERY RATE (CRR): The return of invested capital expressed as an annual rate; often applied in a physical sense to wasting assets with a finite economic life.[5]

COINCIDENCE FACTOR: The fraction of connected load expected to be "on" and using electricity coincident with the electric system peak period.

CONSTRAINED ACHIEVABLE: An achievable potential scenario which assumes a lower level of incentives or lower annual program budgets than in the base case scenario.

[4] Potential definitions taken from National Action Plan for Energy Efficiency (2007). "Guide for Conducting Energy Efficiency Potential Studies." Prepared by Philip Mosenthal and Jeffrey Loiter, Optimal Energy, Inc.
[5] Accuval. http://www.accuval.net/insights/glossary/

COST-EFFECTIVENESS: A measure of the relevant economic effects resulting from the implementation of an energy efficiency measure or program. If the benefits are greater than the costs, the measure is said to be cost-effective.

CUMULATIVE ANNUAL: Refers to the overall annual savings occurring in a given year from both new participants and annual savings continuing to result from past participation with energy efficiency measures that are still in place. Cumulative annual does not always equal the sum of all prior year incremental values as some energy efficiency measures have relatively short lives and, as a result, their savings drop off over time.

COMMERCIAL SECTOR: Comprised of non-manufacturing premises typically used to sell a product or provide a service, where electricity is consumed primarily for lighting, space cooling and heating, office equipment, refrigeration and other end uses. Business types are included in Section 5 – Methodology.

DEMAND RESPONSE: Refers to electric demand resources involving dynamic hourly load response to market conditions, such as curtailment or load control programs.

EARLY REPLACEMENT: Refers to an energy efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with higher-efficiency units.

ECONOMIC POTENTIAL: The November 2007 National Action Plan for Energy Efficiency "Guide for Conducting Energy Efficiency Potential Studies" refers to the subset of the technical potential that is economically cost-effective as compared to conventional supply-side energy resources as economic potential. Both technical and economic potential are theoretical numbers that assume immediate implementation of 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 efficiency. Finally, they only consider the costs of efficiency measures themselves, ignoring any programmatic costs (e.g., marketing, analysis, administration, evaluation) that would be necessary to capture them.

END-USE: A category of equipment or service that consumes energy (*e.g.*, lighting, refrigeration, heating, process heat, cooling).

ENERGY EFFICIENCY: Using less energy to provide the same or an improved level of service to the energy consumer in an economically efficient way. Sometimes "conservation" is used as a synonym, but that term is usually taken to mean using less of a resource even if this results in a lower service level (*e.g.*, setting a thermostat lower or reducing lighting levels).

ENERGY USE INTENSITY (EUI): A unit of measurement that describes a building's energy use. EUI represents the energy consumed by a building relative to its size.[6]

FREE DRIVER: Individuals or businesses that adopt an energy efficient product or service because of an energy efficiency program, but are difficult to identify either because they do not receive an incentive or are not aware of the program.

FREE RIDER: Participants in an energy efficiency program who would have adopted an energy efficiency technology or improvement in the absence of a program or financial incentive.

GROSS SAVINGS: Gross energy (or demand) savings are the change in energy consumption or demand that results directly from program-promoted actions (e.g., installing energy-efficient lighting) taken by program participants regardless of the extent or nature of program influence on their actions.

[6] See http://www.energystar.gov/index.cfm?fuseaction=buildingcontest.eui

INCENTIVE COSTS: A rebate or some form of payment used to encourage people to implement a given demand-side management (DSM) technology.

INCREMENTAL: Savings or costs in a given year associated only with new installations of energy efficiency or demand response measures happening in that specific year.

INDUSTRIAL SECTOR: Comprised of manufacturing premises typically used for producing and processing goods, where electricity is consumed primarily for operating motors, process cooling and heating, and space heating, ventilation, and air conditioning (HVAC). Business types are included in section 5 – Methodology.

MAXIMUM (OR MAX) ACHIEVABLE: An achievable potential scenario which assumes incentives for program participants are equal to 100% of measure incremental or full costs.

MEASURE: Any action taken to increase energy efficiency, whether through changes in equipment, changes to a building shell, implementation of control strategies, or changes in consumer behavior. Examples are higher-efficiency central air conditioners, occupancy sensor control of lighting, and retro-commissioning. In some cases, bundles of technologies or practices may be modeled as single measures. For example, an ENERGY STAR® ™ home package may be treated as a single measure.

MW: A unit of electrical output, equal to one million watts or one thousand kilowatts. It is typically used to refer to the output of a power plant.

MWH: One thousand kilowatt-hours, or one million watt-hours. One MWh is equal to the use of 1,000,000 watts of power in one hour.

NET-TO-GROSS RATIO: A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts

NET SAVINGS: Net energy or demand savings refer to the portion of gross savings that is attributable to the program. This involves separating out the impacts that are a result of other influences, such as consumer self-motivation. Given the range of influences on consumers' energy consumption, attributing changes to one cause (i.e., a particular program) or another can be quite complex.

NON INCENTIVE COST: Costs incurred by the utility that do not include incentives paid to the customer (i.e.: program administrative costs, program marketing costs, data tracking and reporting, program evaluation, etc.)

NONPARTICIPANT SPILLOVER: Savings from efficiency projects implemented by those who did not directly participate in a program, but which nonetheless occurred due to the influence of the program.

PARTICIPANT COST: The cost to the participant to participate in an energy efficiency program.

PARTICIPANT SPILLOVER: Additional energy efficiency actions taken by program participants as a result of program influence, but actions that go beyond those directly subsidized or required by the program.[7]

PORTFOLIO: Either a collection of similar programs addressing the same market, technology, or mechanisms; or the set of all programs conducted by one energy efficiency organization or utility.

PROGRAM: A mechanism for encouraging energy efficiency that may be funded by a variety of sources and pursued by a wide range of approaches (typically includes multiple energy efficiency measures).

[7] The definitions of participant and nonparticipant spillover were obtained from the National Action Plan for Energy Efficiency Report titled "Model Energy Efficiency Program Impact Evaluation Guide", November 2007, page ES-4.

PROGRAM POTENTIAL: The November 2007 National Action Plan for Energy Efficiency 'Guide for Conducting Energy Efficiency Potential Studies" refers to the efficiency potential possible given specific program funding levels and designs as program potential. Often, program potential studies are referred to as "achievable" in contrast to "maximum achievable." In effect, they estimate the achievable potential from a given set of programs and funding. Program potential studies can consider scenarios ranging from a single program to a full portfolio of programs. A typical potential study may report a range of results based on different program funding levels.

REMAINING FACTOR: The fraction of applicable units that have not yet been converted to the electric or natural gas energy efficiency measure; that is, one minus the fraction of units that already have the energy efficiency measure installed.

REPLACE-ON-BURNOUT(ROB): An energy efficiency measure is not implemented until the existing technology it is replacing fails or burns out. An example would be an energy efficient water heater being purchased after the failure of the existing water heater at the end of its useful life.

RESOURCE ACQUISITION COSTS: The cost of energy savings associated with energy efficiency programs, generally expressed in costs per first year or per lifetime MWH saved ($/MWh), kWh ($/kWh), or MMBtu ($/MMBtu) in this report.

RETROFIT: Refers to an efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with higher-efficiency units (also called "early retirement") or the installation of additional controls, equipment, or materials in existing facilities for purposes of reducing energy consumption (e.g., increased insulation, low flow devices, lighting occupancy controls, economizer ventilation systems).

SAVINGS FACTOR: The percentage reduction in electricity or natural gas consumption resulting from application of the efficient technology. The savings factor is used in the formulas to calculate energy efficiency potential.

SOCIETAL COST TEST: Measures the net benefits of the energy efficiency program for a region or service area as a whole. Costs included in the SCT are costs to purchase and install the energy efficiency measure and overhead costs of running the energy efficiency program. The SCT may also include non-energy costs, such as reduced customer comfort levels. The benefits included are the avoided costs of energy and capacity, plus environmental and other non-energy benefits that are not currently valued by the market.

TECHNICAL POTENTIAL: The theoretical maximum amount of energy use that could be displaced by energy efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end-users to adopt the energy efficiency measures. It is often estimated as a "snapshot" in time assuming immediate implementation of all technologically feasible energy saving measures, with additional efficiency opportunities assumed as they arise from activities such as new construction.

TOTAL RESOURCE COST TEST: The TRC measures the net benefits of the energy efficiency program for a region or service area as a whole from the combined perspective of the utility and program participants. Costs included in the TRC are costs to purchase and install the energy efficiency measure and overhead costs of running the energy efficiency program. Costs include all costs for the utility and the participants. The benefits included are the avoided costs of energy and capacity plus any quantifiable non-energy benefits (such as reduced emissions of carbon dioxide).

3 INTRODUCTION

This report assesses the potential for electric energy efficiency programs to assist EKPC in meeting future energy service needs. This section of the report provides the following information:

- Defines the term "energy efficiency";
- Describes the general benefits of energy efficiency programs;
- Provides results of similar energy efficiency potential studies conducted in other states; and,
- Describes contents of the Sections of this report.

The purpose of this energy efficiency potential study is to provide a detailed assessment of the technical, economic and achievable potential for electric energy efficiency in EKPC member service territories. This study has examined a full array of energy efficiency technologies and energy efficient building practices that are technically achievable. The results of this study can be used to develop energy efficiency goals for EKPC in the short and long-term.

3.1 INTRODUCTION TO ENERGY EFFICIENCY

Efficient energy use, often referred to as energy efficiency, is using less energy to provide the same level of energy service. An example would be insulating a home or business in order to use less heating and cooling energy to achieve the same inside temperature. Another example would be installing fluorescent lighting in place of less efficient halogen or incandescent lights to attain the same level of illumination. Energy efficiency can be achieved through more efficient technologies and/or processes as well as through changes in individual behavior.

3.1.1 General Benefits of Energy Efficiency

There are a number of benefits that accrue due to electric energy efficiency programs. These benefits include avoided cost savings, non-electric benefits such as water and fossil fuel savings, environmental benefits, economic stimulus, job creation, risk reduction, and energy security.

Avoided electric energy and capacity costs are based upon the costs an electric utility would incur to construct and operate new electric power plants or to purchase power from another source. These avoided costs of electricity include both fixed and variable costs that can be directly avoided through a reduction in electricity usage. The energy component includes the costs associated with the production of electricity, while the capacity component includes costs associated with the capability to deliver electric energy during peak periods. Capacity costs consist primarily of the costs associated with building peaking generation facilities. The forecasts of electric energy and capacity avoided costs and natural gas avoided costs used in this study were provided to GDS by EKPC. Avoided costs for natural gas include the avoided costs of the natural gas commodity and any other savings on the natural gas distribution system for operations and maintenance expenses or natural gas infrastructure expenditures.

At the consumer level, energy efficient products often cost more than their standard efficiency counterparts, but this additional cost is balanced by lower energy consumption and lower energy bills. Over time, the money saved from energy efficient products will pay consumers back for their initial investment as well as save them money on their electric bills. Although some energy efficient technologies are complex and expensive, such as installing new high efficiency windows or a high efficiency boiler, many are simple and inexpensive. Installing compact fluorescent lighting or low-flow water devices, for example, can be done by most individuals.

3.2 THE EKPC CONTEXT

3.2.1 Continuing Customer Growth

The annual kWh sales and electric system peak load for EKPC is projected to increase over the next decade. This report assesses the potential for electric and natural gas energy efficiency programs to assist EKPC in meeting future electric energy service needs.

3.2.2 Energy Efficiency Activity

Making homes and buildings more energy efficient is seen as a key strategy for addressing energy security, reducing reliance on fossil fuels from other countries, assisting consumers to lower energy bills, and addressing concerns about climate change. Faced with rapidly increasing energy prices, constraints in energy supply and demand, and energy reliability concerns, states are turning to energy efficiency as the most reliable, cost-effective, and quickest resource to deploy.[8]

3.2.3 Recent Energy Efficiency Potential Studies

Table 3-1 below provides the results from a GDS review of a recent energy efficiency potential study conducted for Big Rivers Electric Corporation (also in Kentucky). It is useful to examine these results to understand if they are similar to this latest study for EKPC.

Table 3-1: Results of Recent Energy Efficiency Potential Studies in Kentucky

STATE	STUDY YEAR	AUTHOR	STUDY PERIOD	# OF YEARS	ACHIEVABLE POTENTIAL
Big Rivers	2013	GDS	2014-2023	10	11.2%

3.3 COST-EFFECTIVENESS FINDINGS

The Total Resource Cost (TRC) Test calculations in this study follow the prescribed methodology detailed in the latest version of the California Standard Practice Manual (CA SPM). The California Standard Practice Manual establishes standard procedures for cost-effectiveness evaluations for utility-sponsored or public benefits programs and is generally considered to be an authoritative source for defining cost-effectiveness criteria and methodology. This manual is often referenced by many other states and utilities.

The GDS cost-effectiveness screening tool used for this study quantifies all of the benefits and costs included in the TRC test. For purposes of this study, quantified benefits of the TRC Test include electric energy and capacity avoided supply costs, avoided electric transmission and distribution avoided costs, and alternative fuel and water savings. Costs include the specified measure cost (incremental or full cost, as applicable), any increase in supply costs (electric or fossil fuel), as well as operation and maintenance costs. In addition, the GDS screening tool is capable of evaluation of cost-effectiveness based on various market replacement approaches, including replace-on-burnout, retrofit, and early retirement.

The forecast of electric and natural gas avoided costs of energy and generation capacity were obtained from EKPC. The value for electric T&D avoided costs were obtained from a report from the New York Public Service Commission based on the upstate New York region.

[8] The December 2008 National Action Plan for Energy Efficiency (NAPEE) "Vision for 2025: A Framework for Change" states that "the long-term aspirational goal for the Action Plan is to achieve all cost-effective energy efficiency by the year 2025. Based on studies, the efficiency resource available may be able to meet 50% or more of the expected load growth over this time frame, similar to meeting 20% of electricity consumption and 10 percent of natural gas consumption. The benefits from achieving this magnitude of energy efficiency nationally can be estimated to be more than $100 billion in lower energy bills in 2025 than would otherwise occur, over $500 billion in net savings, and substantial reductions in greenhouse gas emissions."

This energy efficiency potential study concludes that there remains significant achievable cost effective potential for electric energy efficiency measures and programs in EKPC member service territories. Table 3-3 shows the overall benefit-cost ratio ten-year implementation period starting in 2015.

Table 3-3: Scenario #2: TRC Test Benefit-Cost Ratios for the Achievable Potential Scenario Based on TRC Screening 10-Year Implementation Period

ACHIEVABLE POTENTIAL SCENARIOS	TRC $ BENEFITS	TRC $ COSTS	TRC BENEFIT/COST RATIO
10-yr period	$1,632,654,150	$527,373,703	3.10

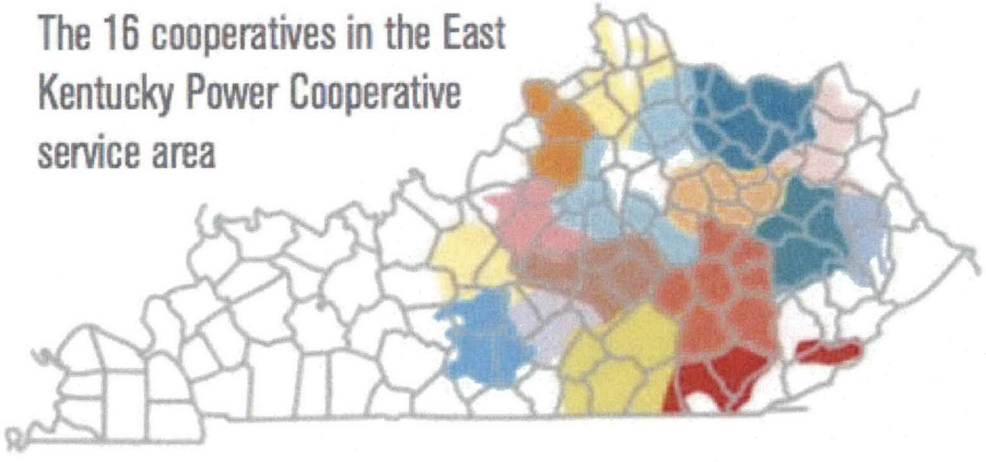
4 CHARACTERIZATION OF ELECTRICITY CONSUMPTION IN EKPC SERVICE AREAS

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.

4.1 EKPC MEMBER SERVICE AREAS

EKPC member service territories are located in an area from central Kentucky to eastern Kentucky. Figure 4-1 shows a map of the 16 cooperatives in EKPC's service area. Note that the size of service areas varies.

Figure 4-1: Map of the 16 Cooperatives in EKPC Service Area



4.2 ECONOMIC/DEMOGRAPHIC CHARACTERISTIC

Kentucky is 39,486.34square miles. According to an estimate done by the Census Bureau, during the year 2014, the total population of Kentucky is 4,413,457. [9]. There are 109.9 Persons per square mile, per 2010 census data.

Kentucky's state's population distribution by age is as follows:

- Under 5 – 6.3%
- Under 18 – 23.1%
- Above 65 – 14.4%

The estimated number of Kentucky housing units from the 2013 census was 1,936,565.

[9] U.S. Department of Commerce, Bureau of the Census, at http://quickfacts.census.gov/qfd/states/21000.html

Table 4-1 provides historical data for the number of electric customers by sector.

Table 4-1: Number of Electric Customers by Market Sector

YEAR	RESIDENTIAL ELECTRIC CUSTOMERS	COMMERCIAL & INDUSTRIAL ELECTRIC CUSTOMERS	TOTAL ELECTRIC CUSTOMERS
2001	421,353	30,234	**451,587**
2002	431,129	32,379	**463,508**
2003	441,589	32,112	**473,701**
2004	451,047	33,716	**484,763**
2005	455,943	36,327	**492,270**
2006	465,468	36,049	**501,517**
2007	471,495	36,964	**508,459**
2008	478,951	38,063	**517,014**
2009	480,398	38,367	**518,765**
2010	481,691	38,637	**520,328**
2011	482,351	38,798	**521,149**
2012	487,769	34,754	**522,523**
2013	489,630	35,042	**524,672**

4.3 RESIDENTIAL, COMMERCIAL AND INDUSTRIAL SECTOR BASELINE SEGMENTATION FINDINGS

This section provides detailed information on the breakdown of residential, commercial and industrial electricity sales by market segment and end use.

4.3.1 Electricity Sales by Sector

Figure 4-2 and Table 4-2 show historical and forecast electricity sales by sector (in millions of kWh) for East Kentucky Power Cooperative for the period 2003 to 2025. The breakout of Industrial versus Commercial sales was estimated based on a sample of customer non-residential data provided by EKPC.

Figure 4-2: EKPC Annual Electric Sales

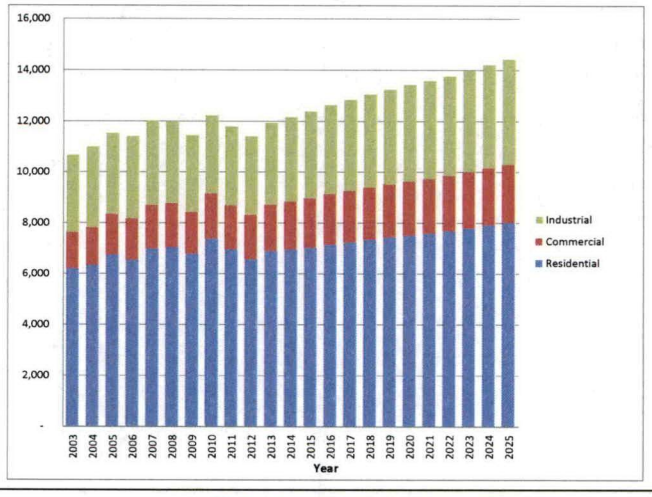


Table 4-2: EKPC Actual and Projected Electric GWh Sales by Sector

YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL	TOTAL
2003	6,205	1,443	3,032	**10,680**
2004	6,338	1,490	3,189	**11,017**
2005	6,752	1,602	3,189	**11,543**
2006	6,546	1,641	3,239	**11,426**
2007	6,998	1,718	3,317	**12,033**
2008	7,055	1,731	3,204	**11,990**
2009	6,789	1,652	3,024	**11,465**
2010	7,389	1,783	3,062	**12,234**
2011	6,967	1,737	3,105	**11,809**
2012	6,573	1,753	3,107	**11,433**
2013	6,905	1,818	3,225	**11,948**
2014	6,965	1,885	3,328	**12,178**
2015	7,043	1,930	3,416	**12,389**
2016	7,157	1,978	3,512	**12,647**
2017	7,253	2,013	3,581	**12,847**
2018	7,358	2,049	3,652	**13,059**
2019	7,452	2,083	3,720	**13,255**
2020	7,518	2,122	3,797	**13,437**
2021	7,594	2,148	3,846	**13,588**
2022	7,689	2,177	3,903	**13,769**
2023	7,808	2,209	3,967	**13,984**
2024	7,928	2,248	4,049	**14,225**
2025	8,035	2,278	4,112	**14,425**

4.3.2 Electricity Consumption by Market Segment

Figure 4-3 shows the breakdown of electricity consumption by building type for the commercial sector. Figure 4-4 shows a similar breakdown of sales by industrial market segment for the industrial sector. The Other market sector (21%) consumes the largest share of commercial electricity consumption, followed by Mercantile (15%) and Education (13%). In the industrial sector, Primary Metals (34% of annual industrial electricity sales) is the largest sector, followed by Converted Paper Products (11%) and Transportation Equipment (10%).

Figure 4-3: 2015 Commercial Electricity Consumption by Market Segment

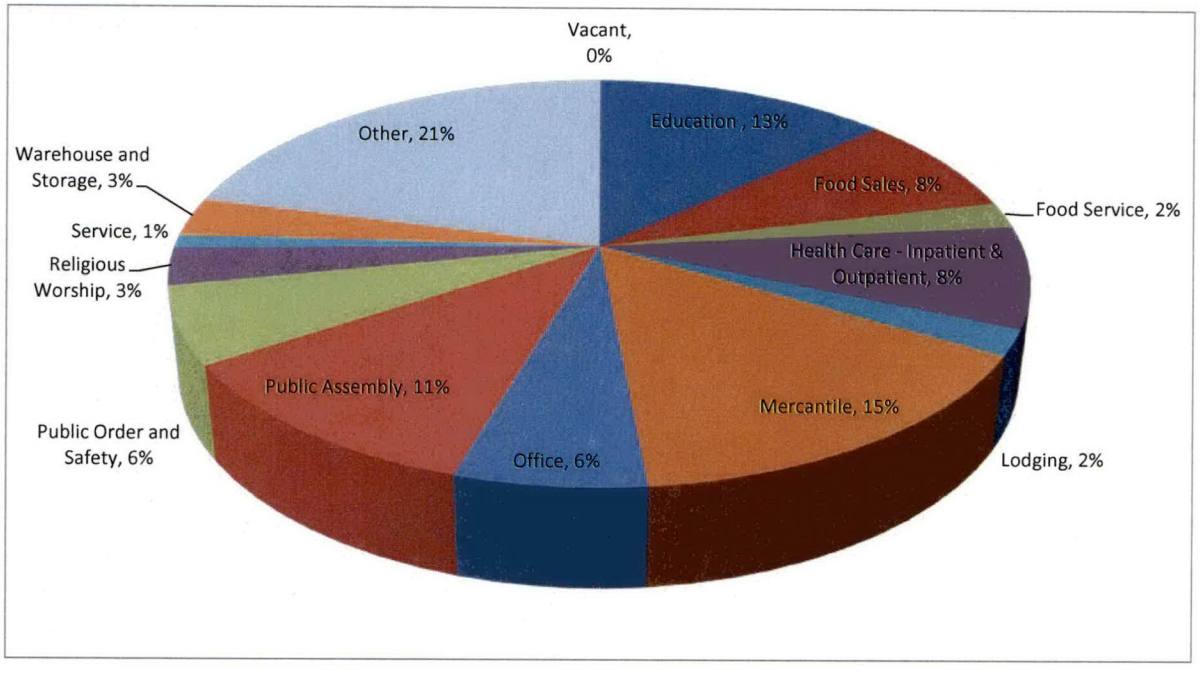


Figure 4-4: 2015 Electric Industrial Energy Consumption by Market Segment

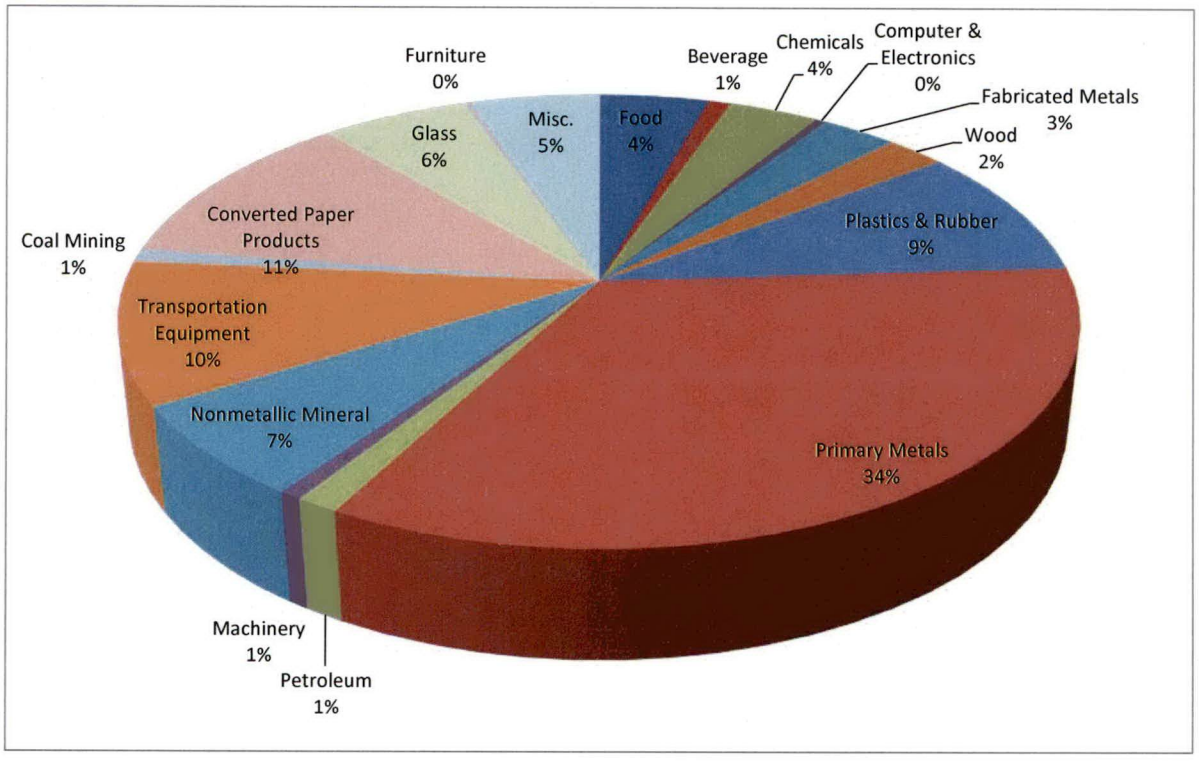


Table 4-3: 2015 Electric Industrial Energy Consumption by Segment

SEGMENT	CONSUMPTION (MWH)	ELECTRICITY SHARE
Food	148,556	4%
Beverage	30,687	1%
Chemicals	122,698	4%
Computer & Electronics	14,587	0%
Fabricated Metals	102,358	3%
Wood	81,241	2%
Plastics & Rubber	318,692	9%
Primary Metals	1,154,217	34%
Petroleum	42,589	1%
Machinery	22,704	1%
Nonmetallic Mineral	224,033	7%
Transportation Equipment	345,187	10%
Coal Mining	31,427	1%
Converted Paper Products	389,943	11%
Glass	200,779	6%
Furniture	11,552	0%
Misc.	174,979	5%
Total	3,416,229	100%

4.3.3 Electric Consumption by End-Use

Table 4-3 shows the breakdown of electric energy consumption by the industrial market segment. Table 4-4 shows the breakdown of electric energy consumption by commercial market segment by end use. Tables 4-4, 4-5, and 4-6 show the same breakdown for the industrial sector by market segment.

Table 4-4: Breakdown of Commercial Electricity Sales by Market Segment and End-Use

	SPACE HEATING	COOLING	VENTILATION	WATER HEATING	LIGHTING	COOKING	REFRIGERATION	OFFICE EQUIPMENT	OTHER	TOTAL
Education	12.34%	11.90%	21.32%	17.70%	13.14%	7.23%	4.59%	16.62%	6.94%	**13%**
Food Sales	10.41%	2.30%	0.82%	1.10%	5.15%	14.58%	39.69%	3.44%	2.37%	**8%**
Food Service	2.02%	2.29%	1.75%	4.75%	1.13%	29.40%	6.03%	1.03%	1.29%	**2%**
Health Care - Inpatient & Outpatient	1.64%	10.25%	10.27%	2.69%	8.98%	11.09%	0.87%	6.74%	7.85%	**8%**
Lodging	3.12%	1.75%	0.78%	4.13%	3.68%	7.69%	0.32%	0.70%	1.68%	**2%**
Mercantile	43.29%	16.23%	9.33%	50.23%	16.96%	18.17%	3.60%	11.80%	12.02%	**15%**
Office	5.37%	8.95%	4.32%	1.94%	7.81%	0.06%	1.50%	16.14%	6.37%	**6%**
Public Assembly	8.48%	8.37%	33.76%	0.24%	5.81%	0.78%	2.65%	3.41%	11.67%	**11%**
Public Order and Safety	8.61%	8.63%	7.29%	12.11%	4.98%	7.32%	4.16%	6.65%	7.49%	**6%**
Religious Worship	1.33%	3.30%	2.50%	0.95%	2.54%	3.56%	1.25%	1.50%	6.17%	**3%**
Service	0.72%	1.02%	0.91%	0.12%	1.12%	0.00%	0.43%	1.07%	1.40%	**1%**
Warehouse and Storage	2.69%	1.87%	1.79%	0.61%	3.90%	0.13%	7.56%	1.84%	2.51%	**3%**
Other	0.00%	23.11%	5.16%	3.43%	24.80%	0.00%	27.36%	29.05%	32.23%	**21%**
Vacant	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**0%**
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4-5: Electric Industrial Energy Consumption by End Use (Table 1 of 3)

	FOOD	BEVERAGE	CHEMICALS	COMPUTER & ELECTRONICS	FABRICATED METALS	WOOD	PLASTICS & RUBBER
Conventional Boiler Use	3%	2%	1%	1%	0%	1%	1%
Process Heating	5%	6%	4%	10%	21%	6%	18%
Process Cooling and Refrigeration	28%	26%	8%	9%	3%	1%	11%
Machine Drive	43%	34%	59%	23%	41%	72%	43%
Electro-Chemical Processes	0%	0%	15%	2%	3%	1%	0%

	FOOD	BEVERAGE	CHEMICALS	COMPUTER & ELECTRONICS	FABRICATED METALS	WOOD	PLASTICS & RUBBER
Other Process Use	1%	2%	1%	5%	3%	1%	3%
Facility HVAC (g)	8%	10%	6%	30%	9%	6%	10%
Facility Lighting	8%	8%	4%	12%	11%	8%	8%
Other Facility Support	2%	2%	1%	5%	2%	2%	2%
Onsite Transportation	0%	0%	0%	0%	0%	0%	0%
Other Nonprocess Use	0%	0%	0%	1%	0%	1%	0%
End Use Not Reported	2%	9%	1%	4%	6%	2%	2%
Total Industrial	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4-6: Electric Industrial Energy Consumption by End Use (Table 2 of 3)

	PRIMARY METALS	PETROLEUM	MACHINERY	NONMETALLIC MINERAL	TRANS. EQUIPMENT	COAL MINING
Conventional Boiler Use	0%	1%	1%	0%	1%	1%
Process Heating	32%	0%	11%	26%	11%	11%
Process Cooling and Refrigeration	1%	5%	3%	3%	5%	3%
Machine Drive	28%	83%	40%	54%	36%	40%
Electro-Chemical Processes	26%	0%	0%	1%	2%	0%
Other Process Use	3%	2%	3%	2%	4%	3%
Facility HVAC (g)	4%	4%	20%	6%	19%	20%
Facility Lighting	3%	3%	15%	5%	15%	15%
Other Facility Support	1%	1%	4%	1%	3%	4%
Onsite Transportation	0%	0%	0%	0%	1%	0%
Other Nonprocess Use	0%	0%	1%	0%	1%	1%
End Use Not Reported	0%	2%	1%	1%	3%	1%
Total Industrial	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 4-7: Electric Industrial Energy Consumption by End Use (Table 3 of 3)

	CONVERTED PAPER PRODUCTS	GLASS	FURNITURE	MISC.	TOTAL INDUSTRIAL
Conventional Boiler Use	1%	1%	1%	1%	**23,877**
Process Heating	10%	15%	5%	11%	**659,995**
Process Cooling and Refrigeration	9%	4%	1%	5%	**192,297**
Machine Drive	23%	37%	47%	30%	**1,232,175**
Electro-Chemical Processes	2%	5%	1%	5%	**364,517**
Other Process Use	5%	4%	2%	3%	**104,455**
Facility HVAC (g)	30%	15%	18%	25%	**399,920**
Facility Lighting	12%	10%	17%	14%	**269,668**
Other Facility Support	5%	7%	4%	4%	**85,785**
Onsite Transportation	0%	0%	1%	0%	**7,057**
Other Nonprocess Use	1%	0%	1%	0%	**17,565**
End Use Not Reported	4%	0%	4%	1%	**58,918**
Total Industrial	**100%**	**100%**	**100%**	**100%**	**3,416,229**

4.4 CURRENT EKPC ENERGY EFFICIENCY PROGRAMS

4.4.1 Current EKPC Energy Efficiency Programs

EKPC provides several energy efficiency programs to its customers in the residential, commercial and industrial markets.

4.4.1.1 Residential Programs

Residential Energy Efficiency Program (Electric)

EKPC offers energy audits, information, and rebates for the installation of qualifying energy efficiency improvements through the following programs:

Residential Energy Audits

EKPC offers energy audits of homes conducted by trained experts from the local co-ops.

SimpleSaver Program

The SimpleSaver Program is a load management program to remotely manage power usage of air conditioners and electric water heaters. Participation is voluntary and participants receive incentives.

CFL Bulb Program

Local co-ops provide CFL bulbs to customers at no cost and have given away thousands of CFL bulbs since 2003.

Touchstone Energy Homes

The Touchstone Energy Homes Program complements federal Energy Star standards for new homes, as well as standards being adopted voluntarily by many Kentucky builders. Rebates are available for qualifying energy efficiency measures.

Button-Up Program

The Button-Up Program offers customers a way to identify leaks in the home's envelope and areas with inadequate levels of insulation and provides valuable tips on insulation and air sealing. Rebates are also available for qualifying measures such as insulation and air sealing.

Heat Pump Retrofit

The Heat Pump Retrofit program offers customers an incentive to convert residential homes from electric resistance heat to an energy efficient heat pump.

HVAC Duct Seal

The HVAC Duct Seal program provides a rebate to customers that seal their leaking duct systems.

4.4.1.2 Commercial/ Industrial Programs

Commercial and Industrial Energy Efficiency Program

EKPC provides energy audits to commercial and industrial customers.

Commercial and Industrial Energy Audits

EKPC offers energy audits of businesses conducted by Envision Energy Services. The audit includes inspections of energy use, lighting, and compressed air systems to identify savings opportunities. Infrared inspections are also available.

5 POTENTIAL STUDY 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 a number of 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.

- Measure List Development
- Measure Characterization
- Load Forecast Development and Disaggregation
- Potential Savings Overview
- Technical Potential
- Measure Cost-Effectiveness Screening
- Economic Potential
- Achievable Potential

5.1 MEASURE LIST DEVELOPMENT

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. In June 2014, the GDS Team provided the energy efficiency measure lists for each sector to interested stakeholders for review and comment. 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.

5.2 MEASURE CHARACTERIZATION

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.[10] 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 was considered to be 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).

Savings: Estimates of annual measure savings as a percentage of base equipment usage were developed from a variety of sources, including:

- EKPC existing program measures
- Secondary sources such as the American Council for an Energy-Efficient Economy ("ACEEE"), Department of Energy ("DOE"), Energy Information Administration ("EIA"), ENERGY STAR, Air Conditioning Contractors of America ("ACCA") and other technical potential studies and Technical Reference Manuals

Measure Costs: Measure costs represent either incremental or full costs, and typically include the incremental cost of measure installation. For purposes of this study, nominal measures costs were held constant over time. This general assumption is being made due to the fact that historically many measure costs (e.g., CFL bulbs, Energy Star appliances, etc.) have declined over time, while some measure costs have increased over time (e.g., fiberglass insulation). Cost estimates were obtained from the following types of data sources:

- Secondary sources such as ACEEE, ENERGY STAR, NREL, NEEP Incremental Cost Study Report, and other technical potential studies and Technical Reference Manuals
- Retail store pricing (such as web sites of Home Depot and Lowe's) and industry experts
- Indiana TRM and Mid-Atlantic TRM

Measure Life: Represents the number of years that energy-using equipment is expected to operate. Useful life estimates have been obtained from the following data sources:

- Manufacturer data
- Savings calculators and life-cycle cost analyses
- Secondary sources such as ACEEE, ENERGY STAR, and other technical potential studies
- The California Database for Energy Efficient Resources ("DEER") database
- Evaluation reports

[10] 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.

- GDS and other consultant research or technical reports

Baseline and Efficient Technology Saturations: In order to assess the amount of electric and natural gas 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:

- 2013 EKPC Member System End-use Survey
- 2009 EIA Residential Energy Consumption Survey (RECS)
- 2007 American Housing Survey (AHS)
- 2010 EIA Manufacturing Energy Consumption Survey (MECS)
- 2003 EIA Commercial Building Energy Consumption Survey (CBECS)

Further detail regarding the development of measure assumptions for energy efficiency in the residential and non-residential sectors are provided in this report in later sections. Additionally, as noted above, the appendices of the report provide a comprehensive listing of all energy efficiency measure assumptions and data sources.

5.3 FORECAST DISAGGREGATION FOR THE COMMERCIAL AND INDUSTRIAL SECTORS

For the commercial sector, the baseline electric and natural gas load forecasts were disaggregated by combining sales breakdowns by business type derived from information provided by EKPC with regional energy use estimates by business type available from the U.S. Energy Information Administration (EIA)[11] The forecasts were then further disaggregated by end use based on end use consumption estimates for the East North Central Region (Michigan, Wisconsin, Ohio, Indiana, Illinois). The disaggregated electric and natural gas sales forecasts provide the foundation for the development of energy efficiency potential estimates for the commercial sector. It was not necessary to develop a disaggregated residential sales forecast because a bottom-up approach was used for the residential sector.

For the industrial sector, the baseline electric and natural gas demand forecasts were disaggregated by industry type derived from information provided by EKPC and then by end use. The industry type breakdowns are based on value of shipments data and U.S. energy intensity data (consumption per $ of value shipped) by industry from the U.S. Census Bureau's Annual Survey of Manufacturers. Further disaggregation by end use is based on data from the EIA's 2010 Manufacturing Energy Consumption Survey (MECS) The disaggregated forecast data provides the foundation for the development of energy efficiency potential estimates for the industrial sector.

5.4 ROLE OF NATURALLY OCCURRING CONSERVATION

Naturally occurring conservation exists through government intervention, improved manufacturing efficiencies, building energy codes, market demand, and increased energy efficiency implementation by early adopters, who will implement measures without explicit monetary incentives. The impacts of new Federal government mandated energy efficiency standards have already been reflected in the baseline data for equipment unit energy consumption being used for this potential study. These new government standards, such as the new standards included in the Federal government's December 2007 Energy Independence and Security Act (EISA)[12], can significantly increase naturally occurring potential through tax incentives, stimulus funding or stricter manufacturing standards. These forces cause certain sector end-use energy consumption values to improve across the baseline forecast. It is important to account for these forces as thoroughly as possible to ensure the energy efficiency potential is not double-counted,

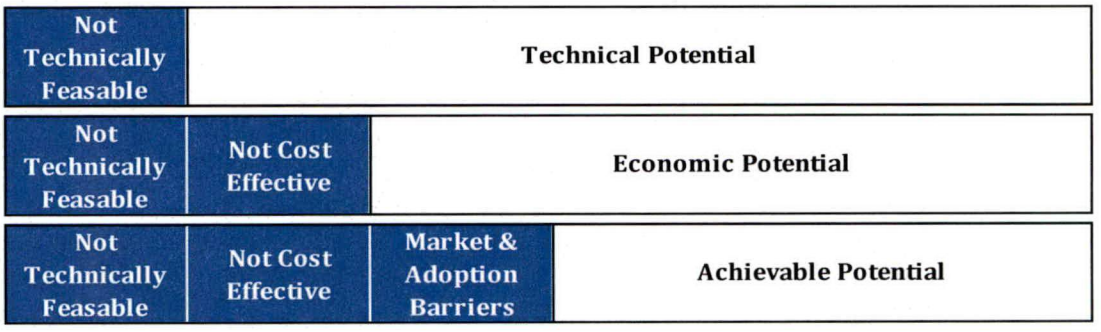
[11] 2003 EIA Commercial Building Energy Consumption Survey (CBECS), East North Central and Midwest Regions.
[12] PUBLIC LAW 110-140—DEC. 19, 2007. Energy Independence and Security Act of 2007

by over-stating the potential that could occur for end-uses where codes and standards are reducing baseline unit energy consumption. In addition, GDS has reflected the impacts of new EISA lighting standards that went into effect starting in 2012, as well as changes to other federal baseline standards across a variety of end uses. These adjustments reduce energy efficiency potential starting in the years these standards come into effect, and in subsequent years.

5.5 POTENTIAL SAVINGS OVERVIEW

Potential studies often distinguish between several types of energy efficiency potential: technical, economic, and achievable. 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 percent of the technical or economic potential. Therefore, achievable potential attempts to estimate what may realistically be achieved, when it can be captured, and how much it would cost to do so. Figure 5-1 below illustrates the three most common types of energy efficiency potential.

Figure 5-1: Types of Energy Efficiency Potential[13]



5.6 TECHNICAL POTENTIAL

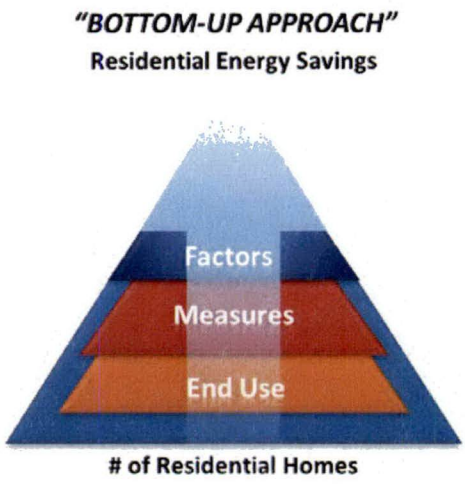
The GDS Team has used the energy efficiency potential definitions included on pages 2-4 of the November 2007 National Action Plan for Energy Efficiency (NAPEE) Guide for Conducting Energy Efficiency Potential Studies. Technical potential is the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end-users to adopt the efficiency measures. It is often estimated as a "snapshot" in time assuming immediate implementation of all technologically feasible energy saving measures, with additional efficiency opportunities assumed as they arise from activities such as new construction.[14]

In general, this study utilizes a "bottom-up" approach in the residential sector to calculate the potential of an energy efficiency measure or set of measures as illustrated in Figure 5-2 below. A bottom-up approach was used for the residential sector due to the amount of data available for this sector from EKPC, from Federal government surveys and research done in nearby states. A bottom-up approach first starts with the savings and costs associated with replacing one piece of equipment with its high efficiency counterpart, and then multiplies these values by the number of measures available to be installed throughout the life of the program. The bottom-up approach is applicable in the residential sector because of better secondary data availability and greater homogeneity of the building and equipment stock to which measures are applied, compared to the non-residential sector. However, this methodology was not utilized in the non-residential sector. For the non-residential sector, a "top-down" approach was used for developing the technical potential estimates. The "top down" approach builds an energy use profile based on estimates of kWh sales by business segment and end use. Savings factors for

[13] Reproduced from "Guide to Resource Planning with Energy Efficiency" November 2007. US EPA. Figure 2-1.
[14] National Action Plan for Energy Efficiency, "Guide for Conducting Energy Efficiency Potential Studies", page 2-4

energy efficiency measures are then applied to applicable end use energy estimates after assumptions are made regarding the fraction of sales that are associated with inefficient equipment and the technical/engineering feasibility of each energy efficiency measure.

Figure 5-2: Residential Sector Savings Methodology - Bottom Up Approach



As shown in Figure 5-2, the methodology starts at the bottom based on the number of residential customers (splitting them into single-family, multi-family and manufactured housing types as well as existing homes vs. new construction). From that point, estimates of the size of the eligible market in EKPC's service area were developed for each energy efficiency measure. For example, energy efficiency measures that affect electric space heating are only applicable to those homes in EKPC's service area that have electric space heating.

Estimates of energy efficient equipment saturations were based on several sources, including data collected from the 2009 RECS and the baseline studies provided by EKPC.

The goal of the approach is to determine how many households that a specific measure applies to (base case factor), then of that group, the fraction of households/buildings which do not have the energy efficient version of the measure being installed (remaining factor). In instances where technical reasons do not permit the installation of the efficient equipment in all eligible households an applicability factor is used to limit the potential. Alternative water heating technologies (efficient water heater tanks, heat pump water heaters or solar water heating systems) are then utilized to meet the remaining market potential. The last factor to be applied is the savings factor, which is the percentage savings achieved from installing the efficient measure over a standard measure.

In developing the overall potential electricity savings, the analysis accounts for the interactive effects of measures designed to impact the same end-use. For instance, if a home were to properly seal all ductwork, the overall space heating and cooling consumption in that home would decrease. As a result, the remaining potential for energy savings derived from a heating/cooling equipment upgrade would be reduced. In instances where there are two (or more) competing technologies for the same electrical (or natural gas) end use, such as heat pump water heaters, water heater efficiency measures and high-efficiency electric storage water heaters, in most cases an equal percentage of the available population is assigned to each measure using the applicability factor[15]. In the event that one of the competing measures is not found to be cost-effective, the homes/buildings assigned to that measure are transitioned over any of the remaining cost effective alternatives.

[15] GDS used its professional judgment in some cases to assign unequal applicability factors to attempt to avoid overstating or understating the potential of the set of competing technologies.

The savings estimates per base unit are determined by comparing the high-efficiency equipment to current installed equipment for existing construction retrofits or to current equipment code standards for replace-on-burnout and new construction scenarios.

5.7 CORE EQUATION FOR THE RESIDENTIAL SECTOR

The core equation used in the residential sector energy efficiency technical potential analysis for each individual efficiency measure is shown below in Equation 5-1 below.

Equation 5-1: Core Equation for Residential Sector Technical Potential

Where:

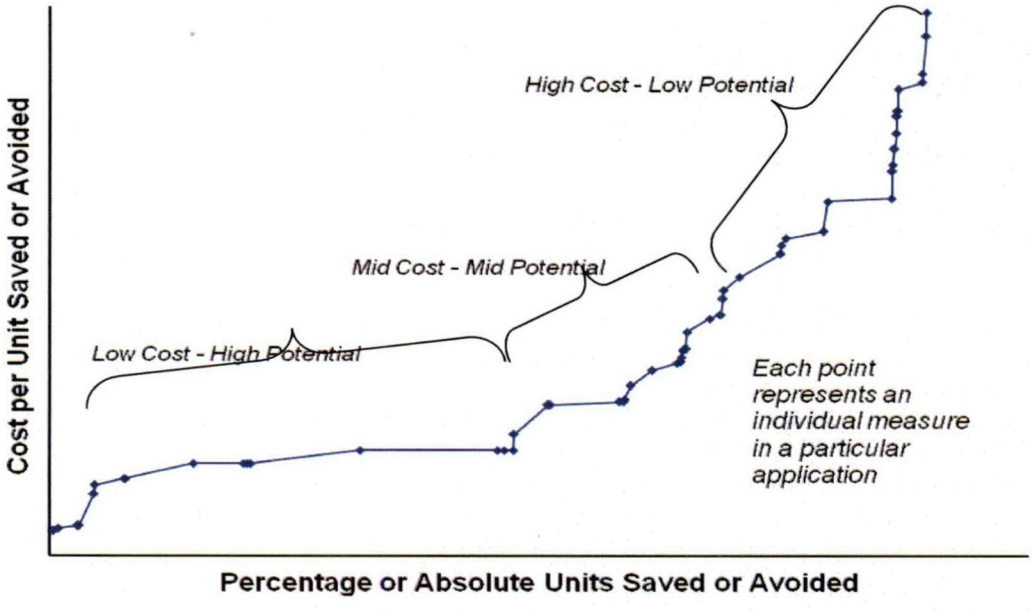
- **Total Number of Households** = the number of households in the market segment (e.g. the number of households living in detached single-family buildings)
- **Base Case Equipment End-use Intensity** = annual energy consumption (kWh or MMBtu) used per customer, per year, by each base-case technology in each market segment. This is the consumption of energy using equipment that efficient technology replaces or affects. This variable fully accounts for any known building characteristics in the service area, such as average square footage of homes in Kentucky.
- **Saturation Share** = this variable has two parts: the first is the fraction of the end use energy that is applicable for the efficient technology in a given market segment. For example, for electric residential water heating, this would be the fraction of all residential electric customers that have electric water heating in their household; the second is the share of the end use electric energy that is applicable for the efficient technology that has not yet been converted to an efficient technology.
- **Applicability Factor** = this factor ensures that a household cannot receive two of the same type of measure. For example, if we assume there are two tiers of efficient air conditioning units, one which yields 10% savings and another which yields 20% savings, a household that needs to replace its unit could either receive the unit which yields 10% savings or the unit which yields 20% savings, but could not receive both units. In general, GDS applies an even distribution to the same type of measure across eligible households when applying this factor. GDS may, in some cases, assign unbalanced applicability factors, if it believes an even distribution is inappropriate[16]. The applicability factor also captures the fraction of applicable units technically feasible for conversion to the efficient technology from an engineering perspective (e.g., it may not be possible to add wall insulation in all homes because the original construction of some homes does not allow for wall insulation to be installed without requiring major reconstruction of the house, which would be an additional cost that does not yield any energy benefits).
- **Savings Factor** = the percentage of energy consumption reduction resulting from application of the efficient technology. The savings factor is a general term used to illustrate the calculation of a measure's technical potential. The Excel-based model GDS uses fully integrates the necessary assumptions to determine the measure-level savings, given the **Base Case Equipment End-use Intensity**, and the expected savings of each technology.

[16] For example, if historical data indicates a technology has been able to garner a large share of the market GDS may assign a higher applicability factor to this technology in order to properly reflect this knowledge.

Technical energy efficiency potential in the residential sector is calculated in two steps. In the first step, all measures are treated *independently*; that is, the savings of each measure are not reduced or otherwise adjusted for overlap between competing or interacting measures. By analyzing measures independently, no assumptions are made about the combinations or order in which they might be installed in customer buildings. However, the cumulative technical potential cannot be estimated by adding the savings from the individual savings estimates because some savings would be double-counted. For example, the savings from a measure that reduces heat loss from a building, such as insulation, are partially dependent on other measures that affect the efficiency of the system being used to heat the building, such as a high-efficiency furnace; the more efficient the furnace, the less energy saved from the installation of the insulation. In the second step, adjustments are made to account for such interactive effects. The adjustments for interactive effects were made by upgrading the baseline conditions while holding the savings percentages constant. The upgraded baseline conditions vary by measure and assume some measures (such as weatherization measures) are installed to increase the building efficiency prior to the installation of the measure that is subject to the baseline adjustment (ex. high efficiency furnaces).

Finally, the GDS Team has developed a supply curve to show the amount of energy efficiency savings available at different cost levels. A generic example of a supply curve is shown in Figure 5-3. As shown in the figure, a supply curve typically consists of two axes; one that captures the cost per unit of saving a resource (e.g., dollars per lifetime kWh saved) and another that shows the amount of savings that could be achieved at each level of cost. The curve is typically built up across individual measures that are applied to specific base-case practices or technologies by market segment. Savings measures are sorted based on a metric of cost. Total savings available at various levels of cost are calculated incrementally with respect to measures that precede them. Supply curves typically, but not always, end up reflecting diminishing returns, i.e., costs increase rapidly and savings decrease significantly at the end of the curve.

Figure 5-3: Generic Example of a Supply Curve



As noted above, the cost portion of this energy efficiency supply curve is represented in dollars per unit of lifetime energy savings. Costs are annualized (often referred to as levelized) in supply curves. For example, electric energy efficiency supply curves usually present levelized costs per lifetime kWh saved

by multiplying the initial investment in an efficient technology or program by the capital recovery rate (CRR), and then dividing that amount by annual kWh savings:

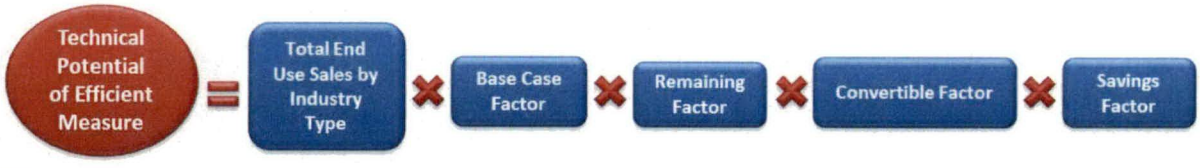
Therefore,

Levelized Cost per lifetime kWh Saved = Initial Cost x CRR/Annual kWh Savings

5.8 CORE EQUATION FOR THE COMMERCIAL SECTOR

The core equation utilized in the commercial sector technical potential analysis for each individual efficiency measure is shown below in Equation 5-2.

Equation 5-2: Core Equation for Commercial Sector Technical Potential



Where:

- **Total end-use kWh or natural gas sales by commercial sector and by building type** = the forecasted electric or natural gas sales level for a given end use (e.g., space heating) in a commercial or industrial industry type (e.g., office buildings or fabricated metals).
- **Base Case factor** = the fraction of end-use energy applicable for the efficient technology in a given commercial sector type. For example, with fluorescent lighting, this would be the fraction of all lighting kWh in a given industry type that is associated with fluorescent fixtures.
- **Remaining factor** = the fraction of applicable kWh or natural gas sales associated with equipment not yet converted to the electric or natural gas energy efficiency measure; that is, one minus the fraction of the industry type with energy efficiency measures already installed.
- **Convertible factor** = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (e.g., it may not be possible to install variable-frequency drives (VFDs) on all motors.
- **Savings factor** = the fraction of electric or natural gas consumption reduced by application of the efficient technology.

For the commercial sector, the development of the energy efficiency technical potential estimate begins with a disaggregated energy sales forecast over the ten year forecast horizon (2013 to 2022). The commercial sector energy sales forecast is broken down by building type, then by electric or natural gas end use. Then a savings factor is applied to end use electricity or natural gas sales to determine the potential electricity or natural gas savings for each end use. The commercial sector, as defined in this analysis, is comprised of the following business segments:

- Warehouse
- Retail
- Grocery
- Office
- Lodging
- Healthcare
- Restaurant
- Institutional, including education
- Other

Similar to the residential sector, technical electric or natural gas energy efficiency savings potential in the commercial sector is calculated in two steps. In the first step, all measures are treated *independently*; that is,

the savings of each measure are not reduced or otherwise adjusted for overlap between competing or synergistic measures. By treating measures independently, their relative economics are analyzed without making assumptions about the order or combinations in which they might be implemented in customer buildings. However, the total technical potential across measures cannot be estimated by summing the individual measure potentials directly because some savings would be double-counted. For example, the savings from a weatherization measure, such as low-e ENERGY STAR windows, are partially dependent on other measures that affect the efficiency of the system being used to cool or heat the building, such as high-efficiency space heating equipment or high-efficiency air conditioning systems; the more efficient the space heating equipment or electric air conditioner, the less energy saved from the installation of low-e ENERGY STAR windows. Accordingly, the second step is to rank the measures based on a metric of cost-effectiveness (using the Total Resource Cost test) and adjust savings for interactive effects so that total savings are calculated incrementally with respect to measures that precede them.

5.9 CORE EQUATION FOR THE INDUSTRIAL SECTOR

Estimating energy efficiency potential for the industrial sector can be more challenging than it is for the residential and commercial sectors because of the significant differences in the way energy is used across manufacturing industries (or market segments). How the auto industry uses energy is very different from how a plastics manufacturer does. Further, even within a particular industrial segment, energy use is influenced by the particular processes utilized, past investments in energy efficiency, the age of the facility, and the corporate operating philosophy.

Recognizing the variability of energy use across industry types and the significance of process energy use in the industrial sector, GDS employed a top-down approach that constructed an energy profile based on local economic data, national energy consumption surveys and any available studies related to industrial energy consumption.

5.10 INDUSTRIAL SECTOR SEGMENTATION & END USE BREAKDOWN

Estimates of energy efficiency potential were developed employing a top-down approach using economic data for key industrial segments (Primarily 3 digit NAICS codes) in EKPC's service area to develop industry-specific energy use estimates based on national energy intensities for each industry. Value of shipments data is available from the U.S. Census Bureau. This economic data was used in conjunction with energy use estimates from the 2010 Manufacturing Energy Consumption Survey[17] which is produced by the Energy Information Administration (EIA), to develop estimates of industrial electric and natural gas energy use by industry type and end use.

Industrial baseline energy consumption data was advanced to 2013 and future years based upon the observed historical trend in industrial consumption and EIA's industrial electricity and natural gas consumption forecast for the U.S. (i.e., Annual Energy Outlook 2013).

End use electric and natural gas energy consumption estimates were calculated for the following end use categories for specific manufacturing segments:

- **Indirect Uses – Boilers**
  - Conventional boiler use
- **Direct Uses - Process**
  - Process heating (e.g., kilns, furnaces, ovens, strip heaters)
  - Process cooling & refrigeration
  - Machine drive
  - Electro-chemical processes
  - Other direct process use

[17] http://www.eia.gov/emeu/mecs/contents.html

- **Direct Uses – Non-process**
  - Facility heating, ventilation and air conditioning
  - Facility lighting
  - Other facility support (e.g., cooking, water heating, office equipment)
- **Other Non-process Use**

5.11 DEVELOPMENT OF POTENTIAL ESTIMATES

Estimates of industrial energy use by industry type and end use served as the foundation upon which energy efficiency potential estimates were calculated. The basic equation for determining technical potential is shown below.

The core equation for estimating technical potential in the industrial sector analysis for each measure is provided below:

Where:

- Total end-use sales by industry type = the forecasted electric or natural gas sales level for a given end use (e.g., space heating) by industrial industry type (e.g., fabricated metals, automobile manufacturing, paper and allied products, etc.).
- Base Case factor = the fraction of end-use energy applicable for the efficient technology in a given industry type. For example, with fluorescent lighting, this would be the fraction of all lighting kWh in a given industry type that is associated with fluorescent fixtures.
- Remaining factor = the fraction of applicable sales associated with equipment not yet converted to the electric energy-efficiency measure; that is, one minus the fraction of the industry type with energy-efficiency measures already installed.
- Convertible factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (e.g., it may not be possible to install variable-frequency drives (VFDs) on all motors.
- Savings factor = the fraction of energy consumption reduced by application of the efficient technology.

5.12 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. 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.*

Furthermore, 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.

5.13 DETERMINING COST-EFFECTIVENESS

GDS Team examined measure cost effectiveness scenarios based on the Total Resource Cost (TRC) test

Total Resource Cost Test[18]

The TRC measures the net benefits of the energy efficiency program for the region as a whole. 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 energy (as with the Utility Cost Test and the Rate Impact Measure Test) as well as non-energy benefits.

The primary purpose of the TRC test is to evaluate the net benefits of energy efficiency measures to the region or State as a whole. Unlike the Utility Cost Test, the Rate Impact Measure (RIM) test or the Participant Cost Test (PCT), the TRC does not take the view of individual stakeholders. It does not include bill savings and incentive payments, as they yield an intra-regional transfer of zero ("benefits" to customers and "costs" to the utility that cancel each other on a regional level). For some utilities, the region considered may be limited strictly to its own service territory, ignoring benefits (and costs) to neighboring areas (a distribution-only utility may, for example, consider only the impacts to its distribution system). In other cases, the region is defined as the state as a whole, allowing the TRC to include benefits to other stakeholders (e.g., other utilities, water utilities, local communities). The TRC is useful for jurisdictions wishing to value energy efficiency as a resource not just for the utility, but for the entire region. Thus the TRC is the most frequently used primary test in the United States. The TRC may be considered the sum of the PCT and RIM, that is, the participant and non-participant cost-effectiveness tests. The TRC is also useful when energy efficiency might fall through the cracks taken from the perspective of individual stakeholders, but would yield benefits on a wider regional level

Table 5-1 below shows the key assumptions used by GDS in the development of the economic and achievable potential estimates based upon cost effectiveness screening using the Total Resource Cost (TRC) test:

Table 5-1: Key Assumptions Used by GDS in the Development of Measure-Level Screening

KEY ASSUMPTION	USED IN TRC SCREENING
Utility weighted average cost of capital for the discount rate	Yes
Forecasts of electric and natural gas energy and capacity avoided costs provided to GDS by the staff at EKPC	Yes
Forecast of electric T&D avoided costs per kW/year based on 2009 study by the New York Public Service Commission	Yes
Average line losses provided by EKPC	Yes
PJM planning reserve margin	Yes
Electricity and natural gas savings benefits both valued in the cost effectiveness test for electric or natural gas energy efficiency programs	Yes
Value of avoided bulb purchases for high efficiency light bulbs	Yes
Water savings where applicable	Yes
Tax credits	Yes

[18] It is important to note that GDS decided not to include any unquantifiable non-energy benefits in the calculation of the TRC Test (beyond savings water, avoided carbon emissions, and O&M savings). While other non-energy benefits may be present, they have not been quantified in the state of Kentucky and were not available for inclusion in this study.

GDS has used average line losses to adjust kWh and kW savings at the customer meter to the generation level of the electric grid.

Financial Incentives for Program Participants

In order to approximate EKPC's structure for providing transfer payments to its member utilities to cover both incentives and lost revenue, GDS used an "incentive" level of 48% of measure costs in the benefit-cost model and used an administrative cost of 25% of incentives.

5.14 ACHIEVABLE POTENTIAL

Achievable potential was determined as the amount of energy and demand that can realistically be saved assuming an aggressive program marketing strategy and no spending cap. Achievable potential takes into account barriers that hinder consumer adoption of energy efficiency measures such as financial, political and regulatory barriers, and the capability of programs and administrators to ramp up activity over time. Cost effectiveness was determined with the TRC test. Year-by-year estimates of achievable potential for the period 2015 to 2024 were estimated by applying market penetration curves to this long-term penetration rate estimate. In general, these curves were developed based on willingness to pay data collected through survey research. Although this simplifies what an adoption curve would look like in practice, it succeeds in providing a concise method for estimating achievable savings potential over a specified period of time. It should be noted that several cost-constrained scenarios were run for the Residential sector, and these are detailed in Section 6 of this report.

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. For existing buildings, determining the annual rate of availability of savings is more complex. Energy efficiency potential in the existing stock of buildings can be captured over time through two principal processes:

1) As equipment replacements are made normally in the market when a piece of equipment is at the end of its effective useful life (referred to as "replace-on-burnout")
2) At any time in the life of the equipment or building (referred to as "retrofit")

For the replace-on-burnout measures, existing equipment is assumed to be replaced with high-efficiency equipment at the time a consumer is shopping for a new appliance or other energy consuming equipment, or if the consumer is in the process of building or remodeling. Using this approach, only equipment that needs to be replaced in a given year is eligible to be upgraded to energy efficient equipment. For the retrofit measures, savings can theoretically be captured at any time; however, in practice, it takes many years to retrofit an entire stock of buildings, even with the most aggressive of energy efficiency programs.

5.15 MARKET PENETRATION METHODOLOGY

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 methodology utilized to forecast participation within each customer sector is described below.

RESIDENTIAL

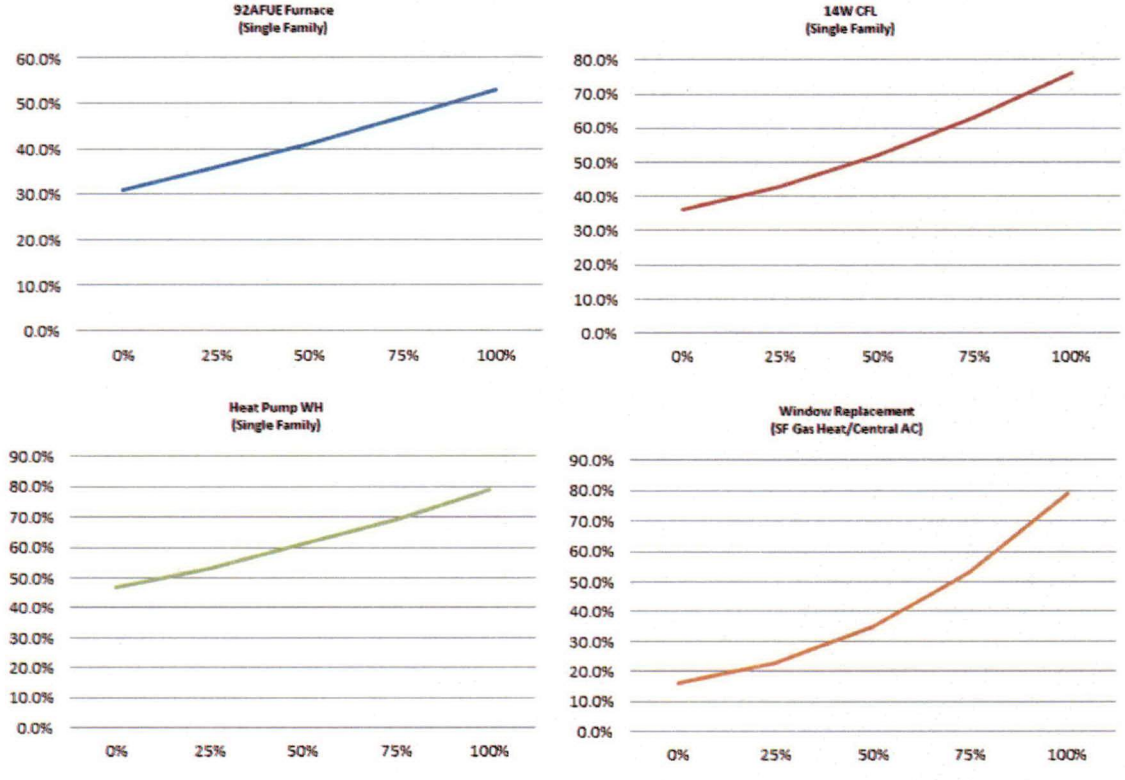
Due to the wide variety of measures across multiple end-uses, GDS employed varied, measures-specific maximum adoption rates versus a singular universal market adoption curve. These long-term market adoption estimates were based on publicly available DSM research including market adoption rate

surveys and other utility program benchmarking.[19] GDS acknowledges that reliance on additional studies and alternate methods could produce different estimates of achievable potential.

For the majority of residential measures, the analysis assumes that increased incentives and reduced participant costs will also reduce the simple payback period of energy efficiency measures. As incentives increase and payback periods decline, maximum market adoption rates will increase. Based on available market adoption surveys with program administrators in the Northeast, GDS assigned end-use specific market adoption curves to the residential measures included in this analysis.[20] Examples of the impact of incentives on payback and maximum market adoption rates are demonstrated in the table below. These curves reflect measures that have significant gas and electric achievable potential over the next 10 years.[21]

Once the long-term market adoption rate was determined, GDS estimated the time interval required to reach the ultimate maximum adoption rate. In general, measures that required less up-front cost from the participant reached their maximum adoption rate over a period of 2-3 years, and continued at the maximum rate for the remainder of the study. Measures with a more substantial cost to the participant required more time to ramp-up, and would not reach their maximum adoption rate until later in the study period. GDS exercised its professional judgment in estimating the time to reach the ultimate market adoption rate.

Figure 5-4: Example Residential Maximum Adoption Rates – Based on Incentive



[19] Massachusetts Multifamily Market Characterization and Potential Study Volume I. May 2012. Cadmus Group. & Appliance Recycling Program Process Evaluation and Market Characterization. Volume I. CALMAC Study ID# SCE0337.01. September 2012. Cadmus.

[20] Massachusetts Multifamily Market Characterization and Potential Study Volume I. May 2012. Cadmus Group. This study presents market adoption curves based on the perspective of both multifamily property managers as well as utility energy efficiency program administrators. Both groups of study participants provide support for the contention that increased incentives/reduced payback result in higher maximum adoption rates.

[21] Where current energy efficiency saturation data exceeded the estimated maximum market adoption, GDS assumed future efficiency installations would occur at the current EE saturation percentage so that the long-term market saturation of energy efficiency measures would not decrease over the study time-frame.

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 period of time.

The market penetration of residential lighting was also strategically adjusted to account for the expected decline in LED bulbs costs over the next decade and an anticipated shift in market adoption from CFL bulbs to LED bulbs. Because LED bulb prices are expected to decline significantly over the next several years, decreasing to typical CFL bulb incremental cost levels, GDS assumed the maximum adoption rate for LED bulbs to be similar to those used for CFL bulbs. Additionally, GDS relied on future unit penetration rates for various lighting sources to model the long term shift towards increased market penetration of LED bulbs compared to CFL bulbs.[22] The table below shows the year-by-year shifting market penetration of CFL and LED bulbs estimated in this analysis. By 2019, LED bulbs are expected to be installed at a greater rate than their CFL counterparts.

Table 5-2. CFL vs. LED Market Penetration Share of Anticipated High Efficiency Residential Lighting Installations

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
LED	32%	39%	45%	50%	53%	58%	64%	66%	68%	70%
CFL	68%	61%	55%	50%	47%	42%	36%	34%	32%	30%

NON-RESIDENTIAL

The non-residential approach for estimating market adoption rates is very similar to the residential sector approach. GDS employed varied, measures-specific maximum adoption rates versus a singular universal market adoption curve.

GDS used this data to estimate long term market penetration for commercial and industrial (process) measures based on the assumed incentive level stated as a percent of incremental cost. GDS assumed two different paths to achieving long term market penetration, one for full cost measures such as insulation and another for incremental cost measures such as energy efficient fluorescent lighting. Those paths are shown below in Table 5-3.

Table 5-3: Path to Achieving Long Term Market Penetration (% of Long Term Market Potential)

YEAR	1	2	3	4	5	6	7	8	9	10
Full Cost Measure	5%	15%	20%	20%	10%	10%	5%	5%	5%	5%
Incremental Cost Measure	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%

As with the residential approach, the non-residential market penetration methodology uses the relationship between incentives and program participation as a concise quantitative method for estimating achievable savings potential over a specified period of time. While there are many other elements that may influence a business customer's willingness to install an energy efficiency measure, such as access to capital, corporate policy or reduced maintenance costs, these factors are difficult to quantify and fit into a forecasting approach.

[22] Fox, Jamie. Does LED Lighting Have a Tipping Point? IMS Research. April 2012.

6 RESIDENTIAL ELECTRIC ENERGY EFFICIENCY POTENTIAL ESTIMATES

This section provides electric energy efficiency potential estimates for the residential sector for EKPC which includes all residential buildings. Estimates of technical, economic and achievable potential are provided.

6.1 RESIDENTIAL ELECTRIC POTENTIAL

According to 2013 historical sales data, the residential sector accounts for approximately 93% of total customers and 58% of total energy sales. The average residential consumer uses approximately 14,100 kWh per year. From 2001-2013, the residential sector sales and customers have experienced steady growth. This analysis assumes residential MWh sales increase at roughly 1.59% annually based upon the based on EKPC utility load forecasts. The residential electric potential calculations are based upon these approximate consumption values and sales forecast figures over the time horizon covered by the study. The potential is calculated for the entire residential sector and includes breakdowns of the potential associated with each end use.

6.1.1 Energy Efficiency Measures Examined

For the residential sector, there were 134 total electric savings measures included in the potential energy savings analysis[23]. Table 6-1 provides a brief description of the types of measures included for each end use in the residential model. The list of measures was developed based on a review of EKPC program measures and measures found in other residential potential studies and TRMs from the Midwest. Measure data includes incremental costs, electricity energy and demand savings, gas and water savings, and measure life.

Table 6-1: Measures and Programs Included in the Electric Residential Sector Analysis

END USE TYPE	MEASURES INCLUDED
Appliances	• Energy Star Compliant Top-Mount Refrigerator • Energy Star Compliant Side-by-Side Refrigerator • Energy Star Compliant Chest Freezer • Energy Star Compliant Upright Freezer (Manual Def.) • Energy Star Dehumidifer • Second Refrigerator Turn In • Second Freezer Turn In
Consumer Electronics - Single Family/Mobile Home	• Efficient Televisions • Energy Star Desktop Computer • Energy Star Computer Monitor • Energy Star Laptop Computer • Smart Strip Power Strip • Efficient Set Top Box
Lighting - Single Family /Mobile Home	• Standard CFL - Average Use (3 hours/day) • Standard LED - Average Use (3 hours/day) • Specialty CFL • Specialty LED • Energy Star Torchiere • LED Nightlight

[23] This total represents the number of unique electric energy efficiency measures and all permutations of these unique measures. For example, there are 12 permutations of the "Improved Duct Sealing" measure to account for the various housing types, heating/cooling combinations, and construction types.

END USE TYPE	MEASURES INCLUDED
	• Exterior CFL Fixture • Exterior LED Fixture
Electric Water Heating - Single Family/Mobile Homes	• Low Flow Faucet Aerators • Low Flow Showerhead • Water Heater Blanket • Water Heater Pipe Wrap • Heat Pump Water Heater (resistance heat) • Heat Pump Water Heater (ASHP heat) • Solar Water Heating • Energy Star Dishwasher (Electric Water Heating) • Energy Star Dishwasher (Non-Electric WH) • Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer) • Energy Star Clothes Washer (w/ NG WH & Elec. Dryer)
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric AC Only (& Gas Heat)	• Insulation - Ceiling (R-0 to R-19) • Insulation - Floor (R-0 to R-19) • Energy Star Windows (.30 U, .40 SHGC) • Insulation -Ceiling (R-19 to R-38) • Insulation -Ceiling (R-0 to R-38) • Insulation -Ceiling (R-9 to R-38) • Insulation -Ceiling (R-11 to R-38) • Air Sealing (11ach50 to 7ach50) • Duct Sealing (14cfm25 to 8cfm25) • Cool Roof • Complete Weatherization Package • Insulation -Ceiling (R-38 to R-49) • Air Sealing (8.5ach50 to 5ach50)
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric Heat Pump	• Insulation - Ceiling (R-0 to R-19) • Insulation - Floor (R-0 to R-19) • Energy Star Windows (.30 U, .40 SHGC) • Insulation -Ceiling (R-19 to R-38) • Insulation -Ceiling (R-0 to R-38) • Insulation -Ceiling (R-9 to R-38) • Insulation -Ceiling (R-11 to R-38) • Air Sealing (11ach50 to 7ach50) • Duct Sealing (14cfm25 to 8cfm25) • Cool Roof • Complete Weatherization Package • Insulation -Ceiling (R-38 to R-49) • Air Sealing (8.5ach50 to 5ach50)
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric Furnace	• Insulation - Ceiling (R-0 to R-19) • Insulation - Floor (R-0 to R-19) • Energy Star Windows (.30 U, .40 SHGC) • Insulation -Ceiling (R-19 to R-38) • Insulation -Ceiling (R-0 to R-38) • Insulation -Ceiling (R-9 to R-38) • Insulation -Ceiling (R-11 to R-38) • Air Sealing (11ach50 to 7ach50) • Duct Sealing (14cfm25 to 8cfm25) • Cool Roof • Complete Weatherization Package

END USE TYPE	MEASURES INCLUDED
Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric AC Only (& Gas Heat)	• Air Sealing (15ach50 to 10ach50) • Insulation - Floor (R-11 to R-30) • Energy Star Windows (.30 U, .40 SHGC) • Duct Sealing (14cfm25 to 10cfm25) • Complete Weatherization Package • Air Sealing (10ach50 to 7ach50) • Insulation - Floor (R-19 to R-30)
Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric Heat Pump	• Air Sealing (15ach50 to 10ach50) • Insulation - Floor (R-0to R-30) • Energy Star Windows (.30 U, .40 SHGC) • Duct Sealing (14cfm25 to 10cfm25) • Complete Weatherization Package • Air Sealing (10ach50 to 7ach50) • Insulation - Floor (R-11 to R-22) • Ceiling Insulation (R-11 to R-38)
Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric Heat	• Air Sealing (15ach50 to 10ach50) • Insulation - Floor (R-0 to R-30) • Energy Star Windows (.30 U, .40 SHGC) • Duct Sealing (14cfm25 to 10cfm25) • Complete Weatherization Package
Space Heating and Space Cooling Equipment - Single Family/Mobile Homes	• HVAC Tune-Up (Central AC) (from 10seer to 11 seer) • HVAC Tune-Up (Heat Pump) (from 10 seer to 11 seer) • Efficient Room A/C (11 EER to 11.5 EER) • High Efficiency Central AC - 16 SEER from 14 seer • Ductless mini-split AC seer 16 (from 11eer RAC) • High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF from 14 seer • Ground Source Heat Pump (HP Upgrade) 18.2 eer from 14 seer ASHP • Heat Pump (Replacing Electric Furnace and 14 seer AC) - 16 SEER/9.0 HSPF • Dual Fuel Heat Pump Upgrade (Replacing New ASHP) • Dual Fuel Heat Pump (Replacing Electric Furnace) • Ductless mini-split HP (replacing ASHP) • Ductless mini-split HP (replacing electric furnace) • ECM Furnace Fan • Programmable Thermostat - Gas/AC • Programmable Thermostat - ASHP • Programmable Thermostat - Elec Furnace/AC • Smart Thermostat - Gas Heat / AC • Smart Thermostat - ASHP • Smart Thermostat - Elec Furnace/AC • Heat Pump (Replacing Electric Furnace) - 16 SEER/9.0 HSPF • High Efficiency Central AC - 16 SEER (gas) from 14 seer • Ductless mini-split AC replacing central AC (gas)
Other	• Pre-Paid Energy Display Monitor - Gas/CAC • Home Energy Reports - Gas/CAC • Pre-Paid Energy Display Monitor - ASHP • Home Energy Reports - ASHP • Pre-Paid Energy Display Monitor - Elec Furn/CAC • Home Energy Reports - Elec Furn/CAC • Two Speed Pool Pumps • Variable Speed Pool Pumps

END USE TYPE	MEASURES INCLUDED
	• Premium Efficiency Pool Pump Motor
Multi-family Units	• Multi-Family Homes Efficiency Kit
New Construction Homes - Single Family	• New Construction - 15% more efficient (w/AC only) • New Construction - 15% more efficient (w/Elec. HP) • New Construction - 15% more efficient (w/ Dual-Fuel HP (w/gas)) • New Construction - 15% more efficient (w/ Geothermal HP) • New Construction - 30% more efficient (w/AC only) • New Construction - 30% more efficient (w/Elec. HP) • New Construction - 30% more efficient (w/ Dual-Fuel HP (w/gas)) • New Construction - 30% more efficient (w/ Geothermal HP)
Early Retirement	• Energy Star Room A/C - Early Retirement • High Efficiency Central AC/Early Retire - 16 SEER • High Efficiency Heat Pump/Early Retire (HP Upgrade) - 16 SEER/9.0 HSPF • Ground Source Heat Pump/Early Retire (HP Upgrade) • Heat Pump/Early Retire (Replacing Electric Furnace)

6.1.2 Overview of Residential Electric Energy Efficiency Potential

This section presents estimates for electric technical, economic, and achievable potential for the residential sector. Each of the tables in the technical, economic and achievable sections present the respective potential for efficiency savings expressed as cumulative annual energy savings (MWh), percentage of savings by end use, and savings as a percentage of forecast sales. Data is provided on a 5-year and 10-year time horizon for EKPC.

This energy efficiency potential study considers the impacts of the Energy and Independence and Security Act (EISA) as an improving code standard for the residential sector. The EISA improves the baseline efficiency of several types of lighting products, including CFL or LED bulbs. Other known increases to federal minimum efficiency standards over the time period studied have also been accounted for in the analysis. These included changes to the efficiency standards central air conditioners, electric water heaters, and appliances.

There are a variety of factors which contribute to uncertainty surrounding the savings estimates produced by this energy efficiency potential study. These factors can include the following:

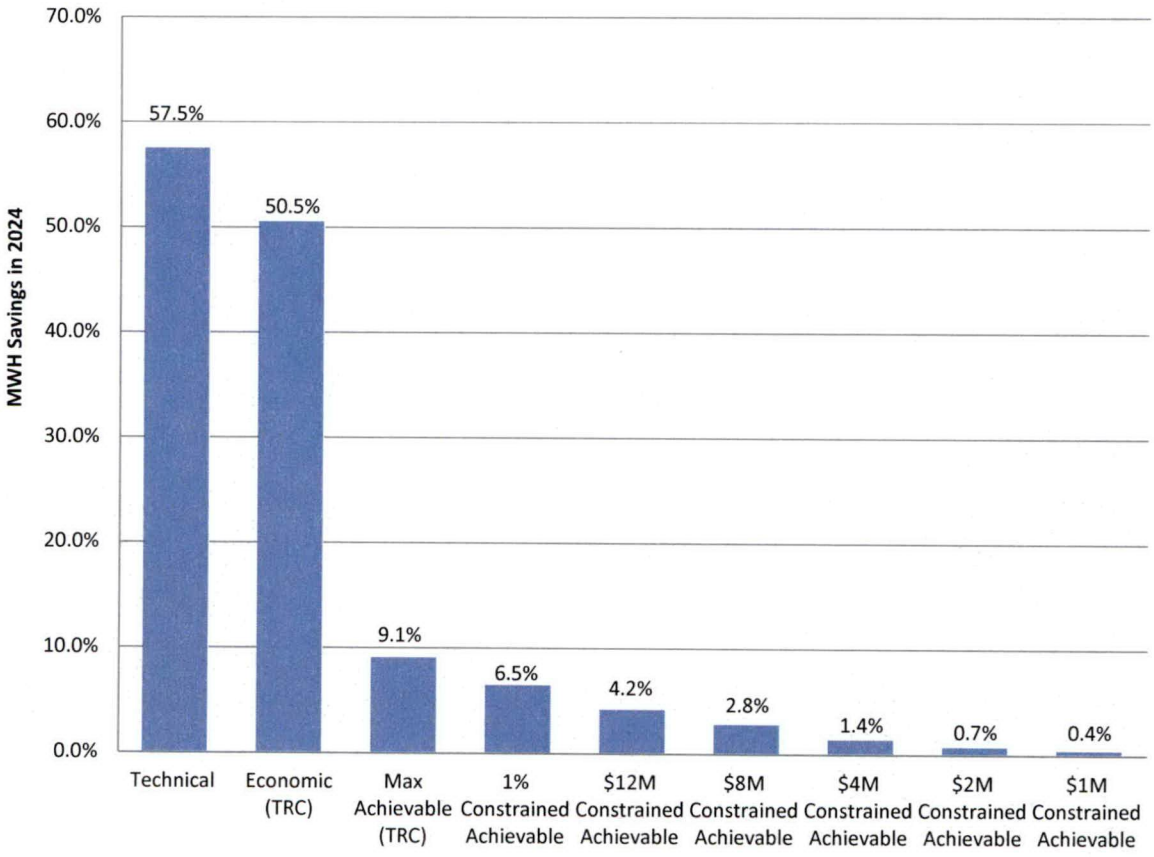
- Uncertainty about economic and fuel price forecasts used as inputs to the electric and natural gas sales forecasts
- The accuracy of results generated by building energy simulation modeling software
- The lack of availability of up-to-date efficiency saturation data
- Changes to codes and standards in the future which cannot be anticipated at the present time, and
- Uncertainty regarding the future adoption of energy efficiency technologies which have minimal market share at the present time, such as LED lighting.

GDS has addressed the areas of uncertainty as robustly as possible given the time and budget constraints of this project. For example, GDS assumes increasing market adoption of LEDs over the life of the study because LED costs are expected to decrease over time.

SUMMARY OF FINDINGS

Figure 6-1 illustrates the estimated savings potential for each of the scenarios included in this study.

Figure 6-1: Summary of Residential Electric Energy Efficiency Potential as a % of 2024 Sales Forecasts



The potential estimates are expressed as cumulative 10-year savings, as percentages of the respective 2024 sector sales. The technical potential is 57.50% 2024.[24] Based on a measure-level screen using the TRC Test, the economic potential is 50.5% in 2024. The slight drop from technical potential to economic potential indicates that most measures are cost-effective, particularly when screening based on the TRC. The 10-year maximum achievable potential is 9%. Lastly, the Constrained Achievable scenarios are a subset of Achievable TRC scenario. GDS ran scenarios for savings at 1% of residential sales, and budgets at $1M, $2M, $4M, $8M, and $12M.

TECHNICAL POTENTIAL

Technical potential represents the quantification of savings that can be realized if all technologically available energy-efficiency measures are immediately adopted in all feasible instances, regardless of cost. Table 6-2 shows that it is technically feasible to save 4,559,451MWh in the residential sector HVAC equipment and HVAC envelope represent the greatest contributor to the potential with both at 33% of savings, while water heating contributes 13% of the savings. Table 6-3 shows the demand savings potential in 2024. The ten year summer peak demand savings potential is 475 MW and 57.5% of the peak forecast.

[24] Technical and Economic Potential may decrease in 2024, relative to 2019, due to the expected impacts of EISA and a 2020 provision that is expected to make CFL bulbs, or technology of similar efficacy, the baseline. As a result, all savings associated with CFL bulbs replacing general service incandescent were modeled to decrease to 0 kWh by 2021.

Table 6-2: Residential Sector Technical Potential Energy Savings by End Use

END USE	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	165,543	4%
Electronics	114,962	3%
Lighting	355,179	8%
Water Heating	587,278	13%
HVAC Envelope	1,518,670	33%
HVAC Equipment	1,509,642	33%
New Construction	110,793	2%
Other	197,384	4%
Total	**4,559,451**	**100%**
% of Annual Sales Forecast	*57.5%*	

Table 6-3: Residential Sector Technical Potential Demand Savings

SUMMER PEAK DEMAND	
	2024
	MW
Total	**475**
% of Peak	*22.8%*

ECONOMIC POTENTIAL

Economic potential is a subset of technical potential, which only accounts for measures that are cost-effective. The economic potential scenario was screened using the TRC Test. The utility incentive was assumed to be equal to 48% of the measure incremental cost. Because the TRC includes participant costs, it goes beyond utility resource acquisition and looks at the measure/program from a more broad perspective.

Table 6-4 indicates that the economic potential based on the TRC screen is just over 4.0 million MWh. Similar to the technical potential scenario, HVAC equipment represents the greatest contributor to the potential at 36% of savings, with HVAC envelope next at 33%. Table 6-5 shows the economic potential demand savings in 2024. The ten year summer peak demand savings potential is 366 MW which is 17.6% of the peak forecast.

Table 6-4: Residential Sector Economic Potential (TRC) Energy Savings by End Use

END USE	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	**165,543**	4%
Electronics	**101,923**	3%
Lighting	**355,179**	9%
Water Heating	**342,069**	9%
HVAC Envelope	**1,333,479**	33%
HVAC Equipment	**1,433,683**	36%
New Construction	**95,809**	2%

END USE	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Other	178,739	4%
Total	4,006,425	100%
% of Annual Sales Forecast	*50.5%*	

Table 6-5: Residential Sector Economic Potential (TRC) Demand Savings

SUMMER PEAK DEMAND	
	2024
	MW
Total	366
% of Peak	*17.6%*

6.1.1 Achievable Electric Potential Savings in the Residential Sector

Achievable potential is a refinement of economic potential that takes into account the estimated market adoption of energy efficiency measures based on the incentive level and measure payback, the natural replacement cycle of equipment, and the capabilities of programs and administrators to ramp up program activity over time. Achievable potential also takes into account the non-measure costs of delivering programs (for administration, marketing, monitoring and evaluation, etc.). For purposes of this analysis, administrative costs were assumed to be equivalent to 25% of incentive costs.

The Achievable TRC scenario assumes incentives set at 48% of the measure incremental cost based on EKPC's transfer payment structure, but only includes measures that passed the TRC Test economic screening.

6.1.1.1 Achievable TRC

Table 6-6 shows the estimated savings for the Maximum Achievable TRC scenario over 5 and 10 year time horizons.

Table 6-6: Residential Maximum Achievable TRC Potential Electric Energy Savings by End Use

END USE	2019 ENERGY (MWH)	% OF 2019 SAVINGS	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	40,865	9%	66,997	9%
Electronics	48,751	11%	58,882	8%
Lighting	100,078	23%	119,003	16%
Water Heating	31,465	7%	53,249	7%
HVAC Envelope	59,342	14%	118,616	16%
HVAC Equipment	81,504	19%	213,684	29%
New Construction	3,359	1%	6,506	1%
Other	72,374	17%	87,852	12%
Total	437,738	100%	724,790	100%
% of Annual Sales Forecast	*5.9%*		*9.1%*	

Table 6-7: Residential Achievable TRC Potential Demand Savings

SUMMER PEAK DEMAND		
	2019	2024
	MW	MW
Total	49.9	80.2
% of Peak	*12.5%*	*19.1%*

The 5-year and 10-year Maximum Achievable TRC potential savings estimates are approximately 437,738 MWh and 724,790 MWh. This equates to 5.9% and 9.1% of sector sales in 2019 and 2024.

6.1.1.1 Additional Constrained Achievable Scenarios

The Tables 6-8 to 6-19 that follow provide saving estimates over a 5 and 10 year time horizon, the percent of sector sales in 2019 and 2024 and demand savings estimates for several constrained achievable savings potential scenarios. The scenarios provided include a one million dollar budget, a two million dollar budget, a four million dollar budget, an eight million dollar budget, a twelve million budget and a savings at 1% of residential sales scenario.

Table 6-8: Residential $1M Budget Constrained Achievable Savings Potential Energy Savings by End Use

END USE	2019 ENERGY (MWH)	% OF 2019 SAVINGS	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	1,692	9%	2,491	9%
Electronics	1,965	11%	2,157	8%
Lighting	4,154	23%	4,607	16%
Water Heating	1,299	7%	2,025	7%
HVAC Envelope	2,457	13%	4,579	16%
HVAC Equipment	3,896	21%	9,368	33%
New Construction	139	1%	252	1%
Other	2,791	15%	3,111	11%
Total	**18,394**	**100%**	**28,591**	**100%**
% of Annual Sales Forecast	*0.2%*		*0.4%*	

Table 6-9: Residential $1M Budget Constrained Achievable Potential Demand Savings

SUMMER PEAK DEMAND		
	2019	2024
	MW	MW
Total	5.5	7.5
% of Peak	*0.3%*	*0.4%*

Table 6-10 shows the estimated savings for the two million dollar Budget Constrained Achievable scenario over a 5 and 10 year time horizon. The 5-year and 10-year potential savings estimates in this scenario are 35,838MWh and 55,149MWh respectively. This equates to 0.5% and 0.7% of sector sales in 2019 and 2024. The five and ten year demand savings estimates in the Constrained Achievable two million dollar budget scenario are depicted in Table 6-11.

Table 6-10: Residential $2M Budget Constrained Achievable Savings Potential Energy Savings, by End Use

END USE	2019 ENERGY (MWH)	% OF 2019 SAVINGS	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	3,385	9%	4,983	9%
Electronics	3,930	11%	4,314	8%
Lighting	8,308	23%	9,214	17%
Water Heating	2,598	7%	4,051	7%
HVAC Envelope	4,915	14%	9,159	17%
HVAC Equipment	6,843	19%	16,703	30%
New Construction	278	1%	503	1%
Other	5,583	16%	6,223	11%
Total	**35,838**	**100%**	**55,149**	**100%**
% of Annual Sales Forecast	*0.5%*		*0.7%*	

Table 6-11: Residential $2M Budget Constrained Achievable Potential Demand Savings

	SUMMER PEAK DEMAND	
	2019	**2024**
	MW	**MW**
Total	**11.0**	**15.0**
% of Peak	*0.6%*	*0.7%*

Table 6-12 shows the estimated savings for the four million dollar Budget Constrained Achievable scenario. The 5-year and 10-year potential savings estimates in this scenario are 70,727MWh and 108,267MWh respectively. This equates to 0.9% and 1.4% of sector sales in 2019 and 2024. The five and ten year demand savings estimates in the Constrained Achievable four million dollar budget scenario are shown in Table 6-13 and are 22.1 MW in 2019 and 29.9 MW in 2024.

Table 6-12: Residential $4M Budget Constrained Achievable Savings Potential Energy Savings, by End Use

END USE	2019 ENERGY (MWH)	% OF 2019 SAVINGS	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	6,769	10%	9,966	9%
Electronics	7,859	11%	8,628	8%
Lighting	16,616	23%	18,428	17%
Water Heating	5,195	7%	8,101	7%
HVAC Envelope	9,830	14%	18,318	17%
HVAC Equipment	12,736	18%	31,375	29%
New Construction	556	1%	1,007	1%
Other	11,166	16%	12,445	11%
Total	**70,727**	**100%**	**108,267**	**100%**
% of Annual Sales Forecast	*0.9%*		*1.4%*	

Table 6-13: Residential $4M Budget Constrained Achievable Potential Demand Savings

	SUMMER PEAK DEMAND	
	2019	2024
	MW	MW
Total	22.1	29.9
% of Peak	*1.2%*	*1.5%*

Table 6-14 provides the eight million dollar Budget Constrained Achievable scenario saving estimates. The 5-year and 10-year potential savings estimates in this scenario are 143,353MWh and 220,597MWh respectively. This equates to 1.9% and 2.8% of sector sales in 2019 and 2024. The five and ten year demand savings estimates in the Constrained Achievable eight million dollar budget scenario are shown in Table 6-15 and are 44.2 MW in 2019 and 59.9 MW in 2024.

Table 6-14: Residential $8M Budget Constrained Achievable Savings Potential Energy Savings, by End Use

END USE	2019 ENERGY (MWH)	% OF 2019 SAVINGS	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	13,538	9%	19,932	9%
Electronics	15,719	11%	17,255	8%
Lighting	33,233	23%	36,855	17%
Water Heating	10,390	7%	16,202	7%
HVAC Envelope	19,660	14%	36,635	17%
HVAC Equipment	27,370	19%	66,813	30%
New Construction	1,112	1%	2,014	1%
Other	22,331	16%	24,890	11%
Total	**143,353**	**100%**	**220,597**	**100%**
% of Annual Sales Forecast	*1.9%*		*2.8%*	

Table 6-15: Residential $8M Budget Constrained Achievable Potential Demand Savings

	SUMMER PEAK DEMAND	
	2019	2024
	MW	MW
Total	44.2	59.9
% of Peak	*2.3%*	*3.0%*

A twelve million dollar Budget Constrained Achievable scenario is included in Table 16. The 5-year and 10-year potential savings estimates in this scenario are 215,029Wh and 330,896MWh respectively. This equates to 1.9% and 2.8% of sector sales in 2019 and 2024. The five and ten year demand savings estimates in the Constrained Achievable twelve million dollar budget scenario are shown in Table 6-17.

Table 6-16: Residential $12M Budget Constrained Achievable Savings Potential Energy Savings, by End Use

END USE	2019 ENERGY (MWH)	% OF 2019 SAVINGS	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	20,307	9%	29,898	9%
Electronics	23,578	11%	25,883	8%
Lighting	49,849	23%	55,283	17%

END USE	2019 ENERGY (MWH)	% OF 2019 SAVINGS	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Water Heating	15,585	7%	24,304	7%
HVAC Envelope	29,490	14%	54,953	17%
HVAC Equipment	41,055	19%	100,219	30%
New Construction	1,669	1%	3,021	1%
Other	33,497	16%	37,335	11%
Total	**215,029**	**100%**	**330,896**	**100%**
% of Annual Sales Forecast	*2.9%*		*4.2%*	

Table 6-17: Residential $12M Budget Constrained Achievable Potential Demand Savings

	SUMMER PEAK DEMAND	
	2019	**2024**
	MW	**MW**
Total	**66.3**	**89.9**
% of Peak	*3.5%*	*4.4%*

Table 6-18 provides a savings at 1% of sales annually constrained achievable scenario. The 5-year and 10-year potential savings estimates in this scenario are 335,171Wh and 514,621MWh. This equates to 4.5% and 6.5% of sector sales in 2019 and 2024. The five and ten year demand savings estimates in this scenario are located in Table 6-19.

Table 6-18: Residential 1% Constrained Achievable Savings Potential Energy Savings, by End Use

END USE	2019 ENERGY (MWH)	% OF 2019 SAVINGS	2024 ENERGY (MWH)	% OF 2024 SAVINGS
Appliances	31,723	9%	46,704	9%
Electronics	36,832	11%	40,433	8%
Lighting	77,871	23%	86,360	17%
Water Heating	24,346	7%	37,966	7%
HVAC Envelope	46,067	14%	85,843	17%
HVAC Equipment	63,400	19%	154,272	30%
New Construction	2,606	1%	4,719	1%
Other	52,327	16%	58,323	11%
Total	**335,171**	**100%**	**514,621**	**100%**
% of Annual Sales Forecast	*4.5%*		*6.5%*	

Table 6-19: Residential 1% Constrained Achievable Potential Demand Savings

	SUMMER PEAK DEMAND	
	2019	**2024**
	MW	**MW**
Total	**103.5**	**140.4**
% of Peak	*5.4*	*6.9%*

Figure 6-2 shows the percentage of electric savings by each end use for the maximum achievable TRC scenario. The HVAC equipment end use shows the largest potential for savings with 30% of total electric savings, followed by lighting and HVAC envelope end uses at 17% and 16%, respectively.

Figure 6-2: Residential Maximum Achievable TRC Potential Electric Energy Savings, by End Use

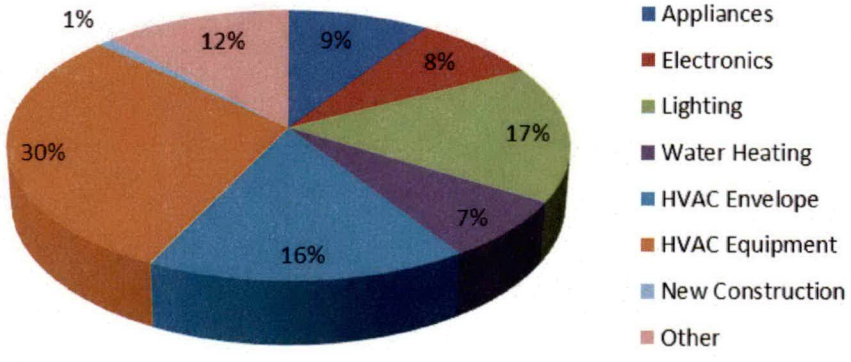
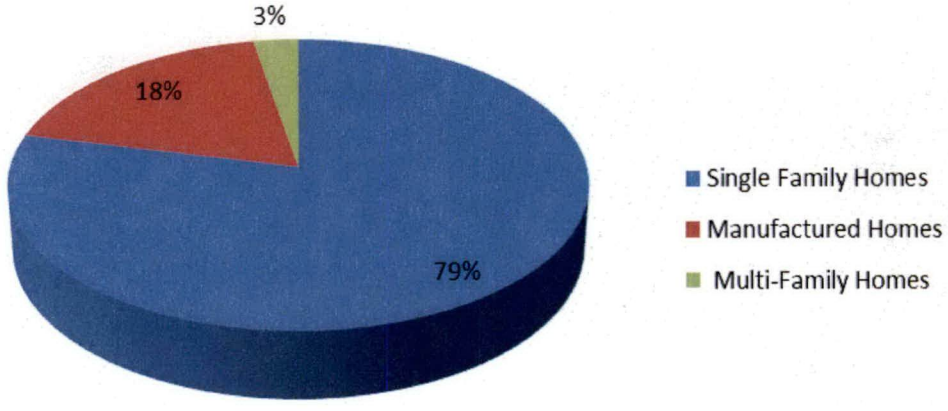


Figure 6-3 shows the breakdown of residential housing by type in EKPC's member service territories.

Figure 6-3: Percentage of EKPC Residential Housing by Type



6.1.2 Annual Achievable Electric Savings Potential

Table 6-20 shows cumulative annual energy savings for the maximum achievable potential scenario for each year across the 10-year time horizon for the study, broken out by end use. The year by year associated transfer payments and administrative costs to achieve these savings are shown later, in Section 6.3.

Table 6-21 shows cumulative annual demand savings for the maximum achievable potential scenario for each year across the 10-year time horizon for the study, broken out by end use. The year by year associated transfer payments and administrative costs to achieve these savings are shown later, in Section 6.3.

Table 6-20: Cumulative Annual Residential Energy Savings in the Achievable TRC Potential Scenario, by End Use

END USE	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Appliances	8,155	16,344	24,528	32,705	40,865	49,022	57,180	65,340	66,171	66,997
Electronics	11,188	22,752	34,454	46,101	48,751	50,876	52,860	54,872	56,886	58,882
Lighting	20,696	41,359	61,466	80,931	100,078	115,724	132,275	103,481	111,286	119,003
Water Heating	5,704	12,053	18,640	25,137	31,465	35,959	40,247	44,570	48,882	53,249
HVAC Envelope	11,855	23,736	35,613	47,483	59,342	71,198	83,055	94,914	106,767	118,616
HVAC Equipment	10,608	24,084	40,387	59,534	81,504	104,413	129,107	155,604	183,885	213,684
New Construction	632	1,353	2,051	2,721	3,359	3,991	4,629	5,266	5,898	6,506
Other	10,514	25,471	44,843	58,623	72,374	81,706	86,626	87,144	87,502	87,852
Total	**79,352**	**167,152**	**261,981**	**353,237**	**437,738**	**512,889**	**585,980**	**611,190**	**667,276**	**724,790**
% of Annual Forecast Sales	*1.1%*	*2.3%*	*3.6%*	*4.8%*	*5.9%*	*6.8%*	*7.7%*	*7.9%*	*8.5%*	*9.1%*

Table 6-21: Cumulative Annual Residential Demand Savings in the Achievable TRC Potential Scenario, by End Use

END USE	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Appliances	0.4	0.8	1.3	1.7	2.1	2.5	2.9	3.3	3.4	3.5
Electronics	0.3	0.6	0.9	1.2	1.3	1.3	1.4	1.5	1.6	1.7
Lighting	0.4	0.8	1.2	1.6	1.9	2.2	2.5	2.0	2.2	2.4
Water Heating	0.1	0.2	0.3	0.4	0.6	0.7	0.7	0.8	0.9	1.0
HVAC Envelope	3.3	6.7	10.0	13.4	16.7	20.1	23.4	17.7	19.9	22.2
HVAC Equipment	0.2	0.5	0.7	1.0	1.3	1.5	1.7	1.8	2.0	2.2
New Construction	0.2	0.4	0.6	0.8	1.0	1.1	1.3	1.5	1.7	1.9
Other	0.3	0.8	1.4	1.8	2.1	2.2	2.4	2.5	2.7	2.8
Total	**5.3**	**10.8**	**16.4**	**21.8**	**26.9**	**31.6**	**36.3**	**31.3**	**34.5**	**37.7**
% of Annual Forecast Sales	*1.4%*	*2.8%*	*4.2%*	*5.5%*	*6.7%*	*7.8%*	*8.9%*	*7.6%*	*8.3%*	*9.0%*

6.1.3 Residential Electric Savings Summary by Measure Group

Table 6-22 provides an end-use breakdown of the residential electric savings potential estimates for technical and economic potential, and achievable potential scenarios.

Table 6-22: Breakdown of Residential Cumulative Annual Electric Savings Potential for Technical, Economic and Achievable Potential, by End Use

End Use	Technical Potential (kWh) Savings per Measure	Economic Potential (kWh) Savings per Measure	Achievable Electricity (kWh) Savings by 2024	Achievable Electricity (kWh) Savings by 2024 ($1,000,000 constrained)
Appliances				
Energy Star Compliant Top-Mount Refrigerator - SF, ROB	1,930,971	1,930,971	877,036	33,858
Energy Star Compliant Side-by-Side Refrigerator - SF, ROB	2,279,518	2,279,518	1,035,344	39,970
Energy Star Compliant Chest Freezer - SF, ROB	1,977,727	1,977,727	904,590	34,922
Energy Star Compliant Upright Freezer (Manual Def.) - SF, ROB	2,055,257	2,055,257	940,051	36,291
Energy Star Dehumidifer - SF, ROB	992,580	992,580	679,470	26,231
Second Refrigerator Turn In - SF, Retrofit	89,279,372	89,279,372	34,925,632	1,291,565
Second Freezer Turn In - SF, Retrofit	28,539,774	28,539,774	11,168,352	413,010
Energy Star Compliant Top-Mount Refrigerator - MH, ROB	724,662	724,662	291,413	11,250
Energy Star Compliant Side-by-Side Refrigerator - MH, ROB	855,466	855,466	344,014	13,281
Energy Star Compliant Chest Freezer - MH, ROB	482,122	482,122	238,457	9,206
Energy Star Compliant Upright Freezer (Manual Def.) - MH, ROB	501,022	501,022	247,805	9,567
Energy Star Dehumidifer - MH, ROB	268,593	268,593	183,180	7,072
Second Refrigerator Turn In - MH, Retrofit	24,163,664	24,163,664	9,456,608	349,709
Second Freezer Turn In - MH, Retrofit	7,724,400	7,724,400	3,021,936	111,752
Energy Star Compliant Top-Mount Refrigerator - SF, NC	761,683	761,683	588,188	22,753
Energy Star Compliant Side-by-Side Refrigerator - SF, NC	899,170	899,170	694,358	26,860
Energy Star Compliant Chest Freezer - SF, NC	393,942	393,942	216,157	8,362
Energy Star Compliant Upright Freezer (Manual Def.) - SF, NC	409,385	409,385	224,631	8,690
Energy Star Dehumidifer - SF, NC	500,976	500,976	411,942	15,935
Energy Star Compliant Top-Mount Refrigerator - MH, NC	206,087	206,087	141,044	5,456
Energy Star Compliant Side-by-Side Refrigerator - MH, NC	243,287	243,287	166,503	6,441
Energy Star Compliant Chest Freezer - MH, NC	106,532	106,532	63,277	2,448
Energy Star Compliant Upright Freezer (Manual Def.) - MH, NC	110,709	110,709	65,757	2,544
Energy Star Dehumidifer - MH, NC	136,107	136,107	111,399	4,310
Consumer Electronics - Single Family/Mobile Home				
Efficient Televisions - SF, ROB	10,446,539	10,446,539	9,276,278	358,114

Energy Star Desktop Computer - SF, ROB	19,077,443	19,077,443	6,893,348	244,903
Energy Star Computer Monitor - SF, ROB	1,108,030	1,108,030	853,160	30,542
Energy Star Laptop Computer - SF, ROB	1,891,416	0	0	0
Smart Strip Power Strip - SF, ROB	7,164,122	0	0	0
Efficient Set Top Box - SF, ROB	33,929,676	33,929,676	21,375,600	759,421
Efficient Televisions - MH, ROB	2,528,789	2,528,789	2,245,885	86,703
Energy Star Desktop Computer - MH, ROB	3,872,484	3,872,484	1,399,244	49,712
Energy Star Computer Monitor - MH, ROB	224,910	224,910	173,180	6,200
Energy Star Laptop Computer - MH, ROB	351,192	0	0	0
Smart Strip Power Strip - MH, ROB	1,938,947	0	0	0
Efficient Set Top Box - MH, ROB	6,996,608	6,996,608	4,407,848	156,600
Efficient Televisions - SF, NC	8,382,648	8,382,648	7,443,869	287,957
Energy Star Desktop Computer - SF, NC	2,381,379	2,381,379	332,255	11,807
Energy Star Computer Monitor - SF, NC	432,978	432,978	161,084	5,768
Energy Star Laptop Computer - SF, NC	693,840	0	0	0
Smart Strip Power Strip - SF, NC	684,949	0	0	0
Efficient Set Top Box - SF, NC	8,241,638	8,241,638	2,004,926	71,244
Efficient Televisions - MH, NC	2,029,273	2,029,273	1,801,974	69,707
Energy Star Desktop Computer - MH, NC	483,406	483,406	67,375	2,394
Energy Star Computer Monitor - MH, NC	87,892	87,892	32,690	1,170
Energy Star Laptop Computer - MH, NC	128,784	0	0	0
Smart Strip Power Strip - MH, NC	185,384	0	0	0
Efficient Set Top Box - MH, NC	1,699,520	1,699,520	413,412	14,690
Lighting - Single Family /Mobile Home				
Standard CFL - Average Use (3 hours/day) - SF, ROB	7,513,889	7,513,889	0	0
Standard LED - Average Use (3 hours/day) - SF, ROB	20,987,487	20,987,487	3,691,980	140,775
Specialty CFL - SF, ROB	60,534,123	60,534,123	30,239,698	1,197,739
Specialty LED - SF, ROB	85,742,781	85,742,781	21,416,219	809,226
Energy Star Torchiere - SF, ROB	16,336,177	16,336,177	9,032,650	329,589
LED Nightlight - SF, ROB	1,144,535	1,144,535	140,202	5,358
Exterior CFL Fixture - SF, ROB	48,978,358	48,978,358	12,233,593	492,763
Exterior LED Fixture - SF, ROB	7,040,748	7,040,748	1,758,592	66,000
Standard CFL - Average Use (3 hours/day) - MH, ROB	1,591,433	1,591,433	0	0
Standard LED - Average Use (3 hours/day) - MH, ROB	4,445,121	4,445,121	780,345	29,742
Specialty CFL - MH, ROB	12,821,058	12,821,058	6,216,638	246,230
Specialty LED - MH, ROB	18,160,196	18,160,196	4,402,721	166,360
Energy Star Torchiere - MH, ROB	2,500,810	2,500,810	1,382,800	50,456
LED Nightlight - MH, ROB	309,767	309,767	37,930	1,450
Exterior CFL Fixture - MH, ROB	6,822,261	6,822,261	1,654,013	66,623
Exterior LED Fixture - MH, ROB	980,707	980,707	237,756	8,923
Standard CFL - Average Use (3 hours/day) - SF, NC	8,042,187	8,042,187	1,183,009	42,932
Standard LED - Average Use (3 hours/day) - SF, NC	2,455,988	2,455,988	1,283,100	48,231

Specialty CFL - SF, NC	10,870,899	10,870,899	5,475,204	217,175
Specialty LED - SF, NC	15,398,031	15,398,031	7,640,224	289,331
Energy Star Torchiere - SF, NC	2,933,771	2,933,771	1,113,475	40,668
LED Nightlight - SF, NC	114,294	114,294	22,399	858
Exterior CFL Fixture - SF, NC	8,795,621	8,795,621	4,468,595	180,082
Exterior LED Fixture - SF, NC	1,264,409	1,264,409	624,702	23,499
Standard CFL - Average Use (3 hours/day) - MH, NC	1,654,801	1,654,801	243,418	8,834
Standard LED - Average Use (3 hours/day) - MH, NC	505,364	505,364	263,596	9,905
Specialty CFL - MH, NC	2,236,857	2,236,857	1,093,460	43,372
Specialty LED - MH, NC	3,168,374	3,168,374	1,525,934	57,786
Energy Star Torchiere - MH, NC	436,477	436,477	165,677	6,051
LED Nightlight - MH, NC	30,954	30,954	6,066	232
Exterior CFL Fixture - MH, NC	1,190,254	1,190,254	587,016	23,656
Exterior LED Fixture - MH, NC	171,106	171,106	82,047	3,086
Electric Water Heating - Single Family/Mobile Homes				
Low Flow Faucet Aerators - SF, Retrofit	9,579,830	9,579,830	0	0
Low Flow Showerhead - SF, Retrofit	60,371,459	60,371,459	0	0
Water Heater Blanket - SF, Retrofit	11,575,791	0	0	0
Water Heater Pipe Wrap - SF, Retrofit	32,552,016	32,552,016	12,241,320	469,037
Heat Pump Water Heater (resistance heat) - SF, ROB	90,772,927	90,772,927	4,548,750	175,606
Heat Pump Water Heater (ASHP heat) - SF, ROB	47,236,266	47,236,266	2,365,350	91,315
Solar Water Heating - SF, Retrofit	188,229,585	0	0	0
Energy Star Dishwasher (Electric Water Heating) - SF, ROB	1,346,004	1,346,004	923,670	35,659
Energy Star Dishwasher (Non-Electric WH) - SF, ROB	92,866	92,866	63,677	2,458
Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer) - SF, ROB	9,878,772	9,878,772	6,918,870	267,106
Energy Star Clothes Washer (w/ NG WH & Elec. Dryer) - SF, ROB	1,145,678	1,145,678	802,638	30,986
Low Flow Faucet Aerators - MH, Retrofit	1,465,480	1,465,480	0	0
Low Flow Showerhead - MH, Retrofit	14,588,740	14,588,740	0	0
Water Heater Blanket - MH, Retrofit	6,885,640	0	0	0
Water Heater Pipe Wrap - MH, Retrofit	10,317,076	10,317,076	3,745,147	142,494
Energy Star Dishwasher (Electric Water Heating) - MH, ROB	370,548	370,548	247,320	9,548
Energy Star Dishwasher (Non-Electric WH) - MH, ROB	25,566	25,566	17,107	660
Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer) - MH, ROB	2,870,034	2,870,034	1,930,554	74,530
Energy Star Clothes Washer (w/ NG WH & Elec. Dryer) - MH, ROB	332,877	332,877	223,992	8,647
Low Flow Faucet Aerators - SF, NC	3,743,334	3,743,334	2,882,404	111,502
Low Flow Showerhead - SF, NC	19,377,868	19,377,868	6,742,020	241,400
Water Heater Blanket - SF, NC	2,286,418	0	0	0
Water Heater Pipe Wrap - SF, NC	3,849,286	3,849,286	1,447,040	55,565
Heat Pump Water Heater (ASHP heat) - SF, NC	18,768,887	18,768,887	937,731	36,278

Solar Water Heating - SF, NC	35,613,131	0	0	0
Energy Star Dishwasher (Electric Water Heating) - SF, NC	493,641	493,641	24,705	956
Energy Star Dishwasher (Non-Electric WH) - SF, NC	34,060	34,060	25,696	994
Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer) - SF, NC	3,866,015	3,866,015	2,918,543	112,900
Energy Star Clothes Washer (w/ NG WH & Elec. Dryer) - SF, NC	448,399	448,399	345,425	13,363
Low Flow Faucet Aerators - MH, NC	1,013,139	1,013,139	780,409	30,189
Low Flow Showerhead - MH, NC	5,244,816	5,244,816	2,205,216	78,958
Water Heater Blanket - MH, NC	618,965	0	0	0
Water Heater Pipe Wrap - MH, NC	1,042,055	1,042,055	45,885	1,715
Energy Star Dishwasher (Electric Water Heating) - MH, NC	125,280	125,280	45,414	1,732
Energy Star Dishwasher (Non-Electric WH) - MH, NC	8,637	8,637	6,332	245
Energy Star Clothes Washer (w/ Elec. WH & Elec. Dryer) - MH, NC	992,195	992,195	728,059	28,165
Energy Star Clothes Washer (w/ NG WH & Elec. Dryer) - MH, NC	114,900	114,900	85,241	3,297
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric AC Only (& Gas Heat)				
Insulation - Ceiling (R-0 to R-19) - SF, Retrofit	6,404,096	6,404,096	1,567,040	60,496
Insulation - Floor (R-0 to R-19) - SF, Retrofit	0	0	0	0
Energy Star Windows (.30 U, .40 SHGC) - SF, Retrofit	11,270,248	0	0	0
Insulation -Ceiling (R-19 to R-38) - SF, Retrofit	2,630,355	0	0	0
Insulation -Ceiling (R-0 to R-38) - SF, Retrofit	7,021,440	7,021,440	807,300	31,166
Insulation -Ceiling (R-9 to R-38) - SF, Retrofit	36,420,300	36,420,300	0	0
Insulation -Ceiling (R-11 to R-38) - SF, Retrofit	6,185,670	6,185,670	34,240	1,322
Air Sealing (11ach50 to 7ach50) - SF, Retrofit	4,295,115	4,295,115	292,050	11,275
Duct Sealing (14cfm25 to 8cfm25) - SF, Retrofit	5,076,045	5,076,045	0	0
Cool Roof - SF, Retrofit	15,856,640	0	0	0
Complete Weatherization Package - SF, Retrofit	12,451,495	12,451,495	7,605,500	293,613
Energy Star Windows (.30 U, .40 SHGC) - SF-D, NC	0	0	0	0
Insulation -Ceiling (R-38 to R-49) - SF-D, NC	7,902	7,902	0	0
Air Sealing (8.5ach50 to 5ach50) - SF-D, NC	46,534	46,534	3,180	123
Duct Sealing (14cfm25 to 8cfm25) - SF-D, NC	46,534	46,534	0	0
Cool Roof - SF-D, NC	25,901	0	0	0
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric Heat Pump				
Insulation - Ceiling (R-0 to R-19) - SF, Retrofit	34,747,181	34,747,181	10,284,890	397,052
Insulation - Floor (R-0 to R-19) - SF, Retrofit	115,841,594	115,841,594	861,620	33,263
Energy Star Windows (.30 U, .40 SHGC) - SF, Retrofit	48,302,501	0	0	0
Insulation -Ceiling (R-19 to R-38) - SF, Retrofit	27,813,208	0	0	0
Insulation -Ceiling (R-0 to R-38) - SF, Retrofit	37,995,241	37,995,241	6,134,340	236,819
Insulation -Ceiling (R-9 to R-38) - SF, Retrofit	60,783,375	60,783,375	0	0
Insulation -Ceiling (R-11 to R-38) - SF, Retrofit	47,742,250	47,742,250	0	0
Air Sealing (11ach50 to 7ach50) - SF, Retrofit	58,113,198	58,113,198	0	0

Duct Sealing (14cfm25 to 8cfm25) - SF, Retrofit	26,189,320	26,189,320	0	0
Cool Roof - SF, Retrofit	4,899,302	0	0	0
Complete Weatherization Package - SF, Retrofit	120,651,488	120,651,488	0	0
Energy Star Windows (.30 U, .40 SHGC) - SF-D, NC	115,784	0	0	0
Insulation -Ceiling (R-38 to R-49) - SF-D, NC	66,364	66,364	940	36
Air Sealing (8.5ach50 to 5ach50) - SF-D, NC	835,904	0	0	0
Duct Sealing (14cfm25 to 8cfm25) - SF-D, NC	383,358	383,358	10,860	419
Cool Roof - SF-D, NC	4,236	0	0	0
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric Furnace				
Insulation - Ceiling (R-0 to R-19) - SF, Retrofit	28,605,265	28,605,265	10,815,550	417,539
Insulation - Floor (R-0 to R-19) - SF, Retrofit	104,052,840	104,052,840	4,445,430	171,618
Energy Star Windows (.30 U, .40 SHGC) - SF, Retrofit	41,512,920	0	0	0
Insulation -Ceiling (R-19 to R-38) - SF, Retrofit	12,318,852	12,318,852	0	0
Insulation -Ceiling (R-0 to R-38) - SF, Retrofit	31,496,855	31,496,855	8,048,740	310,725
Insulation -Ceiling (R-9 to R-38) - SF, Retrofit	53,523,288	35,682,192	0	0
Insulation -Ceiling (R-11 to R-38) - SF, Retrofit	42,250,068	28,166,712	0	0
Air Sealing (11ach50 to 7ach50) - SF, Retrofit	56,474,166	56,474,166	12,067,720	465,879
Duct Sealing (14cfm25 to 8cfm25) - SF, Retrofit	19,568,556	19,568,556	0	0
Cool Roof - SF, Retrofit	0	0	0	0
Complete Weatherization Package - SF, Retrofit	113,855,646	113,855,646	0	0
Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric AC Only (& Gas Heat)				
Air Sealing (15ach50 to 10ach50) - MH, Retrofit	971,568	971,568	0	0
Insulation - Floor (R-11 to R-30) - MH, Retrofit	0	0	0	0
Energy Star Windows (.30 U, .40 SHGC) - MH, Retrofit	5,556,888	5,556,888	0	0
Duct Sealing (14cfm25 to 10cfm25) - MH, Retrofit	342,576	342,576	0	0
Complete Weatherization Package - MH, Retrofit	0	0	0	0
Air Sealing (10ach50 to 7ach50) - MH, NC	55,965	55,965	14,280	552
Insulation - Floor (R-19 to R-30) - MH, NC	0	0	0	0
Energy Star Windows (.30 U, .40 SHGC) - MH, NC	0	0	0	0
Duct Sealing (14cfm25 to 10cfm25) - MH, NC	54,366	54,366	340	13
Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric Heat Pump				
Insulation - Floor (R-0to R-30) - MH, Retrofit	5,194,547	5,194,547	0	0
Energy Star Windows (.30 U, .40 SHGC) - MH, Retrofit	4,649,400	4,649,400	0	0
Duct Sealing (14cfm25 to 10cfm25) - MH, Retrofit	6,272,100	6,272,100	0	0
Complete Weatherization Package - MH, Retrofit	814,219	814,219	0	0
Air Sealing (10ach50 to 7ach50) - MH, NC	6,451,338	6,451,338	3,934,020	151,874
Insulation - Floor (R-11 to R-22) - MH, NC	1,692,873	1,692,873	496,587	19,211
Energy Star Windows (.30 U, .40 SHGC) - MH, NC	1,675,944	1,675,944	22,432	868
Duct Sealing (14cfm25 to 10cfm25) - MH, NC	2,089,737	2,089,737	0	0
Ceiling Insulation (R-11 to R-38) - MH, NC	818,532	818,532	13,068	505
Insulation - Floor (R-0to R-30) - MH, Retrofit	5,004,207	5,004,207	1,467,933	56,788

Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric Heat				
Air Sealing (15ach50 to 10ach50) - MH, Retrofit	59,910,048	59,910,048	0	0
Insulation - Floor (R-0 to R-30) - MH, Retrofit	73,670,251	73,670,251	0	0
Energy Star Windows (.30 U, .40 SHGC) - MH, Retrofit	58,399,484	58,399,484	0	0
Duct Sealing (14cfm25 to 10cfm25) - MH, Retrofit	7,810,243	7,810,243	0	0
Complete Weatherization Package - MH, Retrofit	81,355,122	81,355,122	49,688,100	1,918,229
Space Heating and Space Cooling Equipment - Single Family/Mobile Homes				
HVAC Tune-Up (Central AC) (from 10seer to 11 seer) - SF, Retrofit	5,120,154	5,120,154	1,172,834	41,985
HVAC Tune-Up (Heat Pump) (from 10 seer to 11 seer) - SF, Retrofit	6,145,674	6,145,674	3,056,670	109,424
Efficient Room A/C (11 EER to 11.5 EER) - SF, ROB	2,030,588	2,030,588	735,494	27,579
High Efficiency Central AC - 16 SEER from 14 seer - SF, ROB	10,787,230	10,787,230	630,155	24,327
Ductless mini-split AC seer 16 (from 11eer RAC) - SF, ROB	80,074,437	80,074,437	5,190,486	200,381
High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF from 14 seer - SF, ROB	3,591,908	3,591,908	181,748	7,016
Ground Source Heat Pump (HP Upgrade) 18.2 eer from 14 seer ASHP - SF, ROB	16,659,022	0	0	0
Heat Pump (Replacing Electric Furnace and 14 seer AC) - 16 SEER/9.0 HSPF - SF, ROB	129,830,407	129,830,407	16,022,351	589,971
Dual Fuel Heat Pump Upgrade (Replacing New ASHP) - SF, ROB	52,763,891	52,763,891	6,721,662	252,708
Dual Fuel Heat Pump (Replacing Electric Furnace) - SF, ROB	162,106,183	162,106,183	16,313,301	600,603
Ductless mini-split HP (replacing ASHP) - SF, Retrofit	56,776,919	56,776,919	7,777,044	296,402
Ductless mini-split HP (replacing electric furnace) - SF, Retrofit	150,784,961	150,784,961	19,305,419	710,822
ECM Furnace Fan - SF, ROB	18,171,527	0	0	0
Programmable Thermostat - Gas/AC - SF, Retrofit	4,215,608	4,215,608	2,133,828	80,906
Programmable Thermostat - ASHP - SF, Retrofit	14,170,346	14,170,346	6,884,462	260,969
Programmable Thermostat - Elec Furnace/AC - SF, Retrofit	11,966,189	11,966,189	5,867,939	222,366
Smart Thermostat - Gas Heat / AC - SF, Retrofit	13,776,779	13,776,779	6,093,320	231,558
Smart Thermostat - ASHP - SF, Retrofit	32,226,110	32,226,110	13,644,944	518,416
Smart Thermostat - Elec Furnace/AC - SF, Retrofit	30,321,664	30,321,664	13,722,632	520,675
HVAC Tune-Up (Central AC) (from 10seer to 11 seer) - MH, Retrofit	1,599,752	1,599,752	560,043	20,049
HVAC Tune-Up (Heat Pump) (from 10 seer to 11 seer) - MH, Retrofit	668,659	668,659	311,470	11,150
Efficient Room A/C (11 EER to 11.5 EER) - MH, ROB	1,688,434	1,688,434	521,283	19,362
High Efficiency Central AC - 16 SEER from 14 seer - MH, ROB	4,051,794	4,051,794	172,356	6,362
Ductless mini-split AC seer 16 (from 11eer RAC) - MH, ROB	12,440,508	12,440,508	206,913	7,619
High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF from 14 seer - MH, ROB	822,965	822,965	88,697	3,274

Heat Pump (Replacing Electric Furnace) - 16 SEER/9.0 HSPF - MH, ROB	116,151,169	116,151,169	14,480,179	533,164
Dual Fuel Heat Pump Upgrade (Replacing New ASHP) - MH, ROB	3,897,193	3,897,193	311,775	11,484
Dual Fuel Heat Pump (Replacing Electric Furnace) - MH, ROB	84,487,504	84,487,504	6,646,350	244,685
Ductless mini-split HP (replacing ASHP) - MH, Retrofit	6,408,902	6,408,902	744,145	27,411
Ductless mini-split HP (replacing electric furnace) - MH, Retrofit	128,378,112	128,378,112	19,393,653	714,052
ECM Furnace Fan - MH, ROB	2,728,901	0	0	0
Programmable Thermostat - Gas/AC - MH, Retrofit	688,002	688,002	323,637	12,268
Programmable Thermostat - ASHP - MH, Retrofit	1,324,842	1,324,842	632,033	23,953
Programmable Thermostat - Elec Furnace/AC - MH, Retrofit	15,346,921	15,346,921	7,336,511	277,982
Smart Thermostat - Gas Heat / AC - MH, Retrofit	2,690,765	2,690,765	1,116,298	42,396
Smart Thermostat - ASHP - MH, Retrofit	3,415,476	3,415,476	1,358,600	51,584
Smart Thermostat - Elec Furnace/AC - MH, Retrofit	35,877,525	35,877,525	15,091,613	572,437
Efficient Room A/C (11 EER to 11.5 EER) - SF-D, NC	17,032	17,032	4,972	187
High Efficiency Central AC - 16 SEER (gas) from 14 seer - SF-D, NC	90,723	90,723	8,700	337
Ductless mini-split AC replacing central AC (gas) - SF-D, NC	249,487	249,487	20,995	814
High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF from 14 seer - SF-D, NC	75,977	75,977	5,823	228
Ground Source Heat Pump (HP Upgrade) 18.2 eer from 14 seer ASHP - SF-D, NC	165,361	0	0	0
Dual Fuel Heat Pump Upgrade (Replacing New ASHP) - SF-D, NC	450,114	450,114	98,177	3,704
Ductless mini-split HP (replacing ASHP) - SF-D, NC	230,101	230,101	28,486	1,095
ECM Furnace Fan - SF-D, NC	65,026	0	0	0
Programmable Thermostat - Gas/AC - SF-D, NC	9,665	9,665	1,177	45
Programmable Thermostat - ASHP - SF-D, NC	35,914	35,914	15,948	606
Smart Thermostat - Gas Heat / AC - SF-D, NC	33,542	33,542	4,085	158
Smart Thermostat - ASHP - SF-D, NC	120,369	120,369	53,319	2,026
Efficient Room A/C (11 EER to 11.5 EER) - MH, NC	274,358	274,358	75,740	2,820
High Efficiency Central AC - 16 SEER (gas) from 14 seer - MH, NC	572,558	572,558	43,179	1,597
Ductless mini-split AC replacing central AC (gas) - MH, NC	1,317,842	0	0	0
High Efficiency Heat Pump (HP Upgrade) - 16 SEER/9.0 HSPF from 14 seer - MH, NC	725,686	725,686	138,259	5,113
Dual Fuel Heat Pump Upgrade (Replacing New ASHP) - MH, NC	3,479,026	3,479,026	491,236	18,119
Ductless mini-split HP (replacing ASHP) - MH, NC	1,774,812	0	0	0
ECM Furnace Fan - MH, NC	213,977	0	0	0
Programmable Thermostat - Gas/AC - MH, NC	28,767	28,767	12,554	477
Programmable Thermostat - ASHP - MH, NC	347,134	347,134	153,697	5,837

Smart Thermostat - Gas Heat / AC - MH, NC	100,685	100,685	43,940	1,669
Smart Thermostat - ASHP - MH, NC	923,229	923,229	408,769	15,523
Other				
Pre-Paid Energy Display Monitor - Gas/CAC - SF, Retrofit	12,366,797	0	0	0
Home Energy Reports - Gas/CAC - SF, Retrofit	2,547,560	0	0	0
Pre-Paid Energy Display Monitor - ASHP - SF, Retrofit	47,002,873	47,002,873	19,940,474	704,107
Home Energy Reports - ASHP - SF, Retrofit	9,682,592	9,682,592	5,553,361	194,492
Pre-Paid Energy Display Monitor - Elec Furn/CAC - SF, Retrofit	40,908,688	40,908,688	21,633,785	763,898
Home Energy Reports - Elec Furn/CAC - SF, Retrofit	8,427,190	8,427,190	5,378,808	188,379
Two Speed Pool Pumps - SF, ROB	2,048,415	2,048,415	682,994	26,367
Variable Speed Pool Pumps - SF, ROB	5,510,989	5,510,989	1,837,505	70,938
Premium Efficiency Pool Pump Motor - SF, ROB	1,898,073	1,898,073	683,285	26,314
Pre-Paid Energy Display Monitor - Gas/CAC - MH, Retrofit	2,058,908	0	0	0
Home Energy Reports - Gas/CAC - MH, Retrofit	424,135	0	0	0
Pre-Paid Energy Display Monitor - ASHP - MH, Retrofit	3,646,832	3,646,832	1,728,598	61,038
Home Energy Reports - ASHP - MH, Retrofit	751,247	751,247	454,755	15,927
Pre-Paid Energy Display Monitor - Elec Furn/CAC - MH, Retrofit	39,160,545	39,160,545	22,232,182	785,028
Home Energy Reports - Elec Furn/CAC - MH, Retrofit	8,067,072	8,067,072	5,329,823	186,664
Pre-Paid Energy Display Monitor - Gas/CAC - SF, NC	788,418	0	0	0
Home Energy Reports - Gas/CAC - SF, NC	162,414	0	0	0
Pre-Paid Energy Display Monitor - ASHP - SF, NC	4,517,417	4,517,417	552,114	19,498
Home Energy Reports - ASHP - SF, NC	930,588	930,588	50,122	1,755
Two Speed Pool Pumps - SF, NC	276,598	276,598	92,388	3,573
Variable Speed Pool Pumps - SF, NC	744,151	744,151	248,559	9,612
Premium Efficiency Pool Pump Motor - SF, NC	256,298	256,298	92,173	3,557
Pre-Paid Energy Display Monitor - Gas/CAC - MH, NC	84,883	0	0	0
Home Energy Reports - Gas/CAC - MH, NC	17,486	0	0	0
Pre-Paid Energy Display Monitor - ASHP - MH, NC	940,583	940,583	128,606	4,542
Home Energy Reports - ASHP - MH, NC	193,760	0	0	0
Multi-Family Units				
Multi-Family Homes Efficiency Kit - MF, Retrofit	3,506,474	3,506,474	1,116,614	41,293
Multi-Family Homes Efficiency Kit - MF, NC	462,713	462,713	116,239	4,306
New Construction Homes - Single Family				
New Construction - 15% more efficient (w/AC only) - SF, NC	7,491,865	7,491,865	507,451	19,639
New Construction - 15% more efficient (w/Elec. HP) - SF, NC	8,270,712	8,270,712	562,039	21,749
New Construction - 15% more efficient (w/ Dual-Fuel HP (w/gas)) - SF, NC	6,637,727	6,637,727	451,069	17,455
New Construction - 15% more efficient (w/	8,270,712	8,270,712	562,039	21,749

Geothermal HP) - SF, NC				
New Construction - 30% more efficient (w/AC only) - SF, NC	14,983,729	0	0	0
New Construction - 30% more efficient (w/Elec. HP) - SF, NC	16,541,425	16,541,425	1,124,078	43,498
New Construction - 30% more efficient (w/ Dual-Fuel HP (w/gas)) - SF, NC	13,275,455	13,275,455	902,138	34,910
New Construction - 30% more efficient (w/ Geothermal HP) - SF, NC	16,541,425	16,541,425	1,124,078	43,498
New Construction - 15% more efficient (w/AC only) - MH, NC	732,627	732,627	48,416	1,875
New Construction - 15% more efficient (w/Elec. HP) - MH, NC	5,527,377	5,527,377	376,097	14,542
New Construction - 30% more efficient (w/AC only) - MH, NC	1,465,254	1,465,254	96,831	3,750
New Construction - 30% more efficient (w/Elec. HP) - MH, NC	11,054,755	11,054,755	752,194	29,084
Early Retirement				
Energy Star Room A/C - Early Retirement - SF, ER1	0	0	1,025,754	121,839
Energy Star Room A/C - Early Retirement - SF, ER2	0	0	0	0
Energy Star Room A/C - Early Retirement - SF, ER3	877,111	877,111	297,468	35,333
High Efficiency Central AC/Early Retire - 16 SEER - SF, ER1	0	0	0	0
High Efficiency Central AC/Early Retire - 16 SEER - SF, ER2	0	0	0	0
High Efficiency Central AC/Early Retire - 16 SEER - SF, ER3	10,787,230	0	0	0
High Efficiency Heat Pump/Early Retire (HP Upgrade) - 16 SEER/9.0 HSPF - SF, ER1	0	0	0	0
High Efficiency Heat Pump/Early Retire (HP Upgrade) - 16 SEER/9.0 HSPF - SF, ER2	0	0	0	0
High Efficiency Heat Pump/Early Retire (HP Upgrade) - 16 SEER/9.0 HSPF - SF, ER3	3,591,908	0	0	0
Ground Source Heat Pump/Early Retire (HP Upgrade) - SF, ER1	0	0	0	0
Ground Source Heat Pump/Early Retire (HP Upgrade) - SF, ER2	0	0	0	0
Ground Source Heat Pump/Early Retire (HP Upgrade) - SF, ER3	16,659,022	0	0	0
Heat Pump/Early Retire (Replacing Electric Furnace) - SF, ER1	0	0	4,160,576	487,280
Heat Pump/Early Retire (Replacing Electric Furnace) - SF, ER2	0	0	0	0
Heat Pump/Early Retire (Replacing Electric Furnace) - SF, ER3	117,460,642	117,460,642	4,348,157	509,250
Energy Star Room A/C - Early Retirement - MH, ER1	0	0	234,463	27,850
Energy Star Room A/C - Early Retirement - MH, ER2	0	0	0	0
Energy Star Room A/C - Early Retirement - MH, ER3	729,761	729,761	63,922	7,593
High Efficiency Central AC/Early Retire - 16 SEER - MH, ER1	0	0	0	0
High Efficiency Central AC/Early Retire - 16 SEER - MH, ER2	0	0	0	0

High Efficiency Central AC/Early Retire - 16 SEER - MH, ER3	3,001,329	0	0	0
High Efficiency Heat Pump/Early Retire (HP Upgrade) - 16 SEER/9.0 HSPF - MH, ER1	0	0	0	0
High Efficiency Heat Pump/Early Retire (HP Upgrade) - 16 SEER/9.0 HSPF - MH, ER2	0	0	0	0
High Efficiency Heat Pump/Early Retire (HP Upgrade) - 16 SEER/9.0 HSPF - MH, ER3	822,965	0	0	0
Heat Pump/Early Retire (Replacing Electric Furnace) - MH, ER1	0	0	2,305,909	270,065
Heat Pump/Early Retire (Replacing Electric Furnace) - MH, ER2	0	0	0	0
Heat Pump/Early Retire (Replacing Electric Furnace) - MH, ER3	120,223,904	120,223,904	4,889,105	572,605
Total	**4,559,451,353**	**4,006,424,726**	**724,790,077**	**28,590,583**
% of Annual 2024 Sales Forecast	*57.5%*	*50.5%*	*9.1%*	*0.4%*
Note: Measures in the above Table with "0" achievable potential are ones that did not pass the Economic screening				

Table 6-23 provides a list of the Top 10 residential electric savings measures for the Maximum Achievable scenario. The table provides the measures ranked according to the electric savings potential. The column to the far right shows the results of the measure level cost-effectiveness screening test using the TRC to screen the measures. The measures in the table are representative of a group of comparable measures falling under the umbrella of the measure categories provided in the table. This means that there are a range of TRC ratios for measure iterations that fall into a single measure category. For example, "Specialty LED Bulbs" is a measure category which consists of several measure iterations to account for bulb type and wattage and housing type. The table presents an average of the TRC ratios for all measures which are part of the measure categories in the Top 10.

The Top 10 measures combine to yield an estimated 419,494,602 MWh savings. This accounts for nearly 58% of the total residential electric savings in the Achievable TRC scenario.

Table 6-23: Top 10 Residential Electric Savings Measures in the Max Achievable TRC Scenario

	Measure	2024 Energy (MWh)	% of Sector Savings	TRC Ratio
1	Pre-Paid Energy Display Monitor	66,215,759	9%	4.21
2	Complete Weatherization Package	57,293,600	8%	1.66
3	Smart Thermostat	51,537,520	7%	4.65
4	Ductless mini-split HP	47,248,747	7%	1.40
5	Second Refrigerator Turn In	44,382,240	6%	6.20
6	Specialty CFL	43,025,000	6%	12.83
7	Specialty LED	34,985,098	5%	1.62
8	Dual Fuel Heat Pump	30,582,501	4%	2.30
9	Efficient Set Top Box	28,201,786	4%	6.34
10	Heat Pump (Replacing Electric Furnace and 14 seer AC) - 16 SEER/9.0 HSPF	16,022,351	2%	2.59
Total		**419,494,602**	**58%**	

6.2 ACHIEVABLE POTENTIAL BENEFITS & COSTS

The tables below provide the net present value (NPV) benefits and costs associated with each achievable TRC potential scenario for a 10-year period.

Table 6-24: 10-Year Benefit-Cost Ratios for the Maximum Achievable TRC Scenario – Residential Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	$1,114,326,815	$411,128,583	2.71	$703,198,232

Table 6-24: 10-Year Benefit-Cost Ratios for the $1M Budget Achievable TRC Scenario – Residential Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	$41,861,450	$15,985,267	2.62	$25,876,183

Table 6-26: 10-Year Benefit-Cost Ratios for $2M Budget Achievable TRC Scenario– Residential Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	$83,690,013	$31,948,883	2.62	$51,741,130

Table 6-27: 10-Year Benefit-Cost Ratios for $4M Budget Achievable TRC Scenario– Residential Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	$167,379,765	$63,880,937	2.62	$103,498,828

Table 6-28: 10-Year Benefit-Cost Ratios for $8M Budget Achievable TRC Scenario– Residential Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	334,760,050	$127,795,533	2.62	$206,964,517

Table 6-29: 10-Year Benefit-Cost Ratios for $12M Budget Achievable TRC Scenario– Residential Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	$502,140,075	$191,693,300	2.62	$310,446,775

Table 6-30: 10-Year Benefit-Cost Ratios for 1% Achievable TRC Scenario– Residential Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	$783,302,319	$298,755,257	2.62	$484,547,062

Year by year budgets for all of the achievable scenarios are broken out by transfer payments and administrative costs and depicted in Tables 6-31 through 6-37.

Table 6-31: Annual Program Budgets Associated with the Maximum Achievable TRC Scenario

ACHIEVABLE TRC	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$16,929,413	$19,080,850	$20,857,754	$22,359,956	$23,685,619	$24,881,703	$26,101,225	$27,240,400	$28,389,955	$29,398,788
Admin.	$4,232,353	$4,770,212	$5,214,438	$5,589,989	$5,921,405	$6,220,426	$6,525,306	$6,810,100	$7,097,489	$7,349,697
Total Costs	$21,161,766	$23,851,062	$26,072,192	$27,949,945	$29,607,024	$31,102,128	$32,626,531	$34,050,500	$35,487,444	$36,748,485

Table 6-32: Annual Program Budgets Associated with the Constrained $1M Scenario

CONSTRAINED	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$800,000	$824,000	$848,720	$874,182	$900,407	$927,419	$955,242	$983,899	$1,013,416	$1,043,819
Admin.	$200,000	$206,000	$212,180	$218,545	$225,102	$231,855	$238,810	$245,975	$253,354	$260,955
Total Costs	$1,000,000	$1,030,000	$1,060,900	$1,092,727	$1,125,509	$1,159,274	$1,194,052	$1,229,874	$1,266,770	$1,304,773

Table 6-33: Annual Program Budgets Associated with the Constrained $2M Scenario

CONSTRAINED	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$1,600,000	$1,648,000	$1,697,440	$1,748,363	$1,800,814	$1,854,839	$1,910,484	$1,967,798	$2,026,832	$2,087,637
Admin.	$400,000	$412,000	$424,360	$437,091	$450,204	$463,710	$477,621	$491,950	$506,708	$521,909
Total Costs	$2,000,000	$2,060,000	$2,121,800	$2,185,454	$2,251,018	$2,318,548	$2,388,105	$2,459,748	$2,533,540	$2,609,546

Table 6-34: Annual Program Budgets Associated with the Constrained $4M Scenario

CONSTRAINED	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$3,200,000	$3,296,000	$3,394,880	$3,496,726	$3,601,628	$3,709,677	$3,820,967	$3,935,596	$4,053,664	$4,175,274
Admin.	$800,000	$824,000	$848,720	$874,182	$900,407	$927,419	$955,242	$983,899	$1,013,416	$1,043,819
Total Costs	$4,000,000	$4,120,000	$4,243,600	$4,370,908	$4,502,035	$4,637,096	$4,776,209	$4,919,495	$5,067,080	$5,219,093

Table 6-35: Annual Program Budgets Associated with the Constrained $8M Scenario

CONSTRAINED	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$6,400,000	$6,592,000	$6,789,760	$6,993,453	$7,203,256	$7,419,354	$7,641,935	$7,871,193	$8,107,329	$8,350,548
Admin.	$1,600,000	$1,648,000	$1,697,440	$1,748,363	$1,800,814	$1,854,839	$1,910,484	$1,967,798	$2,026,832	$2,087,637
Total Costs	$8,000,000	$8,240,000	$8,487,200	$8,741,816	$9,004,070	$9,274,193	$9,552,418	$9,838,991	$10,134,161	$10,438,185

Table 6-36: Annual Program Budgets Associated with the Constrained $12M Scenario

CONSTRAINED	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$9,600,000	$9,888,000	$10,184,640	$10,490,179	$10,804,885	$11,129,031	$11,462,902	$11,806,789	$12,160,993	$12,525,823
Admin.	$2,400,000	$2,472,000	$2,546,160	$2,622,545	$2,701,221	$2,782,258	$2,865,726	$2,951,697	$3,040,248	$3,131,456
Total Costs	$12,000,000	$12,360,000	$12,730,800	$13,112,724	$13,506,106	$13,911,289	$14,328,628	$14,758,486	$15,201,241	$15,657,278

Table 6-37: Annual Program Budgets Associated with the Constrained Limiting Savings to 1% of System Usage

CONSTRAINED	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$15,040,210	$15,476,458	$15,925,794	$16,388,609	$16,865,309	$17,356,310	$17,862,041	$18,382,944	$18,919,474	$19,472,100
Admin.	$3,760,053	$3,869,115	$3,981,448	$4,097,152	$4,216,327	$4,339,078	$4,465,510	$4,595,736	$4,729,868	$4,868,025
Total Costs	$18,800,263	$19,345,573	$19,907,242	$20,485,761	$21,081,636	$21,695,388	$22,327,551	$22,978,680	$23,649,342	$24,340,125

7 COMMERCIAL ELECTRIC ENERGY EFFICIENCY POTENTIAL ESTIMATES

This section provides electric energy efficiency potential estimates for the commercial sector. Estimates of technical, economic and achievable potential are provided.

7.1 COMMERCIAL ELECTRIC ENERGY EFFICIENCY POTENTIAL

According to estimated 2013 historical sales, the commercial sector accounts for approximately 15% of retail electric sales in EKPC's service area.

7.1.1 Electric Energy Efficiency Measures Examined

For the commercial sector, there were 79 unique energy efficiency measures included in the electric energy savings potential analysis. Table 7-1 provides a brief description of the types of measures included for each end use in the commercial sector. The list of measures was developed based on a review of the EKPC program measures, measures found in other Technical Reference Manuals (TRMs) and measures included in other commercial energy efficiency potential studies. For each measure, the analysis considered incremental costs, energy and demand savings, and measure useful lives.

Table 7-1: Types of Electric Energy Efficiency Measures Included in the Commercial Sector Analysis

END USE TYPE	MEASURES INCLUDED
Lighting	• Compact Fluorescent bulb • LED Exit Sign • High Performance T8 fixture (vs T8) 4ft • Wall Mounted Occupancy Sensor • Fixture Mounted Occupancy Sensor • Remote Mounted Occupancy Sensor • High Bay 3 or 4 lamp T8VHO fixture vs (Metal Halide 100W - 300W) • High Bay 6 or 8 lamp T8VHO fixture vs (Metal Halide > 300W) • High performance T5 fixture (replacing T8) • CFL Hard Wired Fixture • CFL bulb High Wattage 31-115 • CFL bulb High Wattage 150-199 • Low Bay LED bulb (vs Metal Halide) • High Bay LED bulb(vs Metal Halide) • Outdoor LED bulb (vs Metal Halide) • Outdoor Induction bulb (vs Metal Halide)
Space Cooling	• Split AC (13 SEER to 14.5 SEER) 5 ton • Split AC (13 SEER to 15 SEER) 5 ton • Split AC (13 SEER to 16 SEER) 5 ton • Split AC (11.4 IEER to 13 IEER) 8.3 ton • Split AC (11.4 IEER to 14 IEER) 8.3 ton • Split AC (11.4 IEER to 15 IEER) 8.3 ton • DX Packaged System (CEE Tier 2) 10 ton • DX Packaged System (CEE Tier 2) < 20 ton • DX Packaged System (CEE Tier 2) > 20 ton • Air Cooled Chiller 5 ton • Air Cooled Chiller 8 ton • PTAC 1/2 ton • PTAC 3/4 ton

END USE TYPE	MEASURES INCLUDED
	• PTAC 1 ton • PTAC 1 1/4 ton • HVAC Tune-Up 5 ton
Space Heating	• PTHP 1/2 ton • PTHP 3/4 ton • PTHP 1 ton • PTHP 1 1/4 ton
Ventilation	• Variable Frequency Drives <2 HP • Variable Frequency Drives 3 to 10 HP • Variable Frequency Drives 11 to 50 HP
Motors (Non-Ventilation)	• Variable Frequency Drives <2 HP • Variable Frequency Drives 3 to 10 HP • Variable Frequency Drives 11 to 50 HP
Water Heating	• High Efficiency Storage (tank) • Pre-Rinse Sprayer, Low flow, Commercial Application • On Demand (tankless) • Tank Insulation • Heat Pump Water Heater
Cooking	• Electric Energy Star Fryers • Electric Energy Star Steamers, 3-6 pan • Energy Star Hot Food Holding Cabinet • Energy Star Convection Ovens • Energy Star Griddles
Refrigeration	• Glass Door Freezer, <15-49 cu ft, Energy Star Avg (7.5, 22.5, 40) • Glass Door Freezer, 50+ cu ft, Energy Star 75 cu ft • Solid Door Freezer, <15-49 cu ft, Energy Star Avg (7.5, 22.5, 40) • Solid Door Freezer, 50+ cu ft, Energy Star 75 cu ft • Glass Door Refrigerator, <15 - 49 cu ft Avg (7.5, 22.5, 40) • Glass Door Refrigerator, 50+ cu ft, Energy Star 75 cu ft • Solid Door Refrigerator, <15-49 cu ft, Energy Star Avg (7.5, 22.5, 40) • Solid Door Refrigerator, 50+ cu ft, Energy Star - 75 cu ft • Commercial Refrigeration Tune-Up, Medium Temp, not self-contained • Commercial Refrigeration Tune-Up, Low Temp, not self-contained • Anti-sweat heater controls on freezers - 2 doors • Anti-sweat heater controls, on refrigerators - 2 doors • Vending Miser, Cold Beverage • Brushless DC Motors for freezers and coolers • Humidity Door Heater Controls for freezers and coolers - 2 doors • Refrigerated Case Covers - 6 linear feet • Zero Energy Doors for freezers and coolers • Evaporator Coil Defrost Control • Evaporator Fan Motor Control for freezers and coolers • Ice Machine, Energy Star, Self-Contained • LED Case Lighting (per door)
Office Equipment/Appliances	• Watt Sensors on Office Electronics 50 Watt • Watt Sensors on Office Electronics 150 Watt
Compressed Air	• Fix Air Leaks <5HP • Fix Air Leaks 10-50HP

END USE TYPE	MEASURES INCLUDED
	• Fix Air Leaks 50-100HP • Engineered Nozzles for blow-off

7.1.2 Technical and Economic Potential Electric Savings

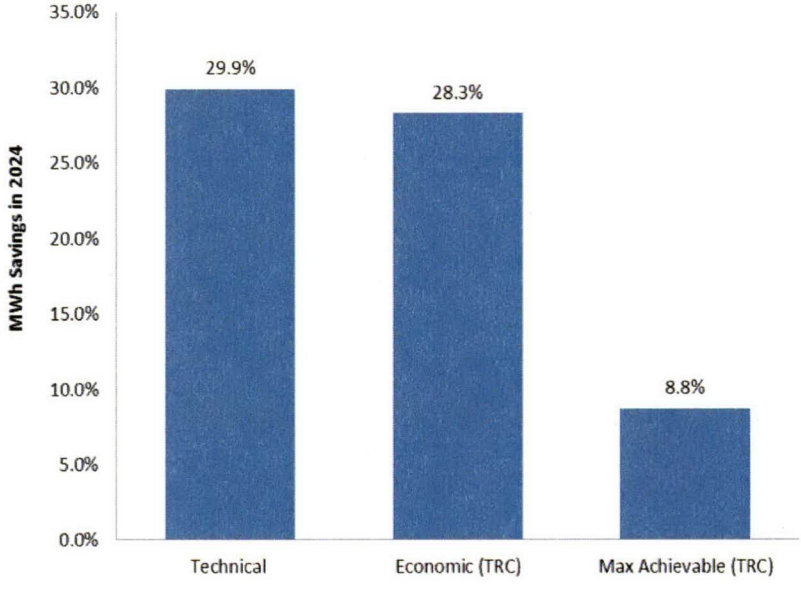
This section presents estimates for electric technical, economic, and achievable savings potential for the commercial sector. Each of the tables in the technical, economic and achievable sections present the respective potential for efficiency savings expressed as cumulative annual savings (MWh) and percentage of commercial sector forecast annual MWh sales. Data is provided for a 5 and 10-year horizon.

This energy efficiency potential study considers the impacts of the December 2007 Energy and Independence and Security Act (EISA) as an improving code standard for the commercial sector. EISA improves the baseline efficiency of compact fluorescent lamps (CFL), general service fluorescent lamps (GSFL), high intensity discharge (HID) lamps and ballasts and motors, all applicable in the commercial sector.

SUMMARY OF FINDINGS

Figure 7-1 illustrates the estimated energy efficiency savings potential for each of the scenarios included in this study.

Figure 7-1: Summary of Commercial Electric Energy Efficiency Potential as a % of Sales Forecasts



The potential savings estimates are expressed as cumulative 10-year savings, as percentages of the 2024 commercial sector sales forecasts. The technical potential is 29.9%. Based on a measure-level screen using the TRC Test, the economic potential is 28.3% in 2024. The slight drop from technical potential to economic potential indicates that most measures are cost-effective. The 10-year potential savings are 8.8% for the Achievable TRC scenario.

TECHNICAL POTENTIAL

Technical potential represents the quantification of savings that can be realized if energy-efficiency measures passing the qualitative screening are applied in all feasible instances, regardless of cost. Table 7-2 shows that it is technically feasible to save approximately 671,288 MWh annually in the commercial sector by 2024, representing 29.9% of the commercial sales forecast in 2024. Lighting represents the majority of the energy efficiency savings potential at 58% of 10-yr savings, followed by Refrigeration and Space Cooling at 19% and 9% respectively, while cooking, and space heating represent the smallest shares, each with 1 percent or less of 10-yr savings. Table 7-3 shows the demand savings potential in 2024. The ten year summer peak demand savings technical potential is 95 MW which is about 20.7% of the estimated commercial peak forecasts for 2024.

Table 7-2: Commercial Sector Technical Potential Electric Energy Savings by End Use

END USE	2024 ENERGY SAVINGS (MWH)	% OF 2024 TOTAL
Space Heating	3,345	0%
Space Cooling	57,686	9%
Ventilation	39,107	6%
Water Heating	18,862	3%
Lighting	388,241	58%
Cooking	2,331	0%
Refrigeration	126,051	19%
Office Equipment	13,585	2%
Other	22,079	3%
Total	**671,288**	**100%**
% of Annual Sales Forecast	***29.9%***	

Table 7-3: Commercial Sector Technical Potential Electric Demand Savings

SUMMER PEAK DEMAND	
	2024
	MW
Total	95
% of Forecast Peak	*20.7%*

ECONOMIC POTENTIAL

Economic potential is a subset of technical potential and only includes measures that are cost-effective. The economic potential scenario was screened using the TRC Test. In this scenario, the utility incentive was assumed to be equal to 48% of the measure incremental cost. The TRC Test considers the cost assumed by the participant as well as all utility costs.

Table 7-4 shows that the economic potential based on the TRC screen is an estimated 636,670 MWh annually by 2024. This represents 28.3% of the commercial MWh sales forecast for 2024. Table 7-7 shows the economic demand savings potential in 2024. Ten year summer peak demand savings potential is 88 MWwhich is 19.2% of the peak forecasts for the commercial sector for those years.

Table 7-4: Commercial Sector Economic Potential (TRC) Electric Savings by End Use

END USE	2024 ENERGY SAVINGS (MWH)	% OF 2024 TOTAL
Space Heating	3,345	1%
Cooling	57,686	9%
Ventilation	39,107	6%
Water Heating	18,862	3%
Lighting	388,241	61%
Cooking	2,331	0%
Refrigeration	106,167	17%
Office Equipment	0	0%
Other	20,930	3%
Total	636,670	100%
% of Annual Sales Forecast	*28.3%*	

Table 7-5: Commercial Sector Economic Potential Electric Demand Savings

SUMMER PEAK DEMAND	
	2024
	MW
Total	88
% of Peak	*19.2%*

7.1.3 Achievable Potential Savings in the Commercial Sector

Achievable potential is an estimate of energy savings that can feasibly be achieved given market barriers and equipment replacement cycles. The Achievable TRC assumes incentives set at 48% of the measure incremental cost, but only includes measures that passed the TRC Test economic screening.

7.1.3.1 Achievable TRC

Tables 7-6 shows the estimated cumulative annual savings for the Achievable TRC scenario over 5 and 10 year time horizons. This scenario assume an incentive level approximately equal to 48% of the incremental measure cost and include estimated 10-year market adoption rates based on incentive levels and equipment replacement cycles. Five year and ten year summer peak demand savings potential is 16.2 MW and 32.2 MW, respectively, which is 3.8% and 7.1% of the peak forecasts for the commercial sector for those years.

Table 7-6: Commercial Achievable TRC Potential Electric Energy Savings, by End Use

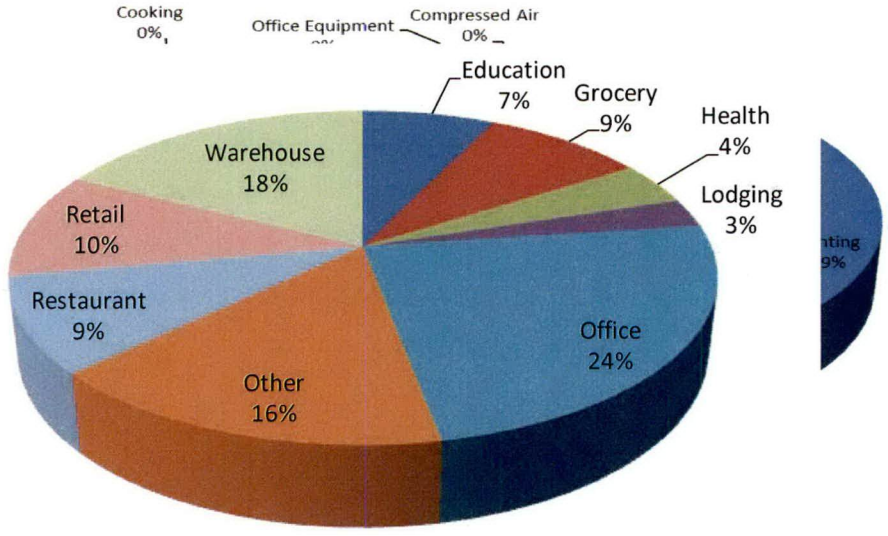
END USE	2019 ENERGY SAVINGS (MWH)	% OF 2019 TOTAL	2024 ENERGY SAVINGS (MWH)	% OF 2024 TOTAL
Lighting	58,236	59%	11,6472	59%
Space cooling	8,653	9%	17,306	9%
Space Heating	502	1%	1,004	1%
Ventilation	5,866	6%	11,732	6%
Motors (Non-Ventilation)	2,870	3%	5,741	3%
Water Heating	3,019	3%	6,039	3%
Cooking	350	0%	699	0%
Refrigeration	18,678	19%	37,357	19%
Office Equipment	0	0%	0	0%
Compressed Air	201	0%	386	0%
Total	**98,375**	**100%**	**196,736**	**100%**
% of Annual Sales Forecast	***4.72%***		***8.75%***	

Table 7-7: Commercial Achievable TRC Potential Electric Demand Savings

	SUMMER PEAK DEMAND	
	2019	**2024**
	MW	**MW**
Total	**16.2**	**32.4**
% of Peak	***3.8%***	***7.1%***

Figure 7-2 shows the estimated 10-year cumulative annual energy efficiency savings potential broken out by end use across the entire commercial sector for the Achievable TRC scenario. The lighting end use shows the largest potential for energy efficiency savings by a wide margin at 59% of total savings, in the Achievable TRC scenario, with Refrigeration and Space Cooling end uses accounting for 19% and 9% respectively.

Figure 7-2: Commercial Sector 2024 Achievable TRC Potential Savings by End Use



7.1.4 Cumulative Annual Achievable Electric Savings Potential

Table 7-8 shows the cumulative annual electric energy savings for each year across the 10-year horizon for the study, broken out by end use.

Table 7-9 shows cumulative annual demand (KW) savings for each year across the 10-year time horizon for the study, broken out by end use.

Table 7-8: Cumulative Annual Commercial Sector Electric Energy Savings in the Achievable TRC Potential Scenario by End Use (MWH)

END USE	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Lighting	11,647	23,294	34,942	46,589	58,236	69,883	81,531	93,178	104,825	116,472
Space cooling	1,731	3,461	5,192	6,922	8,653	10,384	12,114	13,845	15,575	17,306
Space Heating	100	201	301	401	502	602	702	803	903	1,004
Ventilation	1,173	2,346	3,520	4,693	5,866	7,039	8,213	9,386	10,559	11,732
Motors (Non-Ventilation)	574	1,148	1,722	2,296	2,870	3,445	4,019	4,593	5,167	5,741
Water Heating	604	1,208	1,812	2,415	3,019	3,623	4,227	4,831	5,435	6,039
Cooking	70	140	210	280	350	420	489	559	629	699
Refrigeration	3,736	7,471	11,207	14,943	18,678	22,414	26,150	29,886	33,621	37,357
Office Equipment	0	0	0	0	0	0	0	0	0	0
Compressed Air	54	91	128	165	201	238	275	312	349	386
Total	**19,689**	**39,360**	**59,034**	**78,704**	**98,375**	**118,048**	**137,720**	**157,393**	**177,063**	**196,736**
% of Annual Sales Forecast	*1.02%*	*1.99%*	*2.93%*	*3.84%*	*4.72%*	*5.56%*	*6.41%*	*7.23%*	*8.02%*	*8.75%*

Table 7-9: Cumulative Annual Commercial Sector Electric Demand Savings in the Achievable TRC Potential Scenario by End Use (KW)

END USE	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Lighting	1,612.5	3,225.0	4,837.4	6,449.9	8,062.4	9,674.9	11,287.4	12,899.8	14,512.3	16,124.8
Space cooling	775.9	1,551.7	2,327.6	3,103.5	3,879.3	4,655.2	5,431.1	6,206.9	6,982.8	7,758.6
Space Heating	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ventilation	333.9	667.8	1,001.7	1,335.7	1,669.6	2,003.5	2,337.4	2,671.3	3,005.2	3,339.2
Motors (Non-Ventilation)	37.4	74.7	112.1	149.5	186.8	224.2	261.6	299.0	336.3	373.7
Water Heating	76.5	153.0	229.4	305.9	382.4	458.9	535.3	611.8	688.3	764.8
Cooking	28.0	55.9	83.9	111.8	139.8	167.8	195.7	223.7	251.7	279.6
Refrigeration	367.7	735.3	1,103.0	1,470.7	1,838.3	2,206.0	2,573.7	2,941.4	3,309.0	3,676.7
Office Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compressed Air	16.1	27.1	38.1	49.2	60.2	71.2	82.3	93.3	104.3	115.4
Total	**3,248**	**6,491**	**9,733**	**12,976**	**16,219**	**19,462**	**22,704**	**25,947**	**29,190**	**32,433**
% of Annual Demand Forecast	0.8%	1.6%	2.3%	3.0%	3.8%	4.5%	5.2%	5.8%	6.5%	7.1%

7.1.5 Commercial Electric Savings Summary by Measure Group

Table 7-10 below provides an end-use breakdown of the commercial electric savings potential estimates for technical and economic potential, and achievable potential scenarios.

Table 7-10: Commercial Sector Cumulative Annual Electric Savings Potential by End-Use and Measure by 2024

END USE	TECHNICAL POTENTIAL (KWH)	ECONOMIC POTENTIAL (KWH)	ACHIEVABLE ELECTRICITY (KWH) SAVINGS BY 2024
Lighting			
Compact Fluorescent	19,683,782	19,683,782	5,905,135
LED Exit Sign	1,645,333	1,645,333	493,600
High Performance T8 (vs T8) 4ft	24,062,680	24,062,680	7,218,804
Wall Mounted Occupancy Sensor	42,369,945	42,369,945	12,710,984
Fixture Mounted Occupancy Sensor	42,369,945	42,369,945	12,710,984
Remote Mounted Occupancy Sensor	42,369,945	42,369,945	12,710,984
High Bay 3 or 4 lamp T8VHO vs (Metal Halide 100W - 300W)	18,323,375	18,323,375	5,497,013
High Bay 6 or 8 lamp T8VHO vs (Metal Halide > 300W)	22,501,233	22,501,233	6,750,370
High performance T5 (replacing T8)	5,359,305	5,359,305	1,607,792
CFL Hard Wired Fixture	20,759,133	20,759,133	6,227,740
CFL High Wattage 31-115	20,436,133	20,436,133	6,130,840
CFL High Wattage 150-199	24,706,600	24,706,600	7,411,980
Low Bay LED (vs Metal Halide)	32,655,293	32,655,293	9,796,588
High Bay LED (vs Metal Halide)	24,306,209	24,306,209	7,291,863
Outdoor LED (vs 100W Metal Halide)	29,517,564	29,517,564	8,855,269
Outdoor Induction (vs 100W Metal Halide)	17,174,608	17,174,608	5,152,382
Space Cooling (Unitary and Split AC)			
Split AC (13 SEER to 14.5 SEER) 5 ton	796,436	796,436	238,931
Split AC (13 SEER to 15 SEER) 5 ton	1,028,408	1,028,408	308,522
Split AC (13 SEER to 16 SEER) 5 ton	1,453,690	1,453,690	436,107
Split AC (11.4 IEER to 13 IEER) 8.3 ton	951,084	951,084	285,325
Split AC (11.4 IEER to 14 IEER) 8.3 ton	1,438,225	1,438,225	431,468
Split AC (11.4 IEER to 15 IEER) 8.3 ton	1,855,774	1,855,774	556,732
DX Packaged System (CEE Tier 2) 10 ton	6,266,877	6,266,877	1,880,063
DX Packaged System (CEE Tier 2) < 20 ton	1,028,408	1,028,408	308,522
DX Packaged System (CEE Tier 2) > 20 ton	6,472,319	6,472,319	1,941,696
Air Cooled Chiller 5 ton	10,529,747	10,529,747	3,158,924
Air Cooled Chiller 8 ton	10,529,747	10,529,747	3,158,924
PTAC 1/2 ton	4,304,276	4,304,276	1,291,283
PTAC 3/4 ton	2,850,289	2,850,289	855,087
PTAC 1 ton	4,284,020	4,284,020	1,285,206
PTAC 1 1/4 ton	3,896,997	3,896,997	1,169,099
HVAC Tune-up	0	0	0
Space Heating			

PTHP 1/2 ton	579,032	579,032	173,710
PTHP 3/4 ton	782,171	782,171	234,651
PTHP 1 ton	1,063,007	1,063,007	318,902
PTHP 1 1/4 ton	920,797	920,797	276,239
Ventilation			
Variable Frequency Drives <2 HP	1,586,510	1,586,510	475,953
Variable Frequency Drives 3 to 10 HP	11,402,858	11,402,858	3,420,857
Variable Frequency Drives 11 to 50 HP	26,117,946	26,117,946	7,835,384
Motors (Non-Ventilation)			
Variable Frequency Drives <2 HP	776,337	776,337	232,901
Variable Frequency Drives 3 to 10 HP	5,579,831	5,579,831	1,673,949
Variable Frequency Drives 11 to 50 HP	12,780,455	12,780,455	3,834,136
Water Heating			
High Efficiency Storage (tank)	875,951	875,951	262,785
Pre-Rinse Sprayer, Low flow, Commercial Application	4,364,243	4,364,243	1,309,273
On Demand (tankless)	117,449	117,449	35,235
Tank Insulation	4,512,418	4,512,418	1,353,725
Heat Pump Water Heater	8,992,249	8,992,249	2,697,675
Cooking			
Electric Energy Star Fryers	159,749	159,749	47,925
Electric Energy Star Steamers,3-6 pan	566,383	566,383	169,915
Energy Star Hot Food Holding Cabinet	759,397	759,397	227,819
Energy Star Convection Ovens	575,630	575,630	172,689
Energy Star Griddles	269,662	269,662	80,899
Refrigeration			
Glass Door Freezer, <15-49 cu ft, Energy Star	2,319,840	2,319,840	695,952
Glass Door Freezer, 50+ cu ft, Energy Star	2,829,614	2,829,614	848,884
Solid Door Freezer, <15-49 cu ft, Energy Star	2,541,825	2,541,825	762,547
Solid Door Freezer, 50+ cu ft, Energy Star	11,913,123	11,913,123	3,573,937
Glass Door Refrigerator, <15 - 49 cu ft	24,225,336	24,225,336	7,267,601
Glass Door Refrigerator, 50+ cu ft, Energy Star	3,484,579	3,484,579	1,045,374
Solid Door Refrigerator, <15-49 cu ft, Energy Star	18,422,442	18,422,442	5,526,733
Solid Door Refrigerator, 50+ cu ft, Energy Star	6,980,347	6,980,347	2,094,104
Commercial Refrigeration Tune-Up, Medium Temp, not self-contained	4,680,001	0	0
Commercial Refrigeration Tune-Up, Low Temp, not self-contained	0	0	0
Anti-sweat heater controls on freezers	8,256,895	8,256,895	2,477,068
Anti-sweat heater controls, on refrigerators	0	0	0
Vending Miser, Cold Beverage	3,549,602	3,549,602	1,064,881
Brushless DC Motors for freezers and coolers	0	0	0
Humidity Door Heater Controls for freezers and coolers	12,337,836	12,337,836	3,701,351
Refrigerated Case Covers	1,073,442	1,073,442	322,033
Zero Energy Doors for freezers and coolers	5,217,811	5,217,811	1,565,343

Evaporator Coil Defrost Control	0	0	0
Evaporator Fan Motor Control for freezers and coolers	15,204,290	0	0
Ice Machine, Energy Star, Self-Contained	1,556,653	1,556,653	466,996
LED Case Lighting	1,457,670	1,457,670	437,301
Office Equipment/Appliances			
Watt Sensors on Office Electronics - 50W	6,624,780	0	0
Watt Sensors on Office Electronics - 150W	6,960,436	0	0
Compressed Air			
Fix Air Leaks <5HP	1,148,415	0	0
Fix Air Leaks 10-50HP	1,113,962	1,113,962	334,189
Fix Air Leaks 50-100HP	631,628	631,628	189,488
Engineered Nozzles for blow-off	48,134	48,134	14,440
Total	**671,288,118**	**636,670,196**	**191,001,059**
% of Annual 2024 Sales Forecast	30%	28%	8%

Note: Measures in the above Table with "0" achievable potential are ones that did not pass the TRC Test.

Table 7-11 provides a list of the Top 10 commercial electric savings measures for the Achievable TRC scenario. The table provides the measures ranked according to the electric savings potential. The column to the far right shows the results of the measure level cost-effectiveness screening test using the TRC to screen the measures. The measures in the table are representative of a group of comparable measures falling under the umbrella of the measure categories provided in the table. This means that there are a range of TRC ratios for measure iterations that fall into a single measure category. For example, "Specialty LED Bulbs" is a measure category which consists of several measure iterations to account for bulb type and wattage and building type.

The Top 10 commercial sector energy efficiency measures combine to yield an estimated 106,788,551 kWh savings. This accounts for 56% of the total commercial electric savings in the Achievable TRC scenario.

Table 7-11: Top 10 Commercial Sector Electric Savings Measures in the Achievable TRC Scenario by 2024

MEASURE	2024 ENERGY (KWH)	% OF SECTOR SAVINGS	TRC RATIO
Occupancy Sensor	38,132,952	20%	15.69
Low Bay LED Bulb (vs Metal Halide)	9,796,588	5%	3.45
Outdoor LED Bulb (vs 100W Metal Halide)	8,855,269	5%	3.91
Variable Frequency Drives 11 to 50 HP	7,835,384	4%	8.13
CFL Bulb High Wattage 150-199	7,411,980	4%	6.35
High Bay LED Bulb(vs Metal Halide)	7,291,863	4%	2.03
Glass Door Refrigerator, <15 - 49 cu ft	7,267,601	4%	15.5
High Performance T8 (vs T8) 4ft - Fixture	7,218,804	4%	1.72
High Bay 6 or 8 lamp T8VHO vs (Metal Halide > 300W) – Fixture	6,750,370	4%	4.04
CFL Hard Wired Fixture	6,227,740	3%	6.29
Total	**106,788,551**	56%	

7.2 ACHIEVABLE POTENTIAL BENEFITS & COSTS

The table below provides the net present value (NPV) benefits and costs associated with the Achievable TRC Scenario for the commercial sector and 10-year period. The NPV costs in the Achievable TRC scenario include both participant and program administrator costs.

Table 7-12: 10-Year Benefit-Cost Ratios for Achievable TRC Scenario – Commercial Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	$216,669,488	$62,931,360	3.44	$153,738,128

Year by year budgets, broken out by transfer payments and administrative costs are presented in Table 7-13.

Table 7-13: Year By Year Budgets for Maximum Achievable Potential TRC Scenarios – Commercial Sector Only

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$3,426,641	$3,427,124	$3,427,611	$3,459,753	$3,468,153	$3,487,066	$3,512,877	$3,708,462	$3,745,608	$3,774,901
Program Admin	$856,660	$856,781	$856,903	$864,938	$867,038	$871,767	$878,219	$927,115	$936,402	$943,725
Total	$4,283,301	$4,283,905	$4,284,513	$4,324,691	$4,335,192	$4,358,833	$4,391,097	$4,635,577	$4,682,010	$4,718,626

8 INDUSTRIAL SECTOR ELECTRIC ENERGY EFFICIENCY POTENTIAL ESTIMATES

This section provides electric energy efficiency potential estimates for the industrial sector for EKPC. Estimates of technical, economic and achievable potential are provided.

8.1 INDUSTRIAL ELECTRIC ENERGY EFFICIENCY POTENTIAL

According to estimated 2013 historical industrial sales, the industrial sector accounts for approximately 27% of retail electric sales in EKPC's service area.

8.1.1 Electric Energy Efficiency Measures Examined

For the industrial sector, there were 194 unique energy efficiency measures included in the energy savings potential analysis. Table 8-1 provides a brief description of the types of measures included for each end use in the industrial sector. The list of measures was developed based on a review of the EKPC program measures, and measures found in other Technical Reference Manuals (TRMs) and industrial potential studies. For each measure, the analysis considered incremental costs, energy and demand savings, and measure useful measure lives.

Table 8-1: Types of Electric Measures Included in the Industrial Sector Analysis

END USE TYPE	MEASURES INCLUDED
Appliances, Computers, Office Equipment	• Energy Star Compliant Single Door Refrigerator • Energy Star office equipment including computers, monitors, copiers, multi-function machines. • Energy Efficient "Smart" Power Strip for PC/Monitor/Printer • PC Network Energy Management Controls replacing no central control • EZ Save Monitor Power Management Software • Energy Star UPS
Water Heating	• Heat Pump Water Heater • Booster Water Heater • Point of Use Water Heating • Solar Water Heating System • High Efficiency Electric Water Heater • Low Flow Pre-Rinse Spary Nozzle • ES Dishwasher, High Temp, Elec Heat, Elec Booster • ES Dishwasher, High Temp, Gas Heat, Elec Booster • ES Dishwasher, High Temp, Gas Heat, Gas Booster • ES Dishwasher, Low Temp, Elec Heat • ES Dishwasher, Low Temp, Gas Heat • Ozone Commercial laundry System • Low Flow Faucet Aerator • Low Flow Showerhead • Hot Water (DHW) Pipe Insulation • Tank Insulation (electric) • Drain water Heat Recovery Water Heater • Hot Water Circulation Pump Time-Clock • Refrigeration Heat Recovery • Clothes Washer ENERGY STAR, Gas water heater, Gas dryer • Clothes Washer ENERGY STAR, Gas water heater, Electric dryer • Clothes Washer ENERGY STAR, Electric Water heater, Gas Dryer

END USE TYPE	MEASURES INCLUDED
	• Clothes Washer ENERGY STAR, Electric Water heater, Electric Dryer • Efficient Hot Water Pump
Building Envelope	• Integrated Building Design • Energy Efficient Windows • Cool Roofing • Ceiling Insulation R-11 to R-42 • Below Grade Insulation • Wall Insulation R-7.5 to R13 • Roof Insulation R-11 to R-24
Ventilation	• Enthalpy Economizer • Demand-Controlled Ventilation • Variable Speed Drive Control, 15 HP • Variable Speed Drive Control, 5 HP • Variable Speed Drive Control, 40 HP • Improved Duct Sealing • Electronically-Commutated Permanent Magnet Motors (ECPMs) • Destratification Fan • Controled Ventilation Optimization • High Performance Air Filters
Space Cooling - Chillers	• Air-Cooled Recip Chiller • Air-Cooled Screw Chiller • Water-Cooled Centrifugal Chiller < 150 ton • Water-Cooled Centrifugal Chiller 150 - 300 ton • Water-Cooled Centrifugal Chiller > 300 ton • Water-Cooled Screw Chiller < 150 ton • Water-Cooled Screw Chiller 150 - 300 ton • Water-Cooled Screw Chiller > 300 ton • Chiller Tune Up/Diagnostics - 300 ton • Chiller Tune Up/Diagnostics - 500 ton • High Efficiency Pumps • Efficient Chilled Water Pump • Chilled Hot Water Reset
HVAC Controls	• Programmable Thermostats • EMS install • EMS Optimization • Hotel Guest Room Occupancy Control System • Zoning
Space Cooling - Unitary and Split AC	• High Efficiency AC - Unitary & Split Systems • Ductless (mini split) - Cooling • Ground Source Heat Pump - Cooling • Water Loop Heat Pump (WLHP) - Cooling • Packaged Terminal Air Conditioner (PTAC) - Cooling
Cooking	• HE Steamer • HE Combination Oven • HE Convection Ovens • HE Holding Cabinet • HE Fryer • HE Griddle • Induction Cooktops

END USE TYPE	MEASURES INCLUDED
Lighting	• Lamp & Ballast Retrofit (HPT8 Replacing T12) • Lamp & Ballast Retrofit (HPT8 Replacing Standard T8) • Lamp & Ballast Retrofit (Low Wattage HPT8 Replacing Standard T8) • Fluorescent Fixture with Reflectors • T5 HP replacing T12 • LED Exterior Flood and Spotlight • Parking Garage LED • LED Exit Sign • LED Traffic Signals • LED Pedestrian Signals • Light Tube • High Intensity Fluorescent Fixture (replacing HID) • 42W 8 lamp Hi Bay CFL • HID Fixture Upgrade - Pulse Start Metal Halide • Induction Fluorescent • CFL Fixture • CFL Screw-in • LED Screw In • LED Fuel Pump Canopy Fixture • CFL Flood • LED Downlight • LED Replacing Halogen Incandescent • New Fluorescent Fixtures T5/HP T8 (replacing T12) • New Fluorescent Fixtures T5/HP T8 reduced wattage (replacing T8) • LED Roadway Lights • LED Outdoor Area Fixture (Parking Light or Street Light) • LED Pin Based Lamp • LED Wallpack • CFL Exterior Lighting • CFL Screw in Specialty • LED Specialty • Illuminated Signs to LED • LED Lighting in Refrigeration
Lighting Controls	• Controls for HID (Hi/Lo) • Controls for H.I.F. • Daylight Dimming • Daylight Dimming - New Construction • 15% More Efficient Design - New Construction • 30% More Efficient Design - New Construction • Remote Mounted Occupancy Sensor • Switch Mounted Occupancy Sensor • Central Lighting Control • Switching Controls for Multilevel Lighting (Non-HID) • Lighting Power Density - Exceed Code by 10% • Stairwell Bi-Level Control • Occupancy Sensors for LED Refrigerator Lighting
Refrigeration	• Vending Miser for Soft Drink Vending Machines • Refrigerated Case Covers • Refrigeration Economizer • Commercial Ice-makers

END USE TYPE	MEASURES INCLUDED
	• Evaporator Fan Motor Controls on S-P motors • Evaporator Fan Motor Controls on PSC motors • Evaporator Fan Motor Controls on ECM motors • H.E. Evaporative Fan Motors • Zero-Energy Doors • Door Heater Controls • Discus and Scroll Compressors • Floating Head Pressure Control • ENERGY STAR Commercial Solid Door Refrigerators • ENERGY STAR Commercial Solid Door Freezers • ENERGY STAR Commercial Glass Door Refrigerators • ENERGY STAR Commercial Glass Door Freezers • Strip Curtains • Efficient Refrigeration Condenser • Door Gaskets - Cooler and Freezer • Reach-in Refrigerated display case door retrofit • Refrigeration Savings due to Lighting Savings • ECM case fan motors • Efficient low-temp compressor • Automatic High Speed Doors - between freezer and cooler • Refrigerant charging correction
Compressed Air	• Efficient Air Compressors • Automatic Drains • Cycling Dryers • Low Pressure Drop-Filters • Air-Entraining Air Nozzles • Receiver Capacity Addition • Barrel Wraps Inj Mold and Extruders • Pellet Dryer Tanks and Ducts • Compressed Air Audits & Leak Repair • Compressed Air Pressure Flow Controller replacing no flow controller • High Efficiency Air Dryers • Air Compressor Outdoor Air Intake • Variable Displacement Air Compressor
Space Heating	• High Efficiency Heat Pump • Ground Source Heat Pump - Heating • Ductless (mini split) - Heating • High Efficiency Pumps • VFD Pump • ECM motors on furnaces • Water Loop Heat Pump (WLHP) - Heating • Packaged Terminal Air Conditioner (PTAC) - Heating
Machine Drive	• Sensors & Controls • Energy Information System • Electric Supply System Improvements • Advanced Efficient Motors • Industrial Motor Management • Advanced Lubricants • Motor System Optimization (Including ASD) • Pump System Efficiency Improvements

END USE TYPE	MEASURES INCLUDED
	• Fan System Improvements • Compressed Air System Management • Compressed Air - Advanced Compressor Controls
Process Cooling & Refrigeration	• Sensors & Controls • Energy Information System • Electric Supply System Improvements • Improved Refrigeration
Process Heating	• Sensors & Controls • Energy Information System • Electric Supply System Improvements
Other	• Electrically Commutated Plug Fans in data centers • NEMA Premium Transformer, single-phase • NEMA Premium Transformer, three-phase • Commercial Clothes washers - Non-Water Heating Savings • Vendor Miser for Non-Refrig Equipment • Optimized Snow and Ice Melt Controls • Engine Block Heater Timer

8.1.2 Technical and Economic Potential Electric Savings

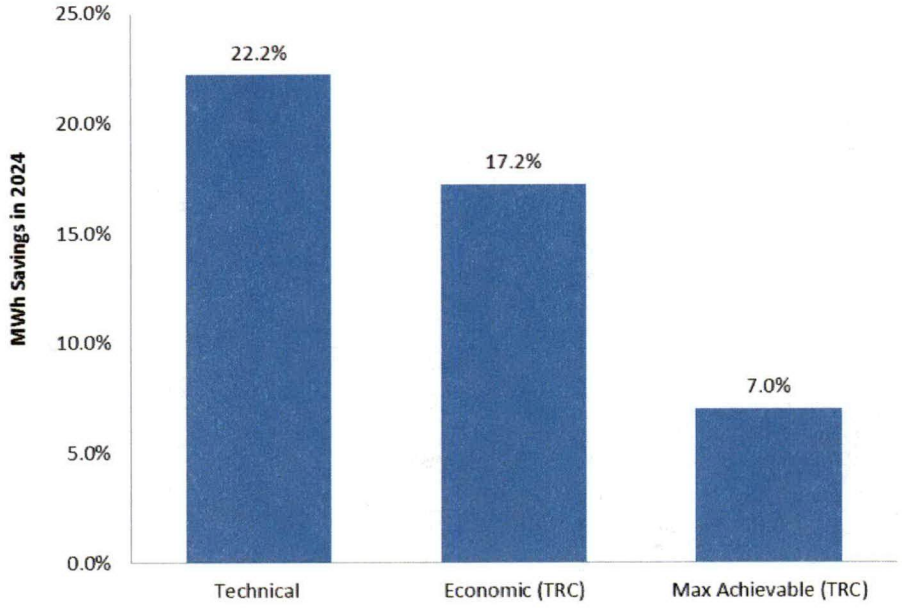
This section presents estimates for electric technical, economic, and achievable savings potential for the industrial sector. Each of the tables in the technical, economic and achievable sections present the respective potential for energy efficiency savings expressed as cumulative annual savings and percentage of annual sales. Data is provided for a 10-year horizon.

This energy efficiency potential study considers the impacts of the December 2007 Energy and Independence and Security Act (EISA) as an improving code standard for the industrial sector. EISA improves the baseline efficiency of compact fluorescent lamps (CFL), general service fluorescent lamps (GSFL), high intensity discharge (HID) lamps and ballasts and motors, all applicable in the industrial sector.

SUMMARY OF FINDINGS

Figure 8-1 illustrates the estimated savings potential for EKPC for each of the scenarios included in this study.

Figure 8-1: Summary of Industrial Electric Energy Efficiency Potential as a % of Sales Forecasts



The potential estimates are expressed as cumulative annual 10-year savings, as percentages of the 2024 forecasts for industrial sector sales. The technical potential is 22.2% in 2024. Based on a measure-level screen using the TRC Test, the economic potential is 17.2% in 2024. The slight drop from technical potential to economic potential indicates that most measures are cost-effective.

The 10-year achievable potential savings for the Achievable TRC scenario is 7.0%. The Achievable TRC scenario also assumes 48% incentives but includes only measures that passed the cost-effectiveness screen based on the TRC Test.

TECHNICAL POTENTIAL

Technical potential represents the quantification of savings that can be realized if energy-efficiency measures passing the qualitative screening are applied in all feasible instances, regardless of cost. Table 8-2 shows a technical potential of 863,024 MWh annually in the industrial sector during the 10 year period from 2015 to 2024 and represents 22.2% of 2024 forecast industrial sales. Machine Drive represents the majority of the potential at 35% of 10-yr savings, while water heating, other and office equipment represent the smallest shares, each with 1 percent of 10-yr savings. Table 8-3 shows the annual (summer) peak demand savings potential in 2024. The ten year summer peak demand savings potential is 160.9 MW.

Table 8-2: Industrial Sector Technical Potential Savings By End Use

END USE	2024 ENERGY SAVINGS (MWH)	% OF 2024 TOTAL
Machine Drive	305,368	35%
Lighting	170,454	20%
Ventilation	143,843	17%
HVAC Controls	30,398	4%
Process Cooling	24,810	3%

END USE	2024 ENERGY SAVINGS (MWH)	% OF 2024 TOTAL
Process Heat	59,132	7%
Space Cooling	45,229	5%
Office Equip	7,405	1%
Space Heat	16,284	2%
Other	10,076	1%
Water Heat	6,002	1%
Envelope	44,023	5%
Total	**863,024**	**100%**
% of Annual Sales Forecast	*22.2%*	

Table 8-3: Industrial Sector Technical Potential Demand Savings

SUMMER PEAK DEMAND	
	2024
	MW
Total	**160.9**
% of Peak	*19.5%*

ECONOMIC POTENTIAL

Economic potential is a subset of technical potential, which only accounts for measures that are cost-effective. The economic potential scenario was screened using the TRC Test. In the TRC test, utility incentive was assumed to be equal to 48% of the measure incremental cost. The TRC Test considers the cost assumed by the participant.

Table 8-4 shows that the economic potential based on the TRC screen is 666,015 MWh. This represents 17.2% of industrial sales in 2024. The machine drive, lighting and process make up a majority of the economic TRC savings potential. Table 8-5 shows the demand savings potential in 2024. The ten year summer peak demand savings potential is 124.1 MW.

Table 8-4: Industrial Sector Economic Potential (TRC) Savings By End Use

END USE	2024 ENERGY SAVINGS (MWH)	% OF 2024 TOTAL
Machine Drive	326,219	49%
Lighting	121,485	18%
Ventilation	58,720	9%
HVAC Controls	30,911	5%
Process Cooling	26,560	4%
Process Heat	61,926	9%
Space Cooling	13,371	2%
Office Equip	6,382	1%
Space Heat	1,936	0%
Other	9,989	1%

END USE	2024 ENERGY SAVINGS (MWH)	% OF 2024 TOTAL
Water Heat	4,974	1%
Envelope	3,541	1%
Total	**666,015**	**100%**
% of Annual Sales Forecast	*17.2%*	

Table 8-5: Industrial Sector Economic Potential Demand Savings

SUMMER PEAK DEMAND	
	2024
	MW
Total	**124.1**
% of Peak	*15.0%*

8.1.3 Achievable Potential Savings in the Industrial Sector

Achievable potential is an estimate of energy savings that can feasibly be achieved given market barriers and equipment replacement cycles. Unlike the economic potential, the industrial achievable potential takes into account the estimated market adoption of energy efficiency measures based on the incentive level and the natural replacement cycle of equipment. The Achievable TRC assumes incentives set at 48% of the measure incremental cost, but only includes measures that passed the TRC Test economic screening.

8.1.3.1 Industrial Achievable TRC

Tables 8-6 shows the estimated savings for the Achievable TRC scenarios over 5 and 10 year time horizons. As noted above, this scenario assumes an incentive level approximately equal to 50% of the incremental measure cost and include an estimate 10-year market adoption rates based on incentive levels and equipment replacement cycles.

Table 8-6: Industrial Achievable TRC Potential Electric Energy Savings, by End Use

	2019	% OF 2019	2024	% OF 2024
Machine Drive	66,330	43%	132,661	47%
Lighting	34,728	23%	62,352	22%
Ventilation	15,867	10%	25,557	9%
HVAC Controls	12,803	8%	18,305	6%
Process Cooling	4,899	3%	9,799	3%
Process Heat	10,299	7%	20,598	7%
Space Cooling	3,708	2%	5,623	2%
Office Equip	1,684	1%	3,231	1%
Space Heat	539	0%	778	0%
Other	1,292	1%	2,472	1%
Water Heat	1,328	1%	2,114	1%
Envelope	226	0%	323	0%

	2019	% OF 2019	2024	% OF 2024
Total	**153,704**	**100%**	**283,812**	**100%**
% of Annual Sales Forecast	*4.1%*		*7.0%*	

Table 8-7: Industrial Achievable TRC Potential Demand Savings

	SUMMER PEAK DEMAND	
	2019	**2024**
	MW	**MW**
Total	**27.4**	**52.9**
% of Peak	*3.5%*	*6.4%*

8.1.3.2 Savings by End Use and Industry Type

Figure 8-2 shows the estimated 10-year cumulative annual efficiency savings potential broken out by end use across the entire industrial sector for the Max Achievable TRC scenario. The Machine Drive end use shows the largest potential for savings with 48% of total savings. Lighting is second at 22% of total savings.

Figure 8-2: Industrial Sector 2024 Max Achievable Potential Savings by End Use

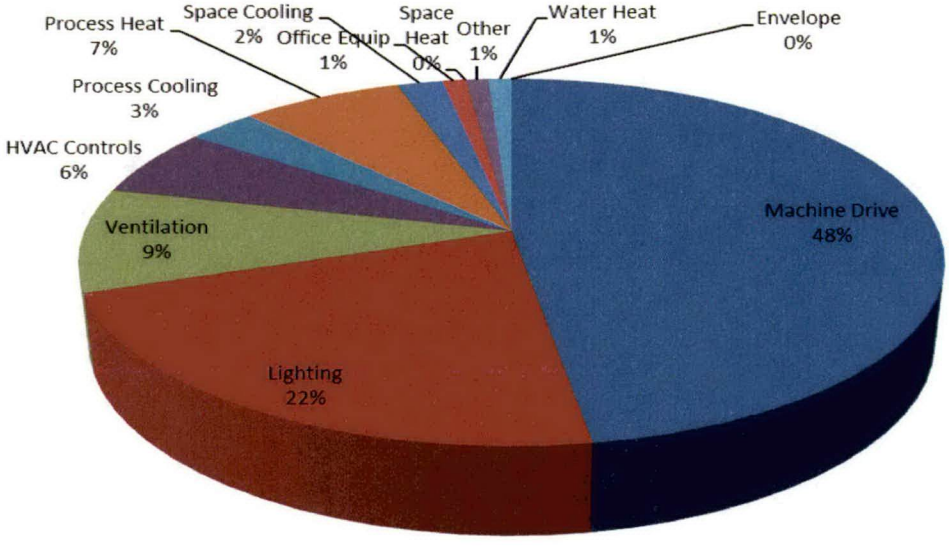
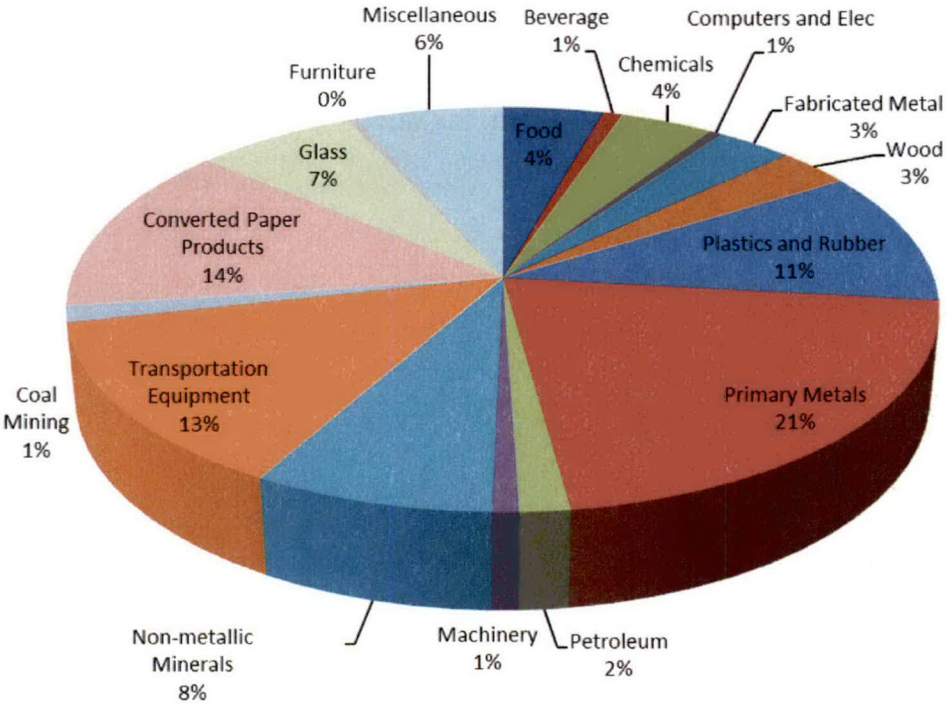


Figure 8-3 shows the breakdown of estimated savings in 2024 by industry. The vast majority of savings come from the primary metals, transportation equipment, and converted paper products industries.

Figure 8-3: Industrial 2024 Savings by Industry



8.1.4 Annual Achievable Electric Savings Potential

Table 8-8 shows the cumulative energy savings for the achievable TRC scenario for each year across the 10-year horizon for the study, broken out by end use.

Table 8-9 shows cumulative annual demand savings for the maximum achievable potential scenario for each year across the 10-year time horizon for the study, broken out by end use. The year by year associated transfer payments and administrative costs to achieve these savings are shown later.

Table 8-8: Cumulative Annual Industrial Energy Savings (MWh) in the Achievable TRC Potential Scenario by End Use

END USE	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Machine Drive	13,266	26,532	39,798	53,064	66,330	79,596	92,863	106,129	119,395	132,661
Lighting	5,578	12,792	20,653	28,509	34,728	40,947	46,348	51,683	57,018	62,352
Ventilation	1,784	5,111	9,211	13,311	15,867	18,423	20,206	21,990	23,773	25,557
HVAC Controls	918	3,661	7,317	10,973	12,803	14,634	15,552	16,470	17,387	18,305
Process Cooling	980	1,960	2,940	3,919	4,899	5,879	6,859	7,839	8,819	9,799
Process Heat	2,060	4,120	6,179	8,239	10,299	12,359	14,419	16,478	18,538	20,598
Space Cooling	338	1,125	2,135	3,145	3,708	4,270	4,608	4,946	5,285	5,623
Office Equip	306	646	1,003	1,360	1,684	2,007	2,313	2,619	2,925	3,231
Space Heat	40	156	308	461	539	617	657	697	737	778
Other	233	494	770	1,045	1,292	1,539	1,772	2,005	2,238	2,472
Water Heat	144	423	770	1,116	1,328	1,539	1,683	1,826	1,970	2,114
Envelope	16	65	129	194	226	259	275	291	307	323
Total	**25,662**	**57,084**	**91,213**	**125,339**	**153,704**	**182,069**	**207,554**	**232,973**	**258,392**	**283,812**
% of Annual Sales Forecast	0.75%	1.63%	2.55%	3.43%	4.13%	4.80%	5.40%	5.97%	6.51%	7.01%

Table 8-9: Cumulative Annual Industrial Demand Savings (KW) in the Achievable TRC Potential Scenario by End Use

END USE	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Machine Drive	2,291.2	4,582.4	6,873.6	9,164.7	11,455.9	13,747.1	16,038.3	18,329.5	20,620.7	22,911.8
Process Heating	355.7	711.5	1,067.2	1,423.0	1,778.7	2,134.5	2,490.2	2,846.0	3,201.7	3,557.5
Process Cooling & Refrigeration	169.2	338.5	507.7	676.9	846.2	1,015.4	1,184.6	1,353.9	1,523.1	1,692.3
Computers & Office Equipment	849.3	1,700.1	2,551.5	3,403.0	4,253.0	5,103.1	5,953.1	6,803.1	7,653.2	8,503.2
Water Heating	13.9	37.3	65.6	93.8	112.5	131.1	145.0	158.9	172.7	186.6
Building Envelope	0.7	2.8	5.6	8.4	9.8	11.2	11.9	12.6	13.3	14.0
Ventilation	209.9	421.4	633.8	846.1	1,056.8	1,267.5	1,477.4	1,687.3	1,897.2	2,107.1
Space Cooling - Chillers	11.7	26.7	43.2	59.8	73.1	86.4	98.2	109.9	121.6	133.4
HVAC Controls	7.6	30.3	60.6	90.9	106.1	121.2	128.8	136.4	144.0	151.5
Space Cooling - Unitary and Split AC	3.9	7.8	11.7	15.6	19.5	23.4	27.3	31.2	35.1	38.9
Cooking	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lighting	519.2	1,038.4	1,503.1	1,966.9	2,430.7	2,895.1	3,359.6	3,809.0	4,258.8	4,721.7
Lighting Controls	608.6	1,636.8	2,875.0	4,113.1	4,931.5	5,749.9	6,358.5	6,967.1	7,575.6	8,184.2
Refrigeration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Space Heating	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Other	73.9	147.8	221.7	295.6	369.5	443.5	517.4	591.3	665.2	739.1
Total	**5,115**	**10,682**	**16,420**	**22,158**	**27,443**	**32,730**	**37,790**	**42,836**	**47,882**	**52,942**
% of Annual Demand Forecast	*0.7%*	*1.4%*	*2.2%*	*2.9%*	*3.5%*	*4.2%*	*4.8%*	*5.3%*	*5.9%*	*6.4%*

8.1.5 Industrial Electric Savings Summary by Measure Group

Table 8-10 below provides an end-use breakdown of the industrial electric savings potential estimates for technical and economic potential and the achievable potential scenario.

Table 8-10 Electric Potential by End-Use and Measure

END USE	TECHNICAL POTENTIAL (KWH)	ECONOMIC POTENTIAL (KWH)	ACHIEVABLE POTENTIAL (KWH)
Water Heating			
Low Flow Faucet Aerator	1,531,697	1,530,551	329,385
Heat Pump Water Heater	1,463,782	1,462,687	615,666
Efficient Hot Water Pump	279,705	279,496	87,684
Tank Insulation (electric)	1,385,323	1,384,287	924,450
Hot Water Circulation Pump Time-Clock	5,251	5,247	2,426
Hot Water (DHW) Pipe Insulation	16,159	16,147	10,522
High Efficiency Electric Water Heater	295,720	295,499	143,515
Solar Water Heating System	980,850	0	0
Drain water Heat Recovery Water Heater	41,497	0	0
Point of Use Water Heating	2,013	0	0
Ventilation			
Electronically-Commutated Permanent Magnet Motors	3,194,800	3,298,337	1,332,956
Demand-Controlled Ventilation	16,424,667	16,956,953	7,269,746
High Performance Air Filters	12,156,267	12,550,224	1,429,941
Variable Speed Drive Control, 15 HP	8,097,415	8,359,833	5,035,566
Variable Speed Drive Control, 5 HP	8,097,415	8,359,833	5,035,566
Variable Speed Drive Control, 40 HP	8,097,415	8,359,833	5,035,566
Controled Ventilation Optimization	201,100	207,618	81,373
Improved Duct Sealing	913,390	0	0
Enthalpy Economizer	18,122,804	0	0
Destratification Fan	991,574	0	0
Space Cooling - Chillers			
EMS Optimization	157,846	162,961	100,320
EMS install	1,466,422	1,513,945	931,994
Wall Insulation R-7.5 to R13	146,515	193,805	9,424
Efficient Chilled Water Pump	1,580,110	2,090,118	397,789
Chilled Hot Water Reset	5,012,033	6,629,755	4,081,317
Programmable Thermostats	607,306	626,987	336,012
Water-Cooled Screw Chiller > 300 ton	230,408	237,875	51,383
Water-Cooled Centrifugal Chiller > 300 ton	244,881	252,817	54,610
Air-Cooled Recip Chiller	1,221,181	1,260,757	272,333
Air-Cooled Screw Chiller	1,239,541	1,279,712	276,427
Water-Cooled Screw Chiller 150 - 300 ton	211,267	218,114	47,114
Water-Cooled Centrifugal Chiller 150 - 300 ton	243,145	251,024	54,223
Water-Cooled Screw Chiller < 150 ton	168,845	174,317	37,654
Water-Cooled Centrifugal Chiller < 150 ton	245,129	253,074	54,666
Below Grade Insulation	2,997	8,676	2,562
High Efficiency Pumps	250,913	726,311	138,231

Energy Efficient Windows	145,980	0	0
Ceiling Insulation R-11 to R-42	119,446	0	0
Improved Duct Sealing	188,126	0	0
Roof Insulation R-11 to R-24	42,279	0	0
Cool Roofing	516,815	0	0
Enthalpy Economizer	5,436,841	0	0
Space Cooling - Unitary and Split AC			
EMS Optimization	1,490,765	1,539,077	947,465
EMS install	13,849,541	14,298,373	8,802,165
Wall Insulation R-7.5 to R13	1,762,989	1,820,124	88,504
Programmable Thermostats	5,735,669	5,921,549	3,173,445
Below Grade Insulation	142,888	147,518	43,559
Enthalpy Economizer	51,347,944	0	0
Water Loop Heat Pump (WLHP) - Cooling	923,093	953,008	344,040
Ceiling Insulation R-11 to R-42	4,756,685	0	0
Improved Duct Sealing	7,491,718	0	0
High Efficiency AC - Unitary & Split Systems	5,277,305	0	0
Energy Efficient Windows	5,653,783	0	0
Ground Source Heat Pump - Cooling	14,219,114	0	0
Ductless (mini split) - Cooling	14,162,226	0	0
Roof Insulation R-11 to R-24	1,381,222	0	0
Cool Roofing	16,883,756	0	0
Lighting			
CFL Screw in Specialty	1,036,108	1,055,633	627,760
CFL Screw-in	673,635	686,330	408,144
LED Exit Sign	433,454	441,622	29,781
CFL Fixture	128,994	131,425	65,129
CFL Flood	105,438	107,425	63,883
LED Pin Based Lamp	747,735	761,826	302,027
LED Screw In	811,233	826,521	327,675
LED Replacing Halogen Incandescent	97,739	99,581	59,218
HID Fixture Upgrade - Pulse Start Metal Halide	4,239,318	4,319,209	993,086
Central Lighting Control	14,205,372	14,473,073	7,832,948
Daylight Dimming	24,740,263	25,206,496	16,370,359
Stairwell Bi-Level Control	6,999,813	7,131,742	4,606,138
High Intensity Fluorescent Fixture (replacing HID)	9,633,572	9,815,118	4,727,252
LED Wallpack	6,848,175	6,977,230	3,020,908
Switch Mounted Occupancy Sensor	7,525,922	0	0
Remote Mounted Occupancy Sensor	7,525,922	7,667,749	4,838,350
Switching Controls for Multilevel Lighting (Non-HID)	9,148,830	9,321,241	5,017,228
LED Downlight	85,994	87,615	50,422
Controls for H.I.F.	1,777,325	1,810,819	1,176,037
T5 HP replacing T12	8,820,321	0	0
New Fluorescent Fixtures T5/HP T8 reduced wattage	4,429,298	4,512,768	0
Induction Fluorescent	10,679,199	10,880,449	5,622,225
LED Specialty	1,120,300	1,141,412	678,771
Fluorescent Fixture with Reflectors	1,312,615	1,337,351	0

CFL Exterior Lighting	6,042,192	6,156,058	2,936,953
Lamp & Ballast Retrofit (HPT8 Replacing T12)	4,238,809	4,318,690	2,076,066
Lamp & Ballast Retrofit (Low Wattage HPT8 Replacing	1,149,626	1,171,290	0
LED Outdoor Area Fixture (Parking Light or Street Light)	1,027,226	1,046,584	522,849
42W 8 lamp Hi Bay CFL	6,489,393	0	0
Light Tube	5,993,569	0	0
Lamp & Ballast Retrofit (HPT8 Replacing Standard T8)	776,032	0	0
New Fluorescent Fixtures T5/HP T8 (replacing T12)	13,212,465	0	0
LED Exterior Flood and Spotlight	7,143,437	0	0
Controls for HID (Hi/Lo)	849,263	0	0
Illuminated Signs to LED	404,955	0	0
Space Heating			
EMS Optimization	501,556	511,935	315,150
EMS install	4,659,572	4,755,992	2,927,817
Wall Insulation R-7.5 to R13	593,144	605,418	29,438
Programmable Thermostats	1,929,722	1,969,653	1,055,566
VFD Pump	1,176,741	1,201,091	650,398
ECM motors on furnaces	523,016	533,839	101,600
Below Grade Insulation	47,128	48,103	14,204
Hotel Guest Room Occupancy Control System	0	0	0
High Efficiency Pumps	197,258	201,340	25,546
Ceiling Insulation R-11 to R-42	1,956,518	0	0
Improved Duct Sealing	3,081,491	0	0
Water Loop Heat Pump (WLHP) - Heating	375,025	0	0
High Efficiency Heat Pump	995,133	0	0
Energy Efficient Windows	2,361,051	0	0
Ground Source Heat Pump - Heating	5,201,353	0	0
Ductless (mini split) - Heating	7,815,373	0	0
Roof Insulation R-11 to R-24	590,799	0	0
Cool Roofing	6,919,493	0	0
Other			
Engine Block Heater Timer	307,718	307,487	198,506
Optimized Snow and Ice Melt Controls	435,733	435,407	281,088
PC Network Energy Management Controls replacing no	690,150	689,634	340,457
Energy Star office equipment including computers,	5,696,923	5,692,660	2,890,409
Electrically Commutated Plug Fans in data centers	113,229	113,144	48,695
NEMA Premium Transformer, three-phase	5,581,479	5,577,302	1,186,742
NEMA Premium Transformer, single-phase	3,558,118	3,555,456	756,532
Vendor Miser for Non-Refrig Equipment	79,618	0	0
Energy Star Compliant Single Door Refrigerator	193,423	0	0
EZ Save Monitor Power Management Software	70,056	0	0
Energy Efficient "Smart" Power Strip for PC/Monitor/Printer	729,571	0	0
Energy Star UPS	24,460	0	0
Process Heating			
Electric Supply System Improvements	25,713,760	26,946,096	8,963,618
Sensors & Controls	25,191,801	26,374,752	8,772,490

Energy Information System	8,226,842	8,605,199	2,861,821
Process Cooling and Refrigeration			
Improved Refrigeration	10,663,498	11,438,832	4,220,446
Electric Supply System Improvements	6,160,287	6,591,788	2,431,819
Sensors & Controls	6,022,956	6,435,348	2,373,948
Energy Information System	1,962,906	2,094,211	772,486
Machine Drive			
Compressed Air - Advanced Compressor Controls	5,175,400	6,509,747	2,535,312
Advanced Lubricants	4,881,298	5,123,666	2,985,327
Compressed Air System Management	24,929,199	31,345,637	18,311,464
Pump System Efficiency Improvements	31,660,967	34,632,169	13,475,252
Motor System Optimization (Including ASD)	151,625,470	158,091,269	61,395,595
Electric Supply System Improvements	26,641,544	27,563,583	10,701,836
Sensors & Controls	26,065,057	26,929,398	10,455,149
Fan System Improvements	3,794,275	4,498,574	1,720,403
Advanced Efficient Motors	15,592,346	16,074,554	3,744,530
Industrial Motor Management	6,689,334	6,890,316	4,012,601
Energy Information System	8,313,438	8,560,056	3,323,282
Total	**863,024,340**	**666,015,354**	**283,812,334**
% of Annual Sales Forecast	*22.20%*	*17%*	*7%*

Note: Measures in the above Table with "0" achievable potential are ones that did not pass the TRC Test.

Table 8-11 provides a list of the Top 10 industrial electric savings measures for the Achievable TRC scenario. The table provides the measures ranked according to the electric savings potential. The column to the far right shows the results of the measure level cost-effectiveness screening test using the TRC to screen the measures.

The Top 10 measures combine to yield an estimated 165,080,877 kWh savings. This accounts for 58% of the total industrial electric savings in the Achievable TRC scenario.

Table 8-11: Top 10 Industrial Electric Savings Measures in the Achievable TRC Scenario

MEASURE	2024 ENERGY (KWH)	% OF SECTOR SAVINGS	TRC RATIO
1. Motor System Optimization (Including ASD)	61,395,595	22%	9.77
2. Compressed Air System Management	18,311,464	6%	8886.07
3. Daylight Dimming	16,370,359	6%	3.92
4. Pump System Efficiency Improvements	13,475,252	5%	11.42
5. Electric Supply System Improvements	10,701,836	4%	9.12
6. Sensors & Controls (Machine Drive)	10,455,149	4%	6.54
7. Electric Supply System Improvements	8,963,618	3%	9.12
8. EMS install	8,802,165	3%	49.08
9. Sensors & Controls (Process Heating)	8,772,490	3%	6.54
10. Central Lighting Control	7,832,948	3%	3.87
Total	165,080,877	58%	

8.2 ACHIEVABLE POTENTIAL BENEFITS & COSTS

The table below provides the net present value (NPV) benefits and costs associated with the achievable potential scenario for the industrial sector at the 10-year period. The TRC scenario benefits include avoided energy supply and demand costs as well as water savings benefits. The Achievable TRC scenario costs include both participant and program administrator costs.

Table 8-12: 10-Year Benefit-Cost Ratios for Achievable Potential Scenarios– Industrial Sector Only

10-YEAR	NPV BENEFITS	NPV COSTS	B/C RATIO	NET BENEFITS
Achievable TRC	$301,657,847	$53,313,760	6.04	$248,244,087

Year by year budgets broken out by transfer payments and administrative costs are depicted in Tables 8-13.

Table 8-13: Annual Program Budgets Associated with the Achievable TRC Scenario

ACHIEVABLE TRC	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Transfer Payments	$2,604,431	$3,094,756	$3,321,495	$3,345,278	$2,925,649	$2,975,937	$2,764,097	$2,794,785	$2,890,402	$3,143,086
Admin.	$651,108	$773,689	$830,374	$836,320	$731,412	$743,984	$691,024	$698,696	$722,600	$785,771
Total Costs	$3,255,539	$3,868,445	$4,151,869	$4,181,598	$3,657,061	$3,719,921	$3,455,122	$3,493,481	$3,613,002	$3,928,857

EAST KENTUCKY POWER COOPERATIVE ENERGY EFFICIENCY POTENTIAL STUDY

Prepared for:

EAST KENTUCKY POWER COOPERATIVE

Prepared By:

GDS ASSOCIATES, INC.
1850 PARKWAY PLACE
SUITE 800
MARIETTA, GA 30067
770.425.8100
770.426.0303 (FAX)
WWW.GDSASSOCIATES.COM

Exhibit DSM-2

2013 Annual Report for DSM

DSM

Demand Side Management
2013 Annual Report

Climbing to new heights in energy efficiency

EAST KENTUCKY POWER COOPERATIVE

A Touchstone Energy Cooperative

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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 2,800 miles of high-voltage transmission lines. EKPC has provided this service for more than 70 years.

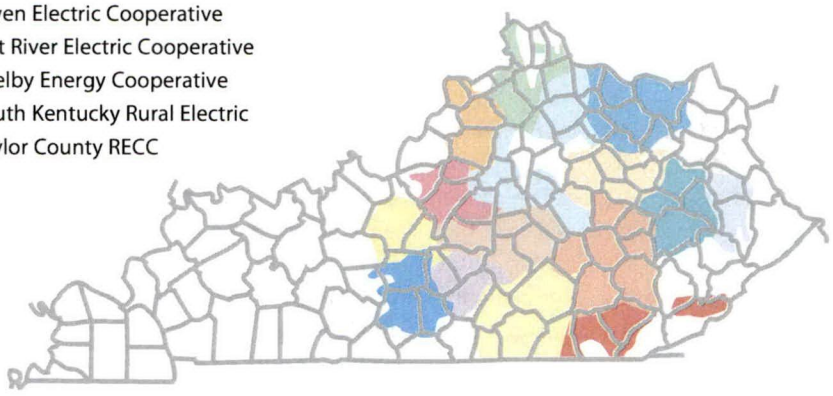
EKPC and each of its 16 owner-member cooperatives is owned and democratically governed by the people who use their energy and services. All are not-for-profit organizations.

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.

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 Rural Electric
- Taylor County RECC

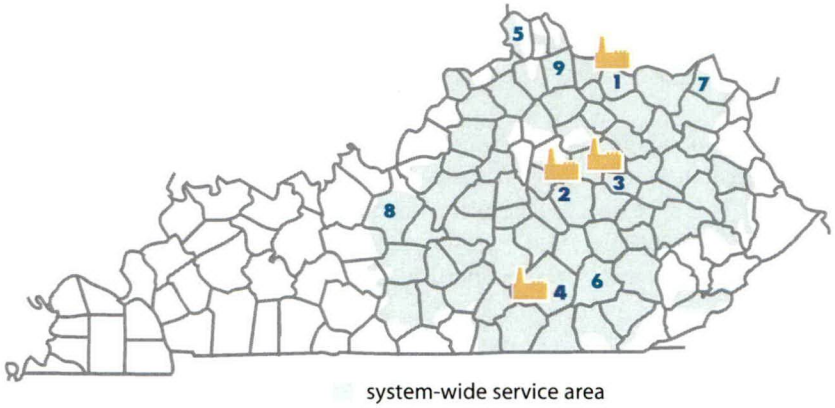


East Kentucky Power Cooperative Generation Capacity

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	3.2 net MW
6	Laurel Ridge	3.2 net MW
7	Green Valley	2.4 net MW
8	Pearl Hollow	2.4 net MW
9	Pendleton	3.2 net MW
10	Mason	0.8 net MW
	Southeastern Power Adm. (SEPA), hydro power	170 MW



system-wide service area

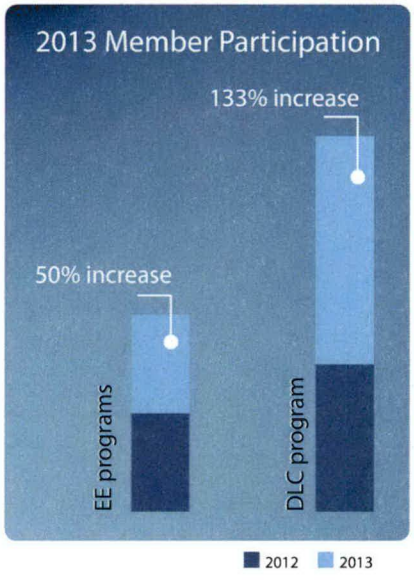
Stepping Up Participation

For more than 30 years, EKPC and its 16 owner-member cooperatives have been leaders in developing demand-side management (DSM) programs for Kentucky. The cooperatives have steadily built a portfolio of programs that is practical and cost-effective for the members.

EKPC and its owner-member cooperatives are proactive in helping members identify opportunities to improve the energy efficiency of their homes and business, and offer a variety of options to achieve that goal. 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 approximately 4,000 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 68 million kilowatt hours, and average annual peak reductions of almost 75 megawatts.

In 2013, participation and savings reached new levels. Overall, energy-efficiency program participation increased 50 percent over 2012. These measures will result in a lifetime savings of 210,141 MWh and 420,218,650 pounds of carbon dioxide emissions. The SimpleSaver (direct load control) program participation increased 133 percent.



Residential Lighting:

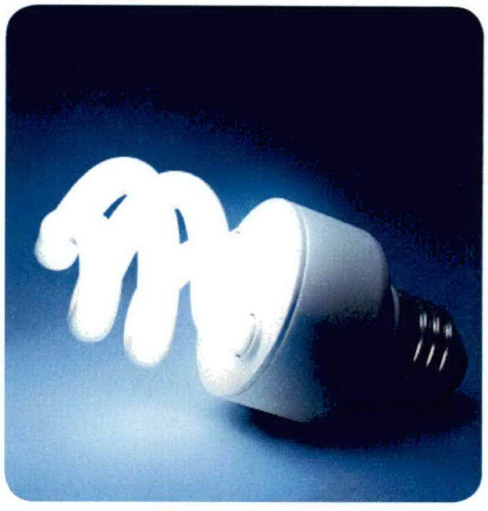
Providing more than 880,000 CFLs to members

Since 2003, EKPC and its owner-member cooperatives have provided more than 880,000 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 2013, cooperatives distributed more than 67,000 20-watt cool white CFLs that are expected to result in a lifetime savings of 10,434 MWh and 20,868,288 pounds of carbon dioxide emissions.

In 2013, EKPC provided 1,000 light-emitting diode (LED) bulbs to its owner-member cooperatives for distribution as a pilot program in an effort to better gauge member opinions on the product.

Continuing its leadership in advanced lighting technology and trends, EKPC partnered with the Midwest Energy Efficiency Alliance (MEEA) to host the 2013 Lighting Utility Midwest Exchange Network. Utility attendees included LG&E/KU, Duke Energy, Hoosier Energy, ComEd, Buckeye Power, DTE Energy, Mid-American Energy, Dayton Power & Light and American Electric Power.



"EKPC was a wonderful host for the Lighting Utility Midwest Exchange Network (LUMEN) event, graciously providing for the group's needs and ensuring a successful meeting."

– *Rose Jordan*
Midwest Energy Efficiency Alliance (MEEA)

HVAC Duct Sealing:

Addressing the big usage issues

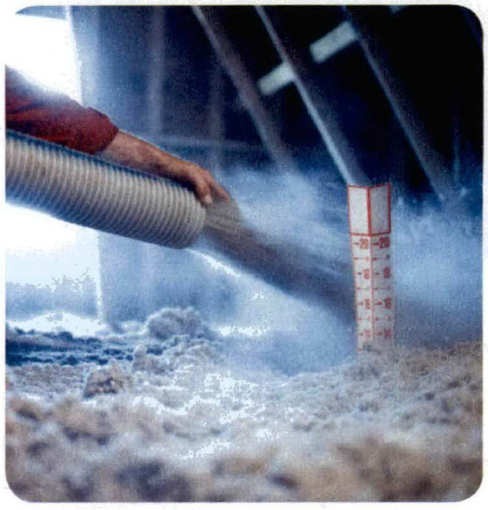
Since the 1990s, EKPC and its owner-member cooperatives have offered this program to reduce the energy loss through a home's HVAC duct system. This program provides incentives to members who seal ductwork through traditional mastic sealers. Duct loss measurement requires the use of a blower door test (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 2013, 230 HVAC Duct Sealing rebates were provided to members, resulting in a lifetime savings of 4,013 MWh and 8,026,512 pounds of carbon dioxide emissions. From 2012 to 2013, participation increased by 54 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.

In 2013, EKPC redesigned its residential weatherization offering 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 2013, 667 Button-Up rebates were provided to members, resulting in a lifetime savings of 22,929 MWh and 45,857,670 pounds of carbon dioxide emissions. The incentives to members for this program were doubled in 2013 to increase participation. From 2012 to 2013, participation increased by 23 percent.

Touchstone Energy Home:

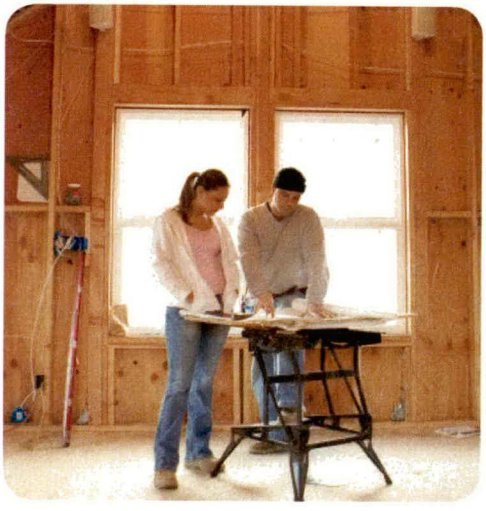
Building the home of your dreams

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 2013, 211 Touchstone Energy Home rebates were provided to members, resulting in a lifetime savings of 10,699 MWh and 21,317,520 pounds of carbon dioxide emissions. The incentives to members for this program were tripled in 2013 to increase participation. From 2012 to 2013, participation increased by 42 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.



"Our partnership with EKPC and their cooperatives helps spread the gospel of the benefits of energy efficient building in Kentucky. Their annual sponsorship of the Midwest Residential Energy Conference is the cornerstone of that effort."

– *Todd Johnson*
Executive Officer,
Home Builders Association of Lexington (HBAL)

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. Off-peak heating improves the utility's load factor, reduces energy costs for the member and delays the need for new peak-load capacity expenses.

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 2013, 18 ETS rebates were provided to members.

Heat Pump Retrofit:

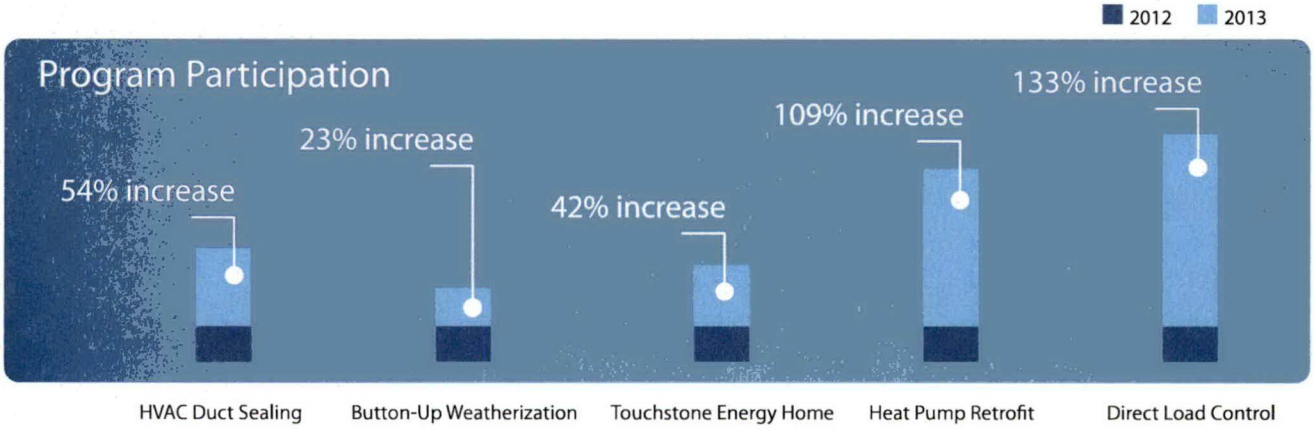
Replacing resistance heat sources

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.

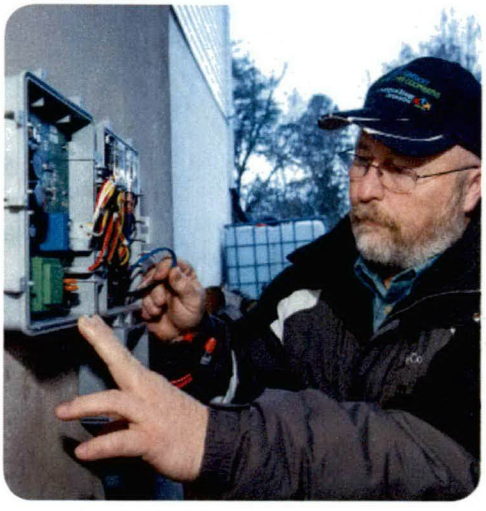
The program is targeted to members who currently use a resistance heat source. Incentives are offered when the homeowner's primary source of heat is an electric resistance furnace, ceiling cable heat, or baseboard heat in both site-built and manufactured homes.

In 2013, 442 Heat Pump Retrofit rebates were provided to members, resulting in a lifetime savings of 66,209 MWh and 132,417,360 pounds of carbon dioxide emissions. The incentives to members for this program were doubled in 2013 to increase participation. From 2012 to 2013, participation increased by 109 percent.



Direct Load Control:

Making saving simple

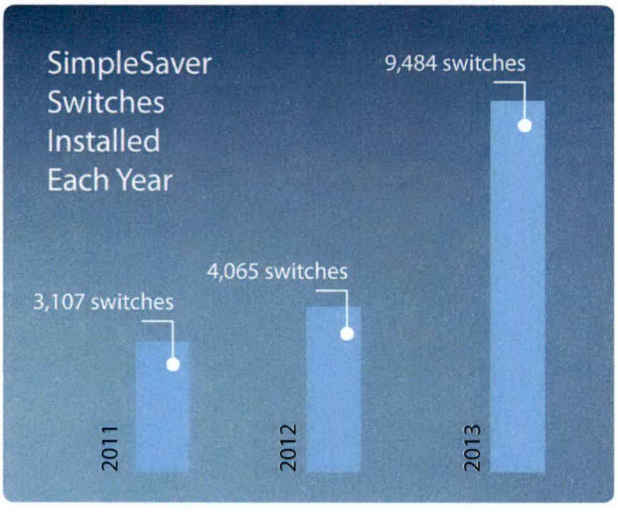


$imple$aver

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.

In 2013, 9,484 switches were installed, resulting in a reduction of 7 MW during the summer months. A sign-on bonus incentive for new participants in this program was added in 2013. From 2012 to 2013, participation increased by 133 percent.



Commercial Programs:

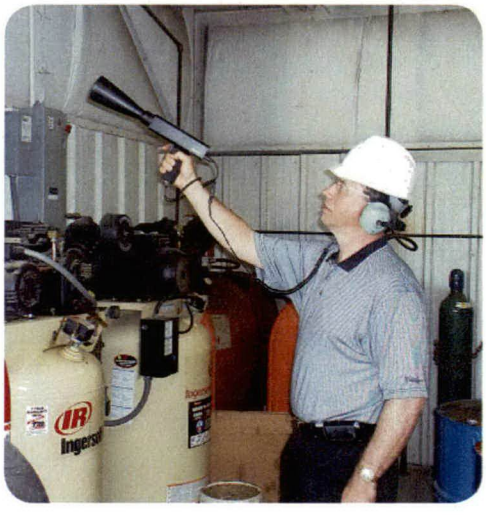
Commercial & Industrial Advanced Lighting

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 2013, 64 C&I Advanced Lighting rebates were provided to members, resulting in a lifetime savings of 96,125 MWh and 192,249,340 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:

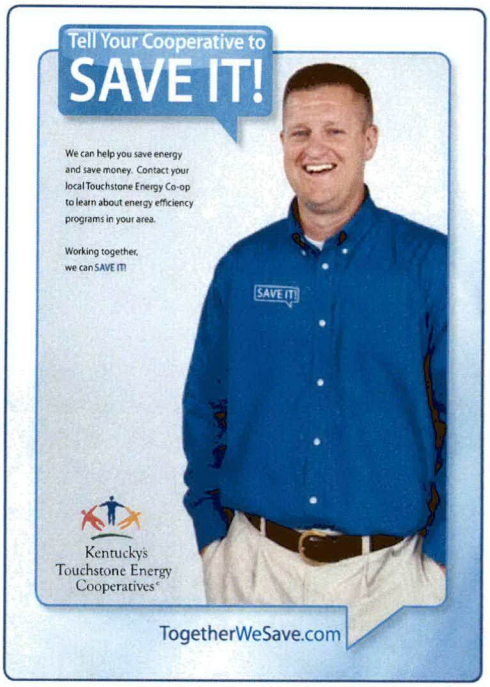
Getting the message out

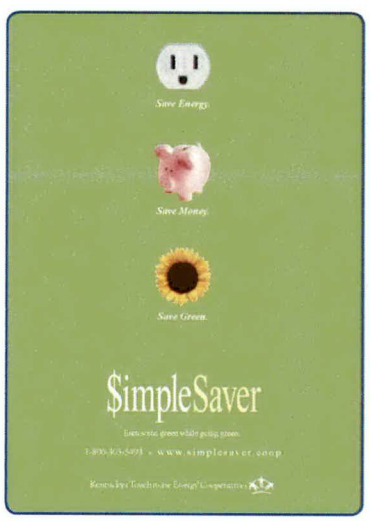
In 2013, EKPC and its owner-member cooperatives utilized several campaigns in efforts to encourage member participation in DSM programs and general energy-efficiency measures. Collectively, the system reached audiences through many forms of media including bill inserts, newspapers, television, billboards, radio, brochures, magazines, web, social media and through personal interaction.

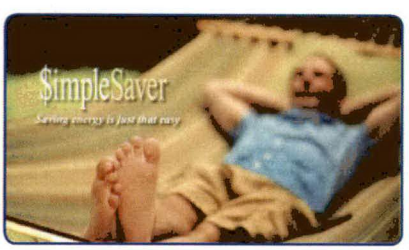
A new campaign, called SAVE IT!, was launched in 2013 to promote DSM programs by featuring local cooperative members. The strategy of this effort is to create a dialogue between the owner-member cooperative and the member. More than 50 variations of this campaign were produced and provided to the owner-member cooperatives.

The Together We Save campaign was revived in 2013 with a new "Working Together" approach on using energy wisely. This campaign is designed to help members realize that the cooperatives offer helpful tools and programs to help in their energy efficiency endeavors.

Several new concepts for promoting the SimpleSaver (DLC) program were created in 2013 to maximize 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. An outbound calling project was also added in 2013. More than half of new participants were added due to this effort.







People, Power and Progress:

Developing partnerships and plans for the future

EKPC and its owner-members collaborate in evaluating, planning and developing new programs. Collectively, the system took further steps to improve initiatives and began new projects in 2013 to potentially expand its DSM portfolio.

Four of EKPC's owner-member cooperatives and Mountain Association for Community Economic Development (MACED) continued efforts in 2013 to make on-bill energy-efficiency financing programs permanent. This on-bill program, called "How$martKY," received a tariff approval from the Kentucky Public Service Commission (PSC) in 2013. 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 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 2013 to further low-income energy-efficiency efforts.

In 2013, EKPC and one of its owner-member cooperatives took on a new research project targeted at manufactured housing. Since approximately 25 percent of EKPC system members reside in manufactured homes, this project is designed to help these members lower their energy costs. A disproportionate number of high-energy bills result from these homes that are notoriously inefficient, and the majority of them rely on an electric furnace for heat. A research project consisting of 25 members was created to install spray foam insulation on the floor of their homes. Spray foam insulation was chosen because it not only insulates, but also air seals the floor and the duct system. Energy usage of these homes will be monitored for several years.

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

"Our partnership with EKPC and their member cooperatives provide much needed support for quality built energy efficient homes in eastern Kentucky."

– *Josh Trent*
Frontier Housing

How$martKY
Energy Efficiency for Everyone

MACED
Mountain Association for Community Economic Development

Peoples' Self-Help Housing

Habitat for Humanity®

Southern Tier Housing Corporation

Impact Measures:

System summary of 2013 DSM program savings

DSM program totals for installed measures in 2013

All programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Lifetime energy savings (MWh)	Cost of demand saved ($/kW)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
All DSM program	78,224	16,678	9.865	5.311	$5,741,002	210,141	$454	$0.012	420,218,650

Residential Lighting

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
CFLs	67,108	1,304	0.130	0.220	$60,397	8	10,434	$0.006	20,868,288

HVAC Duct Seal

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
HVAC Duct Sealing	230	334	0.099	0.264	$124,500	12	4,013	$0.031	8,026,512

Button-Up Weatherization

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Button-Up	609	1,343	0.317	1.041	$417,644	15	20,143	$0.021	40,285,350
Button-Up with air seal	54	164	0.002	0.127	$63,683	15	2,466	$0.026	4,932,900
Button-Up level 2	2	9	0.003	0.007	$4,170	15	137	$0.030	274,020
Button-Up level 3	2	12	0.039	0.009	$5,250	15	183	$0.029	365,400

Touchstone Energy Home

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
TSE Home Prescriptive	42	108	0.028	0.104	$58,800	20	2,157	$0.027	4,314,240
TSE Home HERS 79 or better	158	406	0.104	0.392	$233,350	20	8,155	$0.029	16,229,760
TSE Home HERS 80-85	11	19	0.019	0.005	$8,360	20	387	$0.022	773,520

Electric Thermal Storage

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Electric Thermal Storage	18	(11)	0.000	0.122	$9,000	20	(228)	$(0.040)	(455,040)

Heat Pump Retrofit

Residential program	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Heat Pump 13 SEER	243	1,743	0.036	0.000	$404,595	20	34,866	$0.012	69,731,280
Heat Pump 14 SEER	46	347	0.015	0.000	$89,766	20	6,930	$0.013	13,860,720
Heat Pump 15 SEER or higher	153	1,221	0.069	0.000	$342,873	20	24,413	$0.014	48,825,360

Direct Load Control

Residential program	Participation	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Cost of Demand saved ($/KW)
DLC Air Conditioner	5,672	5.672	0.000	$1,930,037	$340
DLC Water Heater	3,812	1.410	1.982	$1,286,692	$913
DLC total	9,484	7.082	1.982	$3,216,729	$454

Commercial and Industrial

C&I programs	Participation	Annual Energy Savings (MWh)	Summer Demand Savings (MW)	Winter Demand Savings (MW)	2013 program costs	Measure life (years)	Lifetime energy savings (MWh)	Cost of energy saved ($/kWh)	Lifetime CO2 savings (lbs)
Commercial Lighting	64	9,612	1.922	1.038	$701,885	10	96,125	$0.007	192,249,340
Compressed Air	0	0	0.000	0.000	$0	7	-	-	-
Total	64	9,612	1.922	1.038	$701,885		96,125	$0.007	192,249,340

2013 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: CFL Give-away	
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: Air Conditioner

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 CFL give-away 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	bigsandy.recc.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

4775 Lexington Road, 40391
P.O. Box 707,
Winchester, KY 40392-0707
Telephone: 859-744-4812
Fax: 859-744-6008
www.ekpc.coop

Exhibit DSM-3

DSM Program
Assumption Sheets

2015 IRP version

ENERGY STAR Clothes Washer Rebate Program = "CLWSHR_R"
matches KU rebate; includes advertising costs; incorporates contractor pricing

Assumption	***Source***
Load Impacts Before Participant *3,400 kWh, 0.73 kW (coincident with winter system peak), 0.31 kW (summer)*	Typical electric water heater with typical electric dryer. Electricity savings from ENERGY STAR Clothes washers come from lower water heating and clothes drying energy.
After Participant *3,050 kWh, 0.66 kW (coincident with winter system peak), 0.28 kW (summer)*	ENERGY STAR clothes washers save on average 250 kWh on water heating and 100 kWh on clothes drying each year.
Lifetime of savings 12 years	Source: Northeast Energy Efficiency Partnership (NEEP) planning document (Sept 2004).
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $260 one time; $-20 per year O&M cost (savings)	Difference between retail price of an ENERGY STAR clothes washer and a new standard efficiency washer. Source: NEEP (2004), ENERGY STAR (2011). The **negative** $20 per year O&M cost represents savings in water and sewer costs by using less water.. Verified with more recent reports.
Administrative Cost EK **$750** one time set up fee, **$13,750** fixed annual, **$10** per new participant Co-op **$0**	Fixed annual cost includes advertising costs (**$7,000 per year), other marketing and EM&V ($5,000), and monthly admin fee to contractor ($1,750 per year)**. Per unit fee of **$10** is paid to contractor for servicing the rebate application. Contractor fees are pro-rated evenly across all the appliances in the Energy Star Appliance Rebate program. **Co-op is not responsible for providing services to administer this program.**
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - Year by year, 2015-2029: **2,225 (yrs 1-5), 2733, 2688, 2653, 2601, 2571 (yrs 10-15). 10%** Free Riders	Years 1-5 based on share increase of 20% in target market assuming multiplier effect of 2:1 (although free drivers not modelled). Years 6-15 based on achievable potential. Free Riders based on LG&E/KU.
Rebates Co-op to Participant $**75**	**based on current tariff.**

2015 IRP version

ENERGY STAR Refrigerator Rebate Program plus Freezer and Dishwasher
matches KU rebate; includes advertising costs; incorporates contractor pricing

Assumption	***Source***
Load Impacts Before Participant *600 kWh, 0.057 kW (coincident with winter system peak), 0.087 kW (summer)*	New refrigerator meeting current Federal standards for efficiency
After Participant *500 kWh, 0.047 kW (coincident with winter system peak), 0.072 kW (summer)*	New ENERGY STAR Refrigerator. Source: ENERGY STAR
Lifetime of savings 12 years	Source: ENERGY STAR
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ **32** one time;	Incremental cost for the more efficient ENERGY STAR model. Source: ENERGY STAR. Cost is total participation cost across the 3 appliances divided by number of participants
Administrative Cost EK **$2250** one time set up fee, **$41,250** fixed annual, **$10** per new participant, 2% esc Co-op **$0**	Fixed annual cost includes advertising costs (**$21,000 per year), other marketing and EM&V ($15,000), and monthly admin fee to contractor ($5,250 per year)**. Per unit fee of **$10** is paid to contractor for servicing the rebate application. Contractor fees are pro-rated evenly across all the appliances in the Energy Star Appliance Rebate program. **Co-op is not responsible for providing services to administer this program.**
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - Year by year, 2015-2029: **5400 (yrs 1-5); 5760, 5665, 5589, 5483, 5422 (yrs 10-15). 10%** Free Riders	For 2015-2019, participants for each appliance represent a share increase of 20% in target market assuming multiplier effect of 2:1 (although free drivers not modelled). Then counts are adjusted using average savings per appliance. Years 2020-2029 based on achievable potential. Free rider estimate is from California PUC Energy Efficiency Policy Manual.
Rebates Co-op to Participant **$82**	**Based on current tariff. Weighted.**

2015 IRP version	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.
Assumption	***Source***
Load Impacts Before Participant *392 kWh, 0.065 kW (coincident with winter system peak), 0.039 kW summer*	10 EISA compliant Halogen light bulbs, 43 watts each
After Participant *120 kWh, 0.020 kW (coincident with winter system peak), 0.012 kW summer*	portfolio of 10 CFL and LED light bulbs providing equivalent lumens. Savings are modeled year by year for years 2015-2016 to capture transition to EISA efficiency standard in the market (baseline) and with the program. Savings are higher in earlier years because baseline wattage is higher.
Lifetime of savings	**8** Years. 9,000 hour rated life, 20% attrition (removals)
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 52.50	Price premium to purchase the package of CFLs and LEDs versus Halogen light bulbs. Incremental costs are modeled year by year for period 2015-2016.
Administrative Cost	
EK $ 35,000 fixed annual (2015-2019), $210,000 (2020-2029) 2% esc	Assumes $10,000 per year for admin and evaluation, and $25,000 per year for promotional activities (mailings, trade ally) in 2015. Scaled up for higher participation in years 2020-2029.
Co-op $0 per new participant	EKPC pays for all program costs
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2029: **5,000 (years 1-5); 34,335; 33,360; 24,988; 23,520; 23,123 (years 10-15)** Unit is ten(10) light bulbs for ease of modeling. **20%** free riders (2015 forward).	1st 5 years based on 5 year DSM plan. Years 6-15 based on achievable potential. 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. Program assumes a transition period in 2020 and 2021 for meeting CFL equivalent Federal standard in 2020.
Rebates Co-op to Participant $0	Rebate paid by EKPC

2015 IRP version

Appliance Recycling

KU rebate; includes advertising costs; incorporates contractor pricing

This program provides collection and disposal of old, inefficient freezers. Members are paid a bounty for each freezer turned in and taken off of the grid. The freezer will be turned over to a licensed recycler.

Assumption	***Source***
Load Impacts Before Participant *696 kWh, 0.07 kW (coincident with winter peak), 0.10 kW (summer)*	Weighted average usage for a pre-2000 appliance (refrigerator or freezer), where weights are expected levels of participation for refrigerators (783 kWh) and freezers (525 kWh)
After Participant *0 kWh, 0.00 kW (coincident with winter system peak), 0.00 kW (summer)*	The appliance is removed from the grid.
Lifetime of savings	**7** Years based on Xcel and Vermont reports
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 0	No out of pocket expense is incurred by the participant
Administrative Cost EK **$8,250** one time set up fee; **$40,000** per year admin; plus **$81** per participant. 2% esc	$16,000 annual fixed cost is for advertising and EM&V. $24,000 annual fixed cost is admin fee to contractor. Per appliance cost is fee paid to contractor for promotion, enrollment, pickup, recycling and program admin costs.
Co-op $0 per new participant	EKPC pays all costs for this program directly
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - year by year , 2015-2029: **2,340 (yrs 1-5); 7273. 7134, 7035, 6948, 6906 (yrs 10-15). 36%** free riders.	Years 1-5 based on harvest rate of 3.5% per year based on results from PG&E and Pacificorp. Years 6-15 based on achievable potential. Free rider estimate based on ADM study for CA and Fort Collins study
Rebates Co-op to Participant $ **50**	Bounty fee. Based on current tariff.

2015 IRP version

Button-Up Tiered Weatherization Program

The Button-Up Weatherization Program offers an incentive for reducing the heat loss of a home. The retail member may qualify for this incentive by improving insulation, installing higher efficiency doors, or by reducing the air leakage of their home.

Assumption	***Source***
Load Impacts Before Participant *10,500 kWh, 8.12 kW (coinc. with winter system peak), 2.47 kW (summer)*	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.
After Participant *7,455 kWh, 5.77 kW (winter peak), 1.75 (summer peak)*	same mix with 29% savings applied. 29% savings derived from site specific field data and engineering estimates, combined with impact evaluation results for similar programs at other utilities.
Lifetime of savings	**15** Years
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 2,400	Costs from program experience. Comparable to GDS potential study measure costs for major weatherization measures
Administrative Cost EK $95,000 per year (2015-2029), 3% escalation	Program admin estimate of $10,000 provided by EKPC Marketing/Communications, October 2010. Also includes advertising budget of $ 85,000 per year.
Co-op $463 per new participant	Cost estimated from survey of coops. Plus $200 for pre and post blower door test.
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year 2015-2029 = **1109, 1159 (years 2-5), 2660, 2610, 2574, 2541,2526 (years 10-15)** . 10% free riders	1st 5 years based on 5 year DSM plan. Years 6-15 based on Achievable Potential results. Free riders based on Frontier Assoc study for LG&E/KU
Rebates Co-op to Participant $750	Ful incentive according to the tariff

2015 IRP version

Consumer Electronics

This program is designed to work cooperatively with retailers to increase the penetration of Energy Star qualified televisions, desktop computers, and set top boxes

Assumption	***Source***
Load Impacts Before Participant *185 kWh, 0.014 kW (coinc. with winter system peak), 0.029 kW (summer)*	Typical television usage
After Participant *108 kWh, 0.008kW (winter peak), 0.017 (summer peak)*	Energy Star television usage
Lifetime of savings	6 Years
Generation Capacity Cost - **EE = combined cycle,** 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	Based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 14.25	Based on incremental costs in the EE Potential study weighted by savings
Administrative Cost EK $75,000 per year (2015-2029), 2% escalation.	Includes general admin, M&V, promotion to customers and to retailers
Co-op $0 per new participant	No administrative costs paid by cooperatives for this program
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year 2015-2029 = **0 (yrs 1-3), 65969, 84687, 103451, 101625, 100243, 98643, 97783 (years 10-15)** . 25% free riders	Based on Achievable Potential results. Free riders based on review of state TRMs
Rebates Co-op to Participant $20	Point of sale rebates

2015 IRP version

ENERGY STAR Residential Central Air Conditioning program w/ proper sizing & installation
matches KU rebate; includes advertising costs; incorporates contractor pricing

Assumption	***Source***
Load Impacts Before Participant *2,092 kWh, 2.07 kW (coinc. with summer system peak)*	Standard efficiency new Central air conditioner (SEER 13)
After Participant *1,563 kWh, 1.55 kW (coinc. with summer system peak).*	High efficiency new Central Air Conditioner (SEER 15), proper sizing and installation. Savings from SEER 15 are 279 kWh. Savings from proper sizing/installation are 250 kWh.
Lifetime of savings	**15** Years
Generation Capacity Cost - **EE = combined cycle,** 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 300 through 2015, then $550. 2% escalation	Difference in installed cost ($550) between SEER 13 Central AC and SEER 15 CAC - based on ENERGY STAR . Less the $250 KY tax credit for 2015.
Administrative Cost EK **$750** one time set up fee, **$13,750** fixed annual, **$10** per new participant. 2% esc Co-op **$0**	Fixed annual cost includes advertising costs (**$7,000 per year), other marketing and EM&V ($5,000), and monthly admin fee to contractor ($1,750 per year)**. Per unit fee of **$10** is paid to contractor for servicing the rebate application. Contractor fees are pro-rated evenly across all the appliances in the Energy Star Appliance Rebate program. **Co-op is not responsible for providing services to administer this program.**
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - Year by year, 2015-2029: **2,600 (yrs 1-5), 120, 123, 127, 125, 124(yrs 10-15). 10%** free riders	Years 1-5 based on a target of 25% of the replacement market each year. Years 6-15 based on achievable potential. Free Riders from Xcel DSM plan (2009).
Rebates Co-op to Participant $**300**	**Current tariff. $100 plus $100 per 1 SEER improvement.**

2015 IRP version	ASHP **standard replacement** to SEER 15 Energy Star ***matches KU rebate; includes advertising costs; incorporates contractor pricing*** Encourages customers to upgrade their replacement air source heat pump from standard SEER 13 to high efficient SEER 15 heat pumps
Assumption	***Source***
Load Impacts Before Participant ***7,669 kWh, 8.1 kW (coincident with winter peak), 2.1 kW (summer)***	Standard efficiency heat pump: SEER 13, HSPF 7.7 1,700 square foot home, 3 ton unit
After Participant *6,865 kWh, 8.1 kW (coincident with winter system peak), 1.8 kW (summer)*	High efficiency heat pump: SEER 15, HSPF 8.5. 1,700 square foot home, 3 ton unit
Lifetime of savings	**20 years**
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ **750** thru 2015; $1,000 for 2016 on. 2% escalation	Cost premium ($1,000) associated with SEER 15 heat pump over and above the installed cost of a SEER 13 heat pump. $250 Kentucky tax credit is included through 2015. Cost premium based on Energy Star data.
Administrative Cost EK **$750** one time set up fee, **$21,750** fixed annual, **$10** per new participant, 2% esc Co-op **$0**	Fixed annual cost includes advertising costs, marketing and EM&V (**$20,000 per year), and monthly admin fee to contractor ($1,750 per year)**. Per unit fee of **$10** is paid to contractor for servicing the rebate application. Contractor fees are pro-rated evenly across all the appliances in the Energy Star Appliance Rebate program. **Co-op is not responsible for providing services to administer this program.**
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - Year by year, 2015-2029: **2,000 (yrs 1-5), 1654, 1737, 1830, 1919, 2014 (yrs 10-15). 0%** free riders.	Years 1-5 based on a target of 20% of the eligible market = residential customers replacing their air source heat pump at the end of its useful life. Years 6-15 based on achievable potential.
Rebates Co-op to Participant **$ 300**	**Current tariff. $100 plus $100 more per SEER improvement above the Federal standard**

2015 IRP version

Heat Pump Water Heater Energy Star
matches KU rebate; includes advertising costs; incorporates contractor pricing

Heat pump water heaters use a vapor compression refrigeration cycle to concentrate ambient heat instead of generating heat directly. Therefore, they can be two to three times more energy efficient than conventional electric resistance water heaters.

Assumption	***Source***
Load Impacts Before Participant *3,600 kWh, 0.84 kW (coincident with winter peak), 0.32 kW (summer)*	Typical efficiency (EF=0.90) new electric hot water heater, 50 or more gallons
After Participant *1,400 kWh, 0.33 kW (coincident with winter system peak), 0.12 kW (summer)*	ENERGY STAR rated integrated heat pump water heater (EF=2.35), tank size of at least 50 gallons
Lifetime of savings	**13 Y**ears (Lawrence Berkeley Lab, ACEEE)
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 1,105 thru 2016, $1,405 2017 on. 2% escalation	Cost premium associated with the installed cost of the heat pump water heater over and above the installed cost of a new conventional electric water heater. 30% Federal Tax credit is included through 2016. Total installed cost for HPWH is $2,000. Installed cost of conventional electric water heater is $595. Federal tax credit is $ 300.
Administrative Cost EK **$750** one time set up fee, **$13,750** fixed annual**, $10** per new participant, 2% esc Co-op **$0**	Fixed annual cost includes advertising costs (**$7,000 per year), other marketing and EM&V ($5,000), and monthly admin fee to contractor ($1,750 per year)**. Per unit fee of **$10** is paid to contractor for servicing the rebate application. Contractor fees are pro-rated evenly across all the appliances in the Energy Star Appliance Rebate program. **Co-op is not responsible for providing services to administer this program.**
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - Year by year, 2015-2029: **725 (yrs 1-5), 246, 242, 238, 234, 233(yrs 10-15)** . **0%** free riders.	Years 1-5 based on goal of 10% of applicable market, which is the replacement market for single family homes that currently have an electric hot water heater that is 50 gallons or larger. Years 6-15 based on achievable potential.
Rebates Co-op to Participant $ **300**	**Current tariff.**

2015 IRP version	Home Energy Information Home energy display monitor (pre-pay) and reports (similar to O-Power)
Assumption	***Source***
Load Impacts Before Participant ***14,136 kWh, 4.29 kW (coincident with winter peak), 3.06 kW (summer)***	Typical Residential Customer
After Participant *13,480 kWh, 4.05 kW (coincident with winter system peak), 2.92 kW (summer)*	Residential customer with average savings between display and reports
Lifetime of savings	**3 years**
Generation Capacity Cost - **EE = combined cycle,** 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ **55.** 2% escalation	Represents cost of low cost measures adopted by the display monitor group, pro-rated
Administrative Cost EK **$ 250,000** one time set up fee, **$20,000** fixed annual, **$ 6** per new participant, 2% esc	One time setup fee for reports segment of program. Fixed annual cost includes advertising costs, marketing and EM&V (**$20,000 per year).** Per unit fee is for reports segment (pro-rated).
Co-op **$18.50 per partic per year**	**per participant per year cost for depreciation, interest, and O&M on software and in-house display. For monitor segment. Pro-rated.**
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - Year by year, 2015-2029: **0 (yrs 1-3), 22901, 33440, 40937, 40160, 39603, 39103, 38865 (yrs 10-15). 0%** free riders.	Based on achievable potential.
Rebates Co-op to Participant **$ 0**	**No financial incentive. Information and service offered free of charge.**

2015 IRP version

Low Income program with CAAs, updated, true TRC version

EKPC provides an incentive to enhance the weatherization and energy efficiency services provided to its low income residential retail members by the Kentucky Community Action network of not for profit 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, which include an energy audit, air and duct sealing, attic, floor and wall insulation, hot water measures, and efficient light bulbs.

Assumption	***Source***
Load Impacts Before Participant *11,286 kWh, 8.81 kW (coincident with winter system peak), 3.45 kW (summer), 750 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.
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 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 - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	Based on ACES energy forward curve for AEP_Dayton.
Avoided Gas Commodity Costs -	Based on Forward Curve for Fuel at Smith Station
Participant Costs $ 1,567	This is the Kentucky Housing share of measure costs, modeled to calculate a true TRC
Administrative Cost EK $20,000 fixed annual (2015-2019) 2% esx	0.1 FTE for implementation admin, plus M&V
Co-op **$1,765** per new participant	This includes the rebate to the CAA (avg will be $1,665) 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 $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2019: **250, 300, 350, 350, 350. 0%** Free Riders	Based on current DSM 5 year plan.
Rebates Co-op to Participant $0	Direct installation program - no participant out of pocket costs

2015 IRP version

EnergyStar Manufactured Home with heat pump: rebate to manufacturer (SBRA)

All Electric manufactured home built to Energy Star standards with a SEER 13 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
After Participant *5,247 kWh, 6.70 kW (coincident with winter system peak), 2.55 kW (summer)*	Heating & Cooling loads for a Manufactured home built to energy star standards with a SEER 13 ASHP . kWh savings and summer kW savings as reported by TVA (Jan 2014, Haislip)
Lifetime of savings	**15** Years - TVA assumption
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 0	Incremental measure costs are expected to be covered 100% by rebates and tax credits passed on to participating home buyer. Energy star upgrades (assumed to be $1,650) plus incremental cost for the heat pump ($500) less pass-through of rebate paid to home producer ($1,750) and state of Kentucky tax credit to the dealer ($400, through 2015).
Administrative Cost EK **$5,800** one time startup fee, plus **$10,000** fixed annual, plus **$1,900** per home	One time startup fee to SBRA ($5,800). Fixed annual allocated administrative costs ($3,000) plus M&V ($7,000). Variable cost per home is the incentive for home producer paid to SBRA ($1,750 per home) plus SBRA admin fee ($150 per home).
Co-op **$50** per new participant	$50 for rebate processing and tracking
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation -Year by year, 2015-2019 = **400, 400, 400, 400, 400. 0%** Free Riders projected because of nature of program	Participation based on 5 year plan. For 2020-2029, achievable savings captured with weatherization and heat pump categories.
Rebates Co-op to Participant $0	No direct rebate paid to participant. Rebates are modeled as administrative costs because they are paid to the home producer and heat pump contractor

2015 IRP version

Direct Load Control of Residential **Air Conditioners**

Reduce peak demand and energy usage through the installation of load control devices on air conditioners and electric water heaters.

Assumption	***Source***
Load Impacts Water Heater Savings *10 kWh, 0.45 kW (coincident with winter system peak), 0.3 kW (summer)*	Based on M&V data for the program
Air Conditioner savings ***5*** *kWh,* ***0.00 kW (****coincident with winter system peak),* ***1.0*** *kW (summer)*	Based on M&V data for the program
Lifetime of savings	**20** Years
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market **Participant Costs** $ 0	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Administrative Cost **EK $350 per new switch installed (AC or WH); plus $300k fixed annual admin.; plus $370,000 legacy rebate payments per year; escalates at 1.5% per year.** Co-op $0 per new participant	Includes device costs, installation, transportation, scheduling, enrollment, recruitment, and servicing; also marketing, communications, IT, customer service, management contract fee, general admin, M&V. Also includes the rebates for the **18,500 AC** switches already in the field as of Dec 31, 2014
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
New Participation - Year by year, 2015-**2019: 4,500 new per year.**	based on current 5 year plan
Rebates Co-op to Participant **$20 AC, $10 WH**	Program as filed

2015 IRP version

Direct Load Control of Residential **Water Heaters**, participants **future participation**

Reduce peak demand and energy usage through the installation of load control devices on air conditioners and electric water heaters.

Assumption	***Source***
Load Impacts Water Heater Savings ***10*** *kWh,* ***0.45*** *kW (coincident with winter system peak),* ***0.3*** *kW (summer)*	Based on M&V data for the program
Air Conditioner savings *5 kWh, 0.00 kW (coincident with winter system peak), 1.0 kW (summer)*	Based on M&V data for the program
Lifetime of savings	**20** Years
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market **Participant Costs** $ 0	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Administrative Cost **EK $350 per new switch installed (AC or WH); plus $140,000 legacy rebate payments per year; escalates at 1.5% per year.** Co-op $0 per new participant	Includes device costs, installation, transportation, scheduling, enrollment, recruitment, and servicing; NOTE - fixed annual costs are accounted for in the DLC of AC run. Also includes the rebates for the **14,000 WH** switches already in the field as of Dec 31, 2014
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation -Year by year, 2015-2019: 3,000; 3,000; 3,000; 3,000; 3,000	based on 5 year plan.
Rebates Co-op to Participant **$20 AC, $10 WH**	Program as filed

2015 IRP version

Residential Exterior Lighting

This program provides residential customers with incentives to install CFL and LED exterior lighting

Assumption	***Source***
Load Impacts Before Participant *148 kWh, 0.117 kW (coinc. with winter system peak), 0.00 kW (summer)*	Typical exterior incandescent lighting
After Participant *64 kWh, 0.097 kW (winter peak), 0.00 (summer peak)*	CFL/LED exterior lighting
Lifetime of savings	20 Years
Generation Capacity Cost - **EE = combined cycle,** 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 17.50	Based on incremental costs in the EE Potential study weighted by savings and including O&M savings
Administrative Cost EK $35,000 per year (2015-2029), 2% escalation. Plus $1.75 per rebate	Includes general admin, M&V, promotion to customers and to retailers plus rebate processing.
Co-op $0 per new participant	No administrative costs paid by cooperatives for this program
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year 2015-2029 = **0 (yrs 1-3), 28409, 36436, 44963, 44719, 14981, 3462, 3424 (years 10-15)** . 5% free riders	Based on Achievable Potential results. Free riders based on review of state TRMs
Rebates Co-op to Participant $ 10	Mail in rebates

2015 IRP version	Smart Thermostat Rebate program to encourage customers to install smart thermostats
Assumption	***Source***
Load Impacts Before Participant ***10,498 kWh, 8.12 kW (coincident with winter peak), 2.47 kW (summer)***	Typical consumption of heating and cooling in an electric heat home
After Participant *9,687 kWh, 7.49 kW (coincident with winter system peak), 2.28 kW (summer)*	Same home with savings from operation of smart thermostat
Lifetime of savings	**15 years**
Generation Capacity Cost - **EE = combined cycle,** 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ **249.** 2% escalation	Costs based on EE Potential study.
Administrative Cost EK **$750** one time set up fee, **$21,750** fixed annual, **$10** per new participant, 2% esc Co-op **$0**	Fixed annual cost includes advertising costs, marketing and EM&V (**$20,000 per year), and monthly admin fee to contractor ($1,750 per year)**. Per unit fee of **$10** is paid to contractor for servicing the rebate application. Contractor fees are consistent with appliances in the Energy Star Appliance Rebate program. **Co-op is not responsible for providing services to administer this program.**
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - Year by year, 2015-2029: **0 (yrs 1-3), 4147, 6076, 7444, 7301, 7193, 7097, 7044 (yrs 10-15). 0%** free riders.	Based on achievable potential.
Rebates Co-op to Participant **$ 190**	**Rebate covers 75% of measure cost.**

2015 IRP version	Tune-Up HVAC Program with Duct Sealing Coil cleaning and other maintenance measures combined with sealing of ductwork. Reductions in duct losses are measured using a blower door test.
Assumption	***Source***
Load Impacts Before Participant *8,650 kWh, 8.12 kW (coincident with winter system peak), 2.47 kW (summer)*	HVAC loads for a typical heat pump in typical residence: mix of SEER 10 and SEER 12
After Participant *7,612 kWh, 7.15 kW (coincident with winter system peak), 2.17 kW (summer)*	HVAC loads for a typical heat pump home reduced by 12% savings. 12 % savings derived from ACEEE report and site specific blower door results.
Lifetime of savings	**12** Years
Generation Capacity Cost - **EE = combined cycle,** 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 330.00	Average payment to contractors for performing the measures in the program. Source: EKPC Marketing Department - based on Jackson program
Administrative Cost EK $6,000 per year fixed 2% esc	All cost estimates provided by EKPC Marketing/Communications.
Co-op $ 100 per customer	Based on EKPC 5 year plan
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2029= **550, 650, 750 (yrs 3-5), 799, 784, 773, 760, 753 (yrs 10-15). 20%** free riders	2015-2019 Based on 5 year DSM Plan 2020-2029 based on achievable potential. Free riders % based on Frontier Assoc study for LG&E/KU and CPUC DEER update.
Rebates Co-op to Participant $280	Average payment to contractors is $330; participating member pays $50.

2015 IRP version | Water Heater Conservation

Direct installation of low flow showerheads and water heater pipe wrap using contractor

Assumption	***Source***
Load Impacts Before Participant *2748 kWh, 0.64 kW (coincident with winter peak), 0.22 kW (summer)*	Typical electric water heater
After Participant *2197 kWh, 0.51 kW (coincident with winter system peak), 0.17 kW (summer)*	Electric water heater with low flow showerhead and pipe wrap installed
Lifetime of savings	11 Years based on EE Potential study
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 0	No out of pocket expense is incurred by the participant
Administrative Cost EK **$40,000** per year admin; plus **$55** per participant. 2% esc	$16,000 annual fixed cost is for advertising and EM&V. $24,000 annual fixed cost is admin fee to contractor. Per participant cost is fee paid to contractor for promotion, enrollment, transportation, materials, installation, and program admin costs.
Co-op $0 per new participant	EKPC pays all costs for this program directly
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966 **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - year by year , 2015-2029: **0 (yrs 1-3); 2987, 3749, 4550, 4487, 4430, 4317, 4246 (yrs 10-15).** 0% free riders.	Based on achievable potential study.
Rebates Co-op to Participant $ **0**	Direct install program. No rebates.

2015 IRP version

Heat Pump Retrofit Program

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)*	Electric Furnace and Central A.C.
After Participant *7,310 kWh, 8.12 kW (coinc. with winter system peak), 1.93 kW (summer)*	ENERGY STAR efficiency new heat pump: SEER 14, HSPF 8.0
Lifetime of savings	**20** Years
Generation Capacity Cost - **EE = combined cycle,** 100% summer	Combined Cycle Baseload unit. 100% allocation to summer
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 4,150 to $5,150 - use $4,600 for the cost benefit. 2% esc.	Difference in installed cost between SEER 14 heat pump and electric furnace. Spread accounts for fact that the cost of a future purchase of a furnace would be discounted.
Administrative Cost EK $50,000 fixed annual (2015-2029). 2% esc	Program admin based on estimates provided by EKPC Marketing/Communications, Also includes advertising budget of $20,000.
Co-op $177 per new participant. 2% esc.	Cost information provided by various coops in survey of hours and rates.
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year 2015-2029 = **618, 718 (years 2-5), 1142, 1275, 1411, 1545,1685 (years 10-15)** . 0% free riders	1st 5 years based on 5 year DSM plan. Years 6-15 based on Achievable Potential results.
Rebates Co-op to Participant $ 750, 2% esc	3 tier rebate: SEER 13 is $500, SEER 14 is $750, SEER 15 is $1,000. Modeling SEER 14.

2015 IRP version	Touchstone Energy Home: all paths 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 <=79**
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.
After Participant *8,006 kWh, 6.21 kW (coincident with winter system peak), 1.69 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.
Lifetime of savings	**20** Years
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $1,950	Includes (1) costs associated with bringing standard built Kentucky home to enhanced Touchstone Energy standards (2099 IECC); (2) savings from equipment resizing (1/2 ton reduction); (3) incremental cost of an efficient water heater. Cost estimates from E.On. DSM filing, marketing dept sources, and Blue Grass data.
Administrative Cost EK $60,000 fixed annual 2% esc	Includes direct program administration as well as promotional costs
Co-op $ 430 per new participant	Costs of rating and inspection. Based on survey of members for hours and labor rates
Rate Schedule - Retail Average Residential Rate for Co-ops Cust chrg $9.62, Energy Rate $.08966	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2029: **234, 284, 334 (yrs 3-5), 170, 168, 166, 162, 156 (yrs 10-15). 5%** Free Riders	Based on 5 year DSM Plan for 2015-2019, then based on achievable potential thereafter. Free riders based on Frontier Assoc study for LG&E/KU. Participation for all paths, adjusted according to savings relative to Prescriptive path.
Rebates Co-op to Participant $ 750	Recommended incentive according to tariff . Customer also receives free Energy Star rating ($500 value)

2015 IRP version

Industrial Compressed Air Program

Reduces electricity consumption through a comprehensive approach to efficient production and delivery of compressed air in industrial facilities. The program includes, assessment, training, and financial incentives for capital intensive improvements.

Assumption	***Source***
Load Impacts Before Participant *25,320 kWh, 2.00 kW (coincident with winter system peak), 4.99 (summer)*	Compressed air load for industrial corresponding to 1 kW of connected load savings
After Participant *21,520 kWh, 1.70 kW (coincident with winter system peak), 4.24 (summer)*	Compressed air load after program. 15% savings. Source: US DOE Industrial Technologies Program.
Lifetime of savings 7 years	Source: BPA and Pacific Northwest planning numbers. Mix of O&M and capital measures
Generation Capacity Cost - EE = combined cycle, 100% summer **Avoided Electricity Energy Costs** - PJM Market	Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 820 per unit (1 kw savings)	Typical cost of $0.20 per annual kWh savings from set of case studies provided by US DOE
Administrative Cost EK $32,500 fixed annual, $0 per new participant	Marketing,Trade Allies,Tracking, Processing, Eval, Cust Svc. Includes efforts to promote formal training and distribution of Compressed Air Challenge manual. Program experience to date validates the cost.
Co-op $80 per new 1 kW savings	Audit/assessment costs.
Rate Schedule - Retail Owen Schedule II	Current rates in effect. Cust chrg $21.31 , Demand charge $6.13 per kW,Energy Rate $.06498 per kWh
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2019= **250, 625, 1,250, 1250, 1250.** ***10%*** *Free riders*	Based on 5 year DSM Plan. Units are 1 kW of connected load saved.
Rebates Co-op to Participant $ 0	Audit reimbursement treated as admin cost above.

2015 IRP version Industrial Machine Drive

Assumption	***Source***
Load Impacts Before Participant *240,000 kWh, 18.9 kW (coincident with winter system peak), 26.0 kW (summer)*	Motor load for a typical 100 HP set of motors where variable speed drives apply, with inventory matching market size shares, and high efficiency.
After Participant *141,600 kWh, 11.2 kW (coincident with winter system peak), 15.4 kW (summer)*	Motor load for a typical 100 HP set of motors with variable speed drives (VSDs). 41% savings compared to motor load without VSDs. Source: Northeast Energy Efficiency Partnership (NEEP), Strategic Review, Sept 2004.
Lifetime of savings 15 years **Generation Capacity Cost - EE = combined cycle,** 100% summer **Avoided Electricity Energy Costs** - PJM Market	Source: Northeast Energy Efficiency Partnership (NEEP), Strategic Review, Sept 2004 Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 23,500	Cost of the variable speed drive measure, $0.24 per annual kWh saved. Source: NEEP, 2004, adjusted to 2015 $.
Administrative Cost EK $25,000 fixed annual, $1000 per new participant Co-op $0	Marketing,Trade Allies,Tracking, Processing, Eval, Cust Svc. Includes efforts to promote wider application of VSDs. Pre and post site visits for inventory, recommendations, and verification EKPC bears all administrative costs for this program
Rate Schedule - Retail Owen Schedule II **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Cust chrg $21.31 , Demand charge $6.13 per kW,Energy Rate $.06498 per kWh Current rates in effect.
Participation - Year by year, 2015-2029: 17,14, 6, 33, 60,1 35 (yrs 6-15). 10% free riders.	Based on achievable potential. Free riders based on review of state TRMs
Rebates Co-op to Participant $ 5,000	$50 per hp .

2015 IRP version

Industrial Process (Heating and Cooling)

This program provides financial and engineering resources to enable industrial customers to save electricity in their industrial processes. Incentives are structured as a standard offer payment per 1st year kWh. Partial payment is made upon approval of the engineering proposal, with the final payment once savings are verified.

Assumption	***Source***
Load Impacts Before Participant *240,000 kWh, 18.93 kW (coincident with winter system peak), 47.34 kW (summer)*	Industrial profile
After Participant *209,600 kWh, 16.53 kW (coincident with winter system peak), 41.34 (summer)*	Profile with savings applied
Lifetime of savings 10 years	Source: Energy Trust of Oregon
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 11,300 per project	Typical cost of $0.37 per annual kWh savings from studies in Delaware and California
Administrative Cost EK $32,000 fixed annual, $1,700 per new participant	Fixed costs for Marketing,Trade Allies,Tracking, Processing, Eval, Cust Svc. Variable cost is 15% of measure cost (based on Puget Sound Energy report) and includes audit, feasibility study, proposal review and approval, savings verification
Co-op $0	EKPC administers this program
Rate Schedule - Retail Owen Schedule II	Current rates in effect. Cust chrg $21.31 , Demand charge $6.13 per kW,Energy Rate $.06498 per kWh
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2029= **20,28,40, 60, 80, 100 (year 6-15).** ***15%*** *Free riders*	Based on Achievable potential.
Rebates Co-op to Participant $ 1,700	Rebate is 15% of measure cost

2015 IRP version

C&I Demand Response Program

This program provides incentives to large customers to reduce their electricity demands on the grid, with short notice, for short periods of time, to reduce the utility peak load and avoid the purchase of expensive power.

Assumption	***Source***
Load Impacts Before Participant *10,500 kWh, 35.0 kW (coincident with winter system peak), 35.0 kW (summer)*	This is the curtailable load, consisting of a 35 kW load during the 300 highest priced hours using marginal energy costs. 35 kW represents 15% of the average peak demand for the EKPC customer base with peak demands above 50 kW. Source: load research and billing data.
After Participant *0 kWh, 0.0 kW (coincident with winter system peak), 0.0 kW (summer)*	Zero load, since the curtailable load is curtailed.
Lifetime of savings	20 Years
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 600 one time per new participant; $1000 per participant per year	One time cost is the metering cost; annual cost is for program administration and communications: receiving curtailment notices, responding, accounting. Onsite generation is not assumed, and so costs for operating on-site generation (fuel or O&M) are not included.
Administrative Cost	
EK $150,000 fixed one time; $50,000 fixed annual, $500 annual per participant per year	One time cost is to design program, purchase & install curtailment infrastructure (software, hardware, training). Fixed annual cost is for administering the program each year. Annual per participant per year is for marketing, customer assistance, and coordination
Co-op $0	No administrative costs borne by member cooperatives for this program
Rate Schedule - Retail Blue Grass Energy blend of large C&I rates: demand charge of $7.66 per kW	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2017: 150, 200, 150. 0% free riders.	After ramp up, 10% of the eligible customers, or 500 customers, participate.
Rebates Co-op to Participant $500 one-time; $1050 per year	One time rebate for meter cost; annual is payment of $30 per kW-year

2015 IRP version

Commercial & Industrial HVAC Controls

Offers C&I customers incentives for installing systems of controls and sensors that control and reduce a building's energy usage. Incentives are offered for new systems, replacing non-working systems, and adding functionality to existing systems

Assumption	***Source***
Load Impacts Before Participant *13,875 kWh, 2.77 kW (coincident with winter system peak), 3.04 kW (summer)*	Typical 3,000 square foot commercial building, HVAC loads (mix of fossil and electric heat)
After Participant *10,800 kWh, 2.15 kW (coincident with winter system peak), 2.37 kW (summer)*	Same building with savings from controls
Lifetime of savings 15 years **Generation Capacity Cost - EE = combined cycle,** 100% summer **Avoided Electricity Energy Costs** - PJM Market	15 Years (ACEEE, Peco, Xcel, state TRMs) Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 1,075. 2% escalation	based on cost of saved energy of 35 cents per 1st year kWh, and checked against state TRMs and a rule of thumb of 30 cents per square foot (2012$) from several sources (Vermont EE study, ACEEE Ohio study).
Administrative Cost EK $20,000 fixed annual, $300 per new participant Co-op $0 per new participant	Fixed: Marketing,Trade Allies, Tracking, Processing, M&V. Variable: enroll, pre-inspect, post-inspect. Program is administered by EKPC
Rate Schedule - Retail South Kentucky **B** rate . **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect. Current rates in effect as of June, 2011.
Participation - Year by year, 2015-2029: 60, 250, 476, 713, 476, 595, 298 (yrs 7-15). 10 % free riders	Based on achievable potential estimate. Free riders based on LG&E/KU
Rebates Co-op to Participant $540	Industry practice is 50% of incremental cost

2015 IRP version

Commercial New Construction Program

Promotes integrated design, commissioning, and more advanced technologies in commercial construction.

Assumption	***Source***
Load Impacts Before Participant *70,000 kWh, 9.48 kW (coincident with winter system peak), 18.09 kW (summer)*	New construction 5,000 square foot facility.
After Participant *56,000 kWh, 7.58 kW (coincident with winter system peak), 14.47 kW (summer)*	New construction 5,000 square foot facility with 20% savings, from lighting and HVAC measures primarily
Lifetime of savings 20 years **Generation Capacity Cost - EE = combined cycle,** 100% summer **Avoided Electricity Energy Costs** - PJM Market	Northeast Energy Efficiency Partnership, (NEEP), Public Service of New Mexico. Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 4,500	Based on $0.32 per annual kWh reported costs (PSNM, PECo, Missouri,Texas, NJ, NEEP) .
Administrative Cost EK $20,000 fixed annual, $ 350 per new participant Co-op $0 per new participant	Fixed annual: marketing, trade ally, tracking & processing, customer support. The per participant cost includes enrollment, inspections. EKPC administers the program.
Rate Schedule - Retail South Kentucky **B** rate . **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation -132 per year, 2015-2029. 10% free riders.	based on achievable penetration of new C&I floorspace.
Rebates Co-op to Participant $2,250	Industry practice is 50% of incremental cost

2015 IRP version

C&I Ventilation Program

Promotes measures to improve the efficiency of ventilation

Assumption	***Source***
Load Impacts Before Participant *7,113 kWh, 0.600 kW (coincident with winter system peak), 2.01 kW (summer)*	Typical ventilation electricity consumption for a 3,000 square foot commercial building.
After Participant *4,448 kWh, 0.375 kW (coincident with winter system peak), 1.26 kW (summer)*	Efficient ventilation electricity consumption for the same building
Lifetime of savings 15 years **Generation Capacity Cost - EE = combined cycle,** 100% summer **Avoided Electricity Energy Costs** - PJM Market	15 Years (Northeast Energy Efficiency Partnership, Minn. Municipal Utilities, CA PUC) Combined Cycle Baseload unit. 100% allocation to summer. based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 345. 2% escalation	based on Indiana TRM costs for demand controlled ventilation
Administrative Cost EK $40,000 fixed annual, $0 per new participant Co-op $188 per new participant	Marketing,Trade Allies, Tracking, Processing, Eval, Cust Svc. Plus advertising costs. Based on Heat Pump program - Cost information provided by various coops in survey of hours and rates.
Rate Schedule - Retail South Kentucky **B** rate . **Rate Schedule - Wholesale** East Kentucky E-2 rate.	Current rates in effect. Current rates in effect.
Participation - Year by year, 2015-2029: 200, 445, 754, 1135, 1053, 1322, 1035, 1039, 1043, 1048 (yrs 10-15). 10 % free riders	Based on achievable potential estimate. Free riders based on LG&E/KU
Rebates Co-op to Participant $175	Industry practice is 50% of incremental cost

2015 IRP version

Commercial & Industrial Water Heating

Offers commercial and industrial customers incentives for installing efficient water heating equipment and conservation.

Assumption	***Source***
Load Impacts Before Participant *14,185 kWh, 1.51 kW (coincident with winter system peak), 2.83 kW (summer)*	Water heating load for typical C&I facility
After Participant *8.155 kWh, 0.87 kW (coincident with winter system peak), 1.63 kW (summer)*	Efficient water heating load
Lifetime of savings 10 years	state TRMs
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 2,230. 2% escalation	based on cost of saved energy of 37 cents per 1st year kWh, derived from water heating measures in state TRMs.
Administrative Cost EK $10,000 fixed annual, $50 per new participant	Fixed: Marketing,Trade Allies, Tracking, Processing, M&V. Variable: enroll, verification.
Co-op $0 per new participant	Program is administered by EKPC
Rate Schedule - Retail South Kentucky **B** rate .	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2029: 30, 49, 76, 115, 137, 174, 163, 165, 167, 169 (yrs 10-15). 10 % free riders	Based on achievable potential estimate. Free riders based on state TRMs
Rebates Co-op to Participant $1,115	Industry practice is 50% of incremental cost

2015 IRP version

Commercial Lighting including advanced measures/LED exit signs

This Commercial & Industrial Advanced Lighting program offers incentives to commercial and industrial customers to install high efficiency lamps and ballasts in their facilities.

Assumption	***Source***
Load Impacts Before Participant *14,185 kWh, 1.51 kW (coincident with winter system peak), 2.83 kW (summer)*	Lighting load for typical 2,365 square foot commercial building. Equates to 1 kW connected load savings which is unit for program. EUI of 6 kWh per square foot (sources: EPRI Market Profiles, Duke Power end use metering study).
After Participant *9,933 kWh, 1.06 kW (coincident with winter system peak), 1.98 kW (summer)*	Lighting load for 2,365 square foot building with 30% savings applied. Based on achievable potential reported by several sources: EPA, utility impact evaluations. With T5, controls, LED exit signs
Lifetime of savings	**10** Years (source: DEEM database)
Generation Capacity Cost - **EE = combined cycle,** 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 1,100 per unit (through 2015; then $1480)	Midrange of reported values from several programs in NY, CA, MA, Northeast, and national. Used $0.31 per annual saved kWh (NEEP 2004, adjusted to $2009, premium for advanced). KY Tax credit of $500 applied through 2015 (based on typical facility of 3,500 square feet).
Administrative Cost EK $ 26,500 fixed annual, $30 per new participant	Based on 5 year plan admin cost pro-rated between fixed and variable, plus advertising ($15,000 in 2013).
Co-op $ 0 per new participant	EKPC manages rebates, QC and marketing
Rate Schedule - Retail South Kentucky **B** rate .	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2029= **1071, 893, 1715, 2595, 3177, 4011, 3841, 3850, 3879, 3915 (yrs 10-15). 20%** free ridership	Years 1-2 based on 5 year DSM Plan. Years 3-15 based on achievable potential. 1 unit = 1 kW connected load savings= 2,365 square feet of treated space. Free rider based on updated study done by CA PUC DEER. Free rider is a participant who would have installed the measure anyway in the absence of the program.
Rebates Co-op to Participant $213 per kW saved	Marketing rebate.

2015 IRP version

Commercial Efficient HVAC Program

Promotes high efficiency packaged HVAC equipment.

Assumption	***Source***
Load Impacts Before Participant *11,875 kWh, 1.86 kW (coincident with winter system peak), 3.47 kW (summer)*	Typical 2,500 square foot commercial building, 50% unitary AC, 50% heat pump, standard efficiency HVAC = SEER 13, HSPF 7.7
After Participant *10,482 kWh, 1.73 kW (coincident with winter system peak), 3.00 kW (summer)*	Typical 2,500 square foot commercial building, 50% unitary AC, 50% heat pump, high efficiency HVAC = SEER 15, HSPF 9.0.
Lifetime of savings 15 years	15 Years (Northeast Energy Efficiency Partnership, Minn. Municipal Utilities, CA PUC)
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 400 through 2015, then $575. 2% escalation	based on PNNL 2010 study. KY Tax 30% tax credit applied through 2015.
Administrative Cost EK $40,000 fixed annual, $0 per new participant	Marketing,Trade Allies, Tracking, Processing, Eval, Cust Svc. Plus advertising costs.
Co-op $188 per new participant	Based on Heat Pump program - Cost information provided by various coops in survey of hours and rates.
Rate Schedule - Retail South Kentucky **B** rate .	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2029: 314, 541, 847, 1284, 1469, 1858, 1710, 1725, 1741, 1761 (yrs 10-15). 10 % free riders	Based on achievable potential estimate. Free riders based on LG&E/KU
Rebates Co-op to Participant $290	Industry practice is 50% of incremental cost

2015 IRP version

Commercial Refrigeration

Offers commercial customers incentives for installing efficient refrigeration equipment and controls. Incentives are offered for new systems, replacing non-working systems, and adding functionality to existing systems

Assumption	***Source***
Load Impacts Before Participant *40,000 kWh, 3.97 kW (coincident with winter system peak), 5.93 kW (summer)*	Refrigeration load for a typical supermarket
After Participant *28,000 kWh, 2.78 kW (coincident with winter system peak), 4.15 kW (summer)*	Efficient refrigeration load for a typical supermarket
Lifetime of savings 10 years	state TRMs
Generation Capacity Cost - EE = combined cycle, 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 3,000. 2% escalation	based on cost of saved energy of 25 cents per 1st year kWh, and checked against state TRMs.
Administrative Cost EK $20,000 fixed annual, $300 per new participant	Fixed: Marketing,Trade Allies, Tracking, Processing, M&V. Variable: enroll, pre-inspect, post-inspect.
Co-op $0 per new participant	Program is administered by EKPC
Rate Schedule - Retail South Kentucky **B** rate .	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - Year by year, 2015-2029: 37, 54, 78, 119, 161, 205, 206, 208, 211, 214 (yrs 10-15). 10 % free riders	Based on achievable potential estimate. Free riders based on state TRMs
Rebates Co-op to Participant $1,500	Industry practice is 50% of incremental cost

2015 IRP version

DLC for Commercial Central AC

Reduce peak demand and energy usage through the installation of load control devices on commercial air conditioners.

Assumption	***Source***
Load Impacts Before Participant *8,750 kWh, 3.52 kW (coincident with summer system peak)*	Typical 2,500 square foot commercial building, air conditioning load.
After Participant *8,636 kWh, 1.52 kW (coincident with summer system peak)*	50% cycling of air conditioner compressor on peak days during May through September.
Lifetime of savings	20 Years.
Generation Capacity Cost - **EE = combined cycle,** 100% summer	Combined Cycle Baseload unit. 100% allocation to summer.
Avoided Electricity Energy Costs - PJM Market	based on ACES energy forward curve for AEP_Dayton.
Participant Costs $ 0	Participant does not bear any direct costs in this program.
Administrative Cost EK: $215,000 first year startup costs, $105,000 fixed annual cost, $209 per new participant (one time) and $ 4.20 per ongoing participant (each year)	Fix annual costs include M&V, admin, marketing and paging costs attributable to aCommercial CAC DLC program. Variable one time costs per participant include switch cost, transportation, installation, scheduling, and enrollment. Annual variable costs are for servicing, and reconnect/removal.
Coop: 0	EKPC pays all administrative costs for the program.
Rate Schedule - Retail South Kentucky **B** rate .	Current rates in effect.
Rate Schedule - Wholesale East Kentucky E-2 rate.	Current rates in effect.
Participation - 1,200 new per year, 5 years (2015-2019)	Goal is 20 % of the eligible market (commercial buildings with central AC) by year 5.
Rebates Co-op to Participant $ 40 per year	Consistent with existing DLC program, proportionate to kW contribution

Exhibit DSM-4

Summary Sheets
for
DSM Projects

Appliance Recycling for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 9,847,694	Revenue Declines	($14,958,982)
Rebates From EK	$8,053,860	Administrative Costs	$0
		Rebates Paid To Consumers	($2,876,378)
Total Benefits	$17,901,553	Total Costs	($17,835,360)
	Benefit / Cost Ratio: 1.00		

Participant Benefits		Participant Costs	
Electric Bill Declines	$12,878,053	Up Front Investment	$0
Rebates From Distribution System	$ 1,865,225		
Reductions in O&M costs	$0		
Total Benefits	$14,743,278	Total Costs	$0
	Benefit / Cost Ratio: Not applicable		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$8,222,621	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$3,182,233	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$418,408	EK Administrative Costs	($5,119,250)
Reduced Customer O&M costs	$0		
Total Benefits	$11,823,262	Total Costs	($5,119,250)
	Benefit / Cost Ratio: 2.31		

EK Benefits		EK Costs	
Avoided Energy Costs	$8,222,621	Decrease In Revenue	($9,847,694)
Avoided Gen Capacity Costs	$3,182,233	Rebates Paid	($8,053,860)
Avoided Transmission Expense	$418,408	Administrative Costs	($5,119,250)
Total Benefits	$11,823,262	Total Costs	($23,020,804)
	Benefit / Cost Ratio: 0.51		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$9,605,239	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$3,708,611	Utility Admin Costs	($5,711,501)
Avoided Transmission Expense	$487,500		
Environmental Externalities	$0		
Total Benefits	$13,801,350	Total Costs	($5,711,501)
	Benefit / Cost Ratio: 2.42		

Combined RIM:			
Benefits:	$11,823,262	Costs:	($22,954,611)
Benefit / Cost Ratio:	0.52		

Button Up Tiered Weatherization for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 54,221,303	Revenue Declines	($66,063,767)
Rebates From EK	$34,585,055	Administrative Costs	($10,364,324)
		Rebates Paid To Consumers	($16,788,862)
Total Benefits	$88,806,358	Total Costs	($93,216,952)
	Benefit / Cost Ratio: 0.95		

Participant Benefits		Participant Costs	
Electric Bill Declines	$34,589,001	Up Front Investment	($35,623,321)
Rebates From Distribution System	$ 11,132,288		
Reductions in O&M costs	$0		
Total Benefits	$45,721,288	Total Costs	($35,623,321)
	Benefit / Cost Ratio: 1.28		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$38,597,464	Up Front Customer Investment	($48,351,921)
Avoided Gen Capacity Costs	$23,052,262	Distribution System Admin. Costs	($10,364,324)
Avoided Transmission Expense	$6,896,008	EK Administrative Costs	($1,071,760)
Reduced Customer O&M costs	$0		
Total Benefits	$68,545,735	Total Costs	($59,788,005)
	Benefit / Cost Ratio: 1.15		

EK Benefits		EK Costs	
Avoided Energy Costs	$38,597,464	Decrease In Revenue	($54,221,303)
Avoided Gen Capacity Costs	$23,052,262	Rebates Paid	($34,585,055)
Avoided Transmission Expense	$6,896,008	Administrative Costs	($1,071,760)
Total Benefits	$68,545,735	Total Costs	($89,878,117)
	Benefit / Cost Ratio: 0.76		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$47,266,616	Up Front Customer Investment	($53,798,673)
Avoided Gen Capacity Costs	$28,107,512	Utility Admin Costs	($12,704,288)
Avoided Transmission Expense	$8,404,462		
Environmental Externalities	$0		
Total Benefits	$83,778,589	Total Costs	($66,502,961)
	Benefit / Cost Ratio: 1.26		

Combined RIM:			
Benefits:	$68,545,735	Costs:	($94,288,712)
Benefit / Cost Ratio:	0.73		

C&I Demand Response for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 16,747,784	Revenue Declines	($4,542,553)
Rebates From EK	$7,125,100	Administrative Costs	$0
		Rebates Paid To Consumers	($7,125,100)
Total Benefits	$23,872,884	Total Costs	($11,667,654)
	Benefit / Cost Ratio: 2.05		

Participant Benefits		Participant Costs	
Electric Bill Declines	$2,801,492	Up Front Investment	($3,817,311)
Rebates From Distribution System	$ 4,480,140		
Reductions in O&M costs	$0		
Total Benefits	$7,281,632	Total Costs	($3,817,311)
	Benefit / Cost Ratio: 1.91		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$3,687,926	Up Front Customer Investment	($5,434,663)
Avoided Gen Capacity Costs	$33,299,086	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$5,155,809	EK Administrative Costs	($4,154,416)
Reduced Customer O&M costs	$0		
Total Benefits	$42,142,820	Total Costs	($9,589,079)
	Benefit / Cost Ratio: 4.39		

EK Benefits		EK Costs	
Avoided Energy Costs	$3,687,926	Decrease In Revenue	($16,747,784)
Avoided Gen Capacity Costs	$33,299,086	Rebates Paid	($7,125,100)
Avoided Transmission Expense	$5,155,809	Administrative Costs	($4,154,416)
Total Benefits	$42,142,820	Total Costs	($28,027,301)
	Benefit / Cost Ratio: 1.50		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$4,229,629	Up Front Customer Investment	($5,966,538)
Avoided Gen Capacity Costs	$38,055,914	Utility Admin Costs	($4,715,758)
Avoided Transmission Expense	$5,890,069		
Environmental Externalities	$0		
Total Benefits	$48,175,613	Total Costs	($10,682,296)
	Benefit / Cost Ratio: 4.51		

Combined RIM:			
Benefits:	$42,142,820	Costs:	($15,822,070)
	Benefit / Cost Ratio: 2.66		

C&I Equipment Rebate in 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 55,955,904	Revenue Declines	($88,219,529)
Rebates From EK	$40,179,209	Administrative Costs	($4,917,272)
		Rebates Paid To Consumers	($12,921,387)
Total Benefits	$96,135,112	Total Costs	($106,058,187)
	Benefit / Cost Ratio: 0.91		

Participant Benefits		Participant Costs	
Electric Bill Declines	$48,059,962	Up Front Investment	($17,111,219)
Rebates From Distribution System	$ 8,633,751		
Reductions in O&M costs	$0		
Total Benefits	$56,693,714	Total Costs	($17,111,219)
	Benefit / Cost Ratio: 3.31		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$45,208,367	Up Front Customer Investment	($23,073,363)
Avoided Gen Capacity Costs	$30,777,386	Distribution System Admin. Costs	($4,917,272)
Avoided Transmission Expense	$3,371,884	EK Administrative Costs	($3,282,876)
Reduced Customer O&M costs	$0		
Total Benefits	$79,357,637	Total Costs	($31,273,511)
	Benefit / Cost Ratio: 2.54		

EK Benefits		EK Costs	
Avoided Energy Costs	$45,208,367	Decrease In Revenue	($55,955,904)
Avoided Gen Capacity Costs	$30,777,386	Rebates Paid	($40,179,209)
Avoided Transmission Expense	$3,371,884	Administrative Costs	($3,282,876)
Total Benefits	$79,357,637	Total Costs	($99,417,988)
	Benefit / Cost Ratio: 0.80		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$54,713,014	Up Front Customer Investment	($25,613,619)
Avoided Gen Capacity Costs	$37,202,072	Utility Admin Costs	($9,064,779)
Avoided Transmission Expense	$4,068,634		
Environmental Externalities	$0		
Total Benefits	$95,983,719	Total Costs	($34,678,399)
	Benefit / Cost Ratio: 2.77		

Combined RIM:			
Benefits:	$79,357,637	Costs:	($109,341,063)
	Benefit / Cost Ratio:	0.73	

C&I New Construction for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 17,351,204	Revenue Declines	($26,525,910)
Rebates From EK	$10,647,649	Administrative Costs	$0
		Rebates Paid To Consumers	($3,350,659)
Total Benefits	$27,998,853	Total Costs	($29,876,569)
	Benefit / Cost Ratio: 0.94		

Participant Benefits		Participant Costs	
Electric Bill Declines	$13,676,832	Up Front Investment	($4,788,899)
Rebates From Distribution System	$ 2,394,450		
Reductions in O&M costs	$0		
Total Benefits	$16,071,282	Total Costs	($4,788,899)
	Benefit / Cost Ratio: 3.36		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$13,722,450	Up Front Customer Investment	($6,031,186)
Avoided Gen Capacity Costs	$9,415,456	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$1,073,853	EK Administrative Costs	($746,847)
Reduced Customer O&M costs	$0		
Total Benefits	$24,211,759	Total Costs	($6,778,033)
	Benefit / Cost Ratio: 3.57		

EK Benefits		EK Costs	
Avoided Energy Costs	$13,722,450	Decrease In Revenue	($17,351,204)
Avoided Gen Capacity Costs	$9,415,456	Rebates Paid	($10,647,649)
Avoided Transmission Expense	$1,073,853	Administrative Costs	($746,847)
Total Benefits	$24,211,759	Total Costs	($28,745,700)
	Benefit / Cost Ratio: 0.84		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$17,025,722	Up Front Customer Investment	($6,597,766)
Avoided Gen Capacity Costs	$11,616,159	Utility Admin Costs	($817,007)
Avoided Transmission Expense	$1,323,975		
Environmental Externalities	$0		
Total Benefits	$29,965,856	Total Costs	($7,414,774)
	Benefit / Cost Ratio: 4.04		

Combined RIM:			
Benefits:	$24,211,759	Costs:	($30,623,416)
	Benefit / Cost Ratio:	0.79	

Commercial Advanced Lighting for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 62,404,572	Revenue Declines	($100,016,521)
Rebates From EK	$18,429,845	Administrative Costs	$0
		Rebates Paid To Consumers	($7,365,022)
Total Benefits	$80,834,417	Total Costs	($107,381,543)
	Benefit / Cost Ratio: 0.75		

Participant Benefits		Participant Costs	
Electric Bill Declines	$64,895,766	Up Front Investment	($33,200,833)
Rebates From Distribution System	$ 4,836,800		
Reductions in O&M costs	$0		
Total Benefits	$69,732,567	Total Costs	($33,200,833)
	Benefit / Cost Ratio: 2.10		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$50,423,978	Up Front Customer Investment	($40,614,258)
Avoided Gen Capacity Costs	$27,426,643	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$3,305,807	EK Administrative Costs	($1,336,292)
Reduced Customer O&M costs	$0		
Total Benefits	$81,156,428	Total Costs	($41,950,550)
	Benefit / Cost Ratio: 1.93		

EK Benefits		EK Costs	
Avoided Energy Costs	$50,423,978	Decrease In Revenue	($62,404,572)
Avoided Gen Capacity Costs	$27,426,643	Rebates Paid	($18,429,845)
Avoided Transmission Expense	$3,305,807	Administrative Costs	($1,336,292)
Total Benefits	$81,156,428	Total Costs	($82,170,709)
	Benefit / Cost Ratio: 0.99		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$59,905,947	Up Front Customer Investment	($45,297,754)
Avoided Gen Capacity Costs	$32,482,704	Utility Admin Costs	($1,483,047)
Avoided Transmission Expense	$3,914,029		
Environmental Externalities	$0		
Total Benefits	$96,302,680	Total Costs	($46,780,801)
	Benefit / Cost Ratio: 2.06		

Combined RIM:			
Benefits:	$81,156,428	Costs:	($108,717,835)
Benefit / Cost Ratio:	0.75		

Compressed Air for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 5,349,733	Revenue Declines	($6,851,755)
Rebates From EK	$953,370	Administrative Costs	($331,607)
		Rebates Paid To Consumers	$0
Total Benefits	$6,303,103	Total Costs	($7,183,362)
	Benefit / Cost Ratio: 0.88		

Participant Benefits		Participant Costs	
Electric Bill Declines	$5,609,488	Up Front Investment	($2,937,096)
Rebates From Distribution System	$ 36		
Reductions in O&M costs	$0		
Total Benefits	$5,609,523	Total Costs	($2,937,096)
	Benefit / Cost Ratio: 1.91		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$3,896,187	Up Front Customer Investment	($3,059,076)
Avoided Gen Capacity Costs	$2,366,991	Distribution System Admin. Costs	($331,607)
Avoided Transmission Expense	$257,615	EK Administrative Costs	($149,336)
Reduced Customer O&M costs	$0		
Total Benefits	$6,520,793	Total Costs	($3,540,018)
	Benefit / Cost Ratio: 1.84		

EK Benefits		EK Costs	
Avoided Energy Costs	$3,896,187	Decrease In Revenue	($5,349,733)
Avoided Gen Capacity Costs	$2,366,991	Rebates Paid	($953,370)
Avoided Transmission Expense	$257,615	Administrative Costs	($149,336)
Total Benefits	$6,520,793	Total Costs	($6,452,439)
	Benefit / Cost Ratio: 1.01		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$4,205,988	Up Front Customer Investment	($3,170,281)
Avoided Gen Capacity Costs	$2,555,145	Utility Admin Costs	($497,138)
Avoided Transmission Expense	$278,079		
Environmental Externalities	$0		
Total Benefits	$7,039,212	Total Costs	($3,667,418)
	Benefit / Cost Ratio: 1.92		

Combined RIM:			
Benefits:	$6,520,793	Costs:	($7,332,698)
	Benefit / Cost Ratio:	0.89	

Consumer Electronics for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 15,269,306	Revenue Declines	($23,294,249)
Rebates From EK	$23,790,593	Administrative Costs	$0
		Rebates Paid To Consumers	($15,860,395)
Total Benefits	$39,059,899	Total Costs	($39,154,644)
	Benefit / Cost Ratio: 1.00		

Participant Benefits		Participant Costs	
Electric Bill Declines	$16,968,417	Up Front Investment	($7,090,533)
Rebates From Distribution System	$ 9,951,625		
Reductions in O&M costs	$0		
Total Benefits	$26,920,042	Total Costs	($7,090,533)
	Benefit / Cost Ratio: 3.80		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$12,855,005	Up Front Customer Investment	($8,475,399)
Avoided Gen Capacity Costs	$5,395,813	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$626,136	EK Administrative Costs	($630,499)
Reduced Customer O&M costs	$0		
Total Benefits	$18,876,954	Total Costs	($9,105,898)
	Benefit / Cost Ratio: 2.07		

EK Benefits		EK Costs	
Avoided Energy Costs	$12,855,005	Decrease In Revenue	($15,269,306)
Avoided Gen Capacity Costs	$5,395,813	Rebates Paid	($23,790,593)
Avoided Transmission Expense	$626,136	Administrative Costs	($630,499)
Total Benefits	$18,876,954	Total Costs	($39,690,398)
	Benefit / Cost Ratio: 0.48		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$14,995,399	Up Front Customer Investment	($9,530,441)
Avoided Gen Capacity Costs	$6,282,092	Utility Admin Costs	($706,980)
Avoided Transmission Expense	$728,835		
Environmental Externalities	$0		
Total Benefits	$22,006,325	Total Costs	($10,237,421)
	Benefit / Cost Ratio: 2.15		

Combined RIM:			
Benefits:	$18,876,954	Costs:	($39,785,144)
Benefit / Cost Ratio:	0.47		

DLC of Commercial AC for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 864,875	Revenue Declines	($889,319)
Rebates From EK	$3,018,604	Administrative Costs	$0
		Rebates Paid To Consumers	($3,018,604)
Total Benefits	$3,883,479	Total Costs	($3,907,923)
	Benefit / Cost Ratio: 0.99		

Participant Benefits		Participant Costs	
Electric Bill Declines	$519,165	Up Front Investment	$0
Rebates From Distribution System	$ 1,768,180		
Reductions in O&M costs	$0		
Total Benefits	$2,287,345	Total Costs	$0
	Benefit / Cost Ratio: Not applicable		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$486,308	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$21,093,177	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$1,631,847	EK Administrative Costs	($3,287,627)
Reduced Customer O&M costs	$0		
Total Benefits	$23,211,331	Total Costs	($3,287,627)
	Benefit / Cost Ratio: 7.06		

EK Benefits		EK Costs	
Avoided Energy Costs	$486,308	Decrease In Revenue	($864,875)
Avoided Gen Capacity Costs	$21,093,177	Rebates Paid	($3,018,604)
Avoided Transmission Expense	$1,631,847	Administrative Costs	($3,287,627)
Total Benefits	$23,211,331	Total Costs	($7,171,106)
	Benefit / Cost Ratio: 3.24		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$565,582	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$24,435,734	Utility Admin Costs	($3,608,045)
Avoided Transmission Expense	$1,889,634		
Environmental Externalities	$0		
Total Benefits	$26,890,949	Total Costs	($3,608,045)
	Benefit / Cost Ratio: 7.45		

Combined RIM:			
Benefits:	$23,211,331	Costs:	($7,195,550)
	Benefit / Cost Ratio: 3.23		

Res DLC for AC and WH in 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 14,955,718	Revenue Declines	($1,160,316)
Rebates From EK	$7,187,731	Administrative Costs	$0
		Rebates Paid To Consumers	($7,187,731)
Total Benefits	$22,143,449	Total Costs	($8,348,047)
	Benefit / Cost Ratio: 2.65		

Participant Benefits		Participant Costs	
Electric Bill Declines	$677,367	Up Front Investment	$0
Rebates From Distribution System	$ 4,249,283		
Reductions in O&M costs	$0		
Total Benefits	$4,926,650	Total Costs	$0
	Benefit / Cost Ratio: Not applicable		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$686,663	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$47,459,647	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$4,583,449	EK Administrative Costs	($23,034,823)
Reduced Customer O&M costs	$0		
Total Benefits	$52,729,759	Total Costs	($23,034,823)
	Benefit / Cost Ratio: 2.29		

EK Benefits		EK Costs	
Avoided Energy Costs	$686,663	Decrease In Revenue	($14,955,718)
Avoided Gen Capacity Costs	$47,459,647	Rebates Paid	($7,187,731)
Avoided Transmission Expense	$4,583,449	Administrative Costs	($23,034,823)
Total Benefits	$52,729,759	Total Costs	($45,178,272)
	Benefit / Cost Ratio: 1.17		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$798,597	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$54,980,401	Utility Admin Costs	($24,822,980)
Avoided Transmission Expense	$5,307,508		
Environmental Externalities	$0		
Total Benefits	$61,086,506	Total Costs	($24,822,980)
	Benefit / Cost Ratio: 2.46		

Combined RIM:			
Benefits:	$52,729,759	Costs:	($31,382,870)
Benefit / Cost Ratio:	1.68		

Energy Star Appliances in 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 39,087,413	Revenue Declines	($52,996,725)
Rebates From EK	$32,877,988	Administrative Costs	$0
		Rebates Paid To Consumers	($19,028,599)
Total Benefits	$71,965,401	Total Costs	($72,025,324)
	Benefit / Cost Ratio: 1.00		

Participant Benefits		Participant Costs	
Electric Bill Declines	$29,113,665	Up Front Investment	($32,265,212)
Rebates From Distribution System	$ 14,315,124		
Reductions in O&M costs	$2,567,340		
Total Benefits	$45,996,129	Total Costs	($32,265,212)
	Benefit / Cost Ratio: 1.43		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$30,082,995	Up Front Customer Investment	($41,925,626)
Avoided Gen Capacity Costs	$24,897,706	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$2,987,352	EK Administrative Costs	($2,471,852)
Reduced Customer O&M costs	$2,567,340		
Total Benefits	$60,535,394	Total Costs	($44,397,478)
	Benefit / Cost Ratio: 1.36		

EK Benefits		EK Costs	
Avoided Energy Costs	$30,082,995	Decrease In Revenue	($39,087,413)
Avoided Gen Capacity Costs	$24,897,706	Rebates Paid	($32,877,988)
Avoided Transmission Expense	$2,987,352	Administrative Costs	($2,471,852)
Total Benefits	$57,968,054	Total Costs	($74,437,253)
	Benefit / Cost Ratio: 0.78		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$36,068,042	Up Front Customer Investment	($45,452,039)
Avoided Gen Capacity Costs	$29,545,445	Utility Admin Costs	($2,695,678)
Avoided Transmission Expense	$3,559,465		
Environmental Externalities	$0		
Total Benefits	$69,172,952	Total Costs	($48,147,717)
	Benefit / Cost Ratio: 1.44		

Combined RIM:			
Benefits:	$57,968,054	Costs:	($74,497,176)
	Benefit / Cost Ratio:	0.78	

Home Energy Information for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 39,869,160	Revenue Declines	($55,027,140)
Rebates From EK	$27,102,115	Administrative Costs	($16,569,036)
		Rebates Paid To Consumers	$0
Total Benefits	$66,971,275	Total Costs	($71,596,177)
	Benefit / Cost Ratio: 0.94		

Participant Benefits		Participant Costs	
Electric Bill Declines	$32,441,838	Up Front Investment	($10,713,215)
Rebates From Distribution System	$ 1,948		
Reductions in O&M costs	$0		
Total Benefits	$32,443,786	Total Costs	($10,713,215)
	Benefit / Cost Ratio: 3.03		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$30,288,058	Up Front Customer Investment	($17,133,521)
Avoided Gen Capacity Costs	$17,458,336	Distribution System Admin. Costs	($16,569,036)
Avoided Transmission Expense	$2,921,301	EK Administrative Costs	($2,244,207)
Reduced Customer O&M costs	$0		
Total Benefits	$50,667,694	Total Costs	($35,946,764)
	Benefit / Cost Ratio: 1.41		

EK Benefits		EK Costs	
Avoided Energy Costs	$30,288,058	Decrease In Revenue	($39,869,160)
Avoided Gen Capacity Costs	$17,458,336	Rebates Paid	($27,102,115)
Avoided Transmission Expense	$2,921,301	Administrative Costs	($2,244,207)
Total Benefits	$50,667,694	Total Costs	($69,215,482)
	Benefit / Cost Ratio: 0.73		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$34,618,874	Up Front Customer Investment	($19,280,990)
Avoided Gen Capacity Costs	$19,933,408	Utility Admin Costs	($21,413,541)
Avoided Transmission Expense	$3,334,897		
Environmental Externalities	$0		
Total Benefits	$57,887,179	Total Costs	($40,694,531)
	Benefit / Cost Ratio: 1.42		

Combined RIM:			
Benefits:	$50,667,694	Costs:	($73,840,383)
	Benefit / Cost Ratio:	0.69	

Heat Pump Retrofit for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 90,433,543	Revenue Declines	($132,693,838)
Rebates From EK	$26,083,727	Administrative Costs	($2,373,686)
		Rebates Paid To Consumers	($10,057,992)
Total Benefits	$116,517,270	Total Costs	($145,125,517)
	Benefit / Cost Ratio: 0.80		

Participant Benefits		Participant Costs	
Electric Bill Declines	$56,274,231	Up Front Investment	($40,300,984)
Rebates From Distribution System	$ 6,570,813		
Reductions in O&M costs	$0		
Total Benefits	$62,845,043	Total Costs	($40,300,984)
	Benefit / Cost Ratio: 1.56		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$78,285,065	Up Front Customer Investment	($61,689,020)
Avoided Gen Capacity Costs	$8,368,898	Distribution System Admin. Costs	($2,373,686)
Avoided Transmission Expense	$0	EK Administrative Costs	($564,084)
Reduced Customer O&M costs	$0		
Total Benefits	$86,653,963	Total Costs	($64,626,790)
	Benefit / Cost Ratio: 1.34		

EK Benefits		EK Costs	
Avoided Energy Costs	$78,285,065	Decrease In Revenue	($90,433,543)
Avoided Gen Capacity Costs	$8,368,898	Rebates Paid	($26,083,727)
Avoided Transmission Expense	$0	Administrative Costs	($564,084)
Total Benefits	$86,653,963	Total Costs	($117,081,354)
	Benefit / Cost Ratio: 0.74		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$99,135,918	Up Front Customer Investment	($68,907,752)
Avoided Gen Capacity Costs	$10,540,782	Utility Admin Costs	($3,268,526)
Avoided Transmission Expense	$0		
Environmental Externalities	$0		
Total Benefits	$109,676,700	Total Costs	($72,176,278)
	Benefit / Cost Ratio: 1.52		

Combined RIM:			
Benefits:	$86,653,963	Costs:	($145,689,601)
	Benefit / Cost Ratio:	0.59	

Industrial Machine Drive for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 60,975,794	Revenue Declines	($78,836,025)
Rebates From EK	$22,622,105	Administrative Costs	$0
		Rebates Paid To Consumers	($5,090,483)
Total Benefits	$83,597,899	Total Costs	($83,926,508)
	Benefit / Cost Ratio: 1.00		

Participant Benefits		Participant Costs	
Electric Bill Declines	$38,584,819	Up Front Investment	($14,834,348)
Rebates From Distribution System	$ 3,156,244		
Reductions in O&M costs	$0		
Total Benefits	$41,741,063	Total Costs	($14,834,348)
	Benefit / Cost Ratio: 2.81		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$50,255,562	Up Front Customer Investment	($21,532,741)
Avoided Gen Capacity Costs	$15,572,393	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$2,063,674	EK Administrative Costs	($1,300,139)
Reduced Customer O&M costs	$0		
Total Benefits	$67,891,628	Total Costs	($22,832,880)
	Benefit / Cost Ratio: 2.97		

EK Benefits		EK Costs	
Avoided Energy Costs	$50,255,562	Decrease In Revenue	($60,975,794)
Avoided Gen Capacity Costs	$15,572,393	Rebates Paid	($22,622,105)
Avoided Transmission Expense	$2,063,674	Administrative Costs	($1,300,139)
Total Benefits	$67,891,628	Total Costs	($84,898,038)
	Benefit / Cost Ratio: 0.80		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$62,364,258	Up Front Customer Investment	($24,291,460)
Avoided Gen Capacity Costs	$19,246,749	Utility Admin Costs	($1,457,070)
Avoided Transmission Expense	$2,549,569		
Environmental Externalities	$0		
Total Benefits	$84,160,576	Total Costs	($25,748,530)
	Benefit / Cost Ratio: 3.27		

Combined RIM:			
Benefits:	$67,891,628	Costs:	($85,226,646)
	Benefit / Cost Ratio:	0.80	

Industrial Process for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 11,622,267	Revenue Declines	($14,885,118)
Rebates From EK	$5,233,228	Administrative Costs	$0
		Rebates Paid To Consumers	($1,482,748)
Total Benefits	$16,855,495	Total Costs	($16,367,866)
	Benefit / Cost Ratio: 1.03		

Participant Benefits		Participant Costs	
Electric Bill Declines	$9,039,863	Up Front Investment	($6,436,902)
Rebates From Distribution System	$ 968,383		
Reductions in O&M costs	$0		
Total Benefits	$10,008,246	Total Costs	($6,436,902)
	Benefit / Cost Ratio: 1.55		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$8,903,288	Up Front Customer Investment	($8,377,526)
Avoided Gen Capacity Costs	$5,191,948	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$561,579	EK Administrative Costs	($1,843,762)
Reduced Customer O&M costs	$0		
Total Benefits	$14,656,815	Total Costs	($10,221,288)
	Benefit / Cost Ratio: 1.43		

EK Benefits		EK Costs	
Avoided Energy Costs	$8,903,288	Decrease In Revenue	($11,622,267)
Avoided Gen Capacity Costs	$5,191,948	Rebates Paid	($5,233,228)
Avoided Transmission Expense	$561,579	Administrative Costs	($1,843,762)
Total Benefits	$14,656,815	Total Costs	($18,699,257)
	Benefit / Cost Ratio: 0.78		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$10,589,435	Up Front Customer Investment	($9,346,702)
Avoided Gen Capacity Costs	$6,156,085	Utility Admin Costs	($2,049,212)
Avoided Transmission Expense	$665,660		
Environmental Externalities	$0		
Total Benefits	$17,411,181	Total Costs	($11,395,914)
	Benefit / Cost Ratio: 1.53		

Combined RIM:			
Benefits:	$14,656,815	Costs:	($18,211,627)
	Benefit / Cost Ratio: 0.80		

Low Income Weatherization with CAAs for 2015 IRP. includes Kentucky Housing share of measure costs as a participant cost. Look at TRC only here.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 5,420,489	Revenue Declines	($7,332,859)
Rebates From EK	$3,453,712	Administrative Costs	($2,577,506)
		Rebates Paid To Consumers	$0
Total Benefits	$8,874,200	Total Costs	($9,910,365)
	Benefit / Cost Ratio: 0.90		

Participant Benefits		Participant Costs	
Electric Bill Declines	$4,646,345	Up Front Investment	($2,030,429)
Rebates From Distribution System	$ 13		
Reductions in Gas bill	$496,410		
Total Benefits	$5,142,767	Total Costs	($2,030,429)
	Benefit / Cost Ratio: 2.53		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$4,043,974	Up Front Customer Investment	($2,288,358)
Avoided Gen Capacity Costs	$1,643,816	Distribution System Admin. Costs	($2,577,506)
Avoided Transmission Expense	$388,550	EK Administrative Costs	($91,899)
Reduced Nat Gas Costs	$586,516		
Total Benefits	$6,662,855	Total Costs	($4,957,762)
	Benefit / Cost Ratio: 1.34		

EK Benefits		EK Costs	
Avoided Energy Costs	$4,043,974	Decrease In Revenue	($5,420,489)
Avoided Gen Capacity Costs	$1,643,816	Rebates Paid	($3,453,712)
Avoided Transmission Expense	$388,550	Administrative Costs	($91,899)
Total Benefits	$6,076,339	Total Costs	($8,966,099)
	Benefit / Cost Ratio: 0.68		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$4,569,923	Up Front Customer Investment	($2,357,152)
Avoided Gen Capacity Costs	$1,854,306	Utility Admin Costs	($2,749,439)
Avoided Transmission Expense	$438,200		
Environmental Externalities	$0		
Reduced Gas Costs	$ 663,551		
Total Benefits	$7,525,979	Total Costs	($5,106,591)
	Benefit / Cost Ratio: 1.47		

Combined RIM:			
Benefits:	$6,076,339	Costs:	($10,002,264)
	Benefit / Cost Ratio:	0.61	

Energy Star Manufactured Home for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 15,312,507	Revenue Declines	($23,312,971)
Rebates From EK	$4,503,046	Administrative Costs	$0
		Rebates Paid To Consumers	($18)
Total Benefits	$19,815,553	Total Costs	($23,312,989)
	Benefit / Cost Ratio: 0.85		

Participant Benefits		Participant Costs	
Electric Bill Declines	$14,918,961	Up Front Investment	$0
Rebates From Distribution System	$ 16		
Reductions in O&M costs	$0		
Total Benefits	$14,918,978	Total Costs	$0
	Benefit / Cost Ratio: Not applicable		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$12,904,271	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$1,467,017	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$757,644	EK Administrative Costs	($3,543,907)
Reduced Customer O&M costs	$0		
Total Benefits	$15,128,932	Total Costs	($3,543,907)
	Benefit / Cost Ratio: 4.27		

EK Benefits		EK Costs	
Avoided Energy Costs	$12,904,271	Decrease In Revenue	($15,312,507)
Avoided Gen Capacity Costs	$1,467,017	Rebates Paid	($4,503,046)
Avoided Transmission Expense	$757,644	Administrative Costs	($3,543,907)
Total Benefits	$15,128,932	Total Costs	($23,359,460)
	Benefit / Cost Ratio: 0.65		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$14,548,488	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$1,651,104	Utility Admin Costs	($3,641,996)
Avoided Transmission Expense	$852,520		
Environmental Externalities	$0		
Total Benefits	$17,052,112	Total Costs	($3,641,996)
	Benefit / Cost Ratio: 4.68		

Combined RIM:			
Benefits:	$15,128,932	Costs:	($26,856,896)
Benefit / Cost Ratio:	0.56		

Residential Efficient Lighting for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 18,550,157	Revenue Declines	($27,902,508)
Rebates From EK	$5,149,930	Administrative Costs	$0
		Rebates Paid To Consumers	($5,149,930)
Total Benefits	$23,700,087	Total Costs	($33,052,438)

Benefit / Cost Ratio: 0.72

Participant Benefits		Participant Costs	
Electric Bill Declines	$18,439,752	Up Front Investment	($6,570,564)
Rebates From Distribution System	$ 3,285,282		
Reductions in O&M costs	$0		
Total Benefits	$21,725,034	Total Costs	($6,570,564)

Benefit / Cost Ratio: 3.31

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$15,531,594	Up Front Customer Investment	($8,239,887)
Avoided Gen Capacity Costs	$4,556,092	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$835,637	EK Administrative Costs	($1,565,037)
Reduced Customer O&M costs	$0		
Total Benefits	$20,923,323	Total Costs	($9,804,925)

Benefit / Cost Ratio: 2.13

EK Benefits		EK Costs	
Avoided Energy Costs	$15,531,594	Decrease In Revenue	($18,550,157)
Avoided Gen Capacity Costs	$4,556,092	Rebates Paid	($5,149,930)
Avoided Transmission Expense	$835,637	Administrative Costs	($1,565,037)
Total Benefits	$20,923,323	Total Costs	($25,265,124)

Benefit / Cost Ratio: 0.83

Societal Benefits		Societal Costs	
Avoided Energy Costs	$18,311,498	Up Front Customer Investment	($9,237,018)
Avoided Gen Capacity Costs	$5,358,261	Utility Admin Costs	($1,765,307)
Avoided Transmission Expense	$982,531		
Environmental Externalities	$0		
Total Benefits	$24,652,290	Total Costs	($11,002,325)

Benefit / Cost Ratio: 2.24

Combined RIM:			
Benefits:	$20,923,323	Costs:	($34,617,475)

Benefit / Cost Ratio: 0.60

Residential Exterior Lighting for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 10,040,159	Revenue Declines	($15,853,885)
Rebates From EK	$6,097,026	Administrative Costs	$0
		Rebates Paid To Consumers	($1,524,256)
Total Benefits	$16,137,185	Total Costs	($17,378,141)
	Benefit / Cost Ratio: 0.93		

Participant Benefits		Participant Costs	
Electric Bill Declines	$7,919,066	Up Front Investment	($1,950,914)
Rebates From Distribution System	$ 1,114,808		
Reductions in O&M costs	$0		
Total Benefits	$9,033,874	Total Costs	($1,950,914)
	Benefit / Cost Ratio: 4.63		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$9,048,158	Up Front Customer Investment	($2,534,076)
Avoided Gen Capacity Costs	$0	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$432,651	EK Administrative Costs	($560,978)
Reduced Customer O&M costs	$0		
Total Benefits	$9,480,809	Total Costs	($3,095,054)
	Benefit / Cost Ratio: 3.06		

EK Benefits		EK Costs	
Avoided Energy Costs	$9,048,158	Decrease In Revenue	($10,040,159)
Avoided Gen Capacity Costs	$0	Rebates Paid	($6,097,026)
Avoided Transmission Expense	$432,651	Administrative Costs	($560,978)
Total Benefits	$9,480,809	Total Costs	($16,698,163)
	Benefit / Cost Ratio: 0.57		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$11,072,842	Up Front Customer Investment	($2,737,798)
Avoided Gen Capacity Costs	$0	Utility Admin Costs	($618,113)
Avoided Transmission Expense	$526,660		
Environmental Externalities	$0		
Total Benefits	$11,599,502	Total Costs	($3,355,912)
	Benefit / Cost Ratio: 3.46		

Combined RIM:			
Benefits:	$9,480,809	Costs:	($17,939,119)
	Benefit / Cost Ratio:	0.53	

Smart Thermostat for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 40,537,558	Revenue Declines	($49,425,273)
Rebates From EK	$18,653,343	Administrative Costs	$0
		Rebates Paid To Consumers	($10,739,803)
Total Benefits	$59,190,900	Total Costs	($60,165,076)
		Benefit / Cost Ratio:	0.98

Participant Benefits		Participant Costs	
Electric Bill Declines	$21,953,438	Up Front Investment	($8,802,014)
Rebates From Distribution System	$ 6,716,396		
Reductions in O&M costs	$0		
Total Benefits	$28,669,834	Total Costs	($8,802,014)
		Benefit / Cost Ratio:	3.26

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$29,247,303	Up Front Customer Investment	($14,074,795)
Avoided Gen Capacity Costs	$17,207,778	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$5,100,569	EK Administrative Costs	($748,848)
Reduced Customer O&M costs	$0		
Total Benefits	$51,555,650	Total Costs	($14,823,643)
		Benefit / Cost Ratio:	3.48

EK Benefits		EK Costs	
Avoided Energy Costs	$29,247,303	Decrease In Revenue	($40,537,558)
Avoided Gen Capacity Costs	$17,207,778	Rebates Paid	($18,653,343)
Avoided Transmission Expense	$5,100,569	Administrative Costs	($748,848)
Total Benefits	$51,555,650	Total Costs	($59,939,748)
		Benefit / Cost Ratio:	0.86

Societal Benefits		Societal Costs	
Avoided Energy Costs	$36,201,987	Up Front Customer Investment	($15,838,265)
Avoided Gen Capacity Costs	$21,214,383	Utility Admin Costs	($841,849)
Avoided Transmission Expense	$6,285,617		
Environmental Externalities	$0		
Total Benefits	$63,701,987	Total Costs	($16,680,114)
		Benefit / Cost Ratio:	3.82

Combined RIM:			
Benefits:	$51,555,650	Costs:	($60,913,924)
		Benefit / Cost Ratio:	0.85

TSE Home program for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 6,783,587	Revenue Declines	($7,845,148)
Rebates From EK	$3,446,993	Administrative Costs	($1,058,719)
		Rebates Paid To Consumers	($1,846,603)
Total Benefits	$10,230,580	Total Costs	($10,750,471)
	Benefit / Cost Ratio: 0.95		

Participant Benefits		Participant Costs	
Electric Bill Declines	$4,069,745	Up Front Investment	($3,642,119)
Rebates From Distribution System	$ 1,400,815		
Reductions in O&M costs	$0		
Total Benefits	$5,470,560	Total Costs	($3,642,119)
	Benefit / Cost Ratio: 1.50		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$4,583,046	Up Front Customer Investment	($4,561,110)
Avoided Gen Capacity Costs	$2,985,133	Distribution System Admin. Costs	($1,058,719)
Avoided Transmission Expense	$1,003,714	EK Administrative Costs	($676,901)
Reduced Customer O&M costs	$0		
Total Benefits	$8,571,894	Total Costs	($6,296,730)
	Benefit / Cost Ratio: 1.36		

EK Benefits		EK Costs	
Avoided Energy Costs	$4,583,046	Decrease In Revenue	($6,783,587)
Avoided Gen Capacity Costs	$2,985,133	Rebates Paid	($3,446,993)
Avoided Transmission Expense	$1,003,714	Administrative Costs	($676,901)
Total Benefits	$8,571,894	Total Costs	($10,907,481)
	Benefit / Cost Ratio: 0.79		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$5,599,085	Up Front Customer Investment	($4,913,562)
Avoided Gen Capacity Costs	$3,626,781	Utility Admin Costs	($1,881,020)
Avoided Transmission Expense	$1,218,676		
Environmental Externalities	$0		
Total Benefits	$10,444,542	Total Costs	($6,794,582)
	Benefit / Cost Ratio: 1.54		

Combined RIM:			
Benefits:	$8,571,894	Costs:	($11,427,371)
	Benefit / Cost Ratio: 0.75		

Tune-Up with Duct Sealing for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 5,269,748	Revenue Declines	($6,230,370)
Rebates From EK	$4,381,128	Administrative Costs	($826,628)
		Rebates Paid To Consumers	($2,314,558)
Total Benefits	$9,650,877	Total Costs	($9,371,556)
	Benefit / Cost Ratio: 1.03		

Participant Benefits		Participant Costs	
Electric Bill Declines	$4,151,338	Up Front Investment	($1,922,364)
Rebates From Distribution System	$ 1,631,096		
Reductions in O&M costs	$0		
Total Benefits	$5,782,434	Total Costs	($1,922,364)
	Benefit / Cost Ratio: 3.01		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$3,563,468	Up Front Customer Investment	($2,182,298)
Avoided Gen Capacity Costs	$2,634,859	Distribution System Admin. Costs	($826,628)
Avoided Transmission Expense	$722,914	EK Administrative Costs	($67,690)
Reduced Customer O&M costs	$0		
Total Benefits	$6,921,241	Total Costs	($3,076,616)
	Benefit / Cost Ratio: 2.25		

EK Benefits		EK Costs	
Avoided Energy Costs	$3,563,468	Decrease In Revenue	($5,269,748)
Avoided Gen Capacity Costs	$2,634,859	Rebates Paid	($4,381,128)
Avoided Transmission Expense	$722,914	Administrative Costs	($67,690)
Total Benefits	$6,921,241	Total Costs	($9,718,567)
	Benefit / Cost Ratio: 0.71		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$4,223,448	Up Front Customer Investment	($2,394,365)
Avoided Gen Capacity Costs	$3,111,476	Utility Admin Costs	($981,005)
Avoided Transmission Expense	$853,355		
Environmental Externalities	$0		
Total Benefits	$8,188,279	Total Costs	($3,375,370)
	Benefit / Cost Ratio: 2.43		

Combined RIM:			
Benefits:	$6,921,241	Costs:	($9,439,246)
	Benefit / Cost Ratio:	0.73	

Water Heater Conservation for 2015 IRP.

Distribution System Benefits		Distribution System Costs	
Power Bill Declines	$ 11,178,176	Revenue Declines	($16,291,794)
Rebates From EK	$2,887,377	Administrative Costs	$0
		Rebates Paid To Consumers	($348)
Total Benefits	$14,065,554	Total Costs	($16,292,142)
	Benefit / Cost Ratio: 0.86		

Participant Benefits		Participant Costs	
Electric Bill Declines	$7,911,465	Up Front Investment	$0
Rebates From Distribution System	$ 219		
Reductions in O&M costs	$0		
Total Benefits	$7,911,684	Total Costs	$0
	Benefit / Cost Ratio: Not applicable		

Total Resource Benefits		Total Resource Costs	
Avoided Energy Costs	$9,245,775	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$1,757,752	Distribution System Admin. Costs	$0
Avoided Transmission Expense	$176,392	EK Administrative Costs	($2,249,589)
Reduced Customer O&M costs	$0		
Total Benefits	$11,179,919	Total Costs	($2,249,589)
	Benefit / Cost Ratio: 4.97		

EK Benefits		EK Costs	
Avoided Energy Costs	$9,245,775	Decrease In Revenue	($11,178,176)
Avoided Gen Capacity Costs	$1,757,752	Rebates Paid	($2,887,377)
Avoided Transmission Expense	$176,392	Administrative Costs	($2,249,589)
Total Benefits	$11,179,919	Total Costs	($16,315,142)
	Benefit / Cost Ratio: 0.69		

Societal Benefits		Societal Costs	
Avoided Energy Costs	$11,147,360	Up Front Customer Investment	$0
Avoided Gen Capacity Costs	$2,112,529	Utility Admin Costs	($2,527,544)
Avoided Transmission Expense	$211,931		
Environmental Externalities	$0		
Total Benefits	$13,471,820	Total Costs	($2,527,544)
	Benefit / Cost Ratio: 5.33		

Combined RIM:			
Benefits:	$11,179,919	Costs:	($18,541,731)
Benefit / Cost Ratio:	0.60		

Exhibit DSM-5

Program Descriptions for Existing DSM Programs

Program Descriptions for Existing DSM Programs

Introduction

For over 25 years, EKPC and its 16 member cooperatives have promoted the cost-effective use of energy by offering energy efficiency and demand response to the retail customers. These programs have been designed to meet the needs of the customer, 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 member distribution systems. EKPC supports the member systems 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 member systems.

Current DSM programs offered by EKPC's member systems which are being treated as Existing programs in this IRP are listed below and described in this exhibit:

- Button-up Tiered Weatherization Program (Residential)
- Air-Source Heat Pump Retrofit Program (Residential)
- Direct Load Control of Air Conditioners and Water Heaters (Residential)
- Residential Lighting (Residential)
- Touchstone Energy Program (Residential)
- ENERGY STAR® Manufactured Home Program (Residential)
- Tune-Up HVAC with Duct Sealing Program (Residential)
- Low Income with Community Action Program (Residential)
- ENERGY STAR® Appliances Program (Residential)
- Appliance Recycling Program Residential)
- Commercial Lighting Program (Commercial)
- Compressed Air Program (Industrial)
- Large Interruptible (Industrial)
- Other Interruptible (Industrial)

Button-Up Tiered Weatherization Program

Program Description

The Button-Up Weatherization Program offers an incentive for reducing the heat loss of a home. The retail member may qualify for this incentive by improving insulation, installing higher efficiency windows and doors, or by reducing the air leakage of their home.

This program has four tiers representing increasing levels of investment and savings:

- Button Up Level I
- Button Up Level I with Air Sealing
- Whole House Button Up Level II
- Whole House Button Up Level III

Button Up Level I provides incentives for customers to improve their insulation levels or install higher efficiency doors

Button Up Level I with Air Sealing reduces energy use through air sealing measures. To receive this additional incentive, a blower door test must be performed.

Whole House Button Up Level II promotes a comprehensive approach to energy efficiency in the home and pays an additional incentive for greater heat loss savings in the home. Both a blower door test and a duct leakage test are required. The home must meet the minimum requirements of the Button Up Thermal Bypass checklist.

Whole House Button Up Level III is the most comprehensive level that targets the highest reduction in heat loss in the home. Both a blower door test and a duct leakage test are required. The home must meet the minimum requirements of the Button Up Thermal Bypass checklist.

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.

Air Source Heat Pump Retrofit Program

Program Description

The Heat Pump Retrofit Program provides incentives for residential customers to replace their existing resistance heat source with a high efficiency heat pump. Incentives

Homeowners replacing their existing resistance heat source with a heat pump will qualify for the following incentive based on the AHRI Rating:

AHRI RATING	RECOMMENDED REBATE TO MEMBER
13 SEER 7.5 HSPF	$500
14 SEER 8.0 HSPF	$750
≥15 SEER ≥8.5 HSPF	$1,000

When Federal efficiency standards increase the required SEER and HSPF for heat pumps, these targets will be adjusted upward accordingly.

Target Markets

- Incentive only applies when homeowner's primary source of heat is an electric resistance heat furnace, ceiling cable heat, or baseboard heat.
- Existing heat source must be at least 2 years old.
- New manufactured homes are eligible for the incentive.
- Multi-family dwellings are eligible for this incentive.

Direct Load Control of Residential Air Conditioners and Water Heaters Program

Program Description

The objective of the program is to reduce peak demand and energy usage through the installation of load control devices on residential air conditioners and electric water heaters. The priority appliance is the central air conditioner, and homes with central air conditioning will be targeted by marketing efforts.

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 customers receive an annual bill credit incentive.

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. The air conditioner incentive consists of $5 per month bill credits during four hot weather months.

Target Markets

The primary program targets are homes with central air conditioning (including heat pumps). The incentive is available to any residential retail member of a participating EKPC cooperative who has a qualifying central air conditioner. Qualifying water heaters must have a minimum capacity of 40 gallons in order to ensure that the interruption does not affect customer comfort.

Residential Efficient Lighting with Retailers Program

Program Description

The purpose of this program is to transform the market for residential lighting by facilitating a shift in consumer purchasing decisions from market baseline efficiency to higher efficiency lighting products. The program is designed to enter into a partnership with the retail establishments that provide residential lighting products in our service territory. EKPC will sponsor aggressive marketing and promotion activities designed to educate the customer, and will establish and nurture partnerships with key retailers including the development of point of sale marketing materials. It is expected that retailers will develop their own marketing materials as well as sponsor local advertising initiatives. EKPC will underwrite certain discounts and incentives for compact fluorescent and LED light bulbs that are sold to residential members of EKPC distribution cooperatives according to agreements and procedures established between EKPC and the retailers.

Target Markets

The program is targeted to all residential members.

Touchstone Energy Home

Program Description

This program is EKPC's residential new construction program for single family and multi-family homes. 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.

The standard built new home in rural Kentucky typically receives a 100 on the HERS Index. A HERS Index Score of 100 means the home is built to the level of the 2004 International Energy Code. In an effort to improve building practices, East KY Power Cooperative has designed the Touchstone Energy Home Program. This program provides guidance during the building process to guarantee a home that is $\geq$15-20% more efficient than the Kentucky standard built.

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 Member System and must meet the program guidelines following one of the three 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.

Prescriptive Path:

- Home must meet each prescriptive value on EKPC's Touchstone Energy Home Specifications.

Performance Path Level #1:

- Home must receive a HERS Index score between 80-85
- Home must pass 2009 International Energy Conservation Code performance path.

Performance Path Level #2:

- Home must receive a HERS Index score of ≤ 79
- 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 cooperatives. The primary market consists of retail members who are constructing new stick-built homes.

ENERGY STAR® Manufactured Home

Program Description

The ENERGY STAR® Manufactured Home program is designed to expand the market for ENERGY STAR® homes in the EKPC service area by providing manufactured home producers with an incentive to promote and facilitate the production and installation of new ENERGY STAR® certified manufactured homes. The goal is to ensure that end-use cooperative members purchase an energy-efficient manufactured home.

This program is modeled after a successful program offered by the Tennessee Valley Authority. The program works with the home manufacturers and their manufacturing facilities, using a process developed by the Systems Building Research Alliance ("SBRA"), the non-profit research and development organization for the manufactured home industry. This process has been approved by the United States Environmental Protection Agency ("EPA"). It ensures that EPA's ENERGY STAR® standards are met by each manufactured home constructed, and that appropriate verification is performed.

EKPC has an agreement in place with SBRA to administer the ENERGY STAR® Manufactured Home program for EKPC and its participating owner-members.

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 in performance that is significantly more energy efficient than comparable factory-built homes produced in accordance with the United States Department of Housing and Urban Development ("HUD") code.

An ENERGY STAR® certified manufactured home is equipped with the following features:

- Thermal envelope improvements
  - Increased envelope insulation
  - Improved duct insulation
  - Tighter duct construction
  - Higher efficiency windows
  - Tighter envelope construction
- High efficiency equipment and control strategies
  - High efficiency heat pumps in place of standard electric resistance furnaces and air conditioning equipment
  - High efficiency domestic water heater
  - Programmable thermostat

To be eligible for an incentive under this program, new manufactured homes must meet the following criteria:

- ENERGY STAR® certified according to the United States Environmental Protection Agency ("EPA") and Systems Building Research Alliance ("SBRA") guidelines
- Primary source of heat must be a heat pump 13 SEER and 7.5 HSPF or higher as required by SBRA
- Home must be all electric
- Home must be installed by the manufacturer on lines service by one of EKPC's 16 owner-member cooperatives

Target Markets

This program is available to all EKPC's owner-member cooperatives on whose system an ENERGY STAR® certified manufactured home is installed.

Tune-Up HVAC with Duct Sealing Program

Program Description

This program offers the follow measures:

- Cleaning indoor and outdoor heat exchanger coils
- Changing filters
- Measuring the temperature differential across the indoor coil to determine proper compressor operation
- Inspecting and adding refrigerant
- Checking the thermostat to verify operation and proper staging
- Sealing the ductwork, either through traditional mastic sealers or with the *Aeroseal* duct sealing program.

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% of the fan's rated capacity. All joints in the duct system must be sealed with foil tape and mastic. Only contractors trained or approved by EKPC may be used.

Recently, this program has emphasized the duct sealing service. Homeowners can select their own contractor or do the work themselves, with verification by the blower door test.

Going forward, EKPC expects to implement the Tune-Up HVAC with Duct Sealing as two distinct components: a duct sealing incentive, and a tune-up service rebate. EKPC will provide incentives to HVAC contractors to perform the tune-up services (cleaning coils, changing filters, inspecting refrigerant, checking the thermostat).

Target Markets

The program is targeted to single-family homes using electric furnaces or electric heat pumps that have exhibited high energy use. All facilities must have duct systems that are at least two years old to qualify for incentive payments. The program is offered to homes that have centrally ducted heating systems in unconditioned areas.

Low Income with Community Action Program

Program Description

East Kentucky Power Cooperative's 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 ("CAA") network of not for profit community action agencies. 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.

Target Market

The homeowner must be a residential retail member of one of EKPC's 16 member cooperatives.

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.

ENERGY STAR® Appliances Program

Program Description

The ENERGY STAR® Appliances program offers incentives to retail cooperative members to purchase and install ENERGY STAR® certified appliances.

Rebates are offered for the following ENERGY STAR® appliances:

1. Refrigerator
2. Freezer
3. Dishwasher
4. Clothes Washer
5. Heat Pump Water Heater
6. Air Source Heat Pump
7. Central Air Conditioner

The product must be certified as an ENERGY STAR® appliance. A rebate application must be completed and original receipt or copy must be provided for verification. Rebate levels have been set to maintain consistency with neighboring utilities that also offer incentives for the same appliances.

EKPC has established an end-use member web application portal to facilitate enrollment and tracking.

The rebate application can be downloaded from the member-owner's website, filled out through an online portal, or in person at their owner-member's office.

EKPC is contracting with a third party contractor to provide the facilities, resources and personnel to administer the appliance verification, incentive processing, payment distribution, and program reporting.

Target Markets

This program is available to all residential customers in all service territories of the owner-member cooperatives. This program is targeted to new single or multi-family homes, existing single or multi-family homes, and manufactured homes.

A landowner who rents to a tenant who is an end-use member of an EKPC owner-member shall also be eligible to participate in the ENERGY STAR® Appliances program.

Appliance Recycling Program

Program Description

EKPC's Appliance Recycling Program ("ARP" is designed to reduce energy consumption at the participating residences by offering an incentive for the removal and recycling of old energy-inefficient refrigerators and freezers. The program promotes the retirement and recycling of inefficient appliances from residential homes by offering a turn-in incentive for working equipment.

Qualifying residential end-use cooperative members are eligible to have their old, inefficient refrigerator or freezer removed at no cost and will be reward with a $50 incentive per qualifying appliance from their owner-member cooperative. EKPC will reimburse the owner-member cooperative for the incentive and for lost revenues.

Refrigerators and freezers removed form homes in this program will be properly recycled in an environmentally responsible manner.

EKPC is contracting with a qualified company to oversee and implement this program.

Target Markets

This program is targeted to existing single-family, multi-family, and manufactured homes that currently have old, energy-inefficient refrigerators or freezers. The end-use member must own the appliance being turned in for recycling. The appliance must be plugged in, operational, working, and cooling when the collection team arrives. Landowners who own a qualifying appliance that is used by a tenant who is an end-use member of an EKPC owner-member shall also be eligible to participate in the ARP program.

Commercial & Industrial Advanced Lighting including LED Program

Program Description

This program offers incentives to commercial and industrial customers to install high efficiency lamps and ballasts in their facilities. LED exit signs, T-5 fluorescent fixtures, and advanced controls are examples of eligible technologies.

Target Market

The incentive is available to any existing commercial or industrial facility in the service territory of a participating EKPC cooperative. The facility and its lighting system must have been in service for at least two years.

Industrial Compressed Air Program

Program Description

Compressed air is an essential element in a wide variety of operations found in manufacturing. 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 designed to reduce electricity consumption through a comprehensive approach to efficient production and delivery of compressed air in industrial facilities. The program includes (1) training of plant staff; (2) a detailed system assessment of the plant's compressed air system including written findings and recommendations, and (3) incentives for capital-intensive improvements.

EKPC shall conduct an ultrasonic compressed air leakage audit and provide the results of this audit to the customer. The report will have an estimate of the amount of excess load in kW that the leaks are causing. The report will include a list of leaks detected. Upon completion of repairs to the system, EKPC will conduct a follow-up audit and measure the difference in the kW leakage load. Rebates will be paid based on the difference in the kW leakage load.

Target Market

The program is designed to serve any existing commercial or industrial facility that uses electricity compressed air applications.

Large Interruptible

Program Description

The objective of this program is to reduce peak through implementing a special interruptible contract with EKPC's largest retail customer.

EKPC and one of its member cooperative have entered into a long term agreement that provides certain demand credits to the large retail customer in return for the right to interrupt load on a ten minute or ninety minute notice.

Target Market

This is a special contract that applies solely to a single customer.

Other Interruptible Program

Program Description

This program offers incentives to large commercial and industrial customers in return for allowing the utility to interrupt their load. The customer signs a contract for a special interruptible rate. Customers are notified that a power interruption is to begin at a specified time. The customer then reduces their load to a pre-determined firm level. In return for allowing the utility to interrupt this load, the customers are given a monthly credit on their demand charge for all demand above the firm capacity requirements. The credit amount varies, depending on the length of the notice required and the maximum number of hours per year that the load can be interrupted.

Target Market

This program is available to existing large commercial or industrial facilities in the service territory of a participating EKPC cooperative. It is most suitable for customers who can reschedule operations quickly or who own emergency generators.

In order to qualify, a customer must have at least 250 kW of load that is interruptible, have the ability to interrupt that load with notice ranging from 10 minutes to one hour, and be willing to interrupt that load for up to 12 hours per interruption in the summer (6 hours in the winter), with a maximum of 200-400 hours of interruption per year.

Exhibit DSM-6

Program Descriptions for New DSM Programs

Program Descriptions for New DSM Programs for the 2015 IRP

Introduction

This section of the IRP describes the new DSM programs. These programs are in the planning stage, and appear cost-effective as designed to this point. The programs have been designed based on the results of our energy efficiency potential study which showed significant remaining potential exists for the measures targeted by these programs. These program concepts passed our qualitative screening, and there is at least some level of experience with the program in the utility community such that solid data exist for conducting a quantitative cost-effectiveness analysis.

DSM program design and implementation are complex and dynamic undertakings. It is possible that DSM programs that are selected through this evaluation process may not be implemented as they have been described in this document. DSM programs that are ultimately launched will first be subjected to a much more rigorous program design effort. In certain cases, a demonstration or pilot project may precede full-scale implementation to test the validity of the program concept. This could mean that certain program concepts are modified, and some may not ultimately be implemented.

DSM programs that are included as New programs for this IRP are listed below and are also described in this exhibit:

- Consumer Electronics Program (Residential)
- Exterior Lighting (Residential)
- Water Heater Conservation Program (Residential)
- Smart Thermostat Program (Residential)
- Home Energy Information Program (Residential)
- Commercial & Industrial Demand Response
- Industrial Process
- Industrial Machine Drive
- Direct Load Control for Commercial Air Conditioning
- Commercial & Industrial Equipment Rebate Program
- Commercial & Industrial New Construction

Consumer Electronics

Program Description

This program is designed to work cooperatively with retailers such as big box retail stores and consumer electronics stores to increase the penetration of ENERGY STAR® qualified televisions, desktop computers, and set top boxes.

Target Market

This program will be available for any residential customer who is purchasing one of the qualified consumer electronics products.

Residential Exterior Lighting

Program Description

The purpose of this program is to transform the market for residential exterior lighting by facilitating a shift in consumer purchasing decisions from market baseline efficiency to higher efficiency lighting products. This program is designed to provide incentives to residential retail members to purchase efficient compact fluorescent ("CFL") and light-emitting diode ("LED") exterior lighting products. This program is designed to operate as an add-on component to the Residential Lighting program. The program will include partnering with retail firms that provide residential lighting products in our service territory. EKPC will underwrite certain discounts and incentives for compact fluorescent and LED light bulbs that are sold to residential members of EKPC distribution cooperatives.

Target Market

The program is designed to reach residential customers who are purchasing and installing new central air conditioners.

Residential Water Heater Conservation Program

Program Description

This program is designed to offer direct installation of water heater conservation members to reduce the electricity consumption in participating homes. EKPC will enlist the services of one or more qualified contractors to install low-flow showerheads and water heat pipe wrap at homes with electric hot water heaters. The service will be offered at no charge to the participating end use customer. Program will underwrite the cost of any needed repairs associated with the installation of these measures.

Target Market

The program is designed to reach residential customers who currently heat their domestic hot water with electricity.

Smart Thermostat Program

Program Description

This program is designed to provide incentives to residential retail members to install qualified smart thermostats. Field studies have shown that many programmable thermostats are not actually programmed, because of usability and design problems. They are too complicated for many consumers. Smart thermostats do not require the homeowner to program the device in order for savings to occur. Instead, smart thermostats are learning thermostats that adapts the schedule of thermostat settings based on the daily routine in the home. Well-designed impact evaluations have demonstrated that smart thermostats saved customers about 10-12% on their heating bills and 15% on their cooling bills.

Target Market

The program is designed to reach residential customers who heat their homes with electricity.

Home Energy Information

Program Description

This program uses well-crafted, timely information on home energy use to help customers manage their energy use and save energy. The program is designed to offer two kinds of information delivery: the home energy display monitor, and the home energy report. EKPC owner-member cooperatives have experience using a display monitor with their pre-pay programs, and the results show significant energy savings. The second approach is to provide the customer with regular reports that compare their energy use to the energy use of similar households. This reports approach combines customer-specific energy usage data with demographics and housing data to produce specific, targeted recommendations to motivate the customer to install energy efficiency measures and save electricity.

EKPC plans to conduct evaluation, measurement and verification activities to verify the savings level and savings persistence for this program during the first three years of implementation.

Target Market

The program will be available for all residential customers but initial marketing efforts will be directed toward households with higher than average electricity usage.

Commercial & Industrial Demand Response

Program Description

This demand response program is designed to provide incentives to large customers to reduce their electricity demands on the grid, with short notice (less than 24 hours), for short periods of time, in response to short term conditions external to the customer facility. Typically, those conditions will be either an excessively high price or a shortage of available power. Participants are reimbursed for the cost of the smart meter needed, and receive an annual incentive of $30 per kW offered.

Target Market

The program is designed for customers with peak demands above 50 kW.

Industrial Process Efficiency

Program Description

This program provides financial and engineering resources to industrial customers to save electricity in their industrial processes Incentives are structured as a standard offer payment per 1st year kWh with partial payment upon approval of the engineering proposal, and final payment on verified savings. The program as designed includes an audit, a feasibility study, proposal review and approval, and savings verification. The emphasis will be on electric supply system improvements, sensors and controls, and energy information systems for process heating, cooling, and refrigeration.

Target Market

The program is designed for industrial customers who have process loads that represent a significant share of their electricity consumption.

Industrial Machine Drives Program

Program Description

This program is designed to improve the efficiency of machine drive equipment in the industrial sector. Incentives will be provided for compressed air system management, pump system efficiency improvements, motor system optimization, electric supply system improvements, sensors & controls, and other machine drive improvements.

Target Market

This program is designed to improve machine drive efficiency for the industrial market. The incentive is available to any existing commercial or industrial facility in the service territory of a participating EKPC cooperative. The facility must have been in service for two years.

Direct Load Control for Commercial Air Conditioning

Program Description

The objective of the program is to reduce peak demand and energy usage through the installation of load control switches on commercial air conditioners.

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. The typical control duration is four hours. Participating customers receive an annual bill credit incentive.

EKPC plans to rely on a third party administrator to provide enrollment, installation, service calls, and measurement & verification services.

EKPC plans to offer an incentive of $40 per year for each commercial air conditioner being controlled by a switch. This recognizes the load contribution of the commercial facility. The air conditioner incentive will consist of $10 per month bill credits during four hot weather months.

EKPC has a goal of enrolling 6,000 commercial customers over the next five years. The participation goal represents a cumulative penetration of 20% of the current eligible market of commercial facilities with central air conditioning.

Target Markets

The primary program targets are commercial customers with central air conditioning (including heat pumps). The incentive is available to any commercial retail member of a participating EKPC cooperative who has a qualifying central air conditioner.

Commercial & Industrial Equipment Rebate Program

Program Description

This program promotes high efficiency cooling, ventilation, HVAC controls & sensors, refrigeration, and water heating equipment and other efficiency measures for these end uses. There will be standard rebates for prescriptive measures, and a standard offer cents per kWh for custom measures. Custom measures will require upfront approval and back-end verification for full payment.

Target Market

The incentive is available to any existing commercial or industrial facility in the service territory of one of EKPC's member-owner cooperatives. .

Commercial New Construction Program

Program Description

This program promotes integrated design, commissioning, and more advanced technologies in commercial new construction. Electricity savings are realized across a number of end-uses, with the majority occurring from lighting, cooling, and heating. It is anticipated that new K-12 schools would be served by this program.

Target Market

This program is designed to serve the commercial new construction and major renovation market, including the K-12 schools market.

Exhibit DSM-7

Load Impacts by Program

Load Impacts of DSM Programs

Existing:

Button-Up Tiered Weatherization Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	1,109	-3,039	-2.4	-0.7
2016	2,268	-6,215	-4.8	-1.5
2017	3,427	-9,392	-7.3	-2.2
2018	4,586	-12,568	-9.7	-3.0
2019	5,745	-15,744	-12.2	-3.7
2020	8,405	-23,034	-17.8	-5.4
2021	11,015	-30,187	-23.3	-7.1
2022	13,589	-37,241	-28.8	-8.8
2023	16,130	-44,204	-34.2	-10.4
2024	18,656	-51,127	-39.5	-12.0
2025	21,182	-58,049	-44.9	-13.7
2026	23,708	-64,972	-50.2	-15.3
2027	26,234	-71,894	-55.6	-16.9
2028	28,760	-78,817	-61.0	-18.5
2029	31,286	-85,739	-66.3	-20.2

Residential Heat Pump Retrofit

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	618	-4,655	0.0	-0.2
2016	1,336	-10,063	0.0	-0.4
2017	2,054	-15,471	0.0	-0.7
2018	2,772	-20,879	0.0	-0.9
2019	3,490	-26,287	0.0	-1.1
2020	4,632	-34,888	0.0	-1.5
2021	5,907	-44,492	0.0	-1.9
2022	7,318	-55,119	0.0	-2.3
2023	8,863	-66,756	0.0	-2.8
2024	10,548	-79,448	0.0	-3.4
2025	12,233	-92,139	0.0	-3.9
2026	13,918	-104,830	0.0	-4.5
2027	15,603	-117,522	0.0	-5.0
2028	17,288	-130,213	0.0	-5.5
2029	18,973	-142,905	0.0	-6.1

Direct Load Control of Residential Air Conditioners and Water Heaters

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	40,000	-1,026	-7.7	-28.1
2016	47,500	-1,221	-9.0	-33.5
2017	55,000	-1,416	-10.4	-38.9
2018	62,500	-1,611	-11.7	-44.3
2019	70,000	-1,806	-13.1	-49.7
2020	70,000	-1,806	-13.1	-49.7
2021	70,000	-1,806	-13.1	-49.7
2022	70,000	-1,806	-13.1	-49.7
2023	70,000	-1,806	-13.1	-49.7
2024	70,000	-1,806	-13.1	-49.7
2025	70,000	-1,806	-13.1	-49.7
2026	70,000	-1,806	-13.1	-49.7
2027	70,000	-1,806	-13.1	-49.7
2028	70,000	-1,806	-13.1	-49.7
2029	70,000	-1,806	-13.1	-49.7

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)
2015	5,000	-1,088	-0.2	-0.1
2016	10,000	-2,176	-0.3	-0.2
2017	15,000	-3,264	-0.5	-0.4
2018	20,000	-4,352	-0.7	-0.5
2019	25,000	-5,440	-0.8	-0.6
2020	59,335	-12,911	-1.9	-1.4
2021	92,695	-20,170	-3.0	-2.2
2022	117,683	-25,608	-3.8	-2.8
2023	136,203	-29,638	-4.4	-3.3
2024	154,326	-33,581	-5.0	-3.7
2025	172,449	-37,525	-5.6	-4.1
2026	190,572	-41,468	-6.2	-4.6
2027	208,695	-45,412	-6.8	-5.0
2028	197,483	-42,972	-6.4	-4.7
2029	187,246	-40,745	-6.1	-4.5

Touchstone Energy New Construction Home

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	234	-571	-0.6	-0.1
2016	518	-1,264	-1.2	-0.3
2017	852	-2,079	-2.0	-0.5
2018	1,186	-2,894	-2.8	-0.7
2019	1,520	-3,710	-3.6	-1.0
2020	1,690	-4,125	-4.0	-1.1
2021	1,858	-4,535	-4.4	-1.2
2022	2,024	-4,940	-4.8	-1.3
2023	2,186	-5,335	-5.2	-1.4
2024	2,342	-5,716	-5.5	-1.5
2025	2,498	-6,096	-5.9	-1.6
2026	2,654	-6,477	-6.3	-1.7
2027	2,810	-6,858	-6.6	-1.8
2028	2,966	-7,239	-7.0	-1.9
2029	3,122	-7,619	-7.4	-2.0

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)
2015	400	-4,779	-1.2	-0.2
2016	800	-9,558	-2.3	-0.4
2017	1,200	-14,336	-3.5	-0.6
2018	1,600	-19,115	-4.6	-0.8
2019	2,000	-23,894	-5.8	-1.0
2020	2,000	-23,894	-5.8	-1.0
2021	2,000	-23,894	-5.8	-1.0
2022	2,000	-23,894	-5.8	-1.0
2023	2,000	-23,894	-5.8	-1.0
2024	2,000	-23,894	-5.8	-1.0
2025	2,000	-23,894	-5.8	-1.0
2026	2,000	-23,894	-5.8	-1.0
2027	2,000	-23,894	-5.8	-1.0
2028	2,000	-23,894	-5.8	-1.0
2029	2,000	-23,894	-5.8	-1.0

Tune-Up HVAC with Duct Sealing Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	550	-457	-0.4	-0.1
2016	1,200	-996	-0.9	-0.3
2017	1,950	-1,619	-1.5	-0.5
2018	2,700	-2,242	-2.1	-0.6
2019	3,450	-2,865	-2.7	-0.8
2020	4,249	-3,528	-3.3	-1.0
2021	5,033	-4,179	-3.9	-1.2
2022	5,806	-4,821	-4.5	-1.4
2023	6,566	-5,452	-5.1	-1.6
2024	7,319	-6,078	-5.7	-1.7
2025	8,072	-6,703	-6.3	-1.9
2026	8,825	-7,328	-6.9	-2.1
2027	9,028	-7,497	-7.0	-2.1
2028	9,131	-7,582	-7.1	-2.2
2029	9,134	-7,585	-7.1	-2.2

Low Income with Community Action Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	250	-1,183	-0.4	-0.2
2016	550	-2,602	-0.8	-0.4
2017	900	-4,258	-1.3	-0.6
2018	1,250	-5,913	-1.8	-0.9
2019	1,600	-7,569	-2.3	-1.2
2020	1,600	-7,569	-2.3	-1.2
2021	1,600	-7,569	-2.3	-1.2
2022	1,600	-7,569	-2.3	-1.2
2023	1,600	-7,569	-2.3	-1.2
2024	1,600	-7,569	-2.3	-1.2
2025	1,600	-7,569	-2.3	-1.2
2026	1,600	-7,569	-2.3	-1.2
2027	1,600	-7,569	-2.3	-1.2
2028	1,600	-7,569	-2.3	-1.2
2029	1,600	-7,569	-2.3	-1.2

ENERGY STAR® Appliances Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	12,950	-5,634	-0.6	-2.1
2016	25,900	-11,268	-1.2	-4.1
2017	38,850	-16,902	-1.8	-6.2
2018	51,800	-22,536	-2.4	-8.2
2019	64,750	-28,170	-3.0	-10.3
2020	75,263	-31,484	-3.4	-11.0
2021	85,718	-34,834	-3.7	-11.8
2022	96,155	-38,234	-4.1	-12.6
2023	106,517	-41,671	-4.5	-13.4
2024	116,881	-45,166	-4.9	-14.2
2025	127,245	-48,662	-5.2	-15.0
2026	137,609	-52,157	-5.6	-15.8
2027	140,348	-54,463	-5.7	-16.5
2028	142,362	-55,174	-5.5	-17.0
2029	144,376	-55,886	-5.3	-17.6

Appliance Recycling Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	2,340	-1,044	-0.1	-0.1
2016	4,680	-2,088	-0.2	-0.3
2017	7,020	-3,131	-0.3	-0.4
2018	9,360	-4,175	-0.4	-0.6
2019	11,700	-5,219	-0.5	-0.7
2020	18,973	-8,463	-0.8	-1.2
2021	26,107	-11,646	-1.2	-1.7
2022	30,802	-13,740	-1.4	-2.0
2023	35,410	-15,796	-1.6	-2.3
2024	39,976	-17,832	-1.8	-2.6
2025	44,542	-19,869	-2.0	-2.9
2026	49,108	-21,906	-2.2	-3.1
2027	48,741	-21,742	-2.2	-3.1
2028	48,513	-21,641	-2.2	-3.1
2029	48,384	-21,583	-2.2	-3.1

Commercial Lighting Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	1,071	-3,647	-0.4	-0.7
2016	1,964	-6,688	-0.7	-1.3
2017	3,679	-12,528	-1.3	-2.5
2018	6,274	-21,366	-2.3	-4.3
2019	9,451	-32,184	-3.4	-6.4
2020	13,462	-45,844	-4.9	-9.2
2021	17,303	-58,924	-6.3	-11.8
2022	21,153	-72,035	-7.7	-14.4
2023	25,032	-85,244	-9.1	-17.0
2024	28,947	-98,576	-10.5	-19.7
2025	31,791	-108,261	-11.5	-21.6
2026	34,813	-118,552	-12.6	-23.7
2027	37,013	-126,044	-13.4	-25.2
2028	38,333	-130,539	-13.9	-26.1
2029	39,071	-133,053	-14.2	-26.6

Compressed Air Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	250	-855	-0.1	-0.2
2016	875	-2,992	-0.2	-0.6
2017	2,125	-7,266	-0.6	-1.4
2018	3,375	-11,540	-0.9	-2.3
2019	4,625	-15,815	-1.2	-3.1
2020	4,625	-15,815	-1.2	-3.1
2021	4,625	-15,815	-1.2	-3.1
2022	4,375	-14,960	-1.2	-3.0
2023	3,750	-12,823	-1.0	-2.5
2024	2,500	-8,548	-0.7	-1.7
2025	1,250	-4,274	-0.3	-0.8
2026	-	0	0.0	0.0
2027	-	0	0.0	0.0
2028	-	0	0.0	0.0
2029	-	0	0.0	0.0

Large Interruptible

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	1	-30,600	-85.0	-85.0
2016	1	-30,600	-85.0	-85.0
2017	1	-30,600	-85.0	-85.0
2018	1	-30,600	-85.0	-85.0
2019	1	-30,600	-85.0	-85.0
2020	1	-30,600	-85.0	-85.0
2021	1	-30,600	-85.0	-85.0
2022	1	-30,600	-85.0	-85.0
2023	1	-30,600	-85.0	-85.0
2024	1	-30,600	-85.0	-85.0
2025	1	-30,600	-85.0	-85.0
2026	1	-30,600	-85.0	-85.0
2027	1	-30,600	-85.0	-85.0
2028	1	-30,600	-85.0	-85.0
2029	1	-30,600	-85.0	-85.0

Interruptible Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	7	-8,640	-24.0	-24.0
2016	7	-8,640	-24.0	-24.0
2017	7	-8,640	-24.0	-24.0
2018	7	-8,640	-24.0	-24.0
2019	7	-8,640	-24.0	-24.0
2020	7	-8,640	-24.0	-24.0
2021	7	-8,640	-24.0	-24.0
2022	7	-8,640	-24.0	-24.0
2023	7	-8,640	-24.0	-24.0
2024	7	-8,640	-24.0	-24.0
2025	7	-8,640	-24.0	-24.0
2026	7	-8,640	-24.0	-24.0
2027	7	-8,640	-24.0	-24.0
2028	7	-8,640	-24.0	-24.0
2029	7	-8,640	-24.0	-24.0

New:

Consumer Electronics Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	-	0	0.0	0.0
2016	-	0	0.0	0.0
2017	-	0	0.0	0.0
2018	65,969	-3,810	-0.3	-0.6
2019	150,656	-8,700	-0.7	-1.4
2020	254,107	-14,675	-1.1	-2.3
2021	355,732	-20,544	-1.6	-3.2
2022	455,975	-26,333	-2.1	-4.1
2023	554,618	-32,029	-2.5	-5.0
2024	586,432	-33,866	-2.6	-5.3
2025	599,528	-34,623	-2.7	-5.4
2026	593,860	-34,295	-2.7	-5.3
2027	590,018	-34,074	-2.7	-5.3
2028	587,558	-33,931	-2.6	-5.3
2029	586,698	-33,882	-2.6	-5.3

Residential Exterior Lighting Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	-	0	0.0	0.0
2016	-	0	0.0	0.0
2017	-	0	0.0	0.0
2018	28,409	-2,267	-0.5	0.0
2019	64,845	-5,175	-1.2	0.0
2020	109,808	-8,763	-2.1	0.0
2021	154,527	-12,331	-2.9	0.0
2022	169,508	-13,527	-3.2	0.0
2023	172,970	-13,803	-3.3	0.0
2024	176,394	-14,076	-3.4	0.0
2025	179,818	-14,349	-3.4	0.0
2026	183,242	-14,623	-3.5	0.0
2027	186,666	-14,896	-3.5	0.0
2028	190,090	-15,169	-3.6	0.0
2029	193,514	-15,442	-3.7	0.0

Residential Water Heater Conservation program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	-	0	0.0	0.0
2016	-	0	0.0	0.0
2017	-	0	0.0	0.0
2018	2,987	-1,646	-0.4	-0.1
2019	6,736	-3,712	-0.9	-0.3
2020	11,286	-6,219	-1.5	-0.5
2021	15,773	-8,691	-2.1	-0.6
2022	20,203	-11,132	-2.6	-0.8
2023	24,520	-13,511	-3.2	-1.0
2024	28,766	-15,850	-3.7	-1.2
2025	33,012	-18,190	-4.3	-1.3
2026	37,258	-20,529	-4.8	-1.5
2027	41,504	-22,869	-5.4	-1.7
2028	45,750	-25,208	-5.9	-1.8
2029	47,009	-25,902	-6.1	-1.9

Residential Smart Thermostat Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	-	0	0.0	0.0
2016	-	0	0.0	0.0
2017	-	0	0.0	0.0
2018	4,147	-3,363	-2.6	-0.8
2019	10,223	-8,291	-6.4	-1.9
2020	17,667	-14,328	-11.1	-3.4
2021	24,968	-20,249	-15.7	-4.7
2022	32,161	-26,083	-20.3	-6.1
2023	39,258	-31,838	-24.7	-7.5
2024	46,302	-37,551	-29.2	-8.8
2025	53,346	-43,264	-33.6	-10.1
2026	60,390	-48,976	-38.0	-11.5
2027	67,434	-54,689	-42.5	-12.8
2028	74,478	-60,402	-46.9	-14.2
2029	81,522	-66,114	-51.4	-15.5

Home Energy Information Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	-	0	0.0	0.0
2016	-	0	0.0	0.0
2017	-	0	0.0	0.0
2018	22,901	-15,023	-5.5	-3.2
2019	56,341	-36,960	-13.5	-7.9
2020	97,278	-63,814	-23.3	-13.6
2021	114,537	-75,136	-27.5	-16.0
2022	120,700	-79,179	-29.0	-16.9
2023	118,866	-77,976	-28.5	-16.6
2024	117,571	-77,127	-28.2	-16.5
2025	116,833	-76,642	-28.0	-16.4
2026	116,595	-76,486	-28.0	-16.3
2027	116,595	-76,486	-28.0	-16.3
2028	116,595	-76,486	-28.0	-16.3
2029	116,595	-76,486	-28.0	-16.3

Commercial & Industrial Demand Response Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	150	-1,575	-5.5	-5.5
2016	350	-3,675	-12.8	-12.8
2017	500	-5,250	-18.2	-18.2
2018	500	-5,250	-18.2	-18.2
2019	500	-5,250	-18.2	-18.2
2020	500	-5,250	-18.2	-18.2
2021	500	-5,250	-18.2	-18.2
2022	500	-5,250	-18.2	-18.2
2023	500	-5,250	-18.2	-18.2
2024	500	-5,250	-18.2	-18.2
2025	500	-5,250	-18.2	-18.2
2026	500	-5,250	-18.2	-18.2
2027	500	-5,250	-18.2	-18.2
2028	500	-5,250	-18.2	-18.2
2029	500	-5,250	-18.2	-18.2

Industrial Process Program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	20	-517	0.0	-0.1
2016	48	-1,240	-0.1	-0.2
2017	88	-2,274	-0.2	-0.4
2018	148	-3,824	-0.3	-0.8
2019	228	-5,892	-0.5	-1.2
2020	328	-8,476	-0.7	-1.7
2021	428	-11,060	-0.9	-2.2
2022	528	-13,644	-1.1	-2.7
2023	628	-16,228	-1.3	-3.2
2024	728	-18,812	-1.5	-3.7
2025	808	-20,879	-1.6	-4.1
2026	880	-22,739	-1.8	-4.5
2027	940	-24,290	-1.9	-4.8
2028	980	-25,323	-2.0	-5.0
2029	1,000	-25,840	-2.0	-5.1

Industrial Machine Drive program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	17	-1,505	-0.1	-0.2
2016	31	-2,745	-0.2	-0.3
2017	37	-3,277	-0.3	-0.4
2018	70	-6,199	-0.5	-0.7
2019	130	-11,513	-0.9	-1.2
2020	265	-23,468	-1.8	-2.5
2021	400	-35,423	-2.8	-3.8
2022	535	-47,379	-3.7	-5.1
2023	670	-59,334	-4.6	-6.4
2024	805	-71,289	-5.6	-7.7
2025	940	-83,245	-6.5	-9.0
2026	1,075	-95,200	-7.4	-10.3
2027	1,210	-107,155	-8.4	-11.5
2028	1,345	-119,111	-9.3	-12.8
2029	1,480	-131,066	-10.3	-14.1

DLC for Commercial Central Air Conditioners

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	1,200	-138	0.0	-2.4
2016	2,400	-276	0.0	-4.8
2017	3,600	-415	0.0	-7.2
2018	4,800	-553	0.0	-9.6
2019	6,000	-691	0.0	-12.0
2020	6,000	-691	0.0	-12.0
2021	6,000	-691	0.0	-12.0
2022	6,000	-691	0.0	-12.0
2023	6,000	-691	0.0	-12.0
2024	6,000	-691	0.0	-12.0
2025	6,000	-691	0.0	-12.0
2026	6,000	-691	0.0	-12.0
2027	6,000	-691	0.0	-12.0
2028	6,000	-691	0.0	-12.0
2029	6,000	-691	0.0	-12.0

Commercial & Industrial Equipment Rebate program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	641	-1,602	-0.2	-0.4
2016	1,980	-4,889	-0.5	-1.2
2017	4,211	-10,332	-1.2	-2.6
2018	7,577	-18,547	-2.2	-4.6
2019	10,873	-26,714	-3.1	-6.6
2020	15,027	-37,020	-4.2	-9.2
2021	18,439	-45,581	-5.1	-11.3
2022	21,874	-54,203	-6.0	-13.4
2023	25,334	-62,898	-6.9	-15.5
2024	28,824	-71,674	-7.8	-17.6
2025	32,247	-79,887	-8.7	-19.7
2026	35,634	-87,813	-9.5	-21.7
2027	38,970	-95,333	-10.3	-23.6
2028	42,226	-102,199	-11.0	-25.5
2029	45,418	-108,492	-11.7	-27.2

Commercial & Industrial New Construction program

(negative value = reduction in load)

Year	Participants	Impact on Total Requirements (MWh)	Impact on Winter Peak (MW)	Impact on Summer Peak (MW)
2015	132	-1,663	-0.2	-0.4
2016	264	-3,326	-0.5	-0.9
2017	396	-4,989	-0.7	-1.3
2018	528	-6,652	-0.9	-1.7
2019	660	-8,315	-1.1	-2.2
2020	792	-9,978	-1.4	-2.6
2021	924	-11,641	-1.6	-3.0
2022	1,056	-13,304	-1.8	-3.4
2023	1,188	-14,967	-2.0	-3.9
2024	1,320	-16,630	-2.3	-4.3
2025	1,452	-18,293	-2.5	-4.7
2026	1,584	-19,956	-2.7	-5.2
2027	1,716	-21,619	-2.9	-5.6
2028	1,848	-23,281	-3.2	-6.0
2029	1,980	-24,944	-3.4	-6.5

Exhibit DSM-8

DSM Program Tables

2015 IRP
Remaining DSM program tables that are required by Section 8 of the regulations

8.(3)(e)(1). Targeted classes and end-uses;

The following tables provide the targeted classes and end-uses for the Existing and New DSM programs included in the plan. More detailed program descriptions can be found in Exhibits DSM-5 and DSM-6 in the report titled *Demand-Side Management Analysis*.

Table 8.(3)(e)(1)-1
Existing Programs

Program Name	Class	End-uses
Button-Up Tiered Weatherization	Residential	Space Heating, Space Cooling
Heat Pump Retrofit	Residential	Space Heating, Space Cooling
Direct Load Control of AC & WH	Residential	Space Cooling, Water Heating
Residential Lighting	Residential	Lighting
Touchstone Energy (TSE) Home	Residential	Space Heating, Space Cooling, Water Heating
ENERGY STAR® Manufactured Home	Residential	Space Heating, Space Cooling
Tune-Up HVAC w/ Duct Sealing	Residential	Space Heating, Space Cooling
Low Income with Community Action	Residential	Space Heating, Space Cooling, Water Heating, Lighting
ENERGY STAR® Appliances	Residential	Dishwasher, Refrigerator, Freezer, Water Heating, Space Heating & Cooling, Clothes Washer.
Appliance Recycling	Residential	Refrigerator, Freezer
Commercial Lighting	Commercial	Lighting
Compressed Air	Industrial	Compressed Air
Large Interruptible	Industrial	Various
Other Interruptible	Industrial	Various

Table 8.(3)(e)(1)-2
New Programs

Program Name	Class	End-uses
Consumer Electronics	Residential	Televisions, Desktop Computers, Top Boxes
Exterior Lighting	Residential	Lighting
Water Heater Conservation	Residential	Water Heating
Smart Thermostat	Residential	Space Heating, Space Cooling
Home Energy Information	Residential	Various
C&I Demand Response	Commercial, Industrial	Various
Industrial Process	Industrial	Process Loads
Industrial Machine Drive	Industrial	Drive Power
DLC for Commercial Central AC	Commercial	Space Cooling
C&I Equipment Rebate	Commercial	Space Cooling, Space Heating, Ventilation, Refrigeration, Water Heating
C&I New Construction	Commercial, Industrial	Space Cooling, Space Heating, Ventilation, Lighting

8.(3)(e)(2). Expected duration of the program;

The following tables provide the expected duration of the program. For each existing and new 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 Tiered Weatherization	15 years	15 years
Heat Pump Retrofit	15 years	20 years
Direct Load Control of AC & WH	5 years	20 years
Residential Lighting	15 years	8 years
Touchstone Energy (TSE) Home	15 years	20 years
ENERGY STAR® Manufactured Home	5 years	15 years
Tune-Up HVAC w/ Duct Sealing	15 years	12 years
Low Income with Community Action	5 years	15 years
ENERGY STAR® Appliances	15 years	12-20 years
Appliance Recycling	15 years	7 years
Commercial Lighting	15 years	10 years
Compressed Air	5 years	7 years
Large Interruptible	NA	20 years
Other Interruptible	NA	20 years

Table 8.(3)(e)(2)-2
New Programs – Duration

Program Name	New Participants	Savings Lifetime
Consumer Electronics	12 years	6 years
Exterior Lighting	12 years	20 years
Water Heater Conservation	12 years	11 years
Smart Thermostat	12 years	15 years
Home Energy Information	12 years	3 years
C&I Demand Response	3 years	20 years
Industrial Process	15 years	10 years
Industrial Machine Drive	15 years	15 years
DLC for Commercial Central AC	5 years	20 years
C&I Equipment Rebate	15 years	10-15 years
C&I New Construction	15 years	20 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-7

8.(3)(e)(4). Projected cost, including any incentive payments and program administrative costs;

The projected costs for each Existing and New 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. Distribution system rebates are paid to program participants. More details on program costs and cost-effectiveness can be found in Exhibits of the report titled *Demand-Side Management Analysis*, which can be found in the Technical Appendix.

Table 8.(3)(e)(4)
Existing and New DSM Program Costs

	Program costs	present value, 2015 $		
Existing Program	Distribution System Admin	EKPC Admin	Distribution System Rebates	Customer Investment
Button-Up Tiered Weatherization	$10,364,324	$1,071,760	$16,788,862	$48,351,921
Heat Pump Retrofit	$2,373,686	$564,084	$10,057,992	$61,689,020
Direct Load Control of AC & WH	$0	$23,034,823	$7,187,731	$0
Residential Lighting	$0	$1,565,037	$5,149,930	$8,239,887
Touchstone Energy (TSE) Home	$1,058,719	$676,901	$1,846,603	$4,561,110
ENERGY STAR® Manufactured Home	$0	$3,543,907	$0	$0
Tune-Up HVAC w/ Duct Sealing	$826,628	$67,690	$2,314,558	$2,182,298
Low Income with Community Action	$2,577,506	$91,899	$0	$2,288,358
ENERGY STAR® Appliances	$0	$2,471,852	$19,028,599	$41,925,626
Appliance Recycling	$0	$5,119,250	$2,876,378	$0
Commercial Lighting	$0	$1,336,292	$7,365,022	$40,614,258
Compressed Air	$331,607	$149,336	$0	$3,059,076
Totals	$17,532,470	$39,692,831	$72,615,676	$212,911,554

	Program costs	present value, 2015 $		
New Program	Distribution System Admin	EKPC Admin	Distribution System Rebates	Customer Investment
Consumer Electronics	$0	$630,499	$15,860,395	$8,475,399
Exterior Lighting	$0	$560,978	$1,524,256	$2,534,076
Water Heater Conservation	$0	$2,249,589	$0	$0
Smart Thermostat	$0	$748,848	$10,739,803	$14,074,795
Home Energy Information	$16,569,036	$2,244,207	$0	$17,133,521
C&I Demand Response	$0	$4,154,416	$7,125,100	$5,434,663
Industrial Process	$0	$1,843,762	$1,482,748	$8,377,526
Industrial Machine Drive	$0	$1,300,139	$5,090,483	$21,532,741
DLC for Commercial Central AC	$0	$3,287,627	$3,018,604	$0
C&I Equipment Rebate	$4,917,272	$3,282,876	$12,921,387	$23,073,363
C&I New Construction	$0	$746,847	$3,350,659	$6,031,186
Totals	$21,486,308	$21,049,786	$61,113,436	$106,667,271

8.(3)(e)(5). Projected cost savings, including savings in utility's generation, transmission and distribution costs.

The projected cost savings for each Existing and New 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. More details on program costs and cost-effectiveness can be found in the Exhibits of the report titled *Demand-Side Management Analysis*, which can be found in the Technical Appendix.

Table 8.(3)(e)(5)
Existing and New DSM Program Cost Savings

		present value, 2015 $
Existing Program		Projected Cost Savings
Button-Up Tiered Weatherization		$68,545,735
Heat Pump Retrofit		$86,653,963
Direct Load Control of AC & WH		$52,729,759
Residential Lighting		$20,923,323
Touchstone Energy (TSE) Home		$8,571,894
ENERGY STAR® Manufactured Home		$15,128,932
Tune-Up HVAC w/ Duct Sealing		$6,921,241
Low Income with Community Action		$6,662,855
ENERGY STAR® Appliances		$60,535,394
Appliance Recycling		$11,823,262
Commercial Lighting		$81,156,428
Compressed Air		$6,520,793
Totals		$426,173,579

		present value, 2015 $
New Program		Projected Cost Savings
Consumer Electronics		$18,876,954
Exterior Lighting		$9,480,809
Water Heater Conservation		$11,179,919
Smart Thermostat		$51,555,650
Home Energy Information		$50,667,694
C&I Demand Response		$42,142,820
Industrial Process		$14,656,815
Industrial Machine Drive		$67,891,628
DLC for Commercial Central AC		$23,211,331
C&I Equipment Rebate		$79,357,637
C&I New Construction		$24,211,759
Totals		$393,233,018

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-6

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-6

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 7-10 in the DSM technical appendix. All DSM programs are evaluated for cost-effectiveness using the standard California tests.

Exhibit DSM-9

DSM and Renewable Energy Collaborative Annual Reports for 2012 and 2013

Demand Side Management and Renewable Energy Collaborative

2012 Annual Report

EAST KENTUCKY POWER COOPERATIVE

A Touchstone Energy® Cooperative

DSM/Renewable Energy COLLABORATIVE

Collaborative's Purpose

"The purpose of the Collaborative shall be to evaluate and recommend actions to expand deployment of renewable energy and demand-side management, and to promote collaboration among the Parties in the implementation of those ideas. … The Collaborative shall use [study results] to evaluate potential sources of renewable energy for use on EKPC's system along with demand-side management strategies, and recommend which would be commercially applicable, financially beneficial and viable for EKPC's customers."

- *From the charter of the East Kentucky Power Cooperative Demand-Side Management and Renewable Energy Collaborative*

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12 Report of Economics and Rates Work Group

13 Summary of April 10, 2012 Public Forum in Morehead, Ky.

14 Collaborative's Goals for 2012-13

About the EKPC Demand Side Management and Renewable Energy Collaborative

By Tona Barkley, Collaborative Vice Chairwoman & Nick Comer, EKPC

The EKPC Demand Side Management and Renewable Energy Collaborative is a joint project of East Kentucky Power Cooperative (EKPC), its 16 owner-member cooperatives, the Sierra Club, the Kentucky Environmental Foundation and Kentuckians For The Commonwealth.

The group is meeting quarterly over a two-year period to evaluate and recommend actions for EKPC to expand deployment of renewable energy and demand-side management, and to promote collaboration among participants in the implementation of those ideas. Demand-side management (DSM) refers to programs designed to encourage consumers to improve energy efficiency and modify their pattern of electricity usage.

The Collaborative was established following EKPC's decision in late 2010 to cancel plans to construct a coal-fueled power plant in Clark County, Ky., due to changing economic conditions. In cancelling the plant, EKPC entered a settlement agreement which set the framework for the Collaborative. The agreement also called for the Sierra Club, Kentuckians for the Commonwealth and the Kentucky Environmental Foundation to drop eight state and federal administrative and court actions against EKPC targeting two of the co-op's coal-fueled power plants.

The Collaborative's DSM Work Group is expected to review: EKPC's current offerings and participation levels in DSM/ direct load control programs; best practices in DSM; on-bill financing for DSM investments; revenue impact of DSM programs on distribution cooperatives; rate treatment of DSM programs, including rate design; and use of home-energy displays and emerging technologies to facilitate energy efficiency.

The Renewable Energy Work Group is expected to review: renewable technologies with the greatest economic viability; methods for cost recovery; impacts on ratepayers; and the treatment of renewable resources in an integrated resource plan.

The Collaborative is made up of representatives of 17 electric cooperatives, the three organizations that signed the settlement agreement, and other interested stakeholders. Members include:

- Appalachia - Science in the Public Interest – Andy McDonald
- Big Sandy RECC – Jeff Prater
- Blue Grass Energy Cooperative – Mike Williams
- Clark Energy Cooperative – Scott Sidwell
- Cumberland Valley Electric – Jay Hampton
- East Kentucky Power Cooperative – Scott Drake
- Farmers RECC – Chuck Bishop
- Fleming-Mason Energy – Joni Hazelrigg
- Frontier Housing – Josh Trent
- Grayson RECC – Kim Bush
- Inter-County Energy Cooperative – David Phelps
- Jackson Energy Cooperative – Sharon Carson
- Kentuckians For The Commonwealth – Steve Wilkins
- Kentucky Environmental Foundation – Elizabeth Crowe
- Licking Valley RECC – Maudie Nickell
- Mountain Association for Community Economic Development – Kristin Tracz

COLLABORATIVE

Pictured are members of the EKPC Demand Side Management and Renewable Energy Collaborative.
Back row, from left: Andy McDonald, Jeff Prater, Scott Sidwell, David Phelps, Scott Drake, Elizabeth Crowe, Alan Coffey, Jay Hampton, Ann Beard, Kristin Tracz, David Crews and Rick Ryan.
Front row, from left: Sharon Carson, Wallace McMullen, Mark Stallons, Tona Barkley, Steve Wilkins, Kim Bush and Joni Hazelrigg.
Not pictured: Mike Williams, Dan Brewer, Larry Hicks, Theresa Atha, Jay Hampton, Chuck Bishop, Josh Trent and Maudie Nickell.

- Nolin RECC – Rick Ryan
- Office of the Kentucky Attorney General – Dennis Howard/Larry Cook
- Owen Electric Cooperative – Mark Stallons
- Salt River Electric – Larry Hicks
- Shelby Energy Cooperative – Theresa Atha
- Sierra Club – Wallace McMullen
- South Kentucky RECC – Alan Coffey
- Taylor County RECC – Ann Beard
- Gallatin Steel was invited to participate.

In addition to the above decision-making members, the following individuals were added to the work groups with the approval of the chair and vice chair:

- Renewables Work Group: David Brown Kinloch (Soft Energy), Lauren McGrath (Sierra Club),
- DSM Work Group: Sara Pennington (KFTC)

The Collaborative chairman, named by EKPC, is David Crews, and the Vice Chair, named by the other groups, is Tona Barkley. David Crews replaced David Mitchell, who served as chair until January 2012. Mike Williams replaced Dan Brewer in March 2012 as Blue Grass Energy's representative.

East Kentucky Power Cooperative – A Pioneer In Energy Efficiency

East Kentucky Power Cooperative has been a pioneer in developing energy-efficiency programming and renewable energy resources that are viable for electric co-op members in Kentucky.

By Nick Comer, EKPC

Demand-Side Management

EKPC and its owner-members are proactive in helping end-use members identify opportunities to improve the energy efficiency of their homes and businesses, and offer a variety of options to achieve that goal. The co-ops employ 29 energy advisors, most of whom have advanced certifications such as RESNET accredited Home Energy Raters and Building Performance Institute. They play a vital role by conducting free energy audits and investigating high-bill concerns, more than 12,000 in the past three years alone. These visits provide opportunities to direct co-op members to the most appropriate programs to help reduce energy usage and make monthly electric bills more manageable.

The following energy efficiency programs are available to EKPC's owner-member cooperatives:

- SimpleSaver direct load control (DLC);
- HVAC Duct Sealing;
- Button Up and Button-Up with Air Sealing;
- Touchstone Energy Home;
- Touchstone Energy Manufactured Home;
- Compact Fluorescent Light Bulbs;
- Heat Pump Retrofit;
- Electric Thermal Storage;
- Commercial Advanced Lighting; and
- Industrial Compressed Air.

Since 2005, EKPC's portfolio has achieved average annual energy reductions of 42 million kilowatt hours, and average annual peak reductions of almost 60 megawatts.

Renewables

Landfill methane
In 2003, EKPC became the first utility in Kentucky to generate its own renewable power by siphoning methane gas from landfills for use as fuel, preventing that powerful greenhouse gas from reaching the atmosphere. Today, EKPC has six landfill gas plants, generating enough electricity to power more than 9,000 Kentucky homes. This clean, renewable power is marketed through the EnviroWatts program.

Switchgrass
EKPC has partnered with the University of Kentucky's College of Agriculture and farmers in northeastern Kentucky to study the use of switchgrass, a warm-season grass native to the Bluegrass State, as a supplemental fuel for its power plants. More than 2,000 tons of switchgrass has been used as power plant fuel.

Hydroelectric
EKPC holds long-term contracts to purchase up to 170 megawatts of electricity generated by hydroelectric dams, including two in Kentucky—Wolf Creek Dam and Laurel Dam. These facilities are operated by the U.S. Army Corps of Engineers and the electricity they generate is marketed by the Southeastern Power Administration (SEPA).

National Renewables Cooperative Organization
EKPC is a charter member of NRCO, an organization whose mission is to help cooperatives diversify their generation resources with renewable energy.

Summary of Collaborative Meetings

By Tona Barkley, Collaborative Vice Chairwoman

The full Collaborative has met four times. The meetings are open to the public, and members of the public who have chosen to address the group have done so during a public comment period at the end of each meeting.

The first meeting was held March 29, 2011 at the Marriott Griffin Gate Hotel in Lexington, Ky. During this meeting members became acquainted, approved the Collaborative's charter and heard statements of values from the cooperatives and the other groups. The consensus decision-making process outlined in the charter was reviewed and discussed. Members were then asked to join either or both of the two primary work groups: Demand-Side Management (DSM) and Renewable Energy. These groups convened, chose co-chairs and began planning their initial meetings.

The second Collaborative meeting was held on July 19, 2011 at the Marriott Griffin Gate Hotel in Lexington. Members of the DSM Work Group made presentations about on-bill financing, How$martKY, and best practices in energy efficiency programs run by South Carolina electric cooperatives and Vermont Energy Investment Corporation (VEIC). At the invitation of the Renewable Energy Work Group, David Brown Kinloch gave a presentation on renewable energy options in Kentucky, including wind, solar, hydro, biomass and landfill gas. Jeff Shaw and Quang Nguyen of the Kentucky Public Service Commission gave a presentation on the regulatory process in Kentucky as it relates to energy resources and rates.

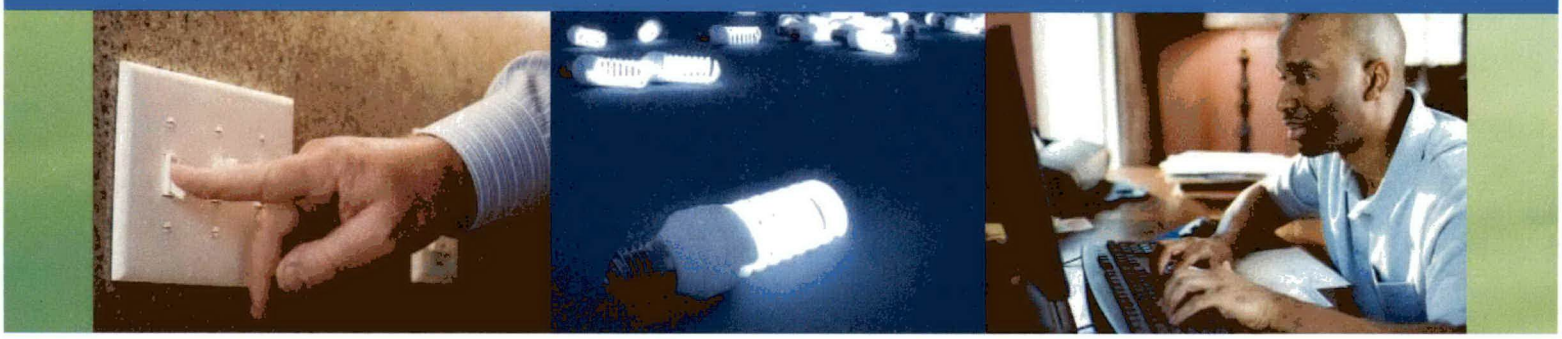
Between the second and third meetings, the chair, vice chair, and co-chairs of the two work groups began to convene periodically as a leadership team to plan future meetings. The group agreed to elevate the Economics and Rates Work Group, which began as a sub-group of the DSM Work Group, into a third major work group charged with looking at cost recovery issues related to both DSM and renewables. The co-chairs of the Economics and Rates Work Group were subsequently included in the Leadership team.

The third Collaborative meeting was held Nov. 15, 2011 at the Marriott Griffin Gate in Lexington. Following a report from the Renewable Energy Work Group, the DSM Work Group presented seven recommendations for discussion. These were organized into three topic areas: measurement and verification; marketing; and overcoming barriers. Members broke into facilitated discussion groups to discuss each set of recommendations. Following each discussion, the groups reported out their reactions and suggestions regarding the proposed recommendations.

The fourth Collaborative meeting took place on Jan. 31, 2012 at the Perkins Center at Eastern Kentucky University in Richmond, Ky. Following an update by the Renewable Energy Work Group and a report from the Public Forum planning team, the group embarked on the consensus decision-making process outlined in the charter to consider the seven recommendations from the DSM group. These recommendations had been revised since the November meeting, taking into consideration the feedback received from the full Collaborative. The Collaborative reached consensus on six of the seven recommendations, with the Attorney General's representative abstaining. The seventh recommendation was sent back to the DSM Work Group with suggestions for revision. The Collaborative then discussed and agreed upon goals and action items for completing its mission in the upcoming twelve months and roughed out the agenda for the next meeting on April 17, 2012.

Report & Recommendations of DSM Work Group

By Steve Wilkins & Mark Stallons
Work Group co-chairs



Over the course of 2011, the Demand-Side Management Work Group's goals included garnering insights on best practices from energy efficiency (EE) leaders and experts. Eight of the group's conversations involved specific demand-side management (DSM) and EE technologies or strategies while two other conversations involved broader spectrum approaches to DSM/EE.

Vermont Energy Investment Corp. (VEIC)
VEIC is a for-profit company that sells efficiency and demand-reduction into Vermont and New England power markets. VEIC has contracted to deliver all electric energy efficiency measures within Vermont, which leads the nation in meeting energy efficiency target goals with annualized savings of about 2 percent on actual retail sales. VEIC provided information on such issues as measurement and verification, marketing efforts, flexibility in program deployment and outcomes-based monitoring of program efficacy.

South Carolina electric cooperatives
Central Electric Power Cooperative and the Electric Cooperatives of South Carolina have pioneered on-bill financing of energy-efficiency retrofits, providing a model for the Rural Energy Savings Program Act. They have set a goal of 10 percent load reduction over 10 years, retrofitting 220,000 homes at an estimated cost of $750 million, which is much lower than the alternative portion of cost for a nuclear unit. The demographics of the area are similar to EKPC's. With about 1,500 retrofits completed, average savings are estimated at 20 to 30 percent. Also, the co-ops are studying the feasibility of retrofitting manufactured homes.

How$martKY
Four distributions cooperatives—Big Sandy RECC, Grayson RECC, Jackson Energy and Fleming-Mason Energy—have partnered with the Mountain Association for Community Economic Development on this 200-home pilot project offering on-bill financing of energy efficiency measures. Participation begins with an energy audit and work is performed by pre-approved contractors. A fixed monthly charge is assigned to the location. The approach is similar to South Carolina's.

Advanced Meter Infrastructure
Advanced metering infrastructure (AMI) technology allows a utility to install "smart meters" that are capable of two-way communication between the structure and the utility. AMI provides information to the utility about members' usage and when usage occurred. It can facilitate introduction of time-of-use rate schedules, allowing utilities to offer flexible rates that encourage members to cut back usage during on-peak times and shift their usage to off-peak times.

Passive House
The term "passive house" refers to a rigorous, voluntary standard for energy efficiency in a building in order to reduce the ecological footprint.

Volt Var Optimization
Volt var optimization (VVO) is an enhancement to the traditional approach of installing fixed and switched capacitors on distribution lines to improve power factor in excess of 95 percent and installing regulators to boost voltage levels. In combination, these improvements allow system

DSM WORK GROUP
Pictured are members of the Collaborative's Demand Side Management Work Group.
Front row, from left: Alan Coffey, Kristin Tracz, Co-Chair Mark Stallons, Scott Drake, Joni Hazelrigg.
Back row, from left: Sara Pennington, Co-Chair Steve Wilkins, Scott Sidwell, Ann Beard, Rick Ryan, Jeff Prater and Kim Bush.
Not pictured: Larry Hicks, Maudie Nickell and Josh Trent.

voltage to be reduced by 3 to 5 percent, resulting in distribution system energy savings of 2 to 4 percent. Blue Grass Energy has implemented a pilot to investigate VVO. The pilot includes one rural substation and one urban substation; installing smart grid assets on power lines; power factor correction capacitors; smart line regulators to boost voltage; and line voltage sensors to ensure quality service.

Smart Home Technology
Electric cooperatives and members are partnering on home energy management in order to better understand, monitor and manage energy use. Owen Electric is working with a group of RFP respondents on a possible pilot project that would include a water heater load-control switch; HVAC smart thermostat; Internet or cell communication to participating homes; Zigbee two-way meter technology, as it becomes available; energy-saving tools and graphs available through smart phones, web portals, PCs and display devices; a home energy management system hosted by third party; and other tools.

Beat The Peak
This is a voluntary program designed to help co-op members gain more control over their electric bill by reducing energy usage at peak times when the power costs are at their highest by providing electronic alerts when the electric usage and spot market prices are high and asking them to conserve energy during this time to help keep energy rates more affordable.

Wabash Valley Power Association
WVPA, a generation and transmission cooperative in Indiana, implemented a meter data management (MDM) system to collect meter data from members with direct load control (DLC) system installations. Over 60,000 DLC switches are installed on water heaters and air conditioners. This data allows WVPA to optimize energy and peak savings potential from demand response programs.

Nolin RECC Prepay Metering
This program provides an alternative for members to pay their bills. They can customize their payment schedule, buy electricity when it is convenient for them and monitor and control their electric consumption. According to studies from other states such as North Carolina, members have seen 10 to 12 percent reductions in energy usage. At Nolin RECC, 67 members have signed-up to participate in PrePay from the end of June 2011 to November 2011.

Recommendations approved by the Full Collaborative
The work group also set a goal to bring initial recommendations to the full Collaborative for their consideration. Seven recommendations were brought before the Collaborative

at the November meeting. Using feedback from that meeting, the DSM Work Group refined those recommendations and presented the revised recommendations at the January 2012 Collaborative meeting. The full Collaborative moved to pass six of the seven recommendations on to EKPC leadership. The seventh recommendation was returned to the DSM Work Group for further refinement. All recommendations were made with the assumption that cost recovery issues will be resolved.

Measurement and Verification Recommendations

1. Partner with distribution member cooperatives and allocate resources for measurement and verification (M&V) of the cooperatives' existing and future DSM efforts. This includes developing a standardized, on-going process to collect data, investigate, and report on dynamic energy and demand impacts.

2. Offer generally accepted DSM quantitative and qualitative analytic services to member systems on an individual, group and/or system average basis using each member cooperative's unique market and cost structures.

Marketing and Implementation Recommendations

3. Aggressively help member systems market those DSM programs with the optimal benefit-cost profiles.

4. Develop strong educational, marketing and training programs for member systems to promote DSM efforts considering all potential markets and channels for messaging.

5. Allocate resources toward becoming and serving as a consultant and expert for member systems in their DSM efforts. Identify best practices, provide research support, and explore partnerships to this end.

Overcoming Barriers/Challenges Recommendations

6. Continually evaluate new and on-going DSM programs, refining efforts to ensure optimal penetration of target markets.

In the future, the DSM Work Group plans to explore additional technologies and strategies. These include:

1. Update on Duke Energy DSM goals and programs;

2. Update on LG&E/KU DSM goals and programs;

3. Summary of OPower's program and results;

4. Update on Combined Heat & Power technology;

5. Update on Wabash Valley Power Association M&V program;

6. Review of California Test assumptions;

7. Short- and long-term impact of natural gas boom;

8. Means to gain regulatory flexibility; and

9. Update on Great Rivers Energy DSM programs.

Report & Recommendations of the Renewable Energy Work Group

By Mike Williams & Elizabeth Crowe
Work Group co-chairs

Work summary

During the first year, the Renewable Energy (RE) Work Group focused on several tasks: developing a shared understanding among work group members of Kentucky's and EKPC's renewable energy potential; developing draft criteria to guide discussions on renewable energy options; and creating potential goal statements that may be useful to EKPC as it considers renewable energy sources in the future. Each of these tasks has been undertaken with the aim of making the best possible recommendations to the full Collaborative and then to EKPC.

In order to facilitate this process, work group members engaged in direct discussion with staff of the Kentucky Public Service Commission (PSC) to understand regulations and case precedent that might affect any recommendations made to the EKPC Board. The Collaborative invited PSC staff to present to its meeting in July 2011. In April 2012, the Collaborative and RE Work Group leadership met with PSC staff members for follow-up questions. Per the PSC, generation projects, including renewable projects, would be required to meet its "least-cost" test to receive PSC-approved rate recovery as a part of EKPC's generation portfolio.

Information gathering and analysis

The committee met by phone and in person for presentations from renewable energy experts, including: David Brown Kinloch, Soft Energy; Michael Coddington, Senior Engineer, National Renewable Energies Laboratory; Brent Beerley, Vice President of Business Development and Public Policy, Community Energy; Jon Farrell, Senior Researcher, Institute for Local Self-Reliance; Amadou Fall, President, National Renewable Cooperatives Organization; Andy McDonald, Director, Kentucky Solar Partners; and Simon Mahan, Renewable Energy Manager, Southern Alliance for Clean Energy. These presenters were selected because they provided a range of perspectives, including that of utilities associations, renewable energy developers, public interest research groups and agencies. Following is a summary of key points and opinions presented by these individuals:

- Within EKPC's transmission system, grid capacity is not currently a hindrance to renewable energy generation. Based on current information, there does not appear to be a transmission problem for EKPC in the near future, given that the level of renewable energy generation under consideration would be very low. (EKPC has not performed transmission studies to confirm this assumption.)

- Across the nation, co-op utilities have deployed 1- to 5-megawatt (MW) renewable energy systems with solar and wind (some in states without a renewable energy portfolio standard and some at kilowatt hour rates not significantly higher than EKPC's wholesale energy rate) as a first-step project. Examples include SMECO in Maryland; Willmar, Minnesota; and United Power in Colorado.

- Wind farms installed in the eastern U.S. from 2007 to 2010 sold electricity for between approximately 6 to 9 cents per kilowatt hour.

- In general, the costs of solar and wind energy have dropped significantly in recent years.

RENEWABLE ENERGY WORK GROUP

Pictured are members of the Collaborative's Renewable Energy Work Group.
Front row, from left: Sharon Carson, Andy McDonald, Co-Chair Elizabeth Crowe, Scott Drake and David Crews.
Back row, from left: David Phelps, Wallace McMullen, Jay Hampton, Kristin Tracz and Tona Barkley.
Not pictured: Dan Brewer, Co-Chair Mike Williams, Theresa Atha and Chuck Bishop.

- Solar hot water, solar photovoltaic and hydro technologies are technically feasible for Kentucky.

- A 2011 National Renewable Energy Laboratory/AWS Truewind assessment of wind potential in Kentucky indicates there are some places where wind turbines with an 80-meter or higher hub height could also be technically feasible. And EKPC may also be able to purchase wind energy from out-of-state.

The Renewable Energy Work Group also talked with Ed Fortner, Director of Berea Municipal Utilities (BMU), and with Joshua Bills from the Mountain Association for Community Economic Development (MACED), and toured the Berea Solar Farm. The solar farm consists of 60 photovoltaic panels with a capacity of 14 kilowatts. Individual BMU customers lease the panels for $750 and a 25-year agreement. The first array of 30 panels was sold out in four days, prompting BMU to add another array that was filled in May 2012 and now is also operational. Lease customers include individual and family residents, non-profit organizations, businesses and schools.

RE Attributes

At the December 2011 meeting, the RE Work Group discussed desirable attributes of renewable energy programs/projects, including:

- Access to clean energy sources beyond landfill gas;

- Projects that would reduce the need for new baseload generation;

- Projects that are scalable;

- Accommodations for low-income member participation; and

- Expansion of EKPC's experience in renewable-generation technologies.

Next Steps

The Renewable Energy Work Group is focusing on the following activities:

1) Development of a recommendation that EKPC modify the Envirowatts program to include several additional renewable energy products such as solar, wind, hydro and biomass.

2) Development of a recommendation that EKCP determine if it can, within the current PSC rules, develop a solar farm model similar to the Berea model.

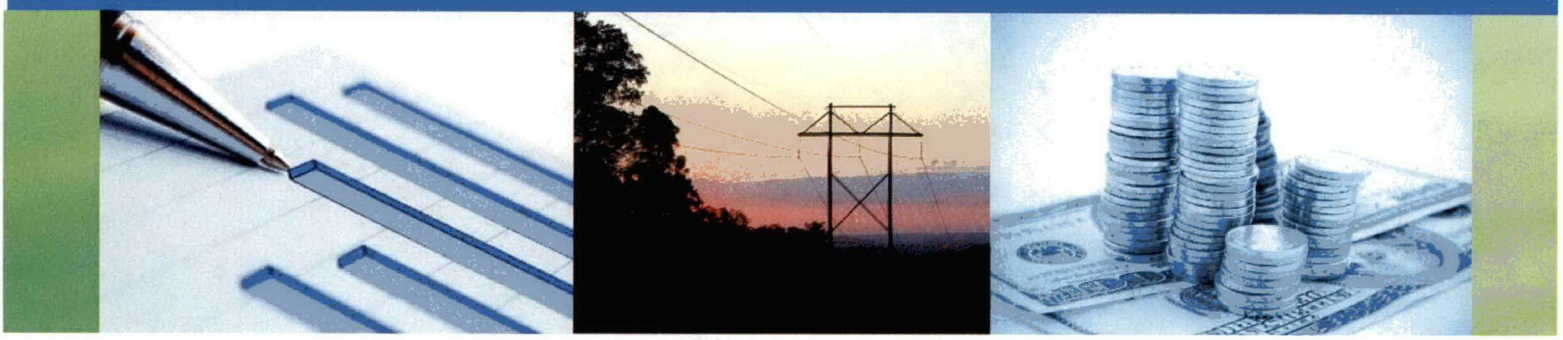
3) Engage the National Renewables Cooperative Organization (NRCO), of which EKPC is a member, to gauge the potential for deeper penetration of DSM and RE programs among owner-members.

4) Engage NRCO to assist EKPC and owner-members in designing effective marketing and educational materials.

The group will work to reach final recommendations by early 2013.

Report of Economics and Rates Work Group

By Larry Hicks and Kristin Tracz
Work group co-chairs



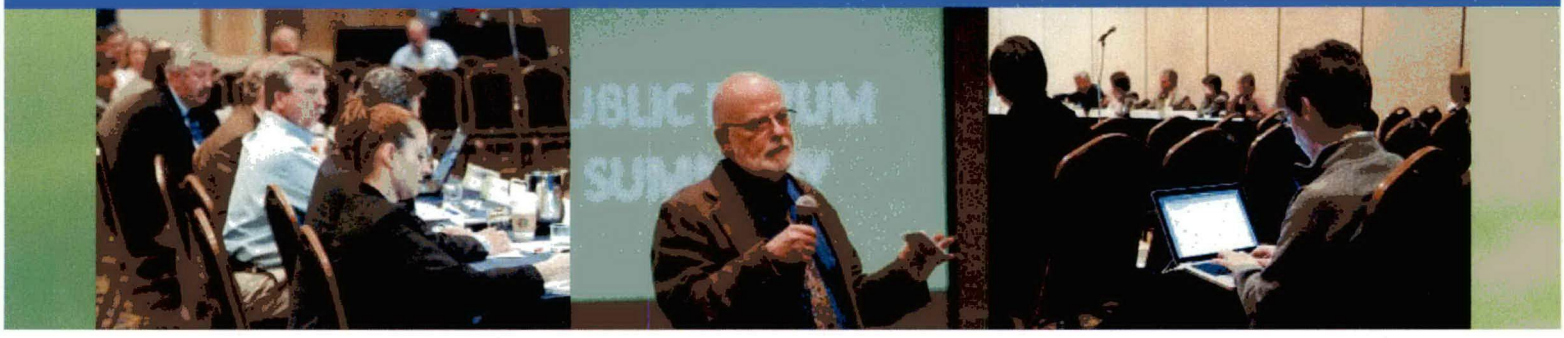
The Economics and Rates Work Group met during the summer of 2011 to assess the group's scope of work. A brief survey of work group members was conducted to better understand current challenges, opportunities and barriers related to the economics surrounding efficiency and renewable projects. The group decided to pause activities until the DSM Working Group and the Renewable Energy Working Group made additional progress towards defining their goals.

Following the proposal of recommendations from both groups, the Economics and Rates team will reassemble to resume activities. We anticipate identifying best practices and possible approaches that other peer utilities have employed to support efficiency and renewable energy projects while protecting the utility's bottom line.

ECONOMICS AND RATES WORK GROUP
Pictured are members of the Collaborative's Economics and Rates Work Group.
Front row, from left: Sara Pennington, Co-Chair Kristin Tracz, Elizabeth Crowe, Scott Drake and Joni Hazelrigg.
Back row, from left: Steve Wilkins, Wallace McMullen, Mark Stallons and Tona Barkley.
Not pictured: Co-Chair Larry Hicks.

Summary of April 10, 2012 Public Forum in Morehead, Ky.

By Steve Wilkins



The Collaborative has committed to conduct at least one public forum annually to gather comments from the public at large regarding demand-side management (DSM) and renewable energy (RE), and to solicit public comments on existing or prospective DSM strategies and RE projects which the Collaborative may be evaluating.

On April 10, 2012, the Collaborative conducted its first public forum at the Carl D. Perkins Center in Morehead, Ky. The forum was publicized through press releases, flyers, online notices on web sites and social media, and an ad in Kentucky Living.

The 2012 forum focused on the Collaborative's efforts in DSM since these had been fast-tracked and had achieved significant progress. With the How$martKY pilot addressing a key financial component of DSM, it was decided to conduct the public forum in proximity to the co-ops involved in that pilot.

The public forum was attended by 17 members of the public, along with 14 representatives of Collaborative member organizations. Response to the forum was a very positive, in general, from those co-op members who attended.

The forum began with informational presentations from Collaborative members on topics including: the use of energy efficiency to lower electric bills; the co-ops' Button-Up program; the How$martKY pilot; and the importance of reducing peak demand and SimpleSaver program's role in achieving that goal.

Following these presentations, attendees broke out into three focus groups, which were facilitated by Collaborative members. Participants provided valuable feedback on such topics as: their impressions of co-op DSM programs; effective ways to communicate about DSM programs; reasons for participating (and not participating) in DSM programs; viewpoints on prepaid metering; and other ideas on a variety of topics. Facilitators recorded each group's feedback and a report was provided at the April 2012 Collaborative meeting.

The 2013 public forum is expected to emphasize renewable energy and will be conducted in the western part of EKPC's territory.

Collaborative's Goals for 2012-13

1. Complete and present the 2011-12 Annual Report to the EKPC Board and stakeholder organizations.
2. Improve attendance at the next public forum.
3. Finalize recommendations to EKPC.
4. Determine if stakeholder organizations will actively support EKPC DSM and Renewable programs.
5. Determine the future of the Collaborative beyond the agreed two-year period.

4775 Lexington Road, 40391
P.O. Box 707,
Winchester, KY 40392-0707
Telephone: 859-744-4812
Fax: 859-744-6008
www.ekpc.coop

Demand Side Management and Renewable Energy Collaborative

2013 Annual Report

EAST KENTUCKY POWER COOPERATIVE

A Touchstone Energy® Cooperative

DSM/Renewable Energy COLLABORATIVE

Collaborative's Purpose

"The purpose of the Collaborative shall be to evaluate and recommend actions to expand deployment of renewable energy and demand-side management, and to promote collaboration among the Parties in the implementation of those ideas. … The Collaborative shall use [study results] to evaluate potential sources of renewable energy for use on EKPC's system along with demand-side management strategies, and recommend which would be commercially applicable, financially beneficial and viable for EKPC's customers."

- *From the charter of the East Kentucky Power Cooperative Demand-Side Management and Renewable Energy Collaborative*

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About the EKPC Demand Side Management and Renewable Energy Collaborative

By Tona Barkley, Collaborative Vice Chairwoman & Nick Comer, EKPC

The EKPC Demand Side Management and Renewable Energy Collaborative is a joint project of East Kentucky Power Cooperative (EKPC), its 16 owner-member distribution cooperatives, the Sierra Club, the Kentucky Environmental Foundation and Kentuckians For The Commonwealth.

The group met over a two-and-a-half year period to evaluate and recommend actions for EKPC to expand deployment of renewable energy and demand-side management, and to promote collaboration among participants in the implementation of those ideas. Demand-side management (DSM) refers to programs designed to encourage consumers to improve energy efficiency and modify their pattern of electricity usage.

The Collaborative was established following EKPC's decision in late 2010 to cancel plans to construct a coal-fueled power plant in Clark County, Ky., due to changing economic conditions. In cancelling the plant, EKPC entered a settlement agreement which set the framework for the Collaborative. The agreement also called for a group of environmentalist organizations to drop eight litigation matters and other regulatory challenges against EKPC targeting coal-fueled plants.

The Collaborative's DSM Work Group has reviewed: EKPC's current offerings and participation levels in DSM/direct load control programs; best practices in DSM; on-bill financing for DSM investments; revenue impact of DSM programs on distribution cooperatives; rate treatment of DSM programs, including rate design; job-creation potential of energy efficiency programs; and use of home-energy displays and emerging technologies to facilitate energy efficiency.

The Renewable Energy Work Group has reviewed: renewable technologies with the greatest economic viability; methods for cost recovery; and impacts on ratepayers.

The Collaborative is made up of representatives of 17 electric cooperatives, three environmental advocacy organizations and other interested stakeholders. Members include:

- Appalachia - Science in the Public Interest – Andy McDonald
- Big Sandy RECC – Jeff Prater
- Blue Grass Energy Cooperative – Mike Williams
- Clark Energy Cooperative – Scott Sidwell
- Cumberland Valley Electric – Robert Tolliver
- East Kentucky Power Cooperative – Scott Drake
- Farmers RECC – Chuck Bishop
- Fleming-Mason Energy – Joni Hazelrigg
- Frontier Housing – Josh Trent
- Grayson RECC – Kim Bush
- Inter-County Energy Cooperative – David Phelps
- Jackson Energy Cooperative – Sharon Carson
- Kentuckians For The Commonwealth – Steve Wilkins
- Kentucky Environmental Foundation – Elizabeth Crowe
- Licking Valley RECC – Maudie Nickell
- Mountain Association for Community Economic Development – Carrie Ray

COLLABORATIVE

Front row, from left: Sara Pennington, Steve Wilkins, Candi Waford, Elizabeth Crowe, Josh Bills

Middle row, from left: Sharon Carson, Chuck Bishop, Vice-Chair Tona Barkley, Ginger Watkins, Kim Bush, Maudie Nickell, Ann Beard, Rick Ryan

Back row, from left: Mark Stallons, Chairman David Crews, Scott Drake, Mike Williams, Wallace McMullen, Larry Hicks, David Phelps, Alan Coffey

Not pictured: Tom Carew, Jay Hampton, Joni Hazelrigg, Jeff Prater, Scott Sidwell

- Nolin RECC – Rick Ryan
- Office of the Kentucky Attorney General – Dennis Howard/Larry Cook
- Owen Electric Cooperative – Mark Stallons
- Salt River Electric – Larry Hicks
- Shelby Energy Cooperative – Theresa Atha
- Sierra Club – Wallace McMullen
- South Kentucky RECC – Alan Coffey
- Taylor County RECC – Ann Beard
- Member At Large – Ginger Watkins
- Gallatin Steel was invited to participate.

In addition to the above decision-making members, the following individuals were added to the work groups with the approval of the chair and vice chair:

- Renewables Work Group: David Kinloch-Brown (Soft Energy), Lauren McGrath (Sierra Club),
- Economics & Rates Work Group: Isaac Scott (EKPC) and Ann Wood (EKPC)
- DSM Work Group: Sara Pennington (KFTC)

The Collaborative chairman, named by EKPC, is David Crews, and the Vice Chair, named by the public interest groups, is Tona Barkley.

Summary of 2nd Year Collaborative Meetings and Renewable Energy

By Tona Barkley, Collaborative Vice Chairwoman

The fifth meeting of the Collaborative was held April 17, 2012, at Eastern Kentucky University in Richmond, Ky. Following an update from the Renewable Energy (RE) Work Group, the attendees turned to a recommendation from the Demand Side Management (DSM) Work Group that had been sent back for rewrite by the Collaborative at its January meeting. The rewritten recommendation on Overcoming Barriers and Challenges was presented and approved by consensus.

The group then reviewed a draft of the first-year annual report and discussed steps to complete the Collaborative's work in the second year. Steve Wilkins gave a report on feedback received at the Collaborative's first public forum, which was held April 9, 2102 in Morehead, Ky. The topic of that forum was demand side management/energy efficiency. The group also heard an update on the progress of the market research being conducted for the Collaborative by the National Rural Electric Cooperative Association (NRECA) and formed a committee to work on the Collaborative's second public forum.

In August 2012, the Collaborative leadership team agreed to place Collaborative activity on hiatus until the Kentucky Public Service Commission's review of EKPC's Integrated Resource Plan (IRP) was completed. This action was in response to intervention by a Collaborative member, the Sierra Club, in the PSC's review of the IRP. It was agreed that discovery issues might make it difficult to conduct productive discussions while the IRP review was ongoing. The Collaborative remained on hiatus until the early months of 2013, at which time work group meetings resumed preparing for the sixth meeting.

The Collaborative convened again on March 26, 2013 in Lexington. The DSM Work Group presented four new recommendations, and the RE Work Group presented two recommendations. Both work groups received feedback from the full Collaborative in preparation for a consensus discussion at the next meeting.

Bruce Barlow of NRECA presented preliminary market research findings. This included video from the qualitative interviews conducted across the territories of selected distribution cooperatives deemed to be representative of the whole group.

Bill Blair and Chris Woolery of the Mountain Association for Community Economic Development gave a presentation on the success of the How$martKY pilot conducted in four of the distribution co-ops. The program provides a funding mechanism whereby qualifying participants can pay for energy upgrades to their homes through savings on their electric bills.

At the seventh Collaborative meeting, held on July 22, 2013 in Lexington, four recommendations of the DSM Work Group and two recommendations of the RE Work Group were approved by consensus. A presentation on the cooperative's research into wind energy was delivered by EKPC's Jeff Brandt. Members then discussed a proposal to hold an additional event following the last Collaborative meeting, the goal of which would be to educate distribution co-op staff about the information the Collaborative explored and the recommendations it has made.

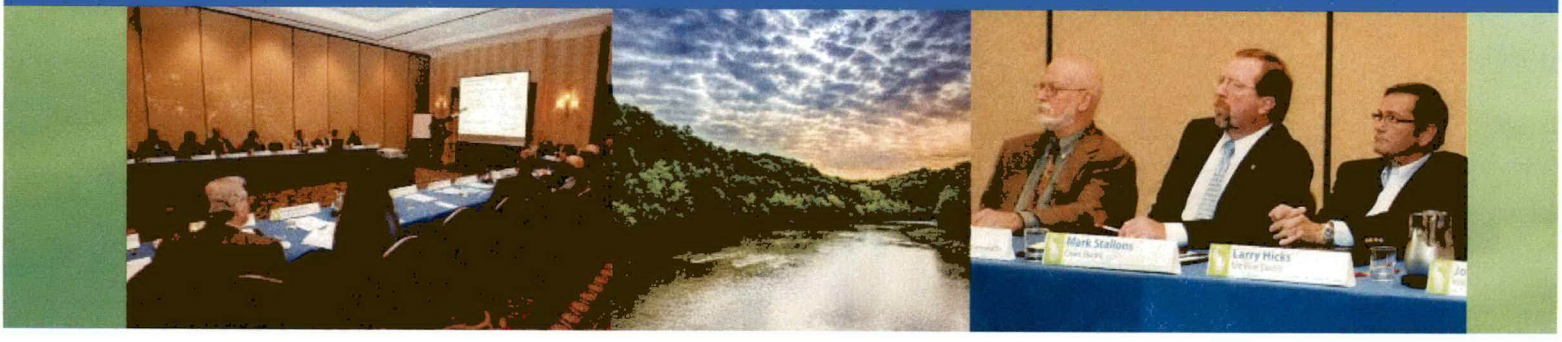
The final meeting of the Collaborative was held on Oct. 23, 2013 in Lexington. At this meeting, Barlow gave a presentation analyzing the results of the research conducted by NRECA into members' awareness, views and context associated with DSM programs offered by the co-ops. Barlow's analysis included suggestions for market segmentation and targeting of specific programs. This final meeting also included a report from Collaborative members Mike Williams and Elizabeth Crowe on the renewable energy public forum conducted in Danville in September and a presentation from EKPC's Scott Drake on actions taken by EKPC and its owner-members to address the Collaborative's previous recommendations. Information from both presentations is summarized elsewhere in this Annual Report.

At the end of the final meeting, Elizabeth Crowe presented a closing statement on behalf of the public interest groups, applauding EKPC and the cooperatives for the progress made toward EE/DSM and RE so far, encouraging EKPC to set percentage goals for savings through energy efficiency, DSM, and renewable energy generation, and offering to continue the conversation and collaborate in the future to assist with implementation of the recommendations of the collaborative to increase participation in existing and future EE/DSM and RE programs. The public interest groups' closing statement is available at: www/ekpc.coop/collaborative/closingstatement.pdf.

Chairman David Crews closed the meeting with thanks to all participants for their hard work, good faith and significant progress. He said a meeting of the leadership would be planned to map out a format in which collaboration among the parties could continue.

Report & Recommendations of DSM Work Group

By Steve Wilkins & Mark Stallons
Work Group co-chairs



During its second year of work, the Demand Side Management (DSM) Work Group developed four new recommendations, which were approved by the Collaborative.

The DSM Work Group also collaborated with National Rural Electric Cooperative Association (NRECA) market research staff to develop a research instrument to gather information about cooperative members' perspectives on energy efficiency and preferences and barriers to adopting various energy efficiency/DSM strategies.

In addition, the work group gathered comparative information about on-bill financing strategies piloted by four EKPC owner-member cooperatives and by a group of South Carolina cooperatives.

New Recommendations

Four new recommendations were approved by the full Collaborative to be passed on to EKPC for consideration. They are:

Recommendation 1

The Collaborative recommends that EKPC, in concert with the CEO/Manager's Association, continue to investigate, develop and implement rate strategies that:

1. Promote energy efficiency/DSM and rate alignment among PJM, EKPC, Distribution Cooperatives, and Members;

2. Promote fair cost recovery; and

3. Resolve shared demand risk and customer charge risk.

Investigation will begin in June 2014 and be based on one year of experience with PJM and on energy and demand data collection on energy efficiency/DSM programs.

Recommendation 2

The Collaborative recommends that EKPC and Owner Members work toward partnership and collaboration with public interest groups, utilities, and other agencies to market and promote energy efficiency, DSM and renewables.

Recommendation 3

The Collaborative recommends that EKPC conduct a study of the How$martKY on-bill financing program to quantify the energy savings and administrative costs. Should the results of the study prove to be positive we recommend that EKPC communicate the program benefits to all Owner-Members and promote How$martKY by providing marketing and advertising support to the participating Owner-Members.

Recommendation 4

The Collaborative recommends that EKPC work with Owner Members who choose to develop a member-to-member "energy ambassador" program to promote DSM efforts in the distribution cooperatives, including providing materials and training and certifying volunteer members.

These recommendations will be forwarded to EKPC's management for consideration.

Market Research on EE/DSM

The DSM Work Group also collaborated with National Rural Electric Cooperative Association (NRECA) market research staff to develop research instruments to gather data about

DSM WORK GROUP

Front row, from left: Co-Chair Mark Stallons, Co-Chair Steve Wilkins, Rick Ryan, Tona Barkley

Back row, from left: Scott Drake, Alan Coffey, Ann Beard, Maudie Nickell, Kim Bush, Sara Pennington

Not pictured: Tom Carew, Joni Hazelrigg, Jeff Prater, Scott Sidwell

cooperative members' perceptions of energy efficiency and preferences and barriers to adopting various energy efficiency/DSM strategies. The effort will include qualitative and quantitative research phases.

On-Bill Financing Pilots

The work group also gathered comparative information about on-bill financing strategies being piloted by four EKPC owner-member cooperatives and by eight South Carolina cooperatives.

Over the past two years, four EKPC owner-member distribution cooperatives—Big Sandy RECC, Fleming-Mason Energy, Grayson RECC, and Jackson Energy—have partnered with the Mountain Association for Community Economic Development (MACED) for a local on-bill financing pilot called House$martKY. The Kentucky Public Service Commission (PSC) has granted permanent on-bill financing tariffs for three EKPC owner-member cooperatives.

By the end of 2012, 116 homes had completed retrofits. There were still 14 homes to be completed when MACED reported to the DSM Work Group in March 2013. A final report from MACED will not be available until 12 months of post-retrofit consumption data can be collected on all participating homes. Preliminary data indicated weather-normalized energy savings of approximately 20 percent.

In South Carolina, the Electric Cooperatives of South Carolina (ECSC) and Central Electric Power Cooperative, a generation and transmission cooperative like EKPC, have embarked on a two-year pilot of on-bill financing of energy efficiency improvements. Through the pilot, which involved 125 homes served by eight co-ops, ECSC found that the average home cut electricity usage 34 percent, with annual dollar savings averaging $1,157.

The two projects featured some key differences. The ECSC program was loan-based while the Kentucky program used a tariffed approach. The Kentucky effort had a primary intent of piloting on-bill financed upgrades to determine the efficacy of pursuing such programs in a more robust way with more of EKPC's distribution cooperatives. The South Carolina cooperatives have set a goal of reducing energy use 10 percent over 10 years, and the pilot was aimed at testing whether that goal could be met in a region where income levels are 15 percent below the national average.

Report & Recommendations of the Renewable Energy Work Group

By Elizabeth Crowe & Mike Williams
Work Group co-chairs

In 2012-2013, the Renewable Energy Work Group investigated specific renewable energy projects, and drafted and approved two recommendations, which were approved by the Collaborative.

The work group reviewed and discussed a variety of renewable energy options that could meet the following attributes:

- Voluntary in nature;
- As financially accessible as possible for co-op members;
- Could drive demand for renewable energy;
- Scalable;
- Increase familiarity with renewable energy technologies; and
- Could lead to more local generation of renewable energy.

One focal point for the group was the expansion of EKPC's EnviroWatts program. While the program's structure is established and useful, the work group agreed that EnviroWatts could be strengthened and made more attractive with an expanded list of renewable energy options, such as solar, wind and hydro. It was noted that barriers to EnviroWatts participation include the current pricing structure and the perception of some people that landfill gas is not renewable. And, if modifications are made, it presents an opportunity to re-examine marketing strategies in order to increase program participation. Collaborative members pledged to work together to encourage participation among individuals and businesses.

The work group also examined the option for EKPC to establish a solar photovoltaic array. In March 2012 the work group met with Ed Fortner, Director of the Berea Municipal Utilities, and in May 2012 made a site visit to Berea to visit BMU's solar installation and meet with staff and partners. The work group also conducted a conference call with Sam Avery of Avery & Suns solar installation. The group identified implementation hurdles and potential solutions to increase participation in the program. Through the year, the work group worked to draft recommendations on pricing, location and configuration of the solar panels. The work group approved a set of recommendations in January 2013 and final recommendations were approved by the Collaborative in July.

The following two recommendations were approved by the Collaborative.

Recommendation 1: Enhance EnviroWatts

- EKPC should revise its Envirowatts program to add the option for cooperative members to voluntarily purchase 100-kilowatt-hour blocks of electricity generated by solar, wind or hydropower, individually. Block rates could be initially based on current renewable energy credit (REC) pricing, and reviewed at a minimum of once every two years to insure that pricing is appropriate. The goal is to make renewable energy accessible, reflect the changing costs of renewable energy and allow cost recovery for EKPC and its owner-member cooperatives.
- Available for residential and commercial members.

RENEWABLE ENERGY WORK GROUP

Front row, from left: Sharon Carson, Ginger Watkins, Candi Waford, Co-Chair Elizabeth Crowe, Josh Bills

Back row, from left: Chuck Bishop, David Crews, Scott Drake, Co-Chair Mike Williams, Tona Barkley, Wallace McMullen, Larry Hicks, David Phelps

Not pictured: Jay Hampton

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- EKPC should review opportunities for out-of-state wind power purchase agreements, particularly the options now available through its membership in PJM.
- Research low-impact hydro potential, prioritizing in-state generation.
- EKPC should rebrand the Envirowatts program; explore marketing strategies.
- EKPC and its owner-member cooperatives should track participation in Envirowatts and assess challenges and opportunities for participation, to enhance marketing and out-reach activities and best serve the needs of co-op members.

Recommendation 2: Solar photovoltaic installation

- Invest in installation and operation of a solar photovoltaic farm, with an initial target capacity of 25-30 kw. Panels can be leased by members at a one-time price through a 25-year agreement. Customers would receive a monthly credit for the amount of electricity generated by the panel.
- EKPC should offer energy from unsubscribed solar farm panels to co-op members through the Envirowatts program.
- Installation location criteria should include opportunities for interaction with co-op members, that could increase publicity and interest in participation; material and installation costs.
- Provide members and the general public with interactive informational materials and activities to familiarize solar technology and its benefits.
- EKPC should research grant and loan opportunities.
- EKPC and its owner members should track participation in renewable energy projects and ensure there are adequate renewable energy options to meet the demand.

In addition to these topics, the Renewable Energy Work Group also created a scope of work for marketing research to determine the interest and potential market for renewable energy and energy efficiency programs recommended through the Collaborative. The research will be conducted by the National Renewables Cooperative Organization and its marketing consultants. Several workgroup participants were also interviewed by the marketing research team. The Collaborative also gather feedback on renewable energy at a September 2013 public forum in Danville at the offices of Inter-County Electric Cooperative. (That forum is discussed in more detail in this annual report.) The market research results, combined with

Report on the Sept. 19, 2013 Renewable Energy Public Forum

By Elizabeth Crowe

The results of more than two years of Collaborative conversation on renewable energy were brought to the public in September when the Collaborative organized a public forum on renewable energy. The forum was hosted by Inter-County Energy Cooperative at the co-op's offices in Danville, Ky.

About 40 people, including co-op members and citizens, joined Collaborative members to hear presentations on: the purpose and goal of the Collaborative by David Crews and Tona Barkley; a primer on renewable energy sources available in Kentucky; and about EKPC's existing renewable energy purchasing program, EnviroWatts, by Josh Bills and Scott Drake. In addition, Mike Williams and Elizabeth Crowe, who co-chaired the Renewable Energy Work Group, presented the Collaborative's renewable energy recommendations.

Following these presentations, participants divided into small groups. Collaborative members prompted discussion with a set of guiding questions to gain feedback on the recommendations and on renewable energy in general. They also gathered ideas and suggestions for how renewable energy projects could be successfully rolled out by EKPC and its owner-member co-ops. Discussion from the small groups included:

- Support for the recommendation for a subscribed solar farm and the belief that it would be fully subscribed;
- Support for including additional renewable energy options in the EnviroWatts program;
- Desire for more options to reduce the cost of renewable energy, and questions about how people can advocate for support of renewable energy among state leaders;
- Discussion of the future use of "smart grid" technology to capture return on investment and support decentralized power; and
- Interest in the cost comparison between solar and wind energy.

Some participants expressed concern that renewable energy can be perceived by utilities and others as accessible only to wealthy people, and a desire to avoid that division. Another felt that they were not getting as much support for renewable energy net metering from their co-ops as they wanted.

One feature of the forum was a solar energy trailer, loaned by Appalachian Science in the Public Interest and transported to the meeting by Josh Bills. Following adjournment of the forum, some participants toured the trailer to see how solar panels function.

From all participants there was appreciation for the opportunity for meaningful conversation between co-op leaders, EKPC staff, public interest groups and co-op members. Some participants specifically suggested that this type of forum be offered by each distribution co-op so that members can be more engaged in discussing co-op programs and activities.

Summary of Recommendations to EKPC's Management

1. Partner with distribution member cooperatives and allocate resources for measurement and verification (M&V) of the cooperatives' existing and future DSM efforts. This includes developing a standardized, on-going process to collect data, investigate, and report on dynamic energy and demand impacts.

2. Offer generally accepted DSM quantitative and qualitative analytic services to member systems on an individual, group and/or system average basis using each member cooperative's unique market and cost structures.

3. Aggressively help member systems market those DSM programs with the optimal benefit-cost profiles.

4. Develop strong educational, marketing and training programs for member systems to promote DSM efforts considering all potential markets and channels for messaging.

5. Allocate resources toward becoming and serving as a consultant and expert for member systems in their DSM efforts. Identify best practices, provide research support, and explore partnerships to this end.

6. Continually evaluate new and on-going DSM programs, refining efforts to ensure optimal penetration of target markets.

7. In concert with the CEO/Manager's Association, continue to investigate, develop and implement rate strategies that:

a. Promote EE/DSM and rate alignment among PJM, EKPC, distribution cooperatives, and members.
b. Promote fair cost recovery
c. Resolve shared demand risk and customer charge risk

Investigation will begin in June 2014 and be based on one year of experience with PJM and on energy and demand data collection on EE/DSM programs.

8. With owner-member cooperatives, work toward partnership and collaboration with public interest groups, utilities, and other agencies to market and promote energy efficiency and DSM.

9. Conduct a study of the How$martKY on-bill financing program to quantify the energy savings and administrative costs. Should the results of the study prove to be positive, we recommend that EKPC communicate the program benefits to all owner-member cooperatives and promote How$martKY by providing marketing and advertising support to the participating owner-member cooperatives.

10. Work with owner-member cooperatives that choose to develop a member-to-member "energy ambassador" program to promote DSM efforts in the distribution cooperatives, including providing materials and training and certifying volunteer members.

Renewable Energy Work Group

1. Enhance the EnviroWatts Program

- EKPC should revise its Envirowatts program to add the option for cooperative members to voluntarily purchase 100-kilowatt-hour blocks of electricity generated by solar, wind or hydropower, individually. Block rates could be initially based on current renewable energy credit (REC) pricing, and reviewed at a minimum of once every two years

to insure that pricing is appropriate. The goal is to make renewable energy accessible, reflect the changing costs of renewable energy and allow cost recovery for EKPC and its owner-member cooperatives.

- Available for residential and commercial members.
- EKPC should review opportunities for out-of-state wind power purchase agreements, particularly the options now available through its membership in PJM.
- Research low-impact hydro potential, prioritizing in-state generation.
- EKPC should rebrand the Envirowatts program; explore marketing strategies.
- EKPC and its owner-member cooperatives should track participation in Envirowatts and assess challenges and opportunities participation, to enhance marketing and outreach activities and best serve the needs of co-op members.

2. Solar Farm Project

- Invest in installation and operation of a solar photovoltaic farm, with an initial target capacity of 25-30 kw. Panels can be leased by members at a one-time price through a 25-year agreement. Customers would receive a monthly credit for the amount of electricity generated by the panel.
- EKPC should offer energy from unsubscribed solar farm panels to co-op members through the Envirowatts program.
- Installation location criteria should include opportunities for interaction with co-op members, that could increase publicity and interest in participation; material and installation costs.
- Provide members and the general public with interactive informational materials and activities to familiarize solar technology and its benefits.
- EKPC should research grant and loan opportunities.
- EKPC and its owner members should track participation in renewable energy projects and ensure there are adequate renewable energy options to meet the demand.

EKPC Actions On First-Year Recommendations

By Scott Drake, EKPC

DSM Work Group Recommendation #1:
Partner with distribution member cooperatives and allocate resources for measurement and verification of the cooperatives' existing and future DSM efforts. This includes developing a standardized, on-going process to collect data, investigate and report on energy and demand impacts.

EKPC has contracted with DNV KEMA Energy & Sustainability to perform a thorough assessment of the cooperative's DSM evaluation, measurement and verification process. DNV KEMA interviewed EKPC staff, consultants and owner-members' staff. The consultant also compared EKPC's process to industry best practices and made recommendations for improvement. As a result, by the end of 2013, EKPC plans to purchase and begin using software to better track program implementation and assist with standardizing energy savings estimates and the California benefit/cost tests. For programs where such analysis is appropriate and there is sufficient participation, DNV KEMA also recommended EKPC conduct its own billing data analysis rather than use a deemed savings approach.

DSM Work Group Recommendation #2:
Offer generally accepted DSM quantitative and qualitative analytic services to member systems on an individual, group and/or system average basis using each member cooperative's unique market and cost structures.

EKPC's consultant, John Farley, is available to provide the owner-member cooperatives with requested DSM program analytics. EKPC has allocated funding to pay for the consultant's time to respond to requests. Over the past year, Farley has performed evaluations for co-ops based on their own cost structures and demographics.

DSM Work Group Recommendation #3:
Aggressively help member systems market those DSM programs with the optimal benefit-cost profile.

EKPC has partnered with owner-member cooperatives to implement outbound telemarketing for the $impleSaver direct load control (DLC) program, which has the highest benefit-cost profile in the EKPC's portfolio. As a result of these efforts, EKPC and the owner-members installations are on a record pace, with more switches installed during the first half of 2013, that all of 2012. The DLC switch installation contractor has hired additional local licensed technicians to keep pace with the consumer response.

DSM Work Group Recommendation #4:
Develop strong educational, marketing and training programs for member systems to promote DSM efforts considering all potential markets and channels for messaging.

In 2012, EKPC developed a new marketing campaign to promote energy-efficiency programs. Called SAVE IT!, this approach can be used to promote all DSM programs collectively or individually. The strategy of the campaign is to create a dialogue between the local cooperative and end-consumers, and cultivate word-of-mouth marketing. More than 50 print and web advertisements have been provided to owner-member co-ops in 2013, and EKPC has produced and distributed two new television spots. The campaign includes print, radio, banners, brochures and Kentucky Living magazine. EKPC is also offering a SAVE IT! booth featuring brochures on DSM programs to each owner-member for its annual meeting. New energy advisor training is set for November 2013.

DSM Work Group Recommendation #5:
Allocate resources to becoming and serving as a consultant and expert for member systems in their DSM efforts. Identify best practices, provide research support, and explore partnerships to this end.

EKPC has dedicated staff to the development, implementation and ongoing improvement of DSM programs. Staff has participated in several industry meetings and conferences to identify DSM program best practices. EKPC has discussed with the owner-member co-ops the different DSM program types and designs that achieve higher energy efficiency per participant, such as whole-house envelope improvement, and those that achieve higher customer participation, such as direct install programs. EKPC, along with one owner-member, is conducting a research project to evaluate the impacts of weatherizing existing manufactured homes.

DSM Work Group Recommendation #6:
Continually evaluate new and on-going DSM program, refining efforts to ensure optimal penetration of target markets.

EKPC and its owner-member cooperatives made changes to four DSM programs in January 2013. The four program changes received PSC tariff approval January 1, 2013. Development of new residential programs is being delayed until measurement and verification software has been chose, as this will help to evaluate existing programs. Also, EKPC staff is working on a new Demand Response program that allows the commercial and industrial members who have backup generators to participate in the PJM Emergency Demand Response markets and be compensated for that participation.

4775 Lexington Road, 40391
P.O. Box 707,
Winchester, KY 40392-0707
Telephone: 859-744-4812
Fax: 859-744-6008
www.ekpc.coop

Exhibit DSM-10

Demand Response Bid into PJM

EKPC DR Capacity Bid in PJM

Year	MW
2013/2014	83.3
2014/2015	128.2