



Kentucky Power Company
2012-2013 Demand Side
Management Portfolio
Evaluation
Process, Market and Impact Evaluations · July 2014

Prepared by:

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Abbreviations

AEG	Applied Energy Group, Inc.
AEP	American Electric Power
AHRI	Air Conditioning, Heating and Refrigeration Institute
APT	Applied Proactive Technologies
CEE	Consortium for Energy Efficiency
CF	Coincidence Factor
CFL	Compact Fluorescent Light Bulb
DSM	Demand Side Management
EER	Energy Efficiency Ratio
EFI	Energy Federation Incorporated
EISA	Energy Independence and Security Act of 2007
EM&V	Evaluation, Measurement and Verification
FLH	Full Load Hours
HSPF	Heating Season Performance Factor
HVAC	Heating Ventilation & Air Conditioning
IL TRM	Illinois Technical Reference Manual
IPMVP	International Performance Measurement and Verification Protocols
ISR	In-Service Rate
KPCO	Kentucky Power Company
MOU	Memorandum of Understanding
NTG	Net-to-Gross Ratio
PSC	Public Service Commission
QA/QC	Quality Assurance/Quality Control
SEER	Seasonal Energy Efficiency Ratio
WHF	Waste Heat Factor

Definitions

Benefit-Cost Ratio: The ratio of total benefits of a program to the total costs discounted over some specified time period. The benefit-cost ratio is a measure of the participant rate of return and provides an indicator of program risk.

Participant Cost Test: Measures the quantifiable benefits and costs to the customer due to participation in a program.

Program Administrator Cost Test: Measures the net costs of a demand-side management program as a resource option based on the costs incurred by the program administrator (including incentive costs), excluding any net costs incurred by the participant. The benefits are similar to the Total Resource Cost benefits, but costs are more narrowly defined.

Ratepayer Impact Measure (RIM) Cost Test: Measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected are less than the total costs incurred by the utility. The RIM test indicates the direction and magnitude of the expected change in customer bills or rate levels.

Total Resource Cost (TRC) Test: Measures the net costs of a demand side management program as a resource option based on the total costs of the program, including both the participant and utility costs.

British thermal unit (Btu): The amount of heat needed to raise one pound of water at maximum density one degree Fahrenheit. Btu is used to describe the power of heating and cooling systems, such as furnaces and air conditioners. Air conditioners for household use typically produce between 5,000 and 15,000 Btu. 1 watt is approximately 3.41 Btu/h.

Coincidence Factor (CF): The ratio, expressed as a numerical value or as a percentage, of the simultaneous maximum demand of a group of electrical appliances or consumers within a specified period to the sum of their individual maximum demands within the same period.

Cost-effectiveness: A criterion that specifies that a technology or measure delivers a good or service at equal or lower cost than current practice, or the lowest cost alternative for the achievement of a given target.

Energy Efficiency Ratio (EER): average efficiency of the equipment under peak conditions. A measure of the relative efficiency of a heating or cooling appliance, such as an air conditioner, that is equal to the unit's output in Btu's per hour divided by its consumption of energy, measured in watts.

Full Load Hours (FLH): The number of hours a system operates at full load during one year for cooling or heating purposes. Expressed as total annual energy use divided by total peak load.

Gross Energy Savings: Energy and demand savings seen by the participant at the meter. These are the appropriate program impacts to calculate bill reductions for the Participant Test.

Heating Season Performance Factor (HSPF): measure of seasonal average efficiency of equipment in heating mode.

In-Service Rate (ISR): Percentage of units that are installed.

International Performance Measurement and Verification Protocols (IPMVP): Provides an overview of current best practice techniques available for verifying results of energy efficiency, water efficiency,

and renewable energy projects in commercial and industrial facilities. It may also be used by facility operators to assess and improve facility performance. Energy conservation measures covered in the protocols include fuel saving measures, water efficiency measures, load shifting and energy reductions through installation or retrofit of equipment, and/or modification of operating procedures.

Kilowatt (kW): A unit of power that describes the rate at which energy is generated or used. It quantifies the electric power required by an appliance or device such as a light bulb.

Kilowatt Hour (kWh): A unit of energy that describes how much electricity is consumed over a period of time. For example, if you turn on a 100 watt light bulb all day for 24 hours the light bulb consumed 2.4 kWh of electricity.

Memorandum of Understanding (MOU): A document that details the criteria that retailers and manufacturers must meet to participate in the program. Retailers entered into an MOU for the Residential Efficient Products Program.

Net Energy Savings: The energy and demand savings attributable to the program, adjusted for free riders and spillover.

Net-to-Gross (NTG) Ratio: The ratio of net energy savings to gross energy savings indicates the overall effectiveness of an energy efficiency program. As the NTG ratio approaches one, the magnitude of the program impact increases.

Free Riders: Customers who participate in energy efficiency programs who would have engaged in the efficient behavior in the absence of the program. As a result, the presence of free riders tends to overestimate the energy savings of the program.

Spillover: Customers who engage in energy efficient behavior, but do not participate in the program, due to some influence of the program.

Seasonal Energy Efficiency Ratio (SEER): average efficiency of the equipment during a typical cooling-season at the location of the measure. Ratio of the cooling output (Btu) divided by the power consumption (total electric energy input in watt-hours) during the same period. The higher the SEER, the more efficient the unit.

Waste Heat Factor (WHF): Factor to account for cooling energy savings from efficient lighting.

1. Introduction

Kentucky Power Company ("Kentucky Power" or "KPCO") retained Applied Energy Group ("AEG") to conduct a comprehensive evaluation of its 2012-2013 Demand Side Management ("DSM") Program Portfolio. The DSM Program Portfolio is implemented to help Kentucky Power reduce electricity use and peak demand, help customers lower their electricity bills, and encourage long-term change in the market through the adoption of energy efficiency technologies and services.

Kentucky Power serves approximately 175,000 electric customers in all or part of 20 eastern Kentucky counties.¹ The utility is part of the American Electric Power ("AEP") system, which is one of the largest electric utilities in the United States.²

A comprehensive market, process and impact evaluation provides valuable information to Kentucky Power, its Demand Side Management Collaborative ("DSM Collaborative"),³ the Kentucky Public Service Commission ("PSC") and various stakeholders to understand KPCO's existing programs and potentially improve Kentucky Power's energy efficiency programs based on the results of the evaluations. The DSM programs evaluated include:

- Residential Efficient Products Program
- Community Outreach CFL Program
- Student Energy Education Program
- Modified Energy Fitness Program
- Mobile Home New Construction Program
- Targeted Energy Efficiency Program
- Residential HVAC Diagnostic and Tune-Up Program
- Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program
- Commercial Incentive Program

This report describes the key findings from the program process, market and impact evaluations and provides recommendations for improving the DSM programs. Section 2 provides an overview of DSM Program Portfolio evaluation. Sections 3 through 11 provide the detailed DSM program evaluations.

¹ Kentucky Power. Facts, Figures & Bios. Accessed at www.kentuckypower.com/info/facts/

² American Electric Power delivers electricity to more than 5 million customers in 11 states and ranks among the nation's largest generators of electricity, with almost 38,000 megawatts of generating capacity in the U.S.

³ The DSM Collaborative includes Kentucky Power, the Attorney General's Office, Community Action Kentucky, Northeast Kentucky Community Action Agency, Big Sandy Community Action Agency, Middle Kentucky Community Action Partnership, Gateway Community Action Council, LKLP Community Action Council, Community Services –Appalachian Research and Defense Fund of Kentucky, Inc. and Big Sandy Area Development District ("BSADD Aging"), Kentucky Housing Corporation, Floyd County Schools, and Our Lady of Bellefonte Hospital.

2. Executive Summary

Evaluation, measurement and verification ("EM&V") demonstrates the value of energy efficiency programs by providing accurate, transparent and consistent assessments of program performance and cost-effectiveness. The comprehensive assessment of Kentucky Power's 2012-2013 DSM Program Portfolio utilized process, market and impact evaluations. Market, process and impact evaluations are designed to work together to support the need for public accountability and oversight of ratepayer-funded programs.

Process and market evaluations identify whether key elements, such as incentive levels, program delivery, program tracking mechanisms and quality assurance/quality control ("QA/QC") procedures, are performing as designed and identifies issues or opportunities to improve these key elements. A comprehensive process evaluation will:

- Assist program implementers and managers in restructuring existing programs and/or designing new programs to achieve cost-effective savings while maintaining high levels of customer satisfaction.
- Determine awareness levels to refine marketing strategies and reduce barriers to participation.
- Provide recommendations for changing the program's structure, management, administration, design, delivery, operations or targets.
- Determine if specific best practices should be incorporated.
- Gather information from a variety of sources to address the issues stated above.

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

AEG designed the process, market and impact evaluations to determine the efficacy of program procedures and systems, evaluate the achievement of program objectives, provide insight into and recommendations for program improvement and verify the direct impacts of program activities. Based on the evaluations, AEG developed savings for each program and program measure, as applicable. The gross and net savings per participant/project shown in the tables below should be utilized by Kentucky Power to track and report DSM program energy and demand savings. AEG's approach to conducting program evaluations followed best practices protocols.

Table 1 Gross Savings per Participant/Project

Program/Measure	Energy Savings per Participant (kWh)	Summer Demand Savings per Participant (kW)	Winter Demand Savings per Participant (kW)
Residential Efficient Products	34.52	0.004	0.004
Standard CFL	31.61	0.003	0.003
Specialty CFL	43.32	0.005	0.005
LED	40.15	0.004	0.004
Community Outreach	132	0.01	0.01
Student Energy Education	117	0.01	0.01
Modified Energy Fitness	842	0.16	0.10
Mobile Home New Construction	2,215	0.77	0.68
Targeted Energy Efficiency	2,418	0.77	0.53
All Electric Home	2,685	0.87	0.60
Non-All Electric Home	514	0.05	0.05
Residential HVAC Diagnostic & Tune-Up	618	0.04	0.09
Heat Pump	618	0.04	0.09
Central Air Conditioner	-	-	-
Small Commercial HVAC Diagnostic & Tune-Up	869	0.06	0.13
Heat Pump	869	0.06	0.13
Central Air Conditioner	-	-	-
Residential High Efficiency Heat Pump	1,564	0.04	0.89
Replace Resistance Heat	2,334	-0.07	1.50
Replace Heat Pump	1,311	0.23	0.48
Mobile Home High Efficiency Heat Pump	2,914	-0.09	1.89
Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive	n/a	n/a	n/a
Heat Pump, ≤36 kBTU/h	1,307	1.07	0.45
Heat Pump, 36 kBTU/h ≤65 kBTU/h	1,789	1.43	0.66
Air Conditioner ≤36 kBTU/h	214	0.45	-
Air Conditioner 36 kBTU/h ≤65 kBTU/h	386	0.82	-
Commercial Incentive			
Per Project	22,540	3.7	3.6
Per Participant	22,515	3.7	3.6

Table 2 Net Savings per Participant/Project

Program/Measure	Energy Savings per Participant (kWh)	Summer Demand Savings per Participant (kW)	Winter Demand Savings per Participant (kW)
Residential Efficient Products	27.27	0.003	0.003
Standard CFL	24.97	0.003	0.003
Specialty CFL	34.22	0.004	0.004
LED	31.72	0.003	0.003
Community Outreach	56	0.01	0.01
Student Energy Education	78	0.01	0.01
Modified Energy Fitness	798	0.15	0.10
Mobile Home New Construction	1,438	0.50	0.44
Targeted Energy Efficiency	2,037	0.64	0.45
All Electric Home	2,262	0.73	0.50
Non-All Electric Home	433	0.04	0.04
Residential HVAC Diagnostic & Tune-Up	284	0.02	0.04
Heat Pump	284	0.02	0.04
Central Air Conditioner	-	-	-
Small Commercial HVAC Diagnostic & Tune-Up	668	0.04	0.10
Heat Pump	668	0.04	0.10
Central Air Conditioner	-	-	-
Residential High Efficiency Heat Pump	891	0.02	0.50
Replace Resistance Heat	1,278	-0.04	0.82
Replace Heat Pump	775	0.13	0.28
Mobile Home High Efficiency Heat Pump	1,668	-0.05	1.08
Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive	n/a	n/a	n/a
Heat Pump, ≤36 kBTU/h	586	0.48	0.20
Heat Pump, 36 kBTU/h ≤65 kBTU/h	803	0.64	0.30
Air Conditioner ≤36 kBTU/h	96	0.20	-
Air Conditioner 36 kBTU/h ≤65 kBTU/h	173	0.37	-
Commercial Incentive			
Per Project	18,813	3.1	3.0
Per Participant	18,792	3.1	3.0

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the efficient technology(s) improve a customer's financial position, decreases overall energy costs to ratepayers, or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

The DSM Portfolio was found to be cost-effective for the 2012-2013 program years as well as on a prospective basis. Therefore, the DSM Portfolio could be continued going forward without regard to program cost-effectiveness based on the TRC standard. The cost-effectiveness results are presented in the tables below.

Table 3 DSM Portfolio Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.42	\$24,868,740	\$10,525,956	(\$14,342,783)
Utility Cost Test	2.00	\$5,250,883	\$10,525,956	\$5,275,073
Participant Test	7.33	\$2,962,913	\$21,732,423	\$18,769,510
Total Resource Cost Test	1.73	\$6,099,230	\$10,525,956	\$4,426,726

Table 4 DSM Portfolio Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.46	\$17,239,161	\$7,853,633	(\$9,385,528)
Utility Cost Test	2.13	\$3,690,675	\$7,853,633	\$4,162,958
Participant Test	7.42	\$2,025,575	\$15,021,730	\$12,996,156
Total Resource Cost Test	1.85	\$4,243,005	\$7,853,633	\$3,610,627

Table 5 DSM Portfolio Cost Effectiveness Summary, 2012-2013

Program	TRC	Net Energy Savings (kWh)	First Year Cost per Energy Saving (\$/kWh)	Net Levelized Cost (\$/kWh)	Gross Levelized Cost (\$/kWh)
Total Portfolio	1.73	24,006,775	\$0.22	\$0.05	\$0.04
Modified Energy Fitness	1.29	1,915,764	\$0.45	\$0.08	\$0.07
Targeted Energy Efficiency	1.79	853,351	\$0.47	\$0.06	\$0.05
Residential Heat Pump	1.28	1,055,295	\$0.47	\$0.06	\$0.04
Residential HVAC Diagnostic	0.24	286,663	\$0.39	\$0.15	\$0.07
Mobile Home Heat Pump	1.12	687,359	\$0.27	\$0.03	\$0.02
Commercial HVAC Diagnostic	0.22	75,489	\$0.42	\$0.15	\$0.12
Commercial HP/CAC	0.74	27,284	\$1.49	\$0.17	\$0.08
Mobile Home New Construction	1.68	367,020	\$0.42	\$0.05	\$0.03
Energy Education for Students	1.73	383,223	\$0.15	\$0.04	\$0.03
Community Outreach	1.56	683,257	\$0.16	\$0.04	\$0.02
Residential Efficient Products	3.08	12,402,054	\$0.06	\$0.02	\$0.02
Commercial Incentive	1.61	5,270,016	\$0.38	\$0.06	\$0.05

3. Residential Efficient Products Program

The Residential Efficient Products Program utilizes markdown incentives to reduce the retail price of eligible products at participating retail stores, as well as Kentucky Power's online store to encourage the purchase and use of efficient residential lighting products. Customer rebates are limited to 12 bulbs per purchase.⁴ Product selection and rebate amounts may vary by store.

Table 6 Eligible Products and Average Rebates⁵

Bulb Type	Incentive
Standard CFL	\$1.00
Specialty CFL	\$1.50
LED	\$10.00

Kentucky Power provides incentives to participating retailers for actual products sold, verified with supporting sales documentation. KPCO entered into a Memorandum of Understanding ("MOU") with manufacturers and retailers detailing the program criteria, such as the retail discount and qualifying bulbs. Independent retailers that do not meet the MOU criteria may participate in the coupon program.

The Kentucky PSC approved budget and participation goals.

Table 7 Program Budget Goals, 2012-2014

	2012	2013	2014
CFL/Markdowns	\$142,659	\$205,980	\$424,554
Other Lighting Incentives	\$1,800	\$33,275	\$12,000
Administration/Promotion	\$194,809	\$248,694	\$379,642
Evaluation	\$15,937	\$0	\$27,744
Total Budget	\$355,205	\$487,950	\$843,940

Table 8 Participation Goals, 2012-2014⁶

	2012	2013	2014
CFLs	125,000	162,100	240,000
Specialty CFLs	25	18,000	20,000
LEDs	775	500	4,500
Total Participants	125,800	180,600	264,500

3.1 2011 Residential Efficient Products Program Evaluation

AEG conducted a process, market and impact evaluation of the 2011 Residential Efficient Products Program, submitted in a report August 2012 to the Kentucky Public Service Commission. The evaluation recommendations included, but were not limited, to:

- Conduct more frequent in-store promotions for independent retailers.
- Modify independent retailer in-store instant coupons to collect only the product information.
- Remove incentives for LED holiday lights, LED nightlights and ENERGY STAR ceiling fans.
- Establish separate goals for standard and non-standard CFLs.
- Examine the cost-effectiveness of incentivizing LED bulbs.

⁴ Product selection and rebate amounts may vary by store.

⁵ The average incentive was developed based upon 2012 and 2013 program data.

⁶ In 2012, Specialty CFLs were limited to ceiling fans and LEDs were limited to holiday LED light bulbs.

As of 2013, based on the recommendations, Kentucky Power removed LED holiday lights, LED night lights and ENERGY STAR Ceiling Fans from the program offerings, began offering instant rebates on LED bulbs, established separate goals for standard and specialty CFLs, and developed a new coupon for independent retailers. The new coupon does not collect customer information, only product information such as the manufacturer, model number, date of purchase and quantity.

3.2 Evaluation Data Collection

The program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation goals?
- Are independent retailers fully engaged in the program?
- Are retailers satisfied with the program?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Could additional measures be added to the program?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interviews

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

Third-Party Implementer Interviews

The program is implemented by Applied Proactive Technologies, Inc. ("APT"). APT provides field support services and fosters retailer and manufacturer relationships. An APT Field Representative visits with retailers to check product stock, displays, and to ensure retail pricing markdowns are current. The representative provides sales staff training and conducts in-store promotions. APT utilizes Energy Federation Incorporated ("EFI") to track and report sales data, process payments, and manage the online store.

AEG interviewed APT in October 2013. The interview provided information on program implementation activities, program data and tracking methods, and barriers to increased participation. The interview guide can be found in Appendix A.

Retailer Interviews

AEG administered a 10 to 12 minute telephone survey to a sample of participating stores to assess product availability, customer satisfaction, potential areas for improvement, marketing and coordination efforts, and educational efforts. AEG conducted 5 surveys of participating stores. The survey guide can be found in Appendix B.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power’s initial program filing savings were reviewed to compare with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Option A of the International Performance Measurement and Verification Protocols (“IPMVP”).⁷

Table 9 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

Engineering calculations referenced from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”), using Kentucky Power specific inputs, were utilized to calculate the gross energy and demand impacts.⁸

3.3 Program Activities and Market Barriers

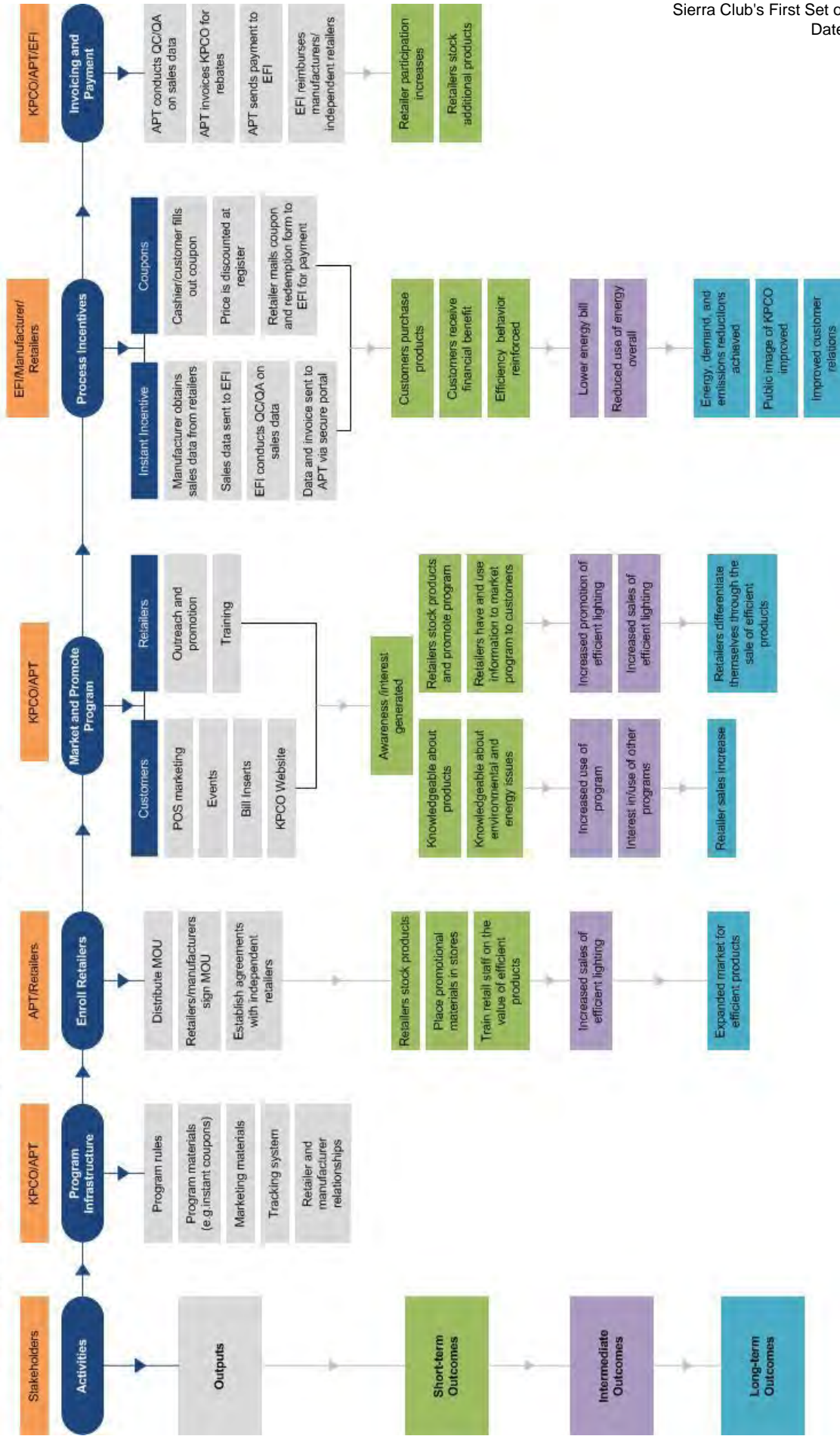
Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

⁷ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

⁸ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 1 Program Logic Model

Inputs: PSC filings, Kentucky Power program staff, implementation contractor, retailers, program materials



3.3.1 Program Activities

The program activities and corresponding outputs help to establish linkages between the situation the program is designed to address and the program's intended outcomes. Program activities include:

Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power program staff and APT, with input from AEP, designed the program, including product offerings, retailer and manufacturer relationships, tracking system, and marketing materials. A list of participating retailers is maintained on the KPCO DSM Program website. The KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Enroll Retailers

APT identified potential manufacturers and retail stores to participate in the program and facilitated MOU negotiations between the parties. APT engaged potential retail stores well within the Kentucky Power service territory to minimize the possibility of sales to non-Kentucky Power customers (i.e. leakage). The MOUs detail the criteria retailers and manufacturers must meet to participate in the program, such as markdowns and eligible models. The manufacturers usually provide the up-front capital to the retailers and Kentucky Power pays incentives for actual products sold, verified with supporting sales documentation. The MOU agreements are renewed every 6-months to one year. The current MOU agreements expire December 31, 2013.

Independent retailers that could not meet the MOU criteria were given the opportunity to participate in the coupon program. Through the coupon program, participating retailers agree to reduce the retail price of eligible products, provide documentation of eligible product sales and receive in-store materials.

Marketing

Marketing activities include a combination of point-of-sale marketing, retailer outreach, bill inserts, radio advertisements, program fact sheets and the KPCO website. An APT Field Representative promotes the program through retailer site visits, in-store events, community events and retailer training.

Process Customer Incentive

Customers purchase qualifying light bulbs through three avenues.

- **MOU Retailer.** Customers receive an instant rebate at the time of purchase. The discounted price is only available for products made by manufacturers that entered into an MOU with Kentucky Power. The manufacturer receives sales data from participating retailers and reviews for completeness and accuracy. The manufacturer submits the sales data to EFI for processing and payment. EFI staff reviews the sales data for anomalies.
- **Independent Retailer.** Customers receive an instant rebate at the time of purchase. The cashier or customer fills out a coupon, which includes the date, product quantity, manufacturer and

model number.⁹ The retailer fills out a coupon redemption form with a summary of coupons by value, the address where the check is to be mailed and the total amount of expected redemption. The retailer then submits the coupons and redemption form to EFI. EFI staff review for completeness and eligibility.

- **Kentucky Power Online Store.** Customers with a KPCO account number and address within Kentucky Power's service territory receive a discount at checkout. The online store is managed by EFI, therefore purchase data is sent directly to EFI staff for review.

Invoicing and Payment

EFI reviews the sales data provided by the manufacturers and typically submits audited sales data as well as an invoice to APT on a bi-weekly basis. APT reviews the audited sales data and ensures the data matches the manufacturer invoice. An audited invoice, with sales data, is submitted to Kentucky Power on a bi-weekly basis, often within one or two days of receiving the audited sales data from EFI. Kentucky Power approves invoices and submits payment to APT within 10 days of receipt. APT submits payment to EFI and EFI submits payment to the manufacturer/retailer.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

3.3.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in efficient lighting may increase among customers, manufacturers and retailers. Retailers may stock efficient lighting products and promote the program. Customers will receive a financial benefit from installing efficient lighting. The program may lead to an increased commitment to energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in and use of other KPCO efficiency programs, increased promotion and sales of efficient lighting products, and lower energy bills.

Long-term Outcomes

The long-term outcomes may include an expanded market for energy efficient products. Retailers may strive to differentiate themselves from other retailers by increasing sales of efficient products. Additional outcomes include reduced utility emissions, fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

⁹ In August 2012, APT issued a new coupon for independent retailers. Prior to that date, the customer had to provide personal information (name, address, telephone number). A previous program evaluation recommended that personal customer information no longer be collected.

3.3.3 External Factors

There are a variety of factors outside the control of Kentucky Power that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Competition among targeted retailers
- Economic conditions
- Internal retailer procedures
- Cost, performance and availability of efficient technologies

3.4 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, retailer participation, program tracking and program satisfaction.

3.4.1 Program Marketing

Kentucky Power and APT marketed the Residential Efficient Products Program through the following:

- **In-Store Materials.** In-store displays, including shelf tags and horizontal and vertical beam signs, which highlight bulb savings and price. Coupons are prominently displayed at independent retailers.
- **Retailer Site Visits.** An APT Field Representative conducts site visits with retailers within Kentucky Power's service territory to check product stock, displays and product labels, and to ensure retail pricing markdowns are current. The representative reviews program details with sales staff and potential program participants. Retailers are visited every one to three weeks, depending on location and lighting sales.
- **In-Store Activities.** The APT Field Representative periodically promotes the program at retail stores. The representative sets up a table with educational lighting information, a light meter and Kentucky Power DSM Program fact sheets and discusses the program with shoppers, answering questions and demonstrating energy savings. In 2012 and 2013, the representative held 19 in-store events and one event for the Eastern Kentucky Electrician's Association.
- **Community Events.** KPCO Community Outreach CFL Program events are held throughout the Kentucky Power service territory, bulbs are distributed to customers and the DSM Programs promoted. Eighteen community events were held in 2012 and 2013. The APT Field Representative displays education materials, demonstrates energy savings on a light meter and answers customer questions.

- **Retailer Training.** The APT Field Representative provides retail staff training on efficient lighting products. Retailers had the option of 16 different training modules.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save. Customers can search an online database for participating retailers by geographic location and access the KPCO online store. Resources on CFL handling and disposal are available.
- **Bill Inserts.** Kentucky Power distributed bill inserts to residential customers in May 2012 and 2013 for the online lighting store.
- **Radio Advertisements.** Kentucky Power ran 93 radio advertisements in June and July 2013.

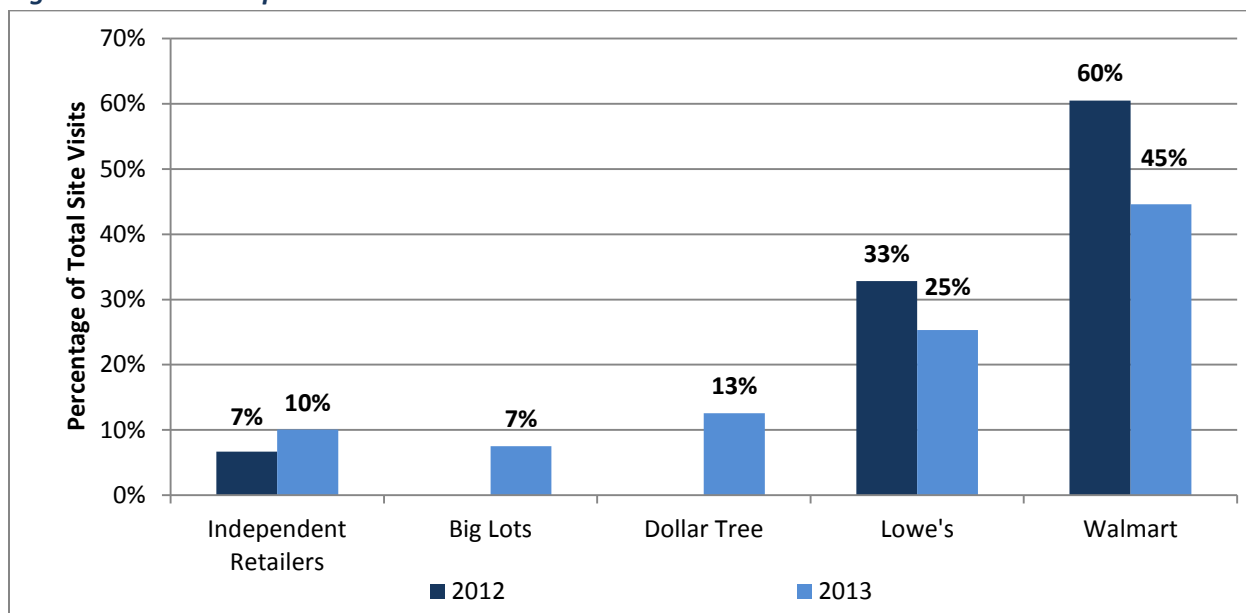
APT Field Representatives spend one week at APT's Springfield, Massachusetts office to receive training and educational resources. The representatives are tested prior to performing site visits in order to ensure they demonstrated competency. APT typically provides training and educational sessions for staff once a year at the Springfield, Massachusetts office and as curriculum is updated.

The APT Field Representative held 18 in-store promotional events and conducted 1,105 site visits in 2012 and 2013. The visits were more equally distributed among retailers in 2013. Big Lots and Dollar Tree stores joined the program in May 2013.

Table 10 Promotional Events, 2012-2013

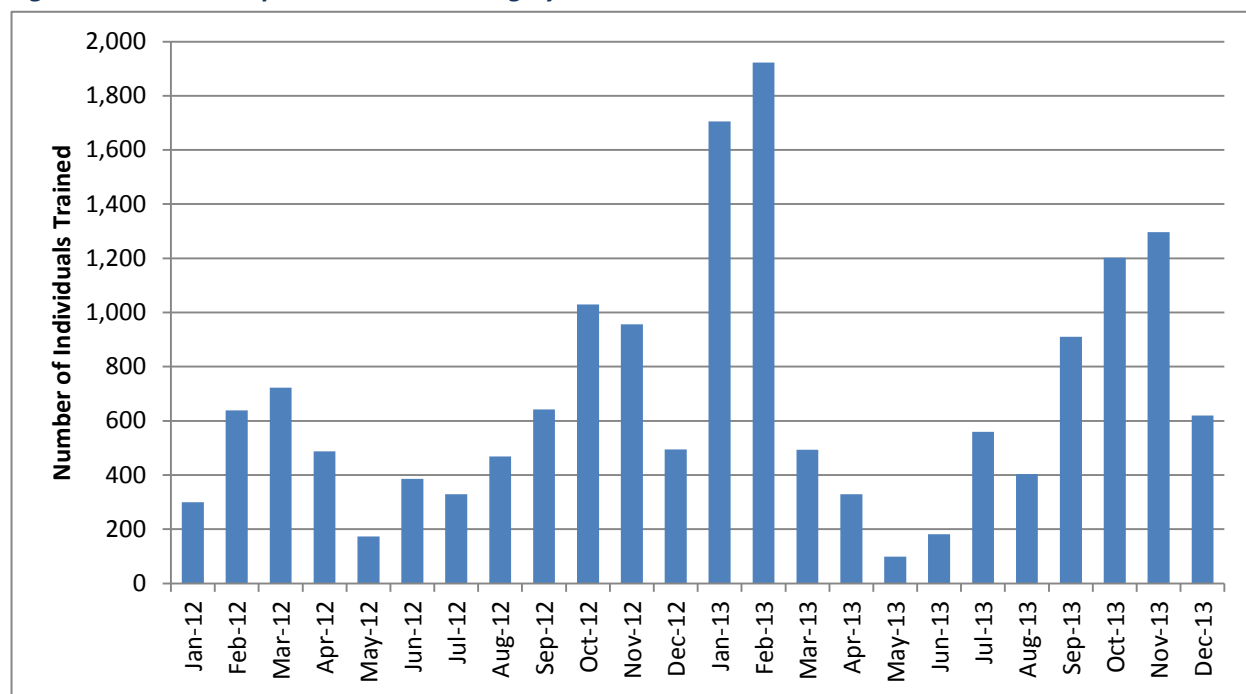
Location	Event Date
Lowe's Ashland	January 5, 2012
Lowe's Paintsville	February 15, 2012
Lowe's Hazard	March 8, 2012
Walmart Ashland RHR	March 12, 2012
Lowe's Paintsville	April 21, 2012
Lowe's Hazard	April 27, 2012
Lowe's Ashland	June 7, 2012
Walmart Ashland RHR	September 13, 2012
Walmart Paintsville	October 17, 2012
Laynes ACE Hardware	November 14, 2012
Walmart Ashland RHR	February 25, 2013
Hometown True Value Hardware	May 17, 2013
Do It Best - Kinner Lumber Company	July 15, 2013
Pikeville Ace Hardware	September 6, 2013
Lowe's Hazard	September 30, 2013
Lowe's Ashland	October 21, 2013
Lowe's Paintsville	October 26, 2013
Lowe's Hazard	November 12, 2013
KPCO-Sponsored Eastern Kentucky Electrician's Association Event	July 9, 2012

Figure 2 APT Field Representative Site Visits¹⁰



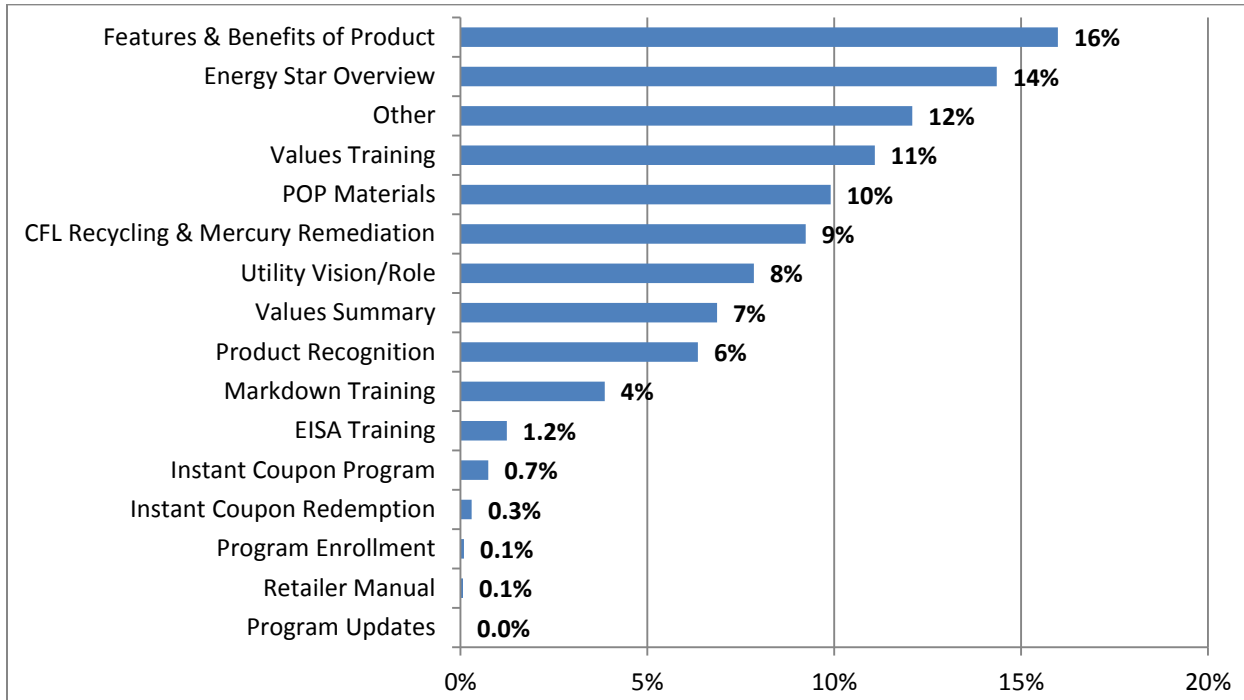
In 2012 and 2013, the APT Field Representative conducted 16,351 trainings. Ninety (90) percent of the individuals trained were customers, followed by sales associates (6 percent) and store managers (3 percent). While the trainings cover a wide array of topics, as shown in Figure 3, product features and benefits (16 percent) and ENERGY STAR® (14 percent) were the most prevalent training topics.

Figure 3 APT Field Representative Training by Month



¹⁰ Big Lots and Dollar Tree stores joined the program in May 2013.

Figure 4 APT Field Representative Training by Type, 2011 and 2012



3.4.2 Program Performance

Between January 1, 2012 and December 31, 2013, Kentucky Power provided incentives for 358,382 efficient light bulbs sold through the Residential Efficient Products Program. Ninety (90) percent of sales were standard CFLs and the remaining 10 percent were specialty CFLs. Kentucky Power began offering incentives for LED bulbs in September 2013.

APT provides audited and unaudited sales data to Kentucky Power. Unaudited sales data provides a real-time look at program sales. Audited sales data has been audited by both EFI and APT and corresponds with the Kentucky Power incentive expenditures but has approximately a one month lag. Due to this time lag, KPCO currently tracks and reports unaudited bulb sales with an end of year true-up between unaudited and audited sales. Audited bulb sales are reported throughout the evaluation.

Table 11 Total Audited Bulb Sales, 2012 and 2013

	2012	2013	Total
Standard CFLs	124,004	198,640	322,644
Specialty CFLs	13,192	22,465	35,657
LEDs	-	81	81
Total Participants	137,196	221,186	358,382

Table 12 Total Unaudited Bulb Sales, 2012 and 2013¹¹

	2012	2013	Total
CFLs	136,219	206,765	342,984
Specialty CFLs	-	25,378	25,378
LEDs	12	115	127
Total Participants	136,231	232,258	368,489

¹¹ In 2012, LEDs were limited to holiday LED light bulbs.

In 2012, the Residential Efficient Products Program had 20 participating retail locations and four manufacturers. Big Lots and Dollar Tree stores joined the program in May 2013, increasing the program to 30 participating retail locations and six manufacturers. APT works with participating retailers well within the Kentucky Power service territory to minimize the possibility of leakage (sales to non-Kentucky Power customers).

Table 13 Participating Retailers

Retailer	2012	2013
Big Lots	n/a	4
Dollar Tree	n/a	5
Lowe's	4	4
Walmart	9	9
Do It Best	5	4
True Value	1	1
ACE Hardware	1	3
Total	20	30

The figure below presents the number of bulbs invoiced by month. Invoices containing audited sales data typically present a one month lag from the actual sales date. However, the invoiced bulb sales have been audited and represent the number of bulbs that Kentucky Power incentivizes.

Figure 5 Number of Bulbs Invoiced by Month, 2012 and 2013

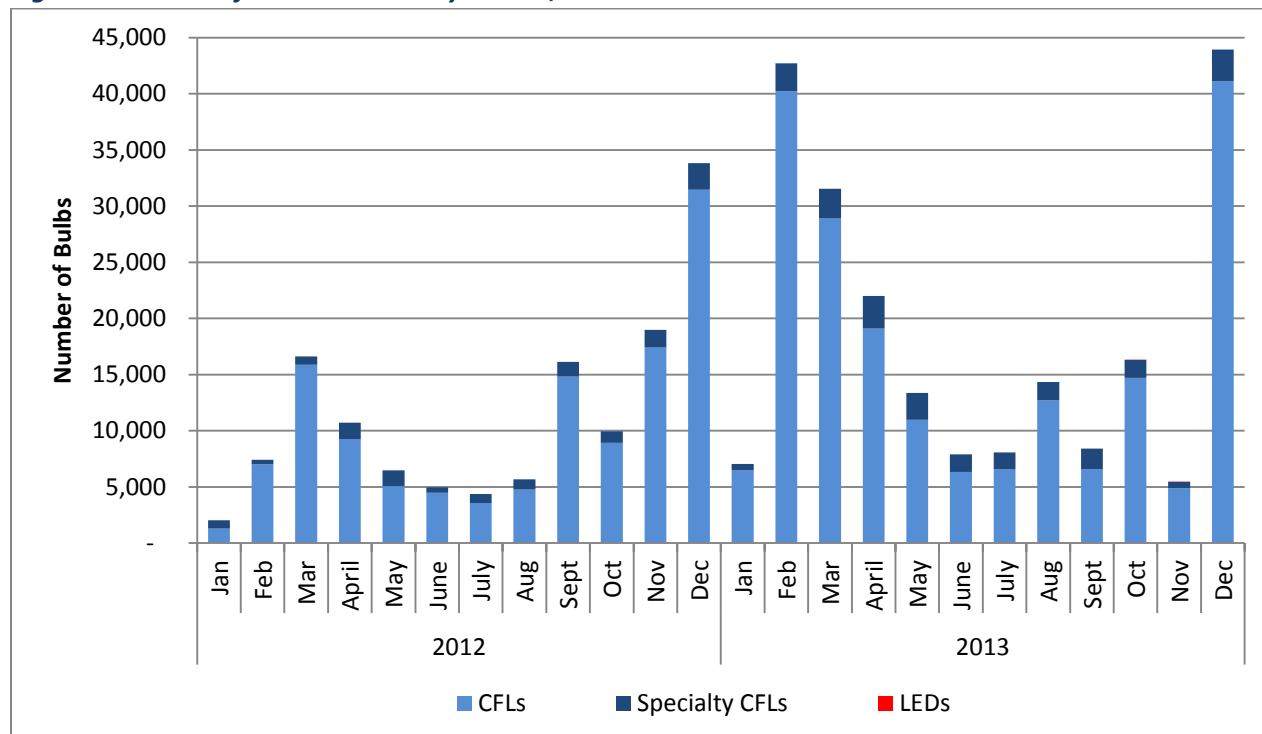
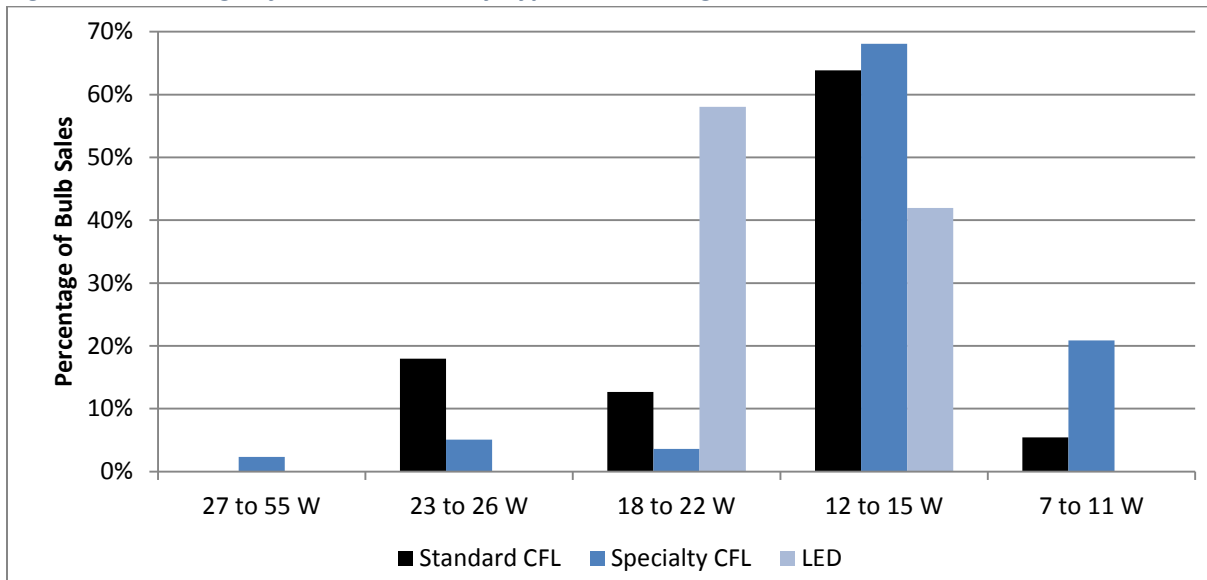


Figure 6 presents the percentage of bulbs sold in 2012 and 2013 by bulb type and wattage. As shown, the majority of bulbs sold in 2012 and 2012 were 12 to 15 Watt bulbs, equivalent to a 60 Watt incandescent light bulb.

Figure 6 Percentage of Bulbs Invoiced by Type and Wattage, 2012 and 2013



The table below presents the budget and budgeted cost per participant as compared to the actual expenditures and actual cost per participant. The actual 2012 and 2013 cost per participant was slightly less than budgeted.

Table 14 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
CFL/Markdowns	\$142,659	\$148,055	\$205,980	\$201,444
Other Lighting Incentives	\$1,800	\$24	\$33,275	\$34,463
Administration/Promotion	\$194,809	\$183,670	\$248,694	\$236,897
Evaluation	\$15,937	\$23,258	\$0	\$5,330
Total	\$355,205	\$355,006	\$487,950	\$478,134
Bulb Sales	125,800	137,196	180,600	221,186
Cost (\$) per Bulb Sold	\$2.82	\$2.59	\$2.70	\$2.16

The participating retailers surveyed noted that the Residential Efficient Products Program has a significant influence on lighting sales. According to the participating retailers surveyed, customers are largely accepting of efficient lighting and are significantly influenced by the price of the bulb. The independent retailers have difficulty increasing bulb sales through the program because their pricing is typically not competitive with larger retailers and they do not have the foot traffic of the larger retailers participating in the program. APT noted that they have seen a general decline in customer lighting purchases at hardware stores.

3.4.3 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.¹² The utility

¹² In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

EFI manages and tracks all data and processes manufacturer invoices and customer coupons. EFI receives confidential sales data from manufacturers and retailers, which can be accessed only by approved EFI staff. Kentucky Power and APT can access program data via EFI's web-based portal.

Manufacturers receive KPCO program-related sales data from participating retailers. APT receives a preliminary report of unaudited data from the manufacturers to identify and resolve any issues with pricing or products prior to EFI review. The complete dataset is submitted directly to EFI for processing and payment. The manufacturers often provide the data in a Microsoft Excel format, compatible with EFI's tracking system. EFI staff review the sales data for anomalies, verifies that the data matches with the guidelines listed in the MOU agreement, and ensures that the manufacturer/retailers are not exceeding their allocated budget. APT is notified as a manufacturer/retailer nears the allocated budget.

Independent retailers submit the coupons and completed coupon redemption form to EFI. The coupon redemption form includes a summary of the coupons by value, the address where the check is to be mailed and the total amount of expected redemption. EFI staff review the redemption form and coupons for completeness and eligibility. Upon approval, an incentive check is mailed to the retailer, reimbursing the retailer for the value of the coupons. The coupon includes the following information:

- Model number
- Manufacturer
- Number of bulbs in package
- Date of purchase

EFI reviews the sales data provided by the manufacturers and submits audited sales data as well as an invoice to APT on a bi-weekly basis. APT reviews the audited sales data and ensures the data matches the manufacturer invoice. An audited invoice is submitted to Kentucky Power on a bi-weekly basis, often within one or two days of receiving the audited sales data from EFI. A monthly progress report contains APT Field Representative site visit notes, training activities and audited and unaudited total sales and incentives by store. Kentucky Power approves invoices and submits payment to APT within 10 days of receiving. APT submits payment to EFI and EFI submits payment to the manufacturer/retailer.

The retailer/manufacturer tracks the following data:

- Measure description and model
- Manufacturer
- Wattage
- Quantity: number of bulbs in a pack, number of packs/bulbs, total number of bulbs
- Life of bulbs
- Retailer name and address
- Total incentive
- Sales date range, invoice submittal and payment
- Invoice number

3.5 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings as well as cost-effectiveness.

3.5.1 Energy Independence and Security Act

The United States Congress passed the Energy Independence and Security Act of 2007 (“EISA”) to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for ‘general service’ light bulbs.

The efficiency standards are being implemented in two phases:

- *Phase 1.* Between 2012 and 2014, standard light bulbs will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs.
- *Phase 2.* Beginning in 2020, there must be a 60 percent reduction in light bulb energy use.

The table below outlines the first phase and the maximum rate wattage required to attain EISA Phase 1 standards. Traditional incandescent 100, 75, 60 and 40 Watt bulbs will not meet the EISA efficiency standards as they take effect from 2012 to 2014. Specialty bulbs, such as 3-way bulbs and dimmable bulbs, are exempt from EISA.

Table 15 EISA Phase 1 Standard¹³

Lumen Ranges	Incandescent Wattage	EISA Maximum Wattage	CFL Wattage	Effective Date
1490-2600	100	72	23-26	1/1/2012
1050-1489	75	53	18-22	1/1/2013
750-1049	60	43	13-14	1/1/2014
310-749	40	29	11	1/1/2014

The Consolidated Appropriations Act of 2014 states that federal funds may not be used to implement or enforce the standards established in EISA.¹⁴ The EISA standards are still effective; however the U.S. Department of Energy has not been provided funding for enforcement.

3.5.2 Gross Energy and Demand Savings

AEG conducted engineering analysis of the Residential Efficient Products Program to assess gross energy and demand savings based on the IPMVP Option A.

Engineering Analysis

AEG conducted the engineering analysis using equations from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”). Energy and demand savings were estimated using the following equations:

$$\Delta kWh = Bulbs \times ((Watts_{base} - Watts_{ee})/1000) \times ISR \times Hours \times WHF_e$$

$$\Delta kW = Bulbs \times ((Watts_{base} - Watts_{ee})/1000) \times ISR \times WHF_d \times CF$$

Where:

- Bulbs = Total bulbs sold through program
- Watts_{base} = Baseline wattage of replaced lighting measure

¹³ Energy Independence and Security Act of 2007. Title III. Subtitle B. January 4, 2007.

¹⁴ Consolidated Appropriates Act, 2014. Division E. Title III. January 3, 2014.

- Watts_{ee} = Efficient wattage of lighting measure
- ISR = In Service Rate, the percentage of units rebated that are actually in service
- Hours = Average hours of use per year
- WHF = Waste heat factor to account for savings from efficient lighting
- CF = Peak Coincidence Factor

The table below summarizes the key variables used in the engineering analysis.

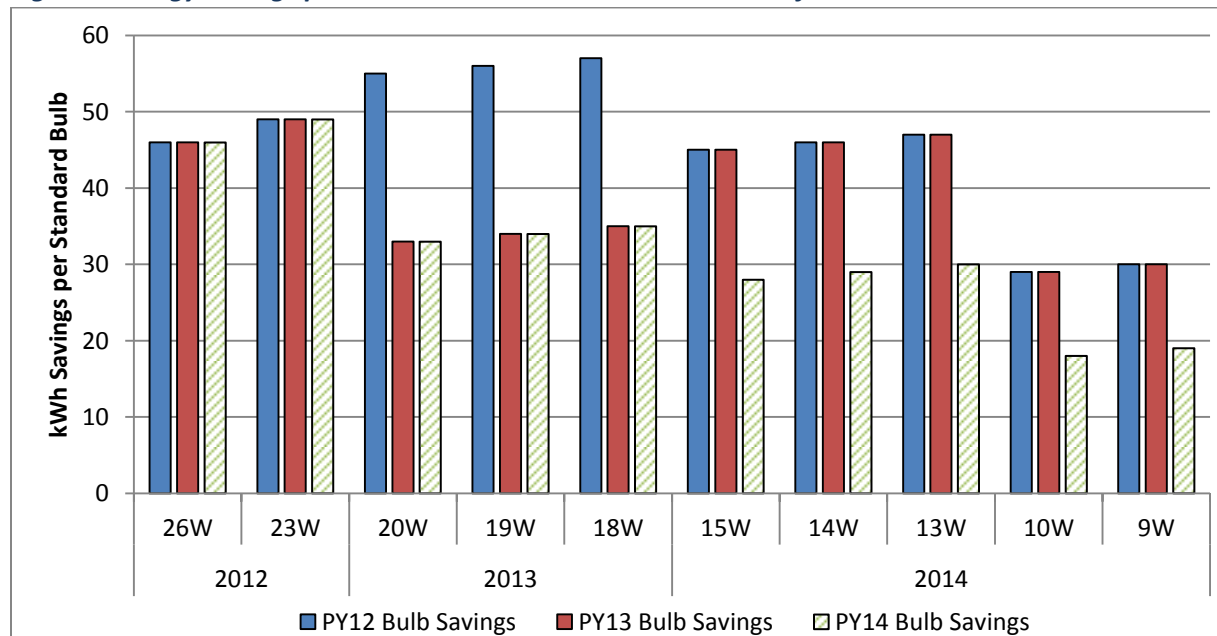
Table 16 Engineering Analysis Variables

Variable	Value	Description
Bulbs	Application	Number of bulbs sold
Watts _{Base}	Varies	Based on incandescent/halogen equivalent for efficient bulb wattage
Watts _{EE}	Application	Wattage of bulbs distributed through program
ISR	96.8%	Based on the NPV of ISR 1 st year 83.8%, 2 nd year 7.7%, and 3 rd year of 6.5%
Hours	938 CFL Bulb 1,010 LED Bulb	IL TRM default for residential and in-unit multi-family
WHF _E	1.06	IL TRM default for single family home unknown location
WHF _D	1.11	IL TRM default for single family home unknown location
CF	Varies	Based on bulb type

The baseline wattage for each bulb was determined using the equivalent bulb wattage, while accounting for EISA standards. The usage hours and coincidence factor correspond to the efficient bulb type. The ISR was gleaned from the Community Outreach CFL Program participant survey.

The bulb savings is largely driven by the corresponding baseline wattage. EISA Phase 1 standards, which coincided with the implementation of the program, have introduced more stringent performance standards for general service lighting products. Specialty bulbs are largely exempt from EISA. The figure below illustrates how EISA has affected the savings attributable to standard lighting measures. The horizontal axis shows the efficient wattage of each standard bulb type offered in the program, separated by the year in which EISA comes into effect. The vertical axis shows the energy savings per bulb.

Figure 7 Energy Savings per Standard Bulb with EISA Baseline Shift



The gross savings results from the engineering analysis for each bulb type and the program overall are shown in the tables below. The savings reflect a weighted average of all bulb wattages. Note that LED bulbs were introduced in 2013, so no savings are reported for this measure type in 2012.

Table 17 Gross Energy (kWh) Savings per Bulb, Engineering Analysis

Measure Type	2012	2013	Program Total
Standard CFLs	44.69	43.14	43.74
Specialty CFLs	46.32	43.32	44.43
LEDs	-	40.15	40.15
Program Total	44.85	43.16	43.80

Table 18 Gross Demand (kW) Savings per Bulb, Engineering Analysis

Measure Type	2012	2013	Program Total
Standard CFLs	0.005	0.005	0.005
Specialty CFLs	0.005	0.005	0.005
LEDs	-	0.004	0.004
Program Total	0.005	0.005	0.005

The total gross energy and demand savings attributable to the program are shown in the tables below.

Table 19 Total Gross Energy (kWh) Savings, Engineering Analysis

Measure Type	2012	2013	Program Total
Standard CFLs	5,542,294	8,569,019	14,111,314
Specialty CFLs	611,021	973,217	1,584,237
LEDs	-	3,252	3,252
Program Total	6,153,315	9,545,488	15,698,803

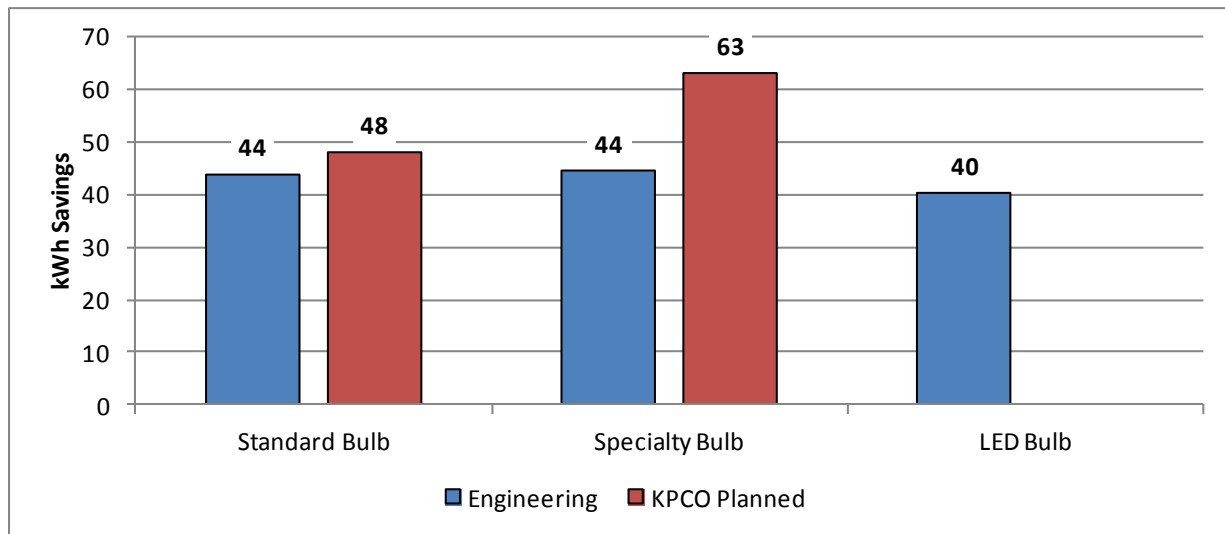
Table 20 Total Gross Demand (kW) Savings, Engineering Analysis

Measure Type	2012	2013	Program Total
Standard CFLs	588	909	1,497
Specialty CFLs	65	103	168
LEDs	-	0.32	0.32
Program Total	653	1,012	1,665

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. The figure below compares the gross energy savings per bulb from the engineering analysis to the planned savings assumptions. As previously noted, the savings per bulb from the engineering analysis are impacted by the EISA legislation. The planned savings assumptions were developed prior to the EISA legislation.

Figure 8 Gross Savings per Bulb



3.5.3 Net Energy and Demand Savings

In order to determine the net savings attributable to the program, AEG utilized a net-to-gross (“NTG”) ratio for similar lighting program in service territory similar to Kentucky Power’s. Estimating a time-of-sale program NTG presents unique challenges to evaluators. Since the program is not designed to collect contact information, participants must be surveyed at the point of sale in order to accurately estimate the net savings attributable to the program. This method of data collection is very costly and time-consuming. For these reasons, AEG utilized NTG value of 79%, gleaned from customer intercept surveys conducted in the Appalachian Power Company and Wheeling Power Company service territory.¹⁵

AEG estimated the net savings attributable to the program by applying this NTG factor to gross savings. The net savings estimates are shown in the tables below.

Table 21 Net Energy (kWh) Savings per Bulb, Engineering Analysis

Measure Type	2012	2013	Program Total
Standard CFLs	35.31	34.08	34.55
Specialty CFLs	36.59	24.22	35.10
LEDs	-	31.72	31.72
Program Total	35.43	34.06	34.61

Table 22 Net Demand (kW) Savings per Bulb, Engineering Analysis

Measure Type	2012	2013	Program Total
Standard CFLs	0.004	0.004	0.004
Specialty CFLs	0.004	0.004	0.004
LEDs	-	0.003	0.003
Program Total	0.004	0.004	0.004

¹⁵ Evaluation of Residential SMART Lighting Program January 2012 through December 2012, ADM Associates, February 2013

Table 23 Total Net Energy (kWh) Savings, Engineering Analysis

Measure Type	2012	2013	Program Total
Standard CFLs	4,378,412	6,769,525	11,147,938
Specialty CFLs	482,706	768,841	1,251,547
LEDs	0	2,569	2,569
Program Total	4,861,119	7,540,936	12,402,054

Table 24 Total Net Demand (kW) Savings, Engineering Analysis

Measure Type	2012	2013	Program Total
Standard CFLs	464	718	1,182
Specialty CFLs	51	82	133
LEDs	0	0.25	0.25
Program Total	516	800	1,315

3.5.4 Savings per Bulb Summary

AEG conducted an engineering analysis of the Residential Efficient Products Program to assess gross energy and demand savings based on the IPMVP Option A. The EISA standards for 60 Watt and 40 Watt incandescent bulbs are effective as of January 1, 2014. AEG recommends utilizing the energy and demand savings associated with the EISA standards effective for 2014. Therefore, AEG updated the engineering analysis, accounting for the 60 Watt and 40 Watt EISA standards, to determine program savings for program tracking purposes as well as PSC filings. The tables below present the gross and nets savings per bulb for the 2014 program year.

Table 25 Recommended Gross Energy and Demand Savings per Bulb

Measure Type	Gross Energy (kWh) Savings per Bulb	Gross Demand (kW) Savings per Bulb
Standard CFLs	31.61	0.003
Specialty CFLs	43.32	0.005
LEDs	40.15	0.004
Program Total	34.52	0.004

Table 26 Recommended Net Energy and Demand Savings per Bulb

Measure Type	Net Energy (kWh) Savings per Bulb	Net Demand (kW) Savings per Bulb
Standard CFLs	24.97	0.0026
Specialty CFLs	34.22	0.004
LEDs	31.72	0.003
Program Total	27.27	0.003

3.5.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the efficient technology(s) improve a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Residential Efficient Products Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.¹⁶ Each test analyzes cost-effectiveness from a different perspective:

¹⁶ The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

The impact evaluation results are utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, participation and incentives, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

Measure-level cost-effectiveness was calculated utilizing the Total Resource Cost Test. Measure-level cost-effectiveness does not account for program administrative costs (administration, marketing, etc.) because they are spent at the program-level and cannot be allocated to specific measure.

Table 27 Measure-Level Cost Effectiveness Results

Measure	TRC
Standard CFL	6.05
Specialty CFL	2.73
LED	1.21

The Residential Efficiency Products Program was found to be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

Table 28 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.41	\$7,729,988	\$3,192,993	(\$4,536,995)
Utility Cost Test	4.00	\$797,333	\$3,192,993	\$2,395,660
Participant Test	12.11	\$602,627	\$7,295,488	\$6,692,861
Total Resource Cost Test	3.08	\$1,037,127	\$3,192,993	\$2,155,867

Evaluating the program on a prospective basis, the Residential Efficiency Products Program is also cost-effective and should be continued going forward. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The cost-effectiveness results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The cost-effectiveness decreases slightly on a prospective basis due to the full implementation of the EISA baselines beginning in 2014. The prospective cost-effectiveness results are presented in the table below.

Table 29 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.44	\$5,834,179	\$2,571,785	(\$3,262,393)
Utility Cost Test	3.45	\$744,907	\$2,571,785	\$1,826,879
Participant Test	9.42	\$579,908	\$5,464,006	\$4,884,098
Total Resource Cost Test	2.71	\$950,081	\$2,571,785	\$1,621,705

3.6 Recommendations

AEG has recommendations on how to improve the program. These include:

Review Product Offerings

AEG recommends that KPCO consider examining the cost-effectiveness of incentivizing other residential products. KPCO should work with APT to determine which products should be evaluated, the incentive levels and the participation goals. Any decision to incorporate additional products into the program portfolio could affect the program's cost-effectiveness. In addition to cost-effectiveness, KPCO should consider the customer benefit of incorporating the additional products and the potential energy savings.

Modify Reporting

AEG recommends that Kentucky Power track and report the invoiced bulb sales. Kentucky Power currently tracks and reports audited and unaudited bulb sales. The unaudited sales provide a real-time look at program sales while the invoiced sales data represents approximately a one month lag. However, the invoiced sales data has been audited by both EFI and APT and corresponds with the Kentucky Power incentive expenditures. APT will be providing Kentucky Power online access to bulb sales data through EFI's Salesforce.com portal. AEG recommends that Kentucky Power utilize the online access to track sales and utilize invoiced bulb sales data for annual reporting.¹⁷

¹⁷ For timing purposes, Kentucky Power may need to report unaudited data for June in the mid-year Kentucky PSC report. However, the June data should be reconciled with audited data for annual reporting and tracking purposes.

4. Community Outreach CFL Program

The Community Outreach CFL Program aims to educate and encourage customers to reduce their electric consumption by utilizing energy efficient lighting. Kentucky Power distributes compact fluorescent light bulbs (“CFLs”) to customers at company-sponsored community events. Typically, a package of four 23 Watt CFLs are distributed to all qualifying residential customers. Customers must provide a copy of their Kentucky Power electric bill before they are provided the bulbs to ensure eligibility. The community events are held throughout Kentucky Power’s service territory over the year.

The Kentucky PSC approved budget and participation goals.

Table 30 Program Budget Goals, 2012-2014

	2012	2013	2014
CFLs	\$54,000	\$54,000	\$52,000
Promotion	\$4,000	\$2,000	\$2,000
Administration	\$500	\$500	\$500
Evaluation	\$0	\$0	\$11,011
Total Budget	\$58,500	\$56,500	\$65,511
Participation Goal	4,800	5,000	5,000

4.1 Evaluation Data Collection

The Community Outreach CFL Program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation goals?
- What marketing/promotional efforts resonate with customers?
- Are the CFLs being used in customer’s homes?
- Are customers satisfied with the program?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

Participating Customer Surveys

AEG administered a two-page survey to a random sample of program participants at the Jackson, Kentucky Community Outreach CFL Program event held on October 1, 2013. Fifty-six (56) participants were surveyed at the event. The survey assessed program experience and awareness, customer

satisfaction, free ridership, in-service rates and areas for improvement. The participant survey guide can be found in Appendix C.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power’s initial program filing planned savings were reviewed to compare with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Option A of the *International Performance Measurement and Verification Protocols* (“IPMVP”).¹⁸

Table 31 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

Engineering calculations referenced from the *Illinois Statewide Technical Reference Manual for Energy Efficiency*, using Kentucky Power specific inputs, were utilized to calculate the gross energy and demand impacts.¹⁹

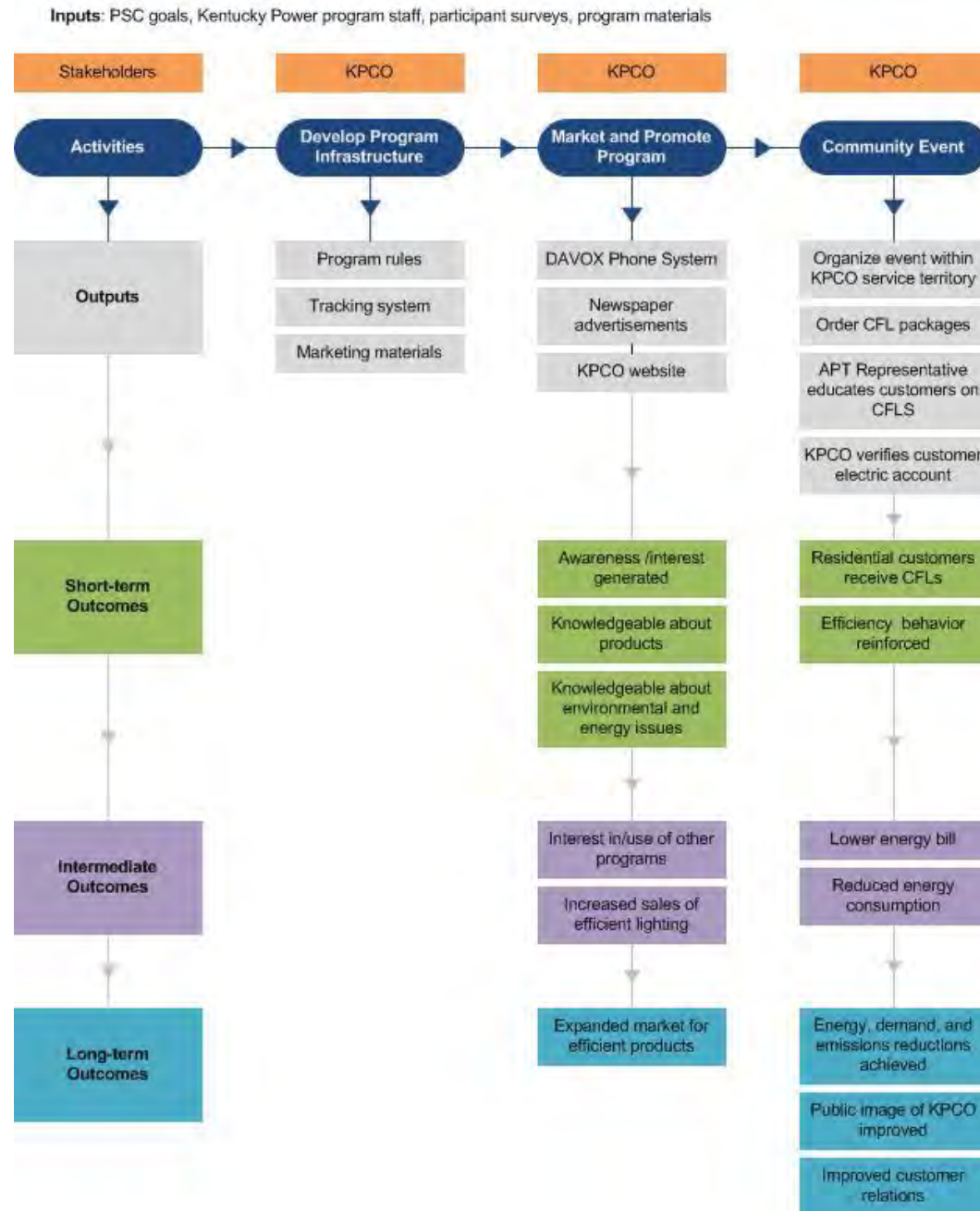
4.2 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

¹⁸ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

¹⁹ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 9 Program Logic Model



4.2.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program’s intended outcomes. Program activities include:

Program Infrastructure

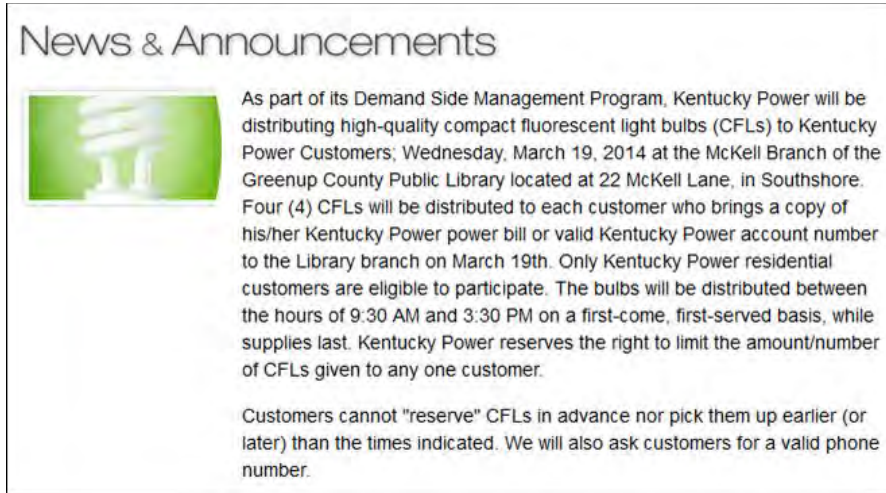
Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power program staff, with input from AEP, designed the program. The

KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Marketing

Marketing activities are targeted towards residential customers within driving distance of a Kentucky Power-sponsored event.

Figure 10 Website Marketing



Community Event

Kentucky Power utilizes DAVOX, an automated, outbound telephone messaging system, to notify customers of upcoming local community events via an automated message as well as posting an announcement on their website. Kentucky Power DSM Program staff organizes an event within the utility service territory. Kentucky Power program staff and the APT representative attend the event.²⁰ The APT Representative provides educational information on CFLs, such as energy efficiency and proper disposal. Residential customers are required to bring a copy of their Kentucky Power electric bill to the event to ensure eligibility. KPCO staff verifies the electric account utilizing the KPCO Customer Information System. Eligible customers typically receive a package of four 23 Watt CFLs on a first come, first serve basis.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

4.2.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

²⁰ Applied Proactive Technologies, Inc. ("APT") implements Kentucky Power's Residential Efficient Products Program. The APT representative visits participating retailers, provides sales staff training and conducts in-store promotions.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in efficient lighting may increase among customers. Customers may become more knowledgeable about energy efficient products and have an increased commitment to energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPSC DSM Programs, increased sales of energy efficient lighting and reduced household energy consumption.

Long-term Outcomes

The long-term outcomes may include an expanded market for efficient products, reduced utility emissions, and fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

4.2.3 External Factors

There are a variety of factors outside the control of Kentucky Power that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Cost, performance and availability of efficient technologies

4.3 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, program tracking and program satisfaction.

4.3.1 Program Marketing

Kentucky Power marketed the Community Outreach CFL Program through the following:

- **DAVOX.** An automated phone messaging system that utilizes voice recordings to notify customer of an upcoming local community event. The system reports on the number of calls made, call connections and messages left.
- **Newspaper Advertisements.** In 2012, Kentucky Power employed newspaper advertisements in local newspapers to increase awareness of events.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save.

The table below presents call results from the DAVOX system in 2013.

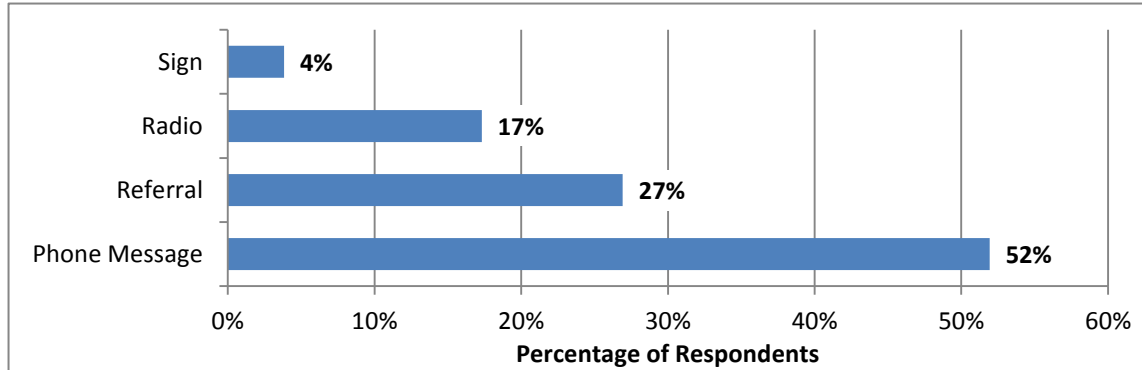
Table 32 DAVOX Statistics, 2013

Location	Event Date	Customers called	Customers contacted	Contact rate
Greenup/Wurtland (1st)	March 25, 2013	8,664	6,333	73%
Greenup/Wurtland (2nd)	March 25, 2013	8,664	6,301	73%
Greenup/Wurtland (3rd)	March 25, 2013	8,664	6,173	71%
Pikeville	May 1, 2013	8,757	6,287	72%
Hindman	May 2, 2013	3,322	2,394	72%
Salyersville CFL	June 13, 2013	3,057	2,078	68%
Carter (1st)	July 16, 2013	5,909	4,145	70%
Carter (2nd)	July 16, 2013	5,909	3,506	60%
Hazard	August 1, 2013	5,863	4,868	83%
Belfry	September 11, 2013	4,583	3,618	79%
Jackson	October 1, 2013	2,845	2,107	74%
Ashland	October 22, 2013	9,610	8,090	84%

The program is also promoted to KPCO employees that receive electrical service from Kentucky Power. The KPCO employee events are designed to promote all DSM Programs through a short presentation, literature and the distribution of CFL packages. During the events, KPCO employees are encouraged to promote the program to family and friends.

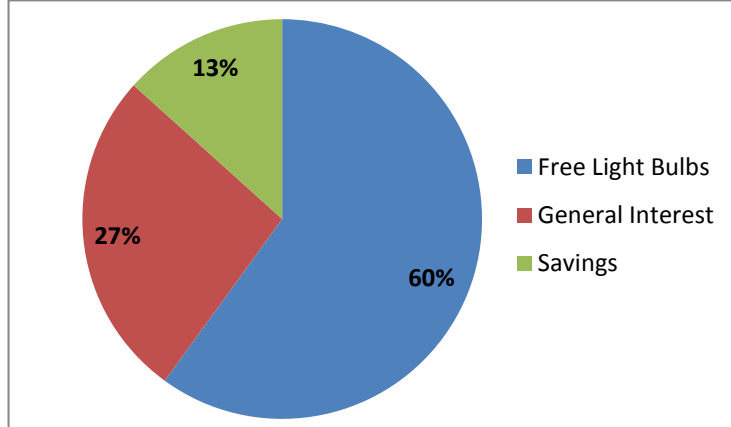
According to the participants surveyed, customers most often learned of the program from the DAVOX phone messaging system (52 percent).

Figure 11 How Customers First Learned of the Program (n=54)



Sixty (60) percent of participants surveyed cited that their primary reason for attending the Community Outreach CFL Program event was the free light bulbs, followed by general interest in the Kentucky Power event.

Figure 12 Customer Motivation for Attending the Event (n=45)



4.3.2 Program Performance

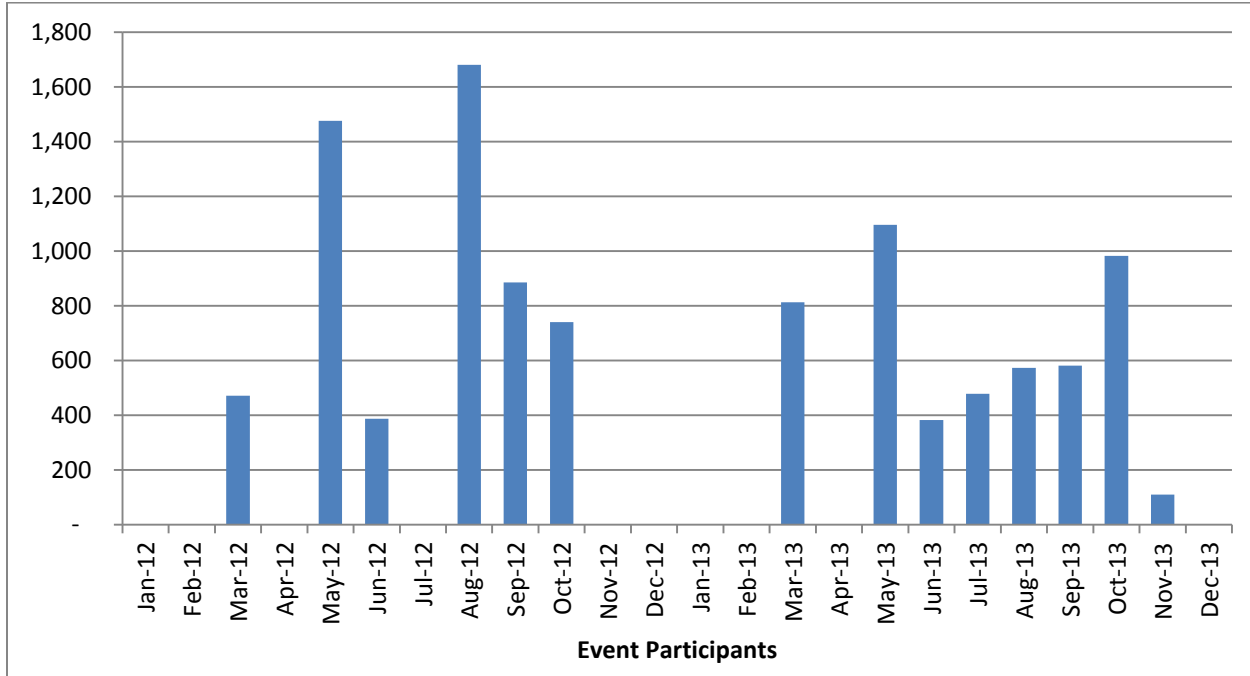
Between January 1, 2012 and December 31, 2013, Kentucky Power held 18 customer events throughout their service territory, distributing bulbs to 10,547 customers. Approximately 95 percent of the customers surveyed noted that they had previously attended a Kentucky Power outreach event. In November and December 2013, Kentucky Power held events for employees that receive electric service from KPCO. The employees received a short presentation and literature on the KPCO DSM Programs and packages of CFL bulbs.

Table 33 Event Date, Location and Number of Participants

Location	Event Date	Participants
Walk in	February 15, 2012	1
Raceland Greenup	March 22, 2012	471
Louisa	May 8, 2012	433
Pikeville	May 30, 2012	1,042
Salyersville	June 21, 2012	387
Hazard	August 1, 2012	769
Inez	August 7, 2012	583
City of Catlettsburg	August 23, 2012	329
Hyden	September 4, 2012	884
Whitesburg	October 9, 2012	740
Raceland Greenup	March 25, 2013	813
Pikeville	May 1, 2013	673
Hindman	May 2, 2013	423
Salyersville	June 13, 2013	382
Grayson/Olive Hill	July 16, 2013	480
Hazard	August 1, 2013	573
Belfry	September 11, 2013	581
Jackson	October 1, 2013	329
City of Ashland	October 22, 2013	655
KPCO Offices	November / December 2013	110

The Community Outreach CFL Program events are held throughout the year across the Kentucky Power service territory. However, the events are primarily held between March and October. Kentucky Power attempts to vary event locations every year to reach additional customers.

Figure 13 Community Outreach CFL Program Events by Month



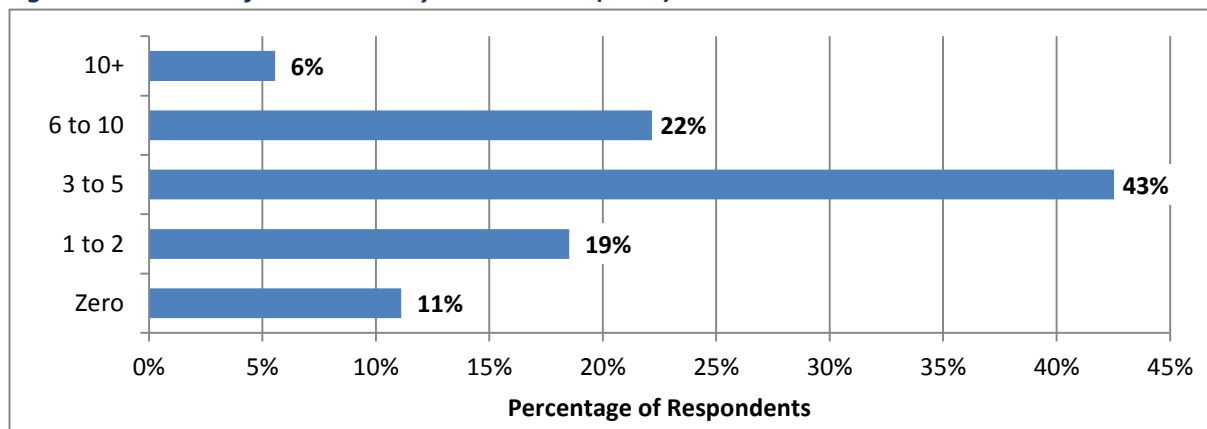
The table below presents the budget and budgeted cost per participant as compared to the actual expenditures and actual cost per participant. Participant goals were exceeded in 2012 and 2013 but the expenditures were very close to the annual budgets. The 2012 cost per participant was less than budgeted and the 2013 cost per participant was almost exactly the amount budgeted.

Table 34 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
CFLs	\$54,000	\$54,372	\$54,000	\$52,654
Promotion	\$4,000	\$573	\$2,000	\$78
Administration	\$500	\$488	\$500	\$109
Evaluation	\$0	\$0	\$0	\$2,135
Other	\$0	\$0	\$0	\$2,827
Total Cost (\$)	\$58,500	\$55,432	\$56,500	\$57,803
Participation	4,800	5,641	5,000	5,016
Cost (\$) per Participant	\$12.2	\$9.8	\$11.3	\$11.5

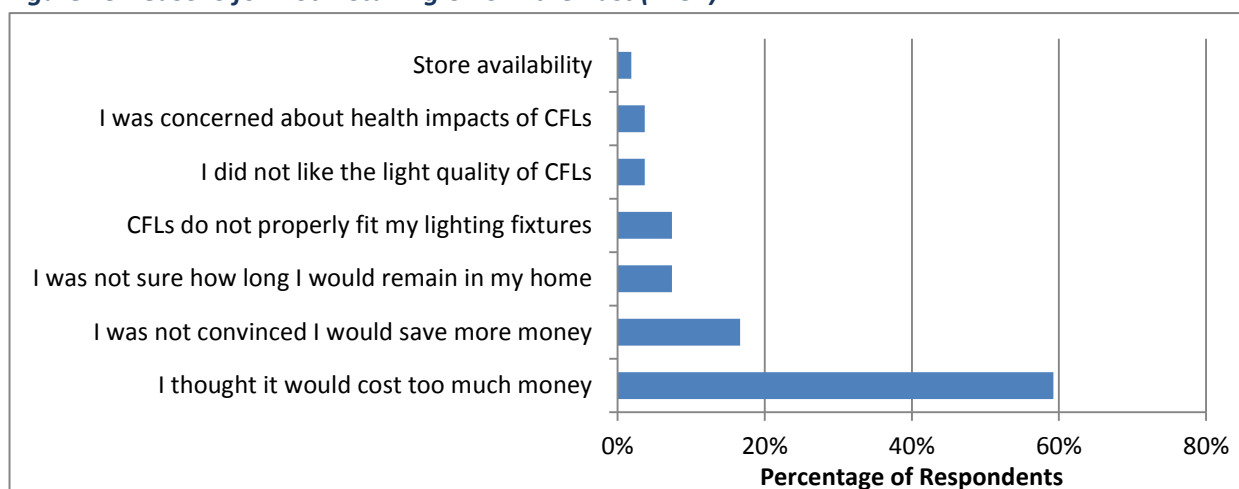
The majority of participants surveyed (74 percent) noted that they would install all four of the CFL bulbs received at the event immediately. Only 6 percent of participants would not install any of the CFL bulbs immediately. Participants planned to install the CFLs primarily in the living room, kitchen, bedroom and bathroom. Most participants already have CFLs currently installed in their home.

Figure 14 Number of CFLs Currently in the Home (n=54)



Fifty-nine (59) percent of the participants surveyed noted that they did not previously install CFLs because they thought the bulbs would cost too much money. However, 14 percent of participants also noted that they had participated in the Residential Efficient Products Program.

Figure 15 Reasons for Not Installing CFLs in the Past (n=54)



4.3.3 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.²¹ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

Staff reviews and validates the customer electric account for customer eligibility at the Customer Outreach CFL events. The customer name and electric account are recorded. Kentucky Power's program tracking system is comprised of an Excel-based database containing event information,

²¹ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

including the event date, custom name, account number, and phone number. The program log is available on a shared drive to specific KPCO staff.

4.4 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, and cost-effectiveness.

4.4.1 Energy Independence and Security Act

The United States Congress passed the Energy Independence and Security Act of 2007 (“EISA”) to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for ‘general service’ light bulbs.

The efficiency standards are being implemented in two phases:

- *Phase 1.* Between 2012 and 2014, standard light bulbs will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. All light bulbs manufactured or imported after December 31, 2011 are subject to the EISA standards.
- *Phase 2.* Beginning in 2020, there must be a 60 percent reduction in light bulb energy use.

The table below outlines the first phase and the maximum rate wattage required to attain EISA Phase 1 standards. Traditional incandescent 100, 75, 60 and 40 Watt bulbs will not meet the EISA efficiency standards as they take effect from 2012 to 2014. Specialty bulbs, such as 3-way bulbs and dimmable bulbs, are exempt from EISA.

Table 35 EISA Phase 1 Standard²²

Lumen Ranges	Incandescent Wattage	EISA Maximum Wattage	CFL Wattage	Effective Date
1490-2600	100	72	23-26	1/1/2012
1050-1489	75	53	18-22	1/1/2013
750-1049	60	43	13-14	1/1/2014
310-749	40	29	11	1/1/2014

The Consolidated Appropriations Act of 2014 states that federal funds may not be used to implement or enforce the standards established in EISA.²³ The EISA standards are still effective; however the U.S. Department of Energy has not been provided funding for enforcement.

4.4.2 Gross Energy and Demand Savings

AEG conducted engineering analysis of the Community Outreach CFL Program to assess gross energy and demand savings based on the IPMVP Option A.

Engineering Analysis

AEG conducted the engineering analysis using equations from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”). Energy and demand savings were estimated using the following equations:

$$\Delta kWh = Bulbs \times ((Watts_{base} - Watts_{ee})/1000) \times ISR \times Hours \times WHF_e$$

$$\Delta kW = Bulbs \times ((Watts_{base} - Watts_{ee})/1000) \times ISR \times WHF_d \times CF$$

²² Energy Independence and Security Act of 2007. Title III. Subtitle B. January 4, 2007.

²³ Consolidated Appropriates Act, 2014. Division E. Title III. January 3, 2014.

Where:

- Bulbs = Total CFL bulbs distributed through program
- Watts_{base} = Baseline wattage of replaced lighting measure
- Watts_{ee} = Efficient wattage of lighting measure
- ISR = In Service Rate, the percentage of units rebated that are actually in service
- Hours = Average hours of use per year
- WHF = Waste heat factor to account for savings from efficient lighting
- CF = Peak Coincidence Factor

The Community Outreach CFL Program distributes 23 Watt CFLs to customers, which are equivalent to a 75 Watt or 100 Watt incandescent bulb. Based on EISA, 100 Watt incandescent bulbs were no longer manufactured as of January 1, 2012 and 75 Watt incandescent bulbs were no longer manufactured as of January 1, 2013. The table below summarizes the key variables used in the engineering analysis.

Table 36 Engineering Analysis Variables

Variable	Value	Description
Bulbs	4	Number of bulbs distributed per participant
Watts _{Base}	73.5 (2012) 62.5 (2013)	Average of baseline corresponding to 23 watt CFL bulb.
Watts _{EE}	23	Wattage of bulbs distributed through program
ISR	84%	Determined through on-site participant survey
Hours	938	IL TRM default hours when location unknown
WHF _E	1.06	IL TRM default for single family home unknown location
WHF _D	1.11	IL TRM default for single family home unknown location
CF	9.5%	IL TRM default for single family home unknown location

The ISR was determined through a participant survey administered on-site at an event. The survey data collected was used to estimate how many bulbs distributed through the program were actually installed in Kentucky Power households. Participants were asked the following question:

How many of the CFLs that you received today do you plan to immediately install in your home? (n=54)

Bulbs Installed	Count	%	ISR
Zero	3	6%	0%
One	2	4%	25%
Two	8	15%	50%
Three	1	2%	75%
Four	40	74%	100%
Weighted Average ISR			84%

Respondents were asked how many of the bulbs they intended to install immediately, representing an ISR of one through four. The responses were weighted by the proportion of respondents. AEG determined that 84 percent of the bulbs were likely to be installed in participants' households.

AEG calculated the gross energy and demand savings of the program. The savings per participant were multiplied by the total number of participants to determine the total gross savings attributable to the program. The results of the engineering analysis are shown in the tables below.

Table 37 Gross Energy (kWh) and Demand (kW) Savings per Participant

	Gross Energy Savings per Participant (kWh)	Summer Gross Demand Savings per Participant (kW)	Winter Gross Demand Savings per Participant (kW)
2012	168	0.02	0.02
2013	132	0.01	0.01
Total Program	151	0.02	0.02

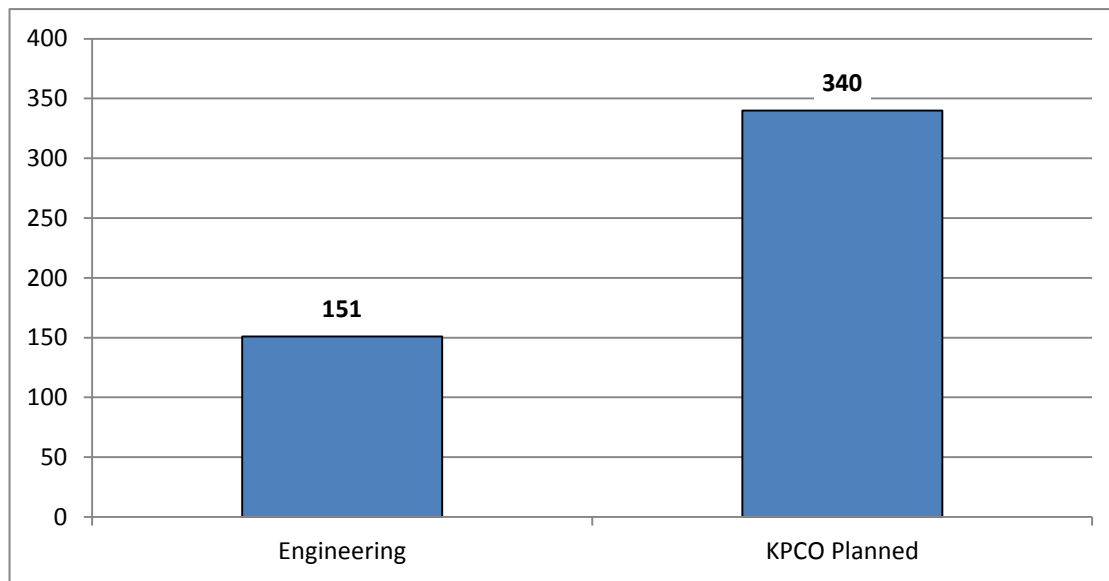
Table 38 Total Gross Energy (kWh) and Demand (kW) Savings

	Gross Energy Savings (kWh)	Summer Gross Demand Savings (kW)	Winter Gross Demand Savings (kW)
2012	949,382	101	101
2013	660,310	70	70
Total Program	1,609,692	171	171

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. The figure below compares the gross energy savings per participant from the engineering analysis to the planned savings assumptions.

Figure 16 Summary Gross Energy Savings per Participant



4.4.3 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after taking into account free ridership and spillover. Free ridership refers to those participants who would have purchased and installed efficient lighting without the program influence. Spillover refers to the savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - Free\ ridership + Spillover$$

AEG conducted an on-site survey of participants at an event to evaluate the effects of free ridership. The following survey question was asked to determine the effects of free ridership.

How likely is it that you would have purchased and installed similar CFLs if Kentucky Power was NOT DISTRIBUTING them for FREE?

FR Probability	Response	Count	Weight	Score
70%	Very Likely	31	55%	39%
53%	Somewhat Likely	17	30%	16%
36%	Neutral	3	5%	2%
19%	Somewhat Unlikely	2	4%	1%
2%	Very Unlikely	3	5%	0%
Total Free Ridership				58%

AEG determined the free ridership to be 58 percent of gross savings. No spillover was attributed to the program. The chosen survey methodology did not include spillover questioning due to survey length and participant survey time. The assumption of no spillover is conservative, but programs with this program design are unlikely to have significant spillover. AEG determined that the NTG factor for the program was 42 percent.

Table 39 Net-to-Gross Factor

Free Ridership	Spillover	NTG
58%	0%	42%

The net program savings were determined by applying the NTG factor to the gross savings. The table below shows the net savings attributable to the program.

Table 40 Net Energy and Demand Savings per Participant

	Net Energy Savings per Participant (kWh)	Summer Net Demand Savings per Participant (kW)	Winter Net Demand Savings per Participant (kW)
2012	71	0.01	0.01
2013	56	0.01	0.01
Total Program	64	0.01	0.01

Table 41 Total Net Energy and Demand Savings

	Net Energy Savings (kWh)	Summer Net Demand Savings (kW)	Winter Net Demand Savings (kW)
2012	402,979	43	43
2013	280,278	30	30
Total Program	683,257	72	72

4.4.4 Savings per Participant Summary

AEG conducted an engineering analysis of the Community Outreach CFL Program to assess gross energy and demand savings based on the IPMVP Option A. Therefore, AEG recommends utilizing the 2013 engineering analysis energy and demand savings per participant to determine program savings for program tracking purposes as well as PSC filings. The table below present the gross and nets savings per participant.

Table 42 Recommended Energy and Demand Savings per Participant

	Energy Savings per Participant (kWh)	Summer Demand Savings per Participant (kW)	Winter Demand Savings per Participant (kW)
Gross Savings	132	0.01	0.01
Net Savings	56	0.01	0.01

4.4.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the efficient technology(s) improve a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Community Outreach CFL Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.²⁴ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

The impact evaluation results are utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, and participation, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

The Community Outreach CFL Program was found to be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

Table 43 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.35	\$489,127	\$171,556	(\$317,571)
Utility Cost Test	1.56	\$109,739	\$171,556	\$61,817
Participant Test	n/a	\$0	\$379,388	\$379,388
Total Resource Cost Test	1.56	\$109,739	\$171,556	\$61,817

Evaluating the program on a prospective basis, the Community Outreach CFL Program is also cost-effective and should be continued going forward. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results are presented in the table below.

²⁴ The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

Table 44 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.36	\$203,902	\$73,614	(\$130,288)
Utility Cost Test	1.27	\$57,824	\$73,614	\$15,790
Participant Test	n/a	\$0	\$146,078	\$146,078
Total Resource Cost Test	1.27	\$57,824	\$73,614	\$15,790

4.5 Program Recommendations

AEG has recommendations on how to improve the program. These include:

Review Bulb Offerings

AEG recommends that KPCO consider offering CFL bulbs that are equivalent to a 60 or 75 Watt incandescent bulb and a different number of bulbs per participant. Kentucky Power currently distributes four 23 Watt CFL bulbs, which are equivalent to a 75 or 100 Watt incandescent bulb. Customers typically utilize a 60 or 75 Watt incandescent bulb throughout their homes. Kentucky Power should discuss with their bulb provider and determine if there is any impact on program costs if the bulb wattage and/or quantity are modified.

Increase Program Awareness

AEG recommends that explore increasing program awareness. Kentucky Power markets the program primarily through DAVOX, newspaper advertisements and the DSM program website. Kentucky Power should also explore sending text messages to customers with cell phones listed as their primary contact to determine if DAVOX has the capabilities and if there would be any cost savings.

AEG recommends that Kentucky Power increase the promotion of other DSM programs at the Community Outreach CFL Program events. KPCO program staff provide program fact sheets to interested customers. In addition to the program fact sheets, Kentucky Power could utilize posters highlighting specific residential programs. The posters should be simple with pertinent language to effectively communicate the program(s) offerings.

Consider Program Expansion

AEG recommends exploring the possibility of expanding the program to include outside agencies (food banks, Community Action Agencies, etc.) to distribute bulbs. When considering expansion to these outside agencies, strict guidelines must be implemented for customer verification to ensure all recipients are Kentucky Power customers. Kentucky Power staff should verify customer electric account numbers utilizing a copy of the customer's electric bill and the Kentucky Power Customer Information System. The outside agencies would need to utilize a similar customer verification system to ensure that only Kentucky Power customers participate in the program.

5. Student Energy Education Program

The Student Energy Education Program is designed to educate and inspire students to make smart energy choices to support a sustainable future. Kentucky Power partners with the National Energy Education Development Project (“NEED”) to offer free classroom instruction and educational materials to help 7th grade students learn about energy, electricity, the environment and economic issues. All schools that have 7th grade students within Kentucky Power’s service territory are eligible to participate.

The program, provided at no cost to participating schools, includes:

- Professional development for teachers where they will receive classroom curriculum and educational materials on energy, electricity, economics and the environment.
- Four 23-watt compact fluorescent lights per student (“CFLs”) to help students apply their classroom learning at home.

The Kentucky PSC approved budget and participation goals for the Student Energy Education Program.

Table 45 Program Budgets and Participation Goals, 2012-2014

	2012	2013	2014
CFLs	\$22,700	\$20,000	\$19,975
Promotion	\$1,000	\$1,000	\$1,000
Educational (workshop)	\$5,000	\$3,000	\$3,000
Program Development & Administration	\$3,000	\$3,000	\$3,000
Evaluation	\$0	\$0	\$9,713
Program Budget	\$31,700	\$27,000	\$36,688
Participation Goal	2,000	2,200	2,200

5.1 Evaluation Data Collection

The Student Energy Education Program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation goals?
- What promotional efforts resonate with teachers?
- How are the instructional materials incorporated into the classroom?
- Are teachers satisfied with the program?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would teachers recommend the program?
- Is the teacher training effective?
- Has participation generated interest in other Kentucky Power programs?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities,

program performance, program data and tracking mechanisms, and opportunities for program improvements.

Implementation Contractor Interview

Kentucky Power partners with the National Energy Education Development Project (“NEED”) to implement the program. NEED is a not-for-profit education association that focuses on K-12 energy education. NEED provides classroom curriculum materials and energy activities as well as participating school teacher development workshops. NEED implements the Louisville Gas & Electric/Kentucky Utilities Company and Duke Energy school programs.

AEG interviewed NEED in October 2013. The interview provided information on program activities, curriculum, teacher training and barriers to increased participation. The interview guide can be found in Appendix A.

Teacher Surveys

AEG administered an internet survey to participating teachers. The interviews provided an assessment of teacher training and classroom curriculum and identified potential areas for improvement. AEG aimed to survey 10 to 15 participating teachers. Teacher email addresses were provided by Kentucky Power program staff. Eleven (11) teachers completed the survey. The survey guide can be found in Appendix B.

Parent Surveys

AEG administered a 10 to 12 minute telephone survey to a random sample of parents whose children participated in the program to assess the dissemination of information from the classroom, installation of the CFLs distributed, free ridership and areas for improvement. Kentucky Power provided information for 667 parents whose children participated in the program between January 1, 2012 and September 30, 2013,²⁵ 563 of whom receive electric service from Kentucky Power. AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Sixty-one (61) participants were randomly selected based on unique identifiers determined by Microsoft Excel’s random number generator. Forty-eight (48) surveys were completed, for an error margin of 11 percent. The survey guide can be found in Appendix C.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power’s initial program filing savings were reviewed to compare with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Option A of the International Performance Measurement and Verification Protocols (“IPMVP”).²⁶

²⁵ Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

²⁶ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

Table 46 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

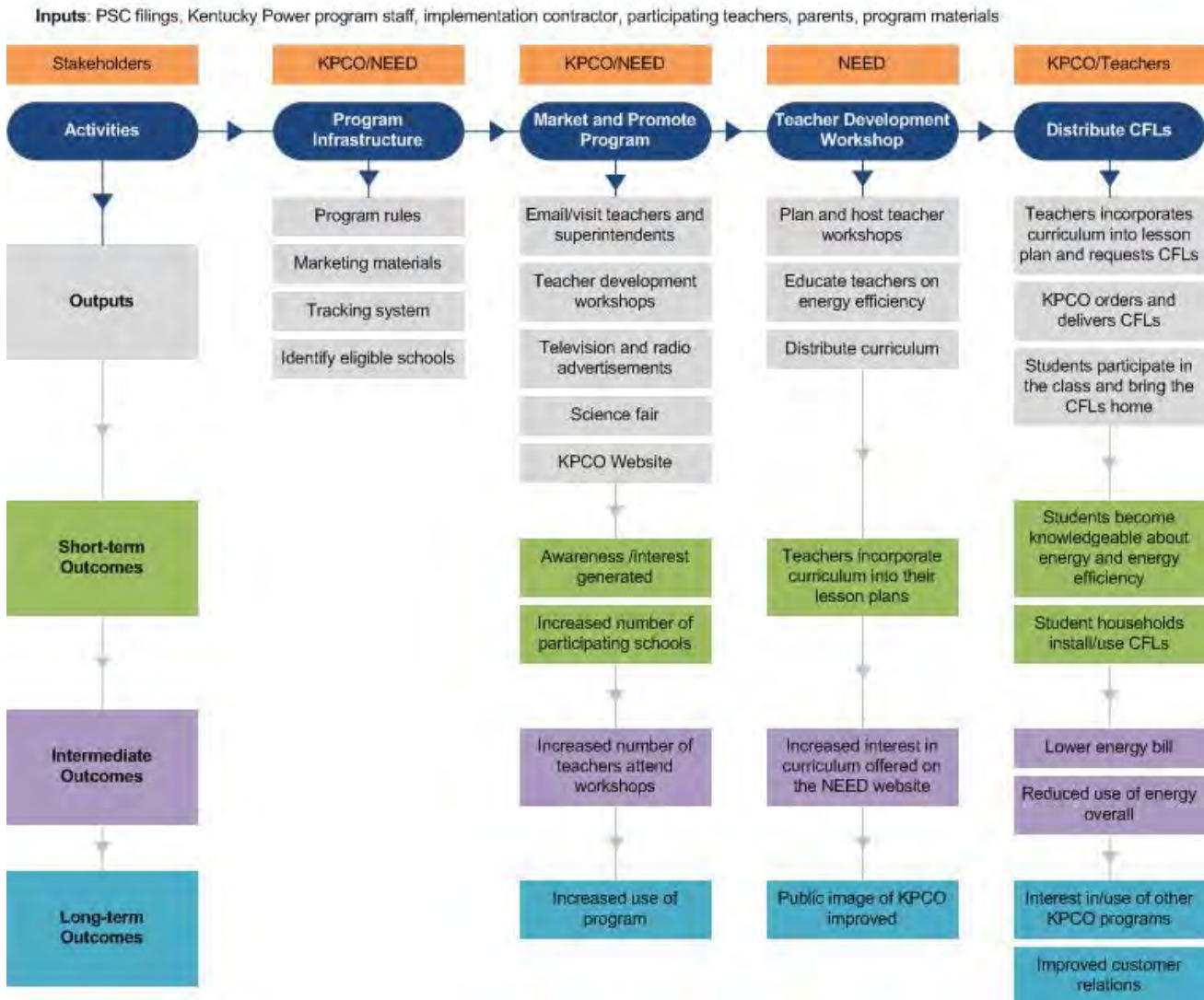
Engineering algorithms from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”), using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts.²⁷

5.2 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

²⁷ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 17 Program Logic Model



5.2.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program’s intended outcomes. Program activities include:

Develop Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power program staff, with input from AEP and NEED, designed the program. The KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Market Program

Marketing activities are targeted towards schools within Kentucky Power’s service territory. Kentucky Power staff promotes the programs directly to the schools, via emails or in-person meetings with superintendents and teachers. The program was marketed through teacher development workshops,

radio and television advertisements, local middle school science fairs, the KPCO website, and the program fact sheet.

Teacher Development Workshop

NEED hosts and facilitates three teacher development workshops per year, often in the beginning of the school year. The events are held in central locations, typically Ashland, Pikeville and Hazard, to provide teachers from all eligible schools the opportunity to attend at least one workshop. The actual locations vary from KPCO service center locations to offsite locations, such as restaurants. The workshops typically host 2 to 8 teachers and last 2 hours on average. Teachers are given information on CFLs, the science of energy and the importance of energy efficiency as well as ideas about how to incorporate the curriculum into the lesson plan. The NEED curriculum is designed to supplement the science of energy lesson plans required by the state of Kentucky. Teachers are given a hard copy of the curriculum at the workshop and can access additional curriculum through the NEED website.

Teach Lesson and Distribute CFLs

Teachers incorporate the NEED curriculum into their lesson plans and requests CFLs to Kentucky Power program staff with an approximate number of students and the date of the lesson plan. Kentucky Power purchases the necessary bulbs through AM Conservation and delivers the bulbs to the school. The 7th grade students that participate in the class receive CFL packages to bring home.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

5.2.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in the program may increase among teachers and schools. Schools may become interested in participating in the program and teachers may attend the development workshop. Students may become knowledgeable about energy and energy efficiency topics. Students will receive their CFLs, which may be installed in their households.

Intermediate Outcomes

Intermediate outcomes may include increased attendance at teacher development workshops, increased interest in NEED curriculum offerings, and reduced household energy consumption.

Long-term Outcomes

The long-term outcomes may include increased use of the program, improved customer relations and increased interest and use of other KPCO programs. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

5.2.3 External Factors

There are a variety of factors outside the control of Kentucky Power that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Cost, performance and availability of efficient technologies

5.3 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, program tracking and program satisfaction.

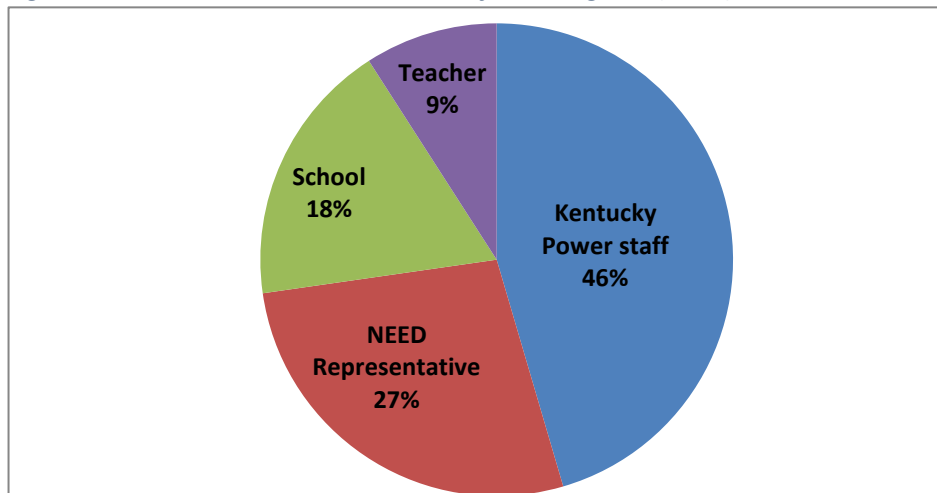
5.3.1 Program Marketing

Kentucky Power marketed the Student Energy Education Program through the following:

- **Teacher/Superintendent Outreach.** Kentucky Power staff promotes the programs directly to the schools within KPCO service territory, via emails or in-person meetings with superintendents and teachers. The list of schools and educators was developed with support from NEED.
- **Teacher Development Workshops.** Each September, Kentucky Power and NEED issue an announcement to eligible schools, providing program information and workshop training opportunities. NEED provides 3 teacher development workshops per year in central locations. At the workshops, gift certificates are awarded to participating teachers for games/quizzes.
- **Radio Advertisements.** In 2012, Kentucky Power paid a portion of 70 advertisements for three local radio stations, WPKE, WLSI, and WZLK.
- **Television Advertisement.** Kentucky Power filmed a television advertisement in 2013 with WYMT for Moms Everyday.
- **Science Fairs.** In 2012 and 2013, Kentucky Power sponsored middle school student awards for the Johnson County Energy Efficiency Science Fair.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save. The NEED website contains classroom curriculum by grade and topic as well as a calendar of teacher development workshops.

The teachers surveyed primarily learned of the Student Energy Education Program from Kentucky Power program staff (46 percent), followed by the NEED Representative (27 percent).

Figure 18 How Teachers First Learned of the Program (n=11)



5.3.2 Program Performance

The Student Energy Education Program achieved 104 percent of the 2012 participant goal and 101 percent of the 2013 goal, with 4,317 students receiving lessons on energy and a 4-pack of CFLs.

Table 47 Program Participation versus Participation Goal

	2012	2013
Target	2,000	2,200
Actual	2,087	2,230

Thirty-five (35) schools participated in the program. Forty-nine (49) percent participated for two school years and 9 percent participated for three school years. The schools that participated for three school years include:

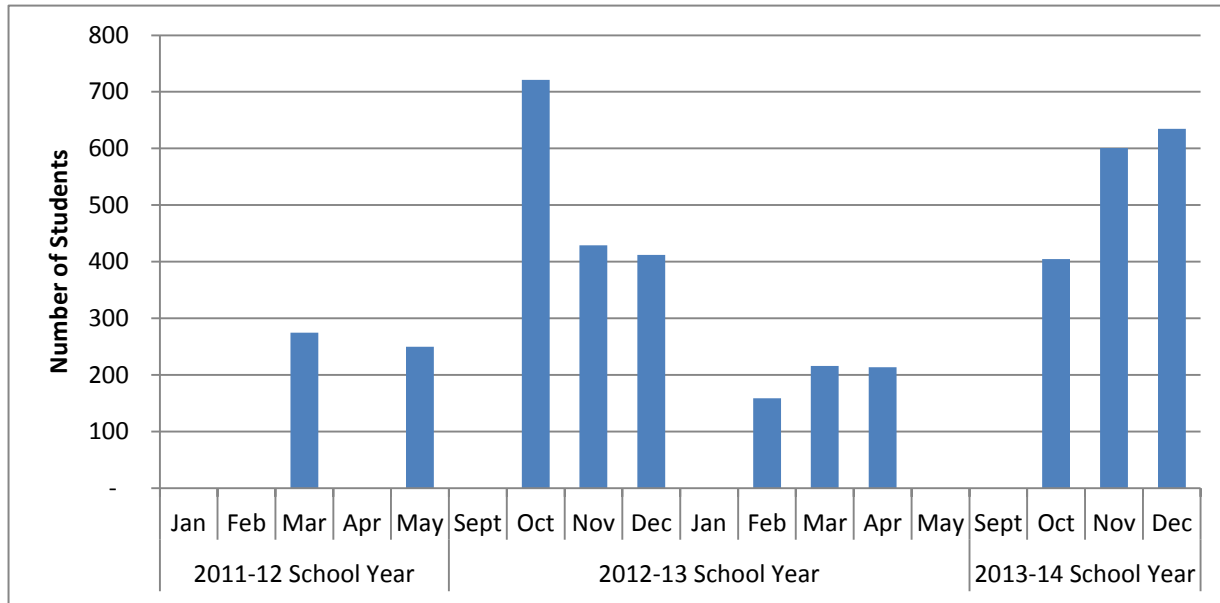
- Betsey Layne Elementary School
- Kimper Elementary School
- Raceland Worthington Independent School

Teachers primarily taught the curriculum in the fall months, between October and December.

Table 48 Number of Schools that Participated by School Year

School Year	Number of Schools
2011-2012	8
2012-2013	27
2013-2014	23

Figure 19 Program Participation by Month



Nine schools represent 50 percent of all CFL packages distributed between January 1, 2012 and December 31, 2013. The table below presents the percentage of CFL packages distributed by the 9 highest performing schools.

Table 49 Percentage of CFL Packages Distributed by School

School	CFL Packages Distributed	Percentage
Boyd County Middle School	460	10.7%
Verity Middle School	350	8.1%
Betsy Layne Elementary School	226	5.2%
McKell Middle School	217	5.0%
Allen Central Middle School	205	4.7%
Virgie Middle School	201	4.7%
Herald Whitaker Middle School	177	4.1%
Belfry Middle School	173	4.0%
Warfield Middle School	164	3.8%
Total Participating Schools	4,317	

The table below presents the budget and cost per participant as compared to the actual expenditures and cost per participant. The actual 2012 and 2013 expenditures were very close to the budget.

Table 50 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
CFLs	\$22,700	\$21,086	\$20,000	\$20,537
Promotion	\$1,000	\$1,000	\$1,000	\$928
Educational (workshop)	\$5,000	\$3,142	\$3,000	\$3,000
Program Development & Administration	\$3,000	\$3,000	\$3,000	\$3,000
Evaluation	\$0	\$0	\$0	\$1,887
Program Budget	\$31,700	\$28,228	\$27,000	\$29,352
Participation Goal	2,000	2,087	2,200	2,230
Budgeted Cost (\$) per Participant	\$15.9	\$13.5	\$12.3	\$13.2

5.3.3 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.²⁸ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

Kentucky Power utilizes a spreadsheet database to track the teachers and principals contacted as well as the CFLs distributed. Students are sent home with a package of four CFL bulbs and a tracking form. The student's parent is expected to complete the form with the following information:

- School Name
- Parent Name
- Student Name
- Address
- Phone Number
- Electric Account Number

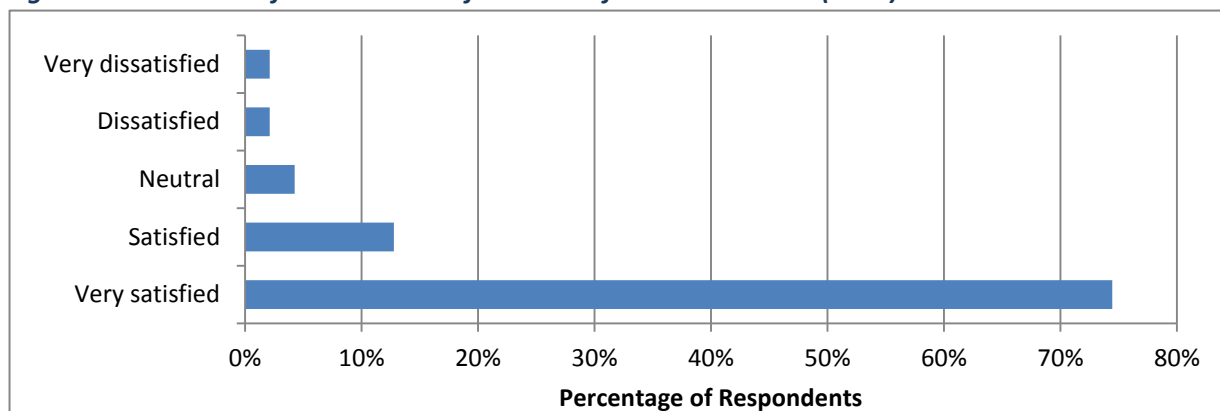
The forms are then sent to Kentucky Program staff. Approximately 17 percent of the forms distributed to students were submitted to Kentucky Power. Of the students that completed the form, 84 percent were Kentucky Power electric customers.

5.3.4 Program Satisfaction

Ninety-eight (98) percent of parents surveyed noted that their child brought home the four 23-Watt CFL bulbs from school. The majority of parents found the educational materials provided to the child were very informative (52 percent). Overall, parents were very satisfied with the performance of the CFL bulbs distributed. One parent noted that they,

Loved the program and thought it was great that Kentucky Power taught students about energy efficiency and gave light bulbs.

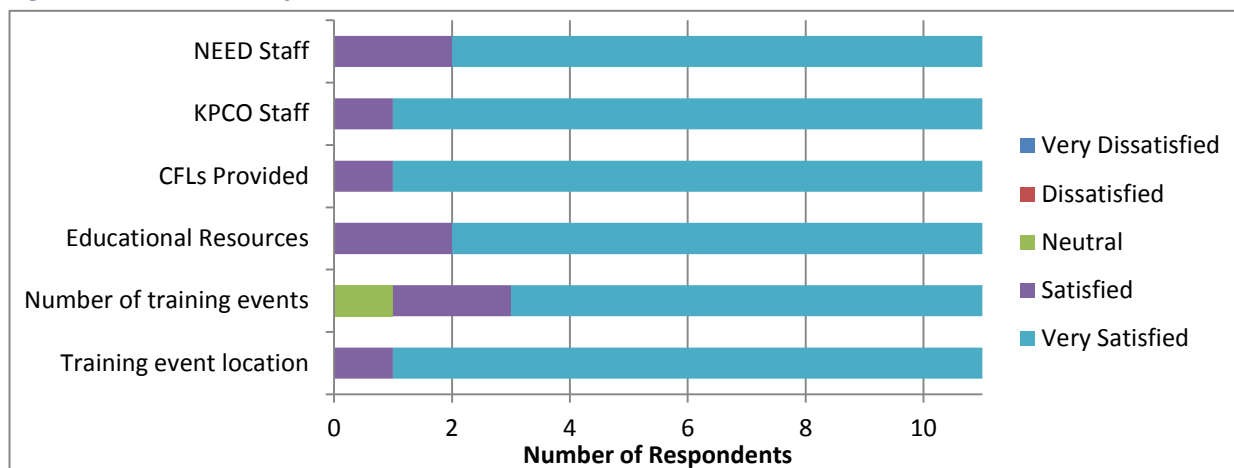
Figure 20 Parent Satisfaction with Performance of CFLs Distributed (n=47)



²⁸ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

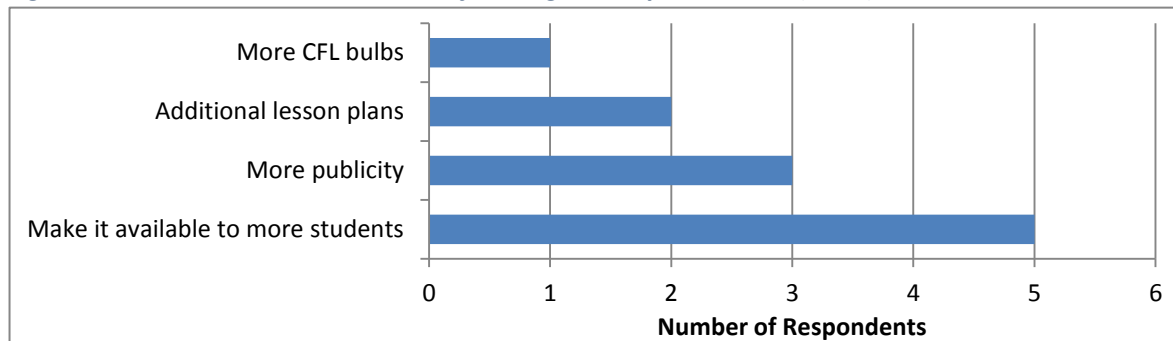
Ninety-one (91) percent of teachers were very satisfied with the Student Energy Education Program. Teachers were overwhelmingly satisfied with the program components as well, including training events, resources and KPCO and NEED staff. The teachers surveyed noted that distance (1) and time (4) were barriers to attending the teacher development workshops.

Figure 21 Teacher Satisfaction (n=11)



Teachers were asked their opinion on how the program could be improved. Teacher recommendations included increasing publicity and making the program available to more students. One teacher noted that energy conservation is not a core subject in 7th grade and that more teachers and students may benefit from the program focusing on 6th grade, where energy conservation is a core subject.

Figure 22 Teacher Recommendations for Program Improvements (n=11)



NEED implements Kentucky utilities, Louisville Gas & Electric/Kentucky Utilities Company and Duke Energy school programs. NEED noted that Kentucky Power's Student Energy Education Program is limited compared to the other utilities, which offer more training events, continuously engage teachers and offer an expanded curriculum to additional grades.

5.4 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

5.4.1 Energy Independence and Security Act

The United States Congress passed the Energy Independence and Security Act of 2007 (“EISA”) to promote energy efficiency through performance standards for electronic appliances and lighting. In particular, the legislation set efficiency standards for ‘general service’ light bulbs.

The efficiency standards are being implemented in two phases:

- *Phase 1.* Between 2012 and 2014, standard light bulbs will be required to use approximately 20 to 30 percent less energy than current incandescent light bulbs. All light bulbs manufactured or imported after December 31, 2011 are subject to the EISA standards.
- *Phase 2.* Beginning in 2020, there must be a 60 percent reduction in light bulb energy use.

The table below outlines the first phase and the maximum rate wattage required to attain EISA Phase 1 standards. Traditional incandescent 100, 75, 60 and 40 Watt bulbs will not meet the EISA efficiency standards as they take effect from 2012 to 2014. Therefore, as EISA standards become effective, the energy and demand savings per bulb will decrease. Specialty bulbs, such as 3-way bulbs and dimmable bulbs, are exempt from EISA.

Table 51 EISA Phase 1 Standard²⁹

Lumen Ranges	Incandescent Wattage	EISA Maximum Wattage	CFL Wattage	Effective Date
1490-2600	100	72	23-26	1/1/2012
1050-1489	75	53	18-22	1/1/2013
750-1049	60	43	13-14	1/1/2014
310-749	40	29	11	1/1/2014

The Consolidated Appropriations Act of 2014 states that federal funds may not be used to implement or enforce the standards established in EISA.³⁰ The EISA standards are still effective; however the U.S. Department of Energy has not been provided funding for enforcement.

5.4.2 Gross Energy and Demand Savings

AEG conducted an engineering analysis of the Student Energy Education Program to evaluate gross energy and demand savings based on Option A of the IPMVP.

Engineering Analysis

AEG conducted the engineering analysis using equations from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”). Energy and demand savings were estimated using the following equations:

$$\Delta kWh = Bulbs \times ((Watts_{base} - Watts_{ee})/1000) \times ISR \times Hours \times WHF_e$$

$$\Delta kW = Bulbs \times ((Watts_{base} - Watts_{ee})/1000) \times ISR \times WHF_d \times CF$$

²⁹ Energy Independence and Security Act of 2007. Title III. Subtitle B. January 4, 2007.

³⁰ Consolidated Appropriates Act, 2014. Division E. Title III. January 3, 2014.

Where:

- Bulbs = Total CFL bulbs distributed through program
- Watts_{base} = Baseline wattage of replaced lighting measure
- Watts_{ee} = Efficient wattage of lighting measure
- ISR = In Service Rate, the percentage of units rebated that are actually in service
- Hours = Average hours of use per year
- WHF = Waste heat factor to account for savings from efficient lighting
- CF = Peak Coincidence Factor

The Student Energy Education Program distributes 23 Watt CFLs to customers, which are equivalent to a 75 Watt or 100 Watt incandescent bulb. Based on EISA, 100 Watt incandescent bulbs were no longer manufactured as of January 1, 2012 and 75 Watt incandescent bulbs were no longer manufactured as of January 1, 2013. The table below summarizes the key variables used in the engineering analysis.

Table 52 Engineering Analysis Variables

Variable	Value	Description
Bulbs	4	Number of bulbs distributed per participant
Watts _{Base}	73.5 (2012) 62.5 (2013)	Average of baseline corresponding to 23 watt CFL bulb.
Watts _{EE}	23	Wattage of bulbs distributed through program
ISR	74%	Determined through participant survey
Hours	938	IL TRM default hours when location unknown
WHF _E	1.06	IL TRM default for single family home unknown location
WHF _D	1.11	IL TRM default for single family home unknown location
CF	9.5%	IL TRM default for single family home unknown location

The ISR was determined through the parent survey. The data collected was used to estimate how many bulbs distributed through the program were actually installed in Kentucky Power households. Participants were asked the following question:

How many of the high efficiency light bulbs that you received are currently installed in your home?

Response	Count	%	ISR
Four	28	57%	100%
Three	3	6%	75%
Two	10	20%	50%
One	1	2%	25%
Zero	5	10%	0%
DK/Refused	2	4%	50%
Weighted Average ISR			74%

Respondents were asked how many of the bulbs they intended to install immediately, representing an ISR of one through four. The responses were weighted by the proportion of respondents. AEG determined that 74 percent of the bulbs were likely to be installed in participants' households.

AEG determined the gross energy and demand savings of the program. The savings per participant was multiplied by the total number of participants to determine the total gross savings attributable to the program. The results of the engineering analysis are shown in the tables below.

Table 53 Gross Energy and Demand Savings per Participant

	Gross Energy Savings per Participant (kWh)	Summer Gross Demand Savings per Participant (kW)	Winter Gross Demand Savings per Participant (kW)
2012	150	0.02	0.02
2013	117	0.01	0.01
Total Program	133	0.01	0.01

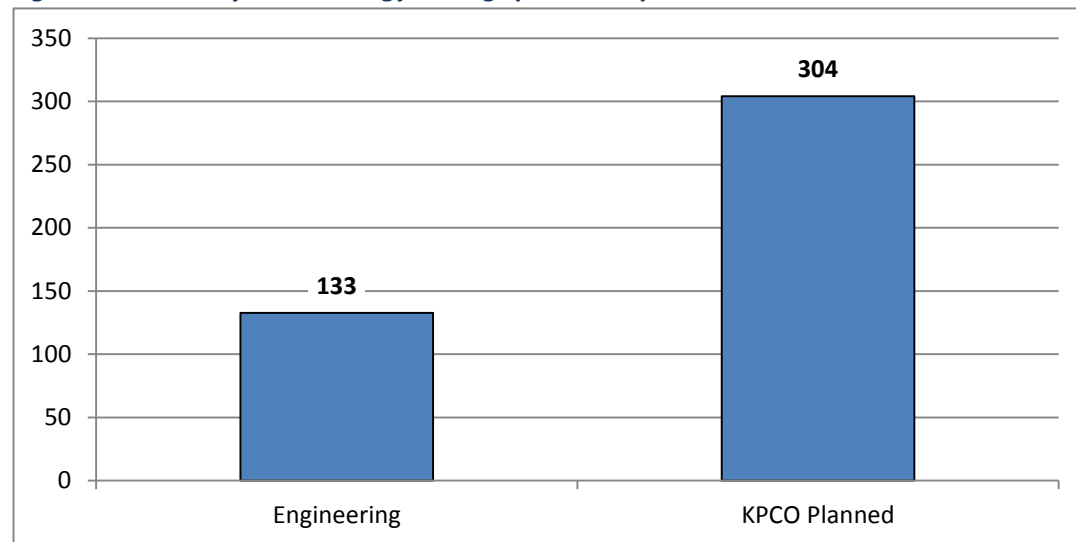
Table 54 Total Gross Energy and Demand Savings

	Gross Energy Savings (kWh)	Summer Gross Demand Savings (kW)	Winter Gross Demand Savings (kW)
2012	312,233	33.1	33.1
2013	260,956	27.7	27.7
Total Program	573,189	60.8	60.8

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. The figure below compares the gross energy savings per participant from the engineering analysis to the planned savings assumptions.

Figure 23 Summary Gross Energy Savings per Participant



5.4.3 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after accounting for free ridership and spillover. Free ridership refers to those participants who would have purchased and installed efficient lighting without the program influence. Spillover refers to additional savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - \text{Free ridership} + \text{Spillover}$$

AEG conducted a survey of parents to evaluate the effects of free ridership and spillover. Survey results are based on a random sample of participants with a margin of error of +/- 11 Percent.

Free Ridership

The following survey question was asked to respondents to determine the effects of free ridership.

How likely is it that you would have purchased and installed high efficiency light bulbs if you had not received them for free through the program?

Response	FR Probability	Count	Percent	Free Rider Score
Very Likely	80%	15	32%	26%
Somewhat Likely	35%	16	34%	12%
Not Likely	10%	15	32%	3%
DK/Refused	50%	1	2%	1%
Free Ridership Score				42%

AEG determined the free ridership to be 42 percent of gross savings.

Spillover

Spillover is the ratio of net spillover savings to gross savings of the participant sample.

$$Spillover = \frac{Net\ Spillover\ Savings}{(Program\ Savings\ per\ Participant \times Total\ Respondents) + Total\ Spillover\ Savings}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and spillover score for each respondent

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the parent survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to question one were included in the spillover calculation. The savings from the spillover actions described in question two were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, spillover participants engaged in a variety of additional energy efficient actions, including upgrading to ENERGY STAR® appliances and installing efficient lighting.

The net spillover savings from each respondent was determined by applying their spillover score to their gross spillover savings to estimate the spillover savings that were directly attributable to the program. The table below illustrates how the program spillover score was calculated. AEG determined the overall spillover score for participants is 10 percent.

Table 55 Spillover Calculation Summary

Line	Variable	Value
A	Total Respondents	49
B	Program Savings per Participant	150
C	Program Savings of Sample (A x B)	7,331
D	Gross Spillover Savings of Sample	2,973
E	Total Gross Sample Savings (C + D)	10,304
F	Net Spillover Savings	882
G	Spillover Score (F ÷ E)	9%

Next, AEG used the calculated free ridership and spillover estimates to determine the NTG factor.

Table 56 Net-to-Gross Factor

Free Ridership	Spillover	Net-to-Gross
42%	9%	68%

The NTG factor was applied to the gross unit savings to determine the net energy and demand savings. The engineering analysis savings are shown in the tables below.

Table 57 Net Energy and Demand Savings per Participant

	Net Energy Savings per Participant (kWh)	Summer Net Demand Savings per Participant (kW)	Winter Net Demand Savings per Participant (kW)
2012	100	0.01	0.01
2013	78	0.01	0.01
Total Program	89	0.01	0.01

Table 58 Total Net Energy and Demand Savings

	Net Energy Savings (kWh)	Summer Net Demand Savings (kW)	Winter Net Demand Savings (kW)
2012	208,753	22.1	22.1
2013	174,470	18.5	18.5
Total Program	383,223	40.6	40.6

5.4.4 Savings per Participant Summary

AEG conducted an engineering analysis of the Student Energy Education Program to assess gross energy and demand savings based on the IPMVP Option A. Therefore, AEG recommends utilizing the 2013 engineering analysis energy and demand savings per participant to determine program savings for program tracking purposes as well as PSC filings. The table below present the gross and nets savings per participant.

Table 59 Recommended Energy and Demand Savings per Participant

	Energy Savings per Participant (kWh)	Summer Demand Savings per Participant (kW)	Winter Demand Savings per Participant (kW)
Gross Savings	117	0.01	0.01
Net Savings	78	0.01	0.01

5.4.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the efficient technology(s) improve a customer's financial position, decreases overall energy costs to ratepayers,

and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Student Energy Education Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.³¹ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

Impact evaluation results are utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, and participation, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

The Student Energy Education Program was found to be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

Table 60 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.36	\$268,211	\$96,397	(\$171,814)
Utility Cost Test	1.73	\$55,804	\$96,397	\$40,593
Participant Test	n/a	\$0	\$212,407	\$212,407
Total Resource Cost Test	1.73	\$55,804	\$96,397	\$40,593

Evaluating the program on a prospective basis, the Student Energy Education Program is also cost-effective and should be continued going forward. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results are presented in the table below.

³¹ The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

Table 61 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.37	\$122,378	\$45,352	(\$77,027)
Utility Cost Test	1.40	\$32,383	\$45,352	\$12,969
Participant Test	n/a	\$0	\$89,996	\$89,996
Total Resource Cost Test	1.40	\$32,383	\$45,352	\$12,969

5.5 Program Recommendations

AEG has recommendations on how to improve the program. These include:

Review Bulb Offerings

AEG recommends that KPCO consider modifying the kits distributed to students. Kentucky Power currently distributes bulb packages that include four 23 Watt CFL bulbs, which are equivalent to a 75 or 100 Watt incandescent bulb. A 15 or 17 Watt CFL bulb is equivalent to a 60 or 75 Watt incandescent bulb, a bulb wattage that most people utilize throughout their homes. This adjustment would potentially lower the bulb costs to the program. Kentucky Power should explore opportunities to offer alternative bulb packages or change the bulbs distributed.

Consider Program Modifications

AEG recommends that KPCO consider offering the Student Energy Education Program to a different grade. One teacher surveyed noted that energy conservation is a core subject in the 6th grade and that the program may benefit 6th graders slightly more than 7th graders. All of the teachers surveyed found the Student Energy Education Program information and very beneficial to students. Kentucky Power should send out a short questionnaire or hold a focus group with educators to determine which grade the program should target, between 4th and 8th grade. It is recommended to continue the program in middle schools due to the proven track record of savings where middle school programs are the industry standard.

AEG recommends that KPCO engage NEED to assist with data tracking if it is cost-effective for NEED to track the data. Students are sent home with a tracking form that is to be completed by the parent and returned to the teacher. Approximately 17 percent of the forms distributed to students were submitted to Kentucky Power. Kentucky Power should work with NEED to determine if any cost-effective changes can be made to the program to increase the number of tracking forms returned.

Increase Teacher Engagement

AEG recommends that Kentucky Power work with NEED to increase teacher engagement. NEED offers three teacher development workshops per school year. The teachers surveyed noted that distance and time were barriers to attending the teacher development workshops. Kentucky Power should work with NEED to determine if the development workshops could be offered electronically to increase access to teachers. Kentucky Power should explore if the electronic development workshops can be credited as continuing education credits.

6. Modified Energy Fitness Program

The Modified Energy Fitness Program is a weatherization program that provides qualifying customers a home energy audit and energy conservation measures free of charge to the customer. A professional energy auditor performs a home energy audit, identifying key areas of the home that are wasting energy and provides recommendations to make the home more energy efficient. In addition to the audits, participants are eligible to receive energy efficiency measures installed. Eligible measures include:

- Domestic hot water pipe insulation
- Water heater insulation wrap
- High efficiency showerhead
- Weatherstripping / caulking / doorsweep
- Duct sealing
- High efficiency lighting

All-electric single family residential customers that used an average of at least 1,000 kWh per month over the last 12-months are eligible to participate.

The Kentucky PSC approved budget and participation goals for the Modified Energy Fitness Program.

Table 62 Program Budgets and Participation Goals, 2012-2014

	2012	2013	2014
Equipment/Vendor	\$427,000	\$441,800	\$794,755
Evaluation	\$0	\$20,950	\$28,934
Other	\$0	\$0	\$15,000
Total Budget	\$427,000	\$462,750	\$838,689
Participation Goal	1,200	1,200	2,000

6.1 Evaluation Data Collection

The Modified Energy Fitness Program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation goals?
- Are auditors sufficiently knowledgeable about the program? Audits? Equipment?
- Are customers satisfied with the program?
- What are the significant drivers of participation?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would customers recommend the program?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?
- Are there additional measures that could be incorporated into the program?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

Third-Party Implementer Interview

The program is implemented by Honeywell International (“Honeywell”). Honeywell provides marketing, customer service, schedules customer appointments, conducts home audits, installs energy efficiency measures, and provides customer education. AEG interviewed Honeywell in October 2013. The interview provided information on program implementation activities, program data and tracking methods. The interview guide can be found in Appendix A.

Participating Customer Surveys

AEG administered a 10 to 12 minute telephone survey to a random sample of program participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. Kentucky Power provided data for 2,106 residential customers who participated in the program between January 1, 2012 and September 30, 2013.³² AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were randomly selected based on unique identifiers determined by Microsoft Excel’s random number generator. Sixty-nine (69) surveys were completed. The survey guide can be found in Appendix C.

AEG also conducted site visits and inspections to verify installation, ensure equipment eligibility, and verify application data matches installed equipment.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power’s initial filed program savings were reviewed to compare with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Options A and C of the International Performance Measurement and Verification Protocols (“IPMVP”).³³ AEG performed separate engineering and customer billing analyses to provide a comparison between the two savings methodologies.

³² Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

³³ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

Table 63 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

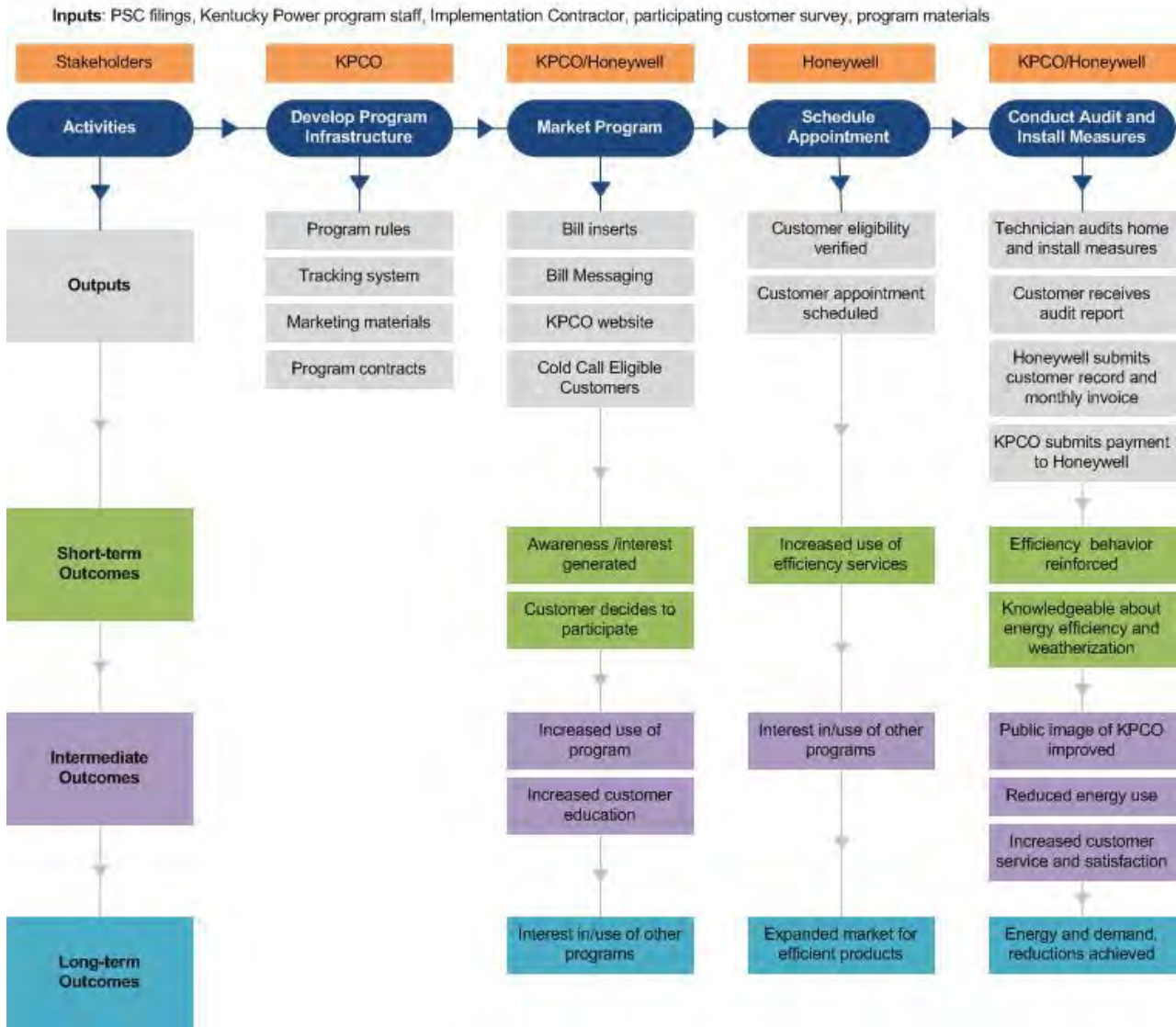
Engineering algorithms from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”), using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts.³⁴ The billing analysis identified changes in participants’ energy usage attributable to the program, comparing energy usage for one year prior to measure installation to one year post measure installation.

6.2 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

³⁴ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 24 Program Logic Model



6.2.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program’s intended outcomes. Program activities include:

Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power program staff, with input from AEP and Honeywell, designed the program, including the list of measures offered and the data tracking system. The KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Market Program

Marketing activities include bill inserts, bill messaging, the KPCO website, and program fact sheets. Additionally, Honeywell conducts cold calls of customers utilizing a list of qualifying customers provided

by AEP/Kentucky Power. Customers within specific regions are targeted to reduce technician travel time between appointments.

Schedule Appointment

Customers schedule an appointment for a technician to audit their home either (1) in response to a Honeywell cold call or (2) calling Customer Service. Customer eligibility is verified to ensure that the customer has an all-electric single family residence that used an average of at least 1,000 kWh per month over the last 12-months and have been a KPCO customer for at least one year. Honeywell verifies customer eligibility utilizing a list of qualifying customers provided once a year by AEP/Kentucky Power. If a customer is not on the list, Honeywell contacts Kentucky Power DSM Program staff to verify customer eligibility. The customer receives a reminder call one day prior to their scheduled appointment.

Conduct Audit and Install Measures

The technician conducts an audit of the home, walking through the home with the customer to identify areas that may be improved. Participants may receive:

- Air infiltration diagnostic test to find air leaks
- Customized report with energy efficiency recommendations
- Energy savings booklet
- Direct installation of energy conservation measures

The technician installs pertinent energy conservation measures, as determined by the audit, focusing on weatherization. According to Honeywell,

Approximately 90 to 95 percent of customers that receive an energy audit have the recommended direct install measures installed by the technician.

The customer signs the work order confirming that the work was completed. A summary report of the audit, detailing the audit findings and energy efficient recommendations, is sent the customer within three weeks of the technician visit.

Honeywell submits each completed customer file to Kentucky Power and submits an invoice for services once a month. KPCO staff checks the customer file and Honeywell invoice for completeness. Honeywell conducts QA/QC with a random sample of 10 percent of program participants every month, 2 percent site visits and 8 percent phone calls, as well as an email survey. The QA/QC is designed to determine participant experience and satisfaction with the program. Kentucky Power maintains the right to conduct inspections. KPCO program staff attended two customer audits in 2012 and one customer audit appointment in 2013.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

6.2.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in energy efficiency may increase among customers. Customers may become more knowledgeable about energy efficient equipment/weatherization and have an increased commitment to energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPSC efficiency programs, reduced household energy consumption, and increased customer satisfaction.

Long-term Outcomes

The long-term outcomes may include reduced utility emissions, and fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

6.2.3 External Factors

There are a variety of factors outside the control of Kentucky Power that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Cost, performance and availability of efficient technologies

6.3 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, program tracking and program satisfaction.

6.3.1 Program Marketing

Kentucky Power and Honeywell marketed the Modified Energy Fitness Program through the following:

- **Cold Calls.** Honeywell conducts cold calls of customers utilizing a list of qualifying customers provided once a year by AEP/Kentucky Power. Customers within specific regions are targeted to reduce technician travel time between appointments.
- **Bill Inserts.** Kentucky Power distributed bill inserts to residential customers in January 2012 as well as July, October and December 2013.
- **Bill Messaging.** Kentucky Power utilized on-bill messaging in December 2012, May 2013 and October 2013.

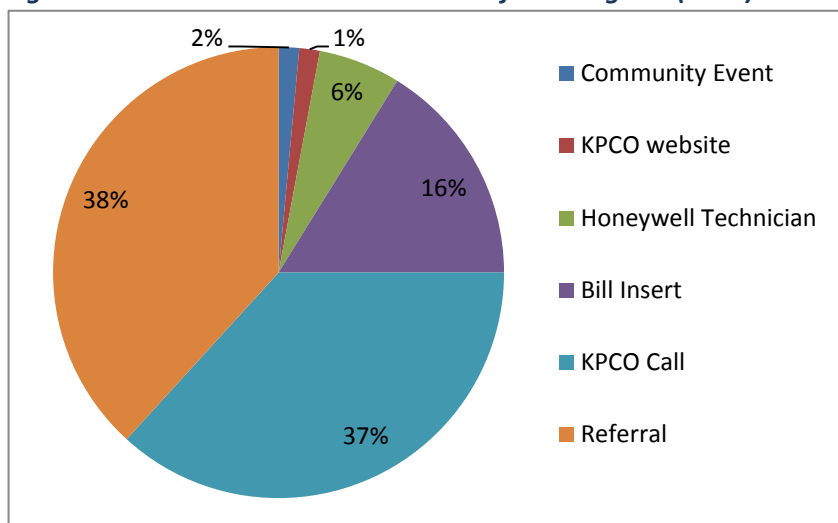
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save. The customer service number to schedule an appointment is provided on the KPCO DSM Program website.
- **Customer Referrals.** Honeywell technicians encourage all customers that participate in the program to refer neighbors, family and friends to enroll in the program.

According to Honeywell,

The Kentucky Power bill inserts have been helpful in raising program awareness.

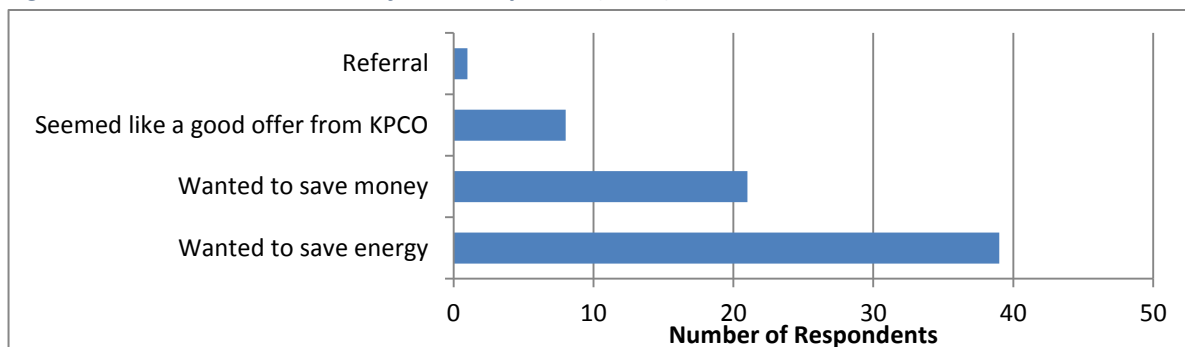
According to participating customers surveyed, participants most often learned of the program from a friend, family member or neighbor referral (38 percent) or the Honeywell cold call (37 percent), followed by a bill insert (16 percent).

Figure 25 How Customers First Learned of the Program (n=68)



Fifty-seven (57) percent of participating customers surveyed cited that their primary reason for participating in the Modified Energy Fitness Program was that they wanted to save energy. An additional 30 percent of participating customers surveyed noted that saving money was also an important motivator.

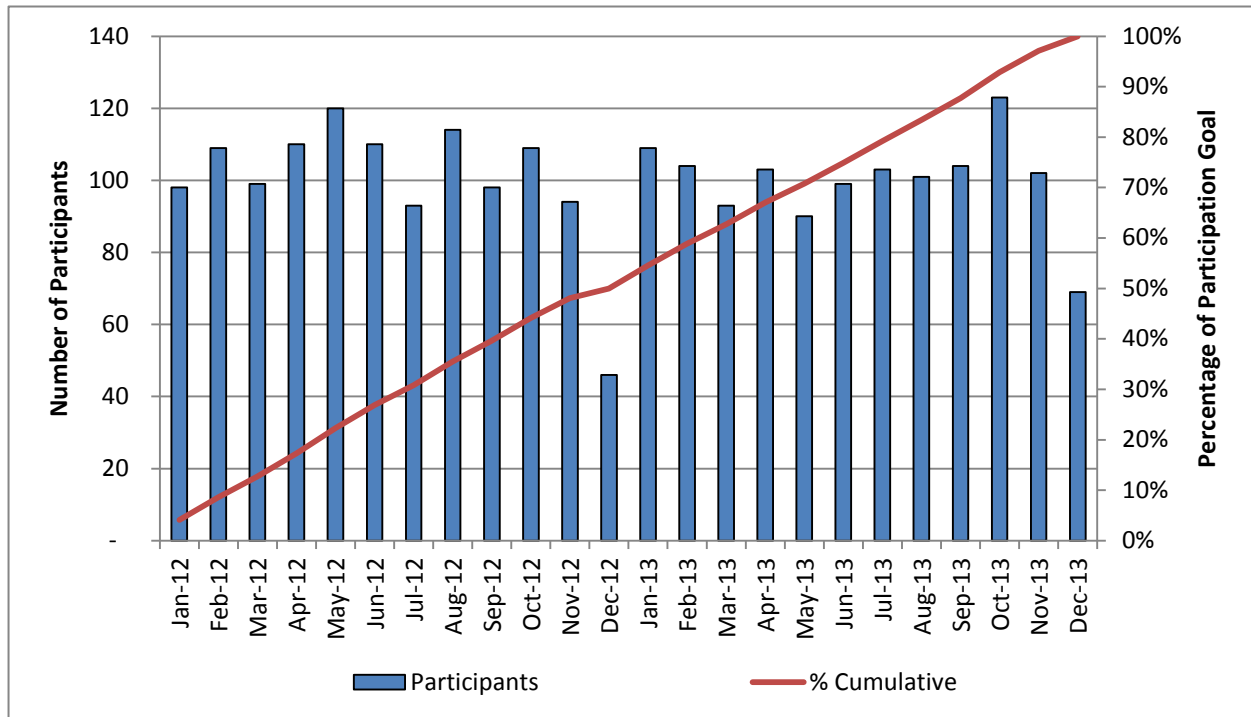
Figure 26 Customer Motivation for Participation (n=69)



6.3.2 Program Performance

Twenty-four hundred (2,400) customers participated in the Modified Energy Fitness Program between January 1, 2012 and December 31, 2013, and achieved the 1,200 participation goal per year. As shown in the figure below, program participation was fairly evenly distributed throughout the year. Honeywell is strictly limited to 1,200 participants per year, accounting for the slight decrease in participation in December.

Figure 27 Program Participants by Month



Honeywell has two field technicians that visit customer’s homes to conduct audits, perform air infiltration diagnostic tests, and install energy conservation measures. Honeywell has ensured that the technicians optimally cover the service territory, with one technician residing in the northern area of Kentucky Power’s service territory and one in the southwest area of the service territory. Additionally, a local supervisor assists with customer visits, distributes energy conservation measures and ensures program quality control.

Honeywell worked with Kentucky Power to develop a list of energy efficiency measures available to directly install in a customer’s home. The actual measures installed are dependent upon the audit findings and the total cost. Participants may receive:

- Air infiltration diagnostic test to find air leaks
- Customized report with energy efficiency recommendations
- Energy savings booklet
- Direct installation of energy conservation measures:
 - Compact fluorescent light (“CFL”) bulbs
 - Domestic hot water pipe insulation
 - Water heater insulation wrap

- High efficiency showerhead
- Weatherstripping / caulking / doorsweep
- Duct sealing

All program participants received a walk-through audit of their home. The majority of participants also received an air infiltration diagnostic test, 95 percent received a blower door test pre- and post-measure installation, and 5 percent received a blower door test pre-measure installation. Participants received an education booklet detailing home energy use and energy savings tips.

The Modified Energy Fitness Program identifies key areas of the home that are wasting energy. The most commonly installed measures include weatherstripping, low flow showerheads, and CFLs. Ninety-four (94) percent of participants had some type of weatherization measure directly installed. On average, customers received 53 feet of weatherstripping per home. Duct sealing and caulking were also frequently applied at 46 percent and 44 percent, respectively.

Table 64 Weatherization Measures Installed 2012-2013

Measure	Participants	Quantity	Average per Participant	Percentage of Participants
Weatherstrip (per foot)	2,199	116,459	53 feet	92%
Duct Sealing (per foot)	1,100	23,883	22 feet	46%
Caulk (per foot)	1,066	67,878	64 feet	44%
Foam (12 oz. can)	210	251	1.2 cans	9%
Door Sweep	195	245	1.26	8%
Total Weatherization	2,265	208,716	n/a	94%

Ninety-nine (99) percent of program participants had at least one lighting measure installed. On average, each participant received 6 lighting measures, primarily 13 Watt and 23 Watt CFL bulbs.

Table 65 Lighting Measures Installed 2012-2013

Measure	Participants	Quantity	Average per Participant	Percentage of Participants
23W CFL	1,636	5,121	3.13	68%
13W CFL	1,480	6,453	4.36	62%
14W CFL	375	1,434	3.82	16%
16W R30 CFL Floodlight	338	1,325	3.92	14%
27W CFL	9	19	2.11	0.38%
Deluxe Neon Night Light	1	6	6.00	0.04%
Total Lighting	2,389	9,237	6.01	99.5%

Ninety-five percent of program participants had at least water measure directly installed. The majority (94 percent) of participants obtained a low flow showerhead. Additionally, 13 percent of participants received a water heater tank wrap and 11 percent had their hot water pipes insulated.

Table 66 Water Measures Installed 2012-2013

Measure	Participants	Quantity	Average per Participant	Percentage of Participants
Low Flow Showerhead	2,245	3,635	1.62	94%
Water Heater Wrap	303	338	1.12	13%
Hot Water Pipe Insulation (3/4 in.)	245	1,468	5.99	10%
Water Heater Turndown	50	51	1.02	2%
Hot Water Pipe Insulation (1/2 in.)	13	135	10.38	1%
Total Water Measures	2,278	5,627	2.47	95%

The table below presents the budget and cost per participant as compared to the actual expenditures and cost per participant. The actual 2012 and 2013 expenditures were slightly higher than budgeted, as was the cost per participant.

Table 67 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
Equipment/Vendor	\$427,000	\$432,225	\$441,800	\$456,909
Evaluation	\$0	\$0	\$20,950	\$7,007
Other	\$0	\$0	\$0	\$2,342
Total Cost (\$)	\$427,000	\$432,225	\$462,750	\$466,257
Participation Goal	1,200	1,200	1,200	1,200
Cost (\$) per Participant	\$356	\$360	\$386	\$389

6.3.3 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.³⁵ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

Honeywell utilizes BBCS, a proprietary system, to track program participation. The BBCS system is utilized to track scheduled appointments, participant home information and audit findings, and the measures directly installed by the technician. The audit report collects information on the following:

- Home Demographics
- Domestic Hot Water Characteristics
- HVAC System
- Thermostat
- Windows/Doors
- Walls
- Basement
- Attic
- Lighting
- Refrigerator
- Blower Door Test

The audit date, auditor name, and customer information are also recorded. The customer signs the work order confirming that the work was completed.

Honeywell invoices Kentucky Power for services rendered on a monthly basis. The invoice details the number of audits, volume of energy conservation measures installed, the total cost of the energy conservation measures installed and the cost of services rendered during the month. Kentucky Power staff reviews Honeywell invoice for completeness and submits payment.

³⁵ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

6.3.4 Program Satisfaction

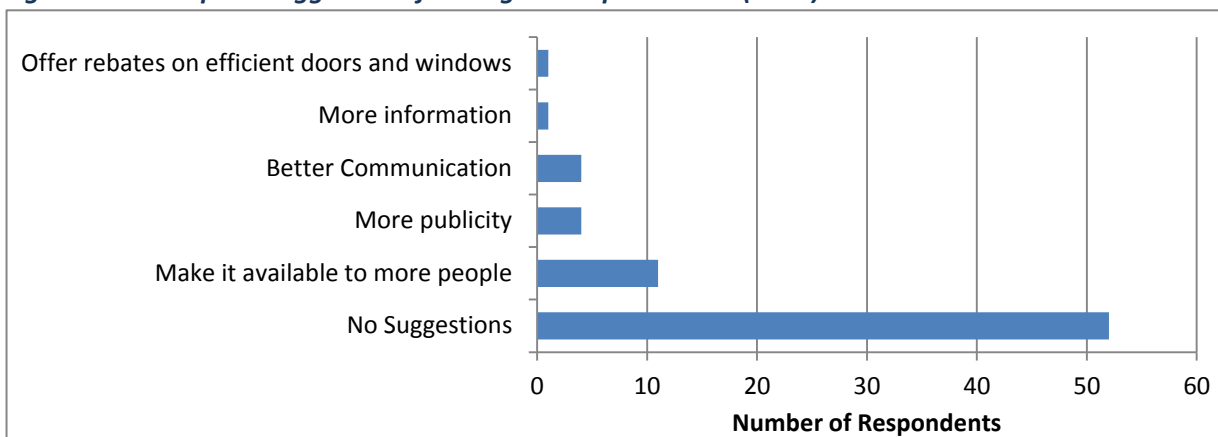
Overall, customers are satisfied with the Modified Energy Fitness Program. Ninety-seven (97) percent of participants surveyed would recommend the program to others. Eighty-seven percent of participants have already recommended the program to their family, friends and/or neighbors. Participants were quite satisfied with the energy auditor; 86 percent noted that they were very knowledgeable about energy savings techniques.

Table 68 Participant Satisfaction (n=69)

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Scheduling the appointment	81%	14%	4%	0%	0%
Energy auditor	83%	16%	1%	0%	0%
Measures Installed	80%	14%	3%	3%	0%
Educational Materials	77%	22%	1%	0%	0%
Response Times for requests for information	78%	17%	3%	0%	1%
Program Overall	77%	22%	1%	0%	0%

Participating customers surveyed were asked their opinion on how the program could be improved. Participant suggestions included making the program available to more people and increasing publicity.

Figure 28 Participant Suggestions for Program Improvement (n=65)



Honeywell noted that the barriers to increased program participation include program awareness and customer skepticism because the program is free. Most customers are not aware of the program prior to the Honeywell cold call, although the program has been offered by Kentucky Power for over 10 years. The Kentucky Power Customer Operations Center staff has been trained on how to respond to these customers and alleviate their concerns.

6.4 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

6.4.1 Gross Energy and Demand Savings

AEG conducted engineering and billing analyses of the Modified Energy Fitness Program to assess gross energy and demand savings based on the IPMVP Options A and C.

Engineering Analysis

AEG conducted the engineering analysis using equations from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* ("IL TRM"). AEG determined the gross savings per participant for each measure type using program tracking data and engineering analysis variables adapted to Kentucky Power's service territory (i.e. annual cooling hours).

As previously noted, the majority of participants had more than one of each measure installed. The savings per participant and total savings takes into account the average number of measures installed by a program participant. Therefore, the annual savings per participant will not equal the sum of the measure savings per participant. The tables below present the results of the engineering analysis.

Table 69 Gross Energy Savings (kWh) per Participant

Measure	2012	2013	Average per Participant
Door Sweep	11	10	11
Weatherstripping	117	108	112
Duct Sealing - Aluminum Tape	324	279	301
Caulk	157	109	135
Foam Insulation - 12Oz Can	153	151	152
Hot Water Pipe Insulation - 3/4"	150	145	148
Water Heater Wrap	206	181	196
Hot Water Pipe Insulation - 1/2"	218	142	171
14W CFL	169		169
23W CFL	84	101	90
13W CFL	105	117	113
16W R30 CFL Floodlight	155	180	166
27W CFL	92	-	92
Deluxe Neon Night Light	0.1	-	0.1
Low Flow Showerhead	329	318	324
Hot Water Heater Turndown	86	91	88

Table 70 Gross Summer Demand Savings (kW) per Participant

Measure	2012	2013	Average per Participant
Door Sweep	0.003	0.003	0.003
Weatherstripping	0.034	0.031	0.032
Duct Sealing - Aluminum Tape	0.142	0.123	0.132
Caulk	0.045	0.031	0.039
Foam Insulation - 12Oz Can	0.044	0.044	0.044
Hot Water Pipe Insulation - 3/4"	0.017	0.017	0.017
Water Heater Wrap	0.023	0.021	0.022
Hot Water Pipe Insulation - 1/2"	0.025	0.016	0.020
14W CFL	0.018	-	0.018
23W CFL	0.009	0.011	0.010
13W CFL	0.011	0.012	0.012
16W R30 CFL Floodlight	0.016	0.019	0.018
27W CFL	0.010	-	0.010
Deluxe Neon Night Light	0.000	-	0.000
Low Flow Showerhead	0.021	0.021	0.021
Hot Water Heater Turndown	0.010	0.010	0.010

Table 71 Gross Winter Demand Savings (kW) per Participant

Measure	2012	2013	Average per Participant
Door Sweep	0.003	0.003	0.003
Weatherstripping	0.018	0.017	0.017
Duct Sealing - Aluminum Tape	0.070	0.061	0.065
Caulk	0.024	0.017	0.021
Foam Insulation - 12Oz Can	0.046	0.045	0.045
Hot Water Pipe Insulation - 3/4"	0.017	0.017	0.017
Water Heater Wrap	0.023	0.021	0.022
Hot Water Pipe Insulation - 1/2"	0.025	0.016	0.020
14W CFL	0.018	-	0.018
23W CFL	0.009	0.011	0.010
13W CFL	0.011	0.012	0.012
16W R30 CFL Floodlight	0.016	0.019	0.018
27W CFL	0.010	-	0.010
Deluxe Neon Night Light	0.000	-	0.000
Low Flow Showerhead	0.021	0.021	0.021
Hot Water Heater Turndown	0.010	0.010	0.010

The overall savings per participant and total program savings as shown in the tables below.

Table 72 Gross Energy and Demand Savings per Participant, All Measures

	Energy Savings per Participant (kWh)	Summer Demand Savings per Participant (kW)	Winter Demand Savings per Participant (kW)
2012	895	0.17	0.11
2013	789	0.15	0.10
Program Total	842	0.16	0.10

Table 73 Total Gross Energy and Demand Savings, All Measures

	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
2012	1,073,745	198	131
2013	947,138	174	115
Program Total	2,020,883	372	247

Billing Analysis

A billing analysis estimates the change in billed energy usage of a participant sample for one year before and after participation in the program using a paired sample t-test. The t-test is used to determine whether there was a significant difference in average energy usage before and after program participation. The t-test compares the average annual energy usage of the participant sample before and after the measure(s) was installed. Kentucky Power provided approximately four years of billing data for all customers via AEP's corporate file transfer protocol, including monthly interval billed energy usage for all customers.

The following steps were taken to develop the participant sample:

- Participants were matched to the Kentucky Power billing data using their account number. If an account number could not be matched, the participant was removed from the sample.

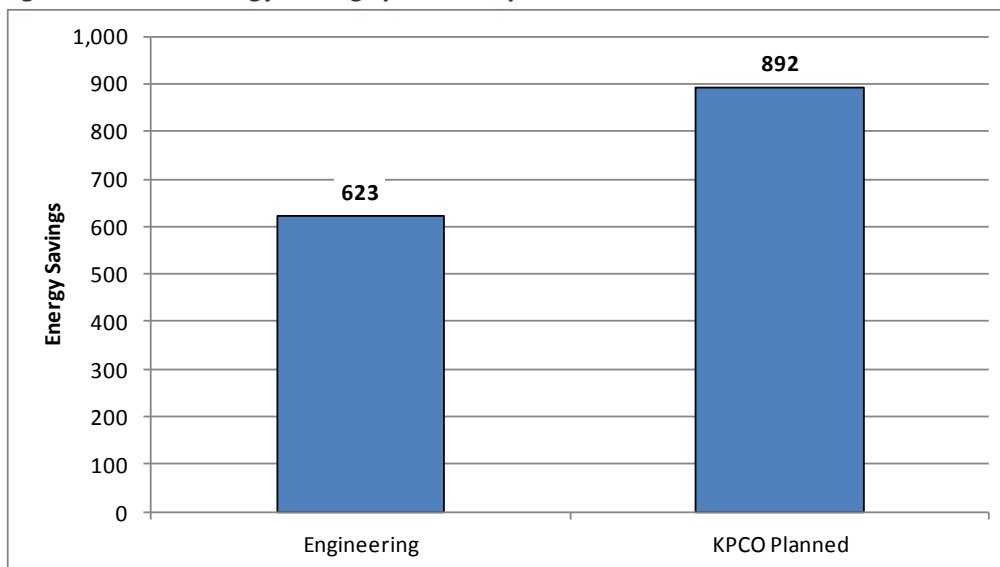
- Customers that participated in multiple Kentucky Power programs were identified and removed from the sample.³⁶
- Only sample participants with exactly 12 monthly intervals before and after the installation interval were included in the sample.
- An outlier screen was applied to the sample participants to remove outliers and other anomalous cases. Participants with an average pre-program annual energy usage greater than two standard deviations from the mean were removed from the sample to limit potential bias.

After screening for outliers and applying other sample validation criteria, the participant sample was significantly reduced and did not represent the program population. Therefore, AEG was unable to determine statistically significant results from the participant sample for the billing analysis.

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. The figure below compares the gross energy savings per participant from the engineering analysis to the planned savings assumptions.

Figure 29 Gross Energy Savings per Participant



6.4.2 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after accounting for free ridership and spillover. Free ridership refers to those participants who would have installed the efficient measures without the program influence. Spillover refers to additional savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - Free\ ridership + Spillover$$

³⁶ Note that account numbers were not available for the Residential Efficient Products program and could not be removed from the sample. However, the interactive effects from this program are considered minimal.

AEG conducted a survey of program participants to evaluate the effects of free ridership and spillover. Survey results are based on a random sample of participants with an overall statistical significance of 90 percent and a margin of error of +/- 10 Percent.

Free Ridership

Two questions in the participant survey were designed to assess the effects of free ridership.

- **Question 1:** Prior to participating in the program, were you planning to purchase and install the measures installed through the program?
- **Question 2:** If you had not participated in the program, how likely is it that you would have purchased and installed the measures you described?

Each response to the free ridership questions was assigned a probability that that respondent was a free rider. The free ridership probability reflects the likelihood that a respondent would have installed the efficient measures absent the program. The proportion of each response was multiplied by the free ridership probability to calculate the free ridership score.

Table 74 Free Ridership Question 1

Response	FR Probability	Count	Percent	Free Rider Score
Yes	50%	14	20%	10%
No	0%	55	80%	0%
Question 1 Free Ridership Score				10%

Table 75 Free Ridership Question 2

Response	FR Probability	Count	Percent	Free Rider Score
Very likely	85%	5	7%	6%
Somewhat likely	35%	5	7%	3%
Not likely	10%	10	14%	1%
Would Not Install	0%	49	71%	0%
Question 2 Free Ridership Score				10%

The free ridership score for each question was weighted based on its contribution to the overall free ridership factor. Weights were based on the assumption that survey responses may not reflect the actual behavior of respondents (i.e. social desirability bias). The weighted average of the scores determines the free ridership factor for the program.

Table 76 Free Ridership Question Summary

Question	Weight	Free Rider Score
Question 1	50%	10%
Question 2	50%	10%
Free Ridership Score		10%

Based on the responses to the survey questions, free ridership is estimated at 10 percent.

Spillover

Spillover is the ratio of net spillover savings to gross savings of the participant sample.

$$Spillover = \frac{Net\ Spillover\ Savings}{(Program\ Savings\ per\ Participant \times Total\ Respondents) + Total\ Spillover\ Savings}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and spillover score for each respondent

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the participant survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to question one were included in the spillover calculation. The savings from the spillover actions described in question two were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, spillover participants engaged in a variety of additional energy efficient actions, including upgrading to ENERGY STAR® appliances, installing efficient lighting and installing new efficient windows and doors.

Finally, each respondent was asked how much the program influenced their additional actions by answering question three. The table below shows the spillover score assigned to each of the responses.

Table 77 Spillover Score

Response	Score
Very likely	10%
Somewhat likely	35%
Not likely	80%
Don't Know/Refused	50%

The net spillover savings from each respondent was determined by applying their spillover score to their gross spillover savings to estimate the spillover savings that were directly attributable to the program. The table below illustrates how the program spillover score was calculated. AEG determined the overall spillover score for participants was 6 percent.

Table 78 Spillover Calculation Summary

Line	Variable	Value
A	Total Respondents	69
B	Program Savings per Participant	842
C	Program Savings of Sample (A x B)	58,100
D	Gross Spillover Savings of Sample	13,820
E	Total Gross Sample Savings (C + D)	71,920
F	Net Spillover Savings	3,555
G	Spillover Score (F ÷ E)	5%

Next, AEG used the free ridership and spillover estimates to determine the NTG factor using the methodology described above. The NTG factor for the program is 95 percent.

Table 79 Net-to-Gross Factor

Free Ridership	Spillover	Net-to-Gross
10%	5%	95%

Net Savings Results

The NTG factor was applied to the unit savings to determine the net energy and demand savings. The engineering analysis savings are shown in the tables below.

Table 80 Net Savings per Participant, All Measures

	Energy Savings per Participant (kWh)	Summer Demand Savings per Participant (kW)	Winter Demand Savings per Participant (kW)
2012	848	0.16	0.10
2013	748	0.14	0.09
Program Total	798	0.15	0.10

Table 81 Total Net Savings, All Measures

	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
2012	1,017,893	188	125
2013	897,871	165	109
Program Total	1,915,764	353	234

6.4.3 Savings per Participant Summary

AEG was unable to determine statistically significant results from the participant sample for the billing analysis. Therefore, AEG recommends utilizing the 2013 engineering analysis energy and demand savings per participant to determine program savings for program tracking purposes as well as PSC filings. The tables below present the gross and net savings per participant.

Table 82 Recommended Savings per Participant, All Measures

	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Gross Savings per Participant	842	0.16	0.10
Net Savings per Participant	798	0.15	0.10

6.4.4 Program Site Inspections and Installation Verification

AEG performed site inspections and installation verification on four³⁷ completed projects to perform quality assurance/quality control and verify application information. Proper installation verification was confirmed at all locations. The table below shows the number of completed site inspections.

Table 83 Site Inspection Summary

Area	Count	%
Ashland	1	25%
Pikeville	1	25%
Hazard	2	50%
Total	4	100%

6.4.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the efficient

³⁷ A fifth homeowner cancelled the inspection appointment.

technology(s) improve a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Modified Energy Fitness Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.³⁸ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

Impact evaluation results are utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, and participation, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

The Modified Energy Fitness Program was found to be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

Table 84 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.42	\$2,676,422	\$1,119,697	(\$1,556,724)
Utility Cost Test	1.29	\$870,272	\$1,119,697	\$249,425
Participant Test	n/a	\$0	\$1,806,150	\$1,806,150
Total Resource Cost Test	1.29	\$870,272	\$1,119,697	\$249,425

Evaluating the program on a prospective basis, the Modified Energy Fitness also cost-effective and should be continued going forward. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The cost-effectiveness results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results are presented in the table below.

³⁸ The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

Table 85 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.45	\$2,305,281	\$1,044,261	(\$1,261,020)
Utility Cost Test	1.41	\$740,272	\$1,044,261	\$303,989
Participant Test	n/a	\$0	\$1,565,009	\$1,565,009
Total Resource Cost Test	1.41	\$740,272	\$1,044,261	\$303,989

6.5 Recommendations

AEG has recommendations on how to improve the program. These include:

Increase Technician Awareness of DSM Programs

AEG recommends that Kentucky Power educate Honeywell and Honeywell technicians on other Kentucky Power residential DSM programs. The Modified Energy Fitness Program offers a good opportunity to engage customers and educate them on all Kentucky Power DSM programs. Kentucky Power should consider providing Honeywell with a DSM fact sheet summarizing the program offerings to include in the customer educational materials.

Modify Program Requirements

AEG recommends that Kentucky Power consider modifying the program requirements to include multi-family units and renter-occupied units. Renter-occupied units would require owner consent to participate in the program. Kentucky Power should work with Honeywell to determine if the current measure mix is adequate for multi-family customers and adjust the measure mix, if necessary, for multi-family customers.

AEG recommends that Kentucky Power consider modifying the program requirements to include non-all electric customers that have electric water heating. Typically electric water heating measures are cost-effective. Kentucky Power should work with Honeywell to determine which measures should be offered to electric water heating customers.

AEG recommends that Kentucky Power consider permitting customers who have previously participated in the program, to participate in the Modified Energy Fitness Program every 5 to 10 years. The measure lives of the measures offered through the program vary from 5 to 20 years. Therefore, an average customer could replace a number of measures after 7 years.

Increase Participation Goals

AEG recommends that Kentucky Power consider increasing program participation goals. Honeywell is strictly limited to 1,200 participants per year and achieved program goals in 2012 and 2013. The Modified Energy Fitness Program is cost-effective and customers are very satisfied with the program.

7. Mobile Home New Construction Program

The Mobile Home New Construction Program is designed to lower electric usage in new mobile homes. Kentucky Power provides a \$500 incentive to residential customers that purchase a new mobile home with Zone 3 insulation and a high efficiency heat pump system. The heat pump system must have a minimum rating of SEER 13.0 and HSPF 7.7. Participating Manufactured Home Dealers receive a \$50 rebate for each qualifying mobile home system installed at a site that receives electric service from Kentucky Power.

The Kentucky PSC approved budget and participation goals.

Table 86 Detailed Program Budgets and Participation Goals, 2012-2014

	2012	2013	2014
Equipment/Vendor	\$9,500	\$7,750	\$7,750
Customer Incentives	\$95,000	\$77,500	\$77,500
Promotion	\$0	\$400	\$1,000
Other	\$250	\$250	\$250
Evaluation	\$0	\$0	\$12,372
Total Budget	\$104,750	\$85,900	\$98,872
Target Participation	190	155	155

7.1 Evaluation Data Collection

The Mobile Home New Construction Program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation?
- What marketing/promotional efforts resonate with customers?
- Are participating Manufactured Home Dealers sufficiently knowledgeable about the program?
- Are participating Manufactured Home Dealers promoting the program to customers?
- Are customers/ participating Manufactured Home Dealers satisfied with the program?
- Are rebate applications processed, approved and paid on a timely basis?
- Is the rebate processing system effective in managing the application and rebate payment process?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would customers recommend the program?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities,

program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

Manufactured Home Dealer Interviews

AEG administered a 10 to 12 minute telephone interview to a sample of participating Manufactured Home Dealers. The survey provided an assessment of customer satisfaction, identified potential areas for improvement and provided insight about customer attitudes toward energy efficiency and conservation issues. The interview guide can be found in Appendix B. Of the 27 participating Manufactured Home Dealers, AEG interviewed 3 Dealers.

Participating Customer Surveys

AEG administered a 10 to 12 minute telephone survey to a random sample of program participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. Kentucky Power provided data for 256 program participants that received a rebate between January 1, 2012 and September 30, 2013.³⁹ AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were randomly selected based on unique identifiers determined by Microsoft Excel's random number generator. Fifty-four (54) surveys were completed. The participant survey guide can be found in Appendix C.

AEG also conducted site visits and inspections of four participants to verify the application data matches installed equipment.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power's initial program filing savings were reviewed to ensure consistence with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Option A of the International Performance Measurement and Verification Protocols ("IPMVP")⁴⁰ outlined in the table below.

³⁹ Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

⁴⁰ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

Table 87 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

Engineering algorithms from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”), using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts.⁴¹

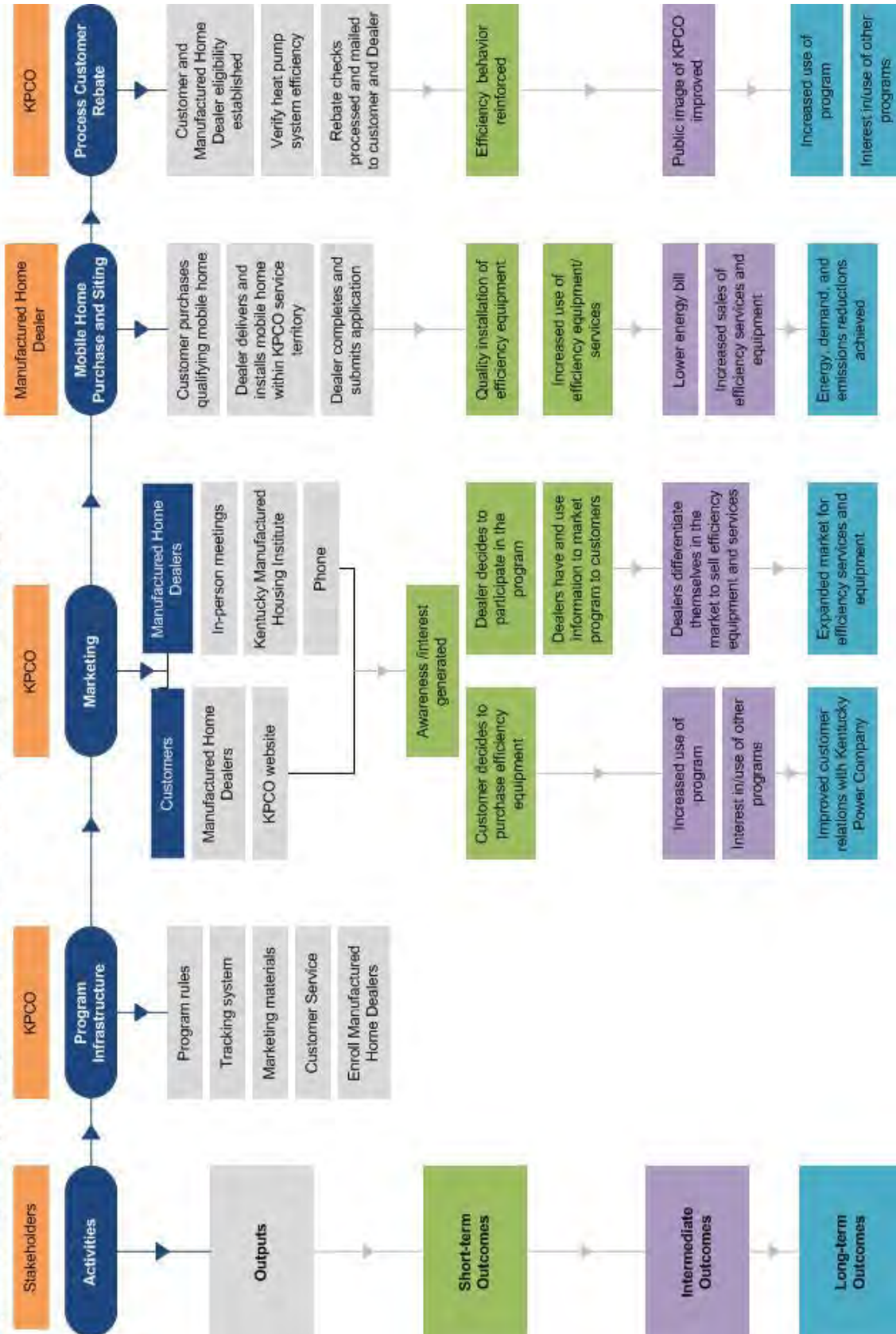
7.2 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

⁴¹ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 30 Program Logic Model

Inputs: PSC filings, Kentucky Power program staff, Manufactured Home Dealers, participating customer surveys, program materials



7.2.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program's intended outcomes. Program activities include:

Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power staff, with input from AEP, designed the program, including rebate applications and the data tracking system.

Kentucky Power program staff maintains relationships with participating Manufactured Home Dealers through periodic telephone calls and in-person visits. Kentucky Power program staff educates Manufactured Home Dealers on customer eligibility, qualifying equipment and rebate forms. The KPCO Customer Operations Center has descriptions of all DSM Programs to assist with customer inquiries.

Marketing

Marketing activities are targeted towards Manufactured Home Dealers via telephone calls and in-person meetings. Participating Manufactured Home Dealers are encouraged to promote the program to eligible customers.

Mobile Home Purchase and Siting

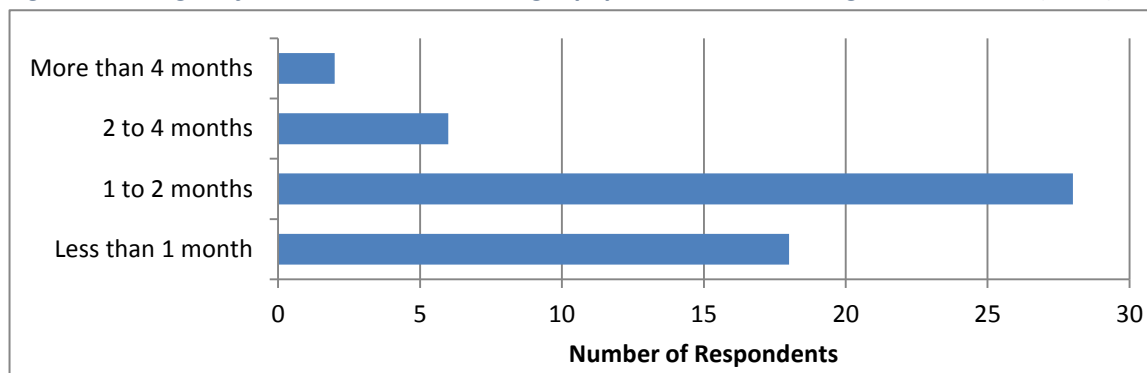
The customer purchases a new mobile home that meets the insulation and heat pump system requirements from a participating Manufactured Home Dealer. The Manufactured Home Dealer delivers and installs the mobile home on a site within the Kentucky Power service territory and verifies that the customer will receive electric service from Kentucky Power. The Manufactured Home Dealer completes and faxes the rebate application to Kentucky Power.

Process Rebate Application

Customer rebates are processed by Kentucky Power program staff. Staff verifies customer and Manufactured Home Dealer eligibility and checks for application completeness. Heat pump system eligibility is verified with the Air Conditioning, Heating and Refrigeration Institute ("AHRI") database. The application data is entered into the program tracking system and a payment request submitted for review. Once approved, the customer and Manufactured Home Dealer data is submitted to AEP's Accounting Group where rebate checks are issued and mailed.

Kentucky Power program staff aim to process customer rebate applications within 4 to 6 weeks. According to participating customers surveyed, applications are typically processed within two months.

Figure 31 Length of Time between Installing Equipment and Receiving Rebate Check (n=54)



Kentucky Power maintains the right to conduct inspections. Kentucky Power reviewed applications to ensure they were completed and met the minimum program efficiency requirements.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

7.2.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in energy efficient equipment may increase among customers and Manufactured Home Dealers. Customers may become more knowledgeable about efficient equipment and Manufactured Home Dealers may have information to market the program. The program may lead to an increased commitment to energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPSC efficiency programs, increased sales of energy efficient mobile homes and reduced household energy consumption.

Long-term Outcomes

The long-term outcomes may include an expanded market for energy efficient mobile homes, reduced utility emissions and fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

7.2.3 External Factors

There are a variety of factors outside the control of KPSC that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Economic conditions
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Competition among targeted Manufactured Home dealers
- Cost, performance and availability of efficient technologies

7.2.4 Market Barriers

Manufactured Home Dealers play an important role in this program by encouraging customers to make energy efficient upgrades. Dealers are often the primary source of information and the first point of contact for customers in need of a new mobile home. Therefore, it is critical that Dealers have accurate and up-to-date information about the benefits of insulation and energy efficient HVAC equipment and are able to effectively communicate these benefits to customers.

Key barriers to achieving greater market penetration include:

- Lowest bid quotes. Customers are often price-sensitive, especially during a weak economy.
- Lack of consumer awareness.

Kentucky Power's program tries to address these barriers through a combination of education and financial incentives to customers and Manufactured Home Dealers.

7.3 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, Manufactured Home Dealer participation and program tracking.

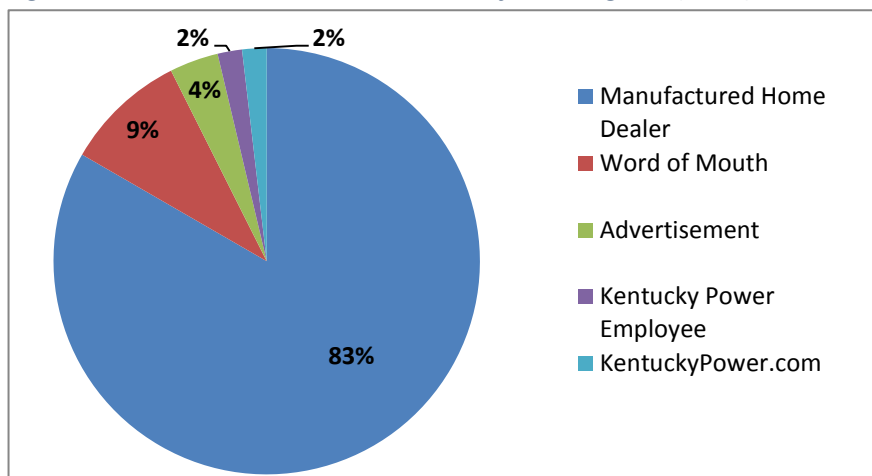
7.3.1 Program Marketing

Kentucky Power marketed the program through the following:

- **Manufactured Home Dealers.** Kentucky Power staff promotes the program directly to Manufactured Home Dealers via telephone calls or in-person meetings with prospective and current Dealers to discuss the program. Kentucky Power is a member of the Kentucky Manufactured Housing Institute and actively recruits Dealers in neighboring states that sell mobile homes to residential customers within the KPCO service territory.
- **Internet.** Kentucky Power markets the program through kentuckypower.com/save

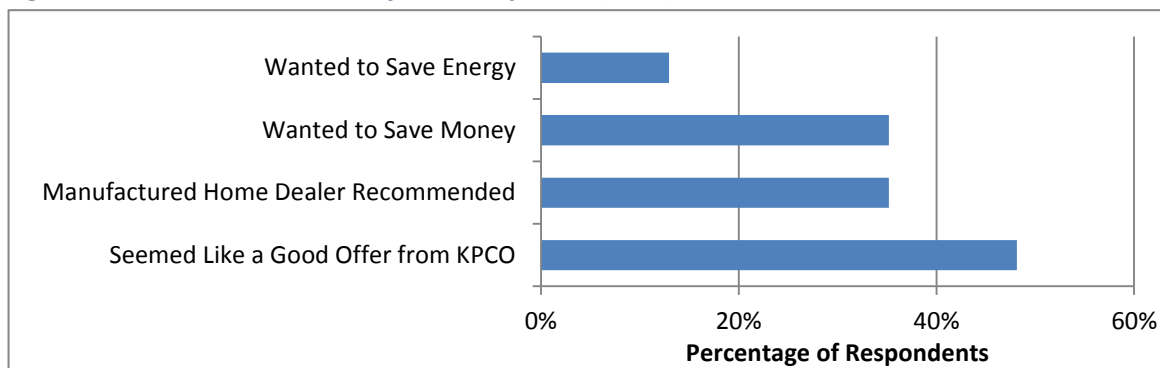
Kentucky Power program staff markets the program directly to Manufactured Home Dealers. In turn, the participating Manufactured Home Dealers are encouraged to promote the program to eligible customers. According to participating customers surveyed, participants most often learned of the program from the Manufactured Home Dealer (83 percent).

Figure 32 How Customers First Learned of the Program (n=54)



Forty-eight (48) percent of participating customers surveyed cited that their primary reason for participating in the Mobile Home New Construction Program was that it seemed like a good offer from Kentucky Power. Additionally, 74 percent of participating customers noted that information from the Manufactured Home Dealer was very important in their decision to upgrade to the high efficiency heat pump.

Figure 33 Customer Motivation for Participation (n=53)



The participating Manufactured Home Dealers interviewed noted that the telephone calls and in-person visits from Kentucky Power staff are very helpful and informative.

7.3.2 Program Performance

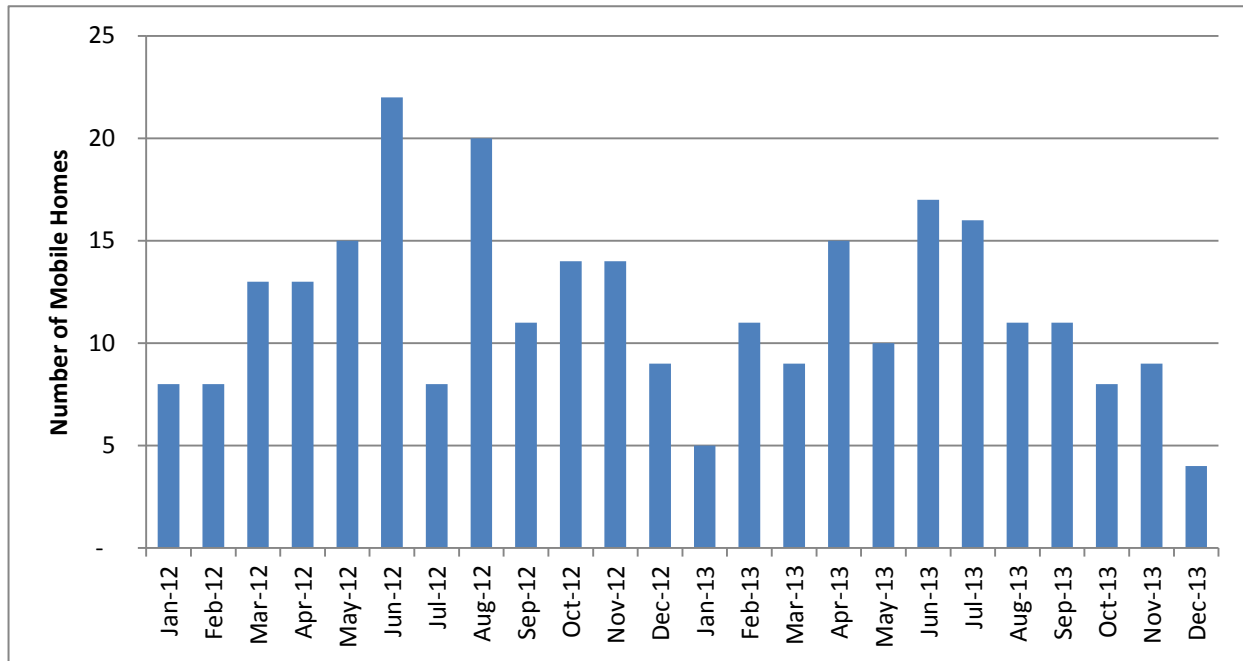
Between January 1, 2012 and December 31, 2013, 281 mobile homes were rebated through the Mobile Home New Construction Program. Kentucky Power rebated 155 heat pumps in 2012, achieving 82 percent of the goal, and 126 heat pumps in 2013, achieving 81 percent of the goal. Thirteen rebate applications were denied, primarily because the customer was not a Kentucky Power customer.

Table 88 Program Participation

	2012	2013
Target Participation	190	155
Actual	155	126

While customers purchased mobile homes throughout the year, rebate applications were higher in the summer months.

Figure 34 Mobile Homes Rebated by Month



The Mobile Home New Construction Program requires that the installed heat pump system have a minimum efficiency of SEER \geq 13 and HSPF \geq 7.7. In a review of the program tracking system, all of the participant applications met the efficiency requirements.⁴² The majority of heat pumps rebated (99.6 percent) were a SEER 13 and 71 percent had an HSPF rating between 8.0 and 8.5.

Table 89 Heat Pump Installations by Efficiency

	HSPF Rating	Percentage
HSPF 7.7 < 8.0	98	39%
HSPF 8.0 < 8.5	177	71%
HSPF 8.5 < 9.0	6	2%

The table below presents the budget and cost per participant as compared to the actual expenditures and cost per participant. The actual 2012 and 2013 expenditures and participation were less than budgeted. However, the actual cost per participant was slightly higher than budgeted.

Table 90 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
Equipment/Vendor	\$9,500	\$7,750	\$7,750	\$6,550
Customer Incentives	\$95,000	\$77,500	\$77,500	\$65,500
Promotion	\$0	\$0	\$400	\$0
Other	\$250	\$250	\$250	\$250
Evaluation	\$0	\$0	\$0	\$2,395
Total Cost (\$)	\$104,750	\$85,500	\$85,900	\$74,695
Participation	190	155	155	126
Cost (\$) per Participant	\$551	\$552	\$554	\$593

⁴² An initial review of the program log found that 30 participant entries were missing the HSPF rating. Kentucky Power reviewed the corresponding rebate applications and corrected the participant entries.

There are currently 27 Manufactured Home Dealers, 17 of whom participated in the Mobile Home New Construction Program between January 1, 2012 and December 31, 2013. Of the 281 mobile homes rebated, 40 percent were installed by one Manufactured Home Dealer.

7.3.3 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.⁴³ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

Rebate applications are processed by Kentucky Power program staff. Staff reviews and validates the applications for completeness, including customer and Manufactured Home Dealer eligibility. Applications are reviewed based on the date received and the DSM Program. Each customer application is assigned a unique identifier. Hard-copy rebate applications are labeled with the assigned unique identifier and payment request number, then grouped and archived in a binder.

Kentucky Power's program tracking system is comprised of three databases:

KCPO Customer Records (MACCS) is an internal intranet-based database. A note is entered in the customer record with the DSM Program and the date the rebate application was received. KPCO Customer Operations Center can access the note if a customer calls about their rebate status. KPCO program staff utilizes the data to monitor program performance.

Program Log is an Excel- or Access-based database that contains data from the rebate application. Each DSM Program has a program log, which is available on a shared drive to specific KPCO staff.

Kentucky Power collects the following data on the rebate application:

- Customer Information: name, account number, address (service and mailing), telephone number, social security number, and electric meter number.
- General Information: home size, zone three insulation (Y/N), fireplace (Y/N), skylights (Y/N), new construction (Y/N), and installed in AEP/Kentucky region (Y/N)
- Heat Pump Equipment: manufacturer, system size (tons), outdoor unit model number, indoor unit model number, SEER, HSPF, and system type (split/package).
- Dealer Information: name, address, telephone number, salesperson, tax exempt number, and social security number.
- Dates: customer signature date, Dealer signature date, purchase date and on-site date.

Electronic Payment Request (PeopleSoft). Each rebate application has two payment requests, one for the customer and one for the Manufactured Home Dealer. The payment request includes the accounting code, unique identification number, customer/Dealer name and address, dealer Federal Tax ID and rebate amount.

⁴³ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

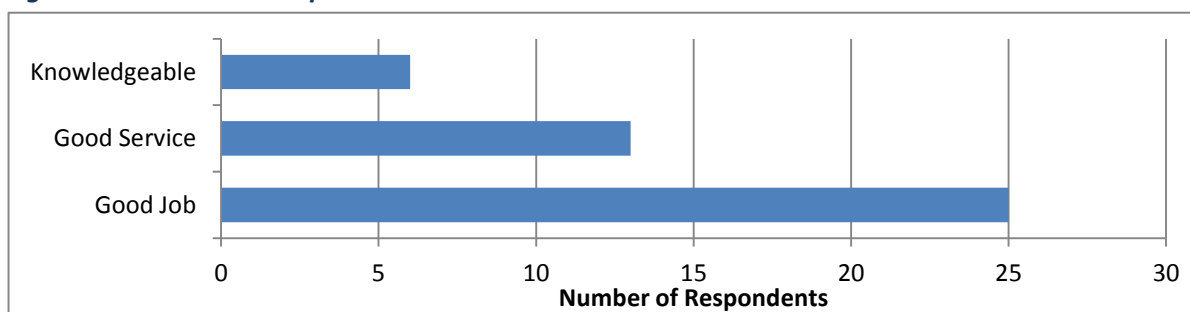
Prior to approval, the Electronic Payment Request is reviewed by the Kentucky Power program coordinator. The coordinator ensures the account number, program account, rebate amount and unique identifier were correct. Once approved, the Electronic Payment Request is submitted electronically to the AEP Accounting Group in Canton, Ohio and rebate checks issued and mailed.

The program log does not contain all data collected on the rebate application.⁴⁴

7.3.4 Program Satisfaction

Ninety-one (91) percent of participating customers surveyed would recommend their Manufactured Home Dealer to someone else. Five (5) participating customers surveyed had already recommended their Dealer. Five (5) participants surveyed would not recommend their Manufactured Home Dealer to others, one participant had scheduling issues and another did not feel they received good service.

Figure 35 Reasons Participants Would Recommend the Dealer

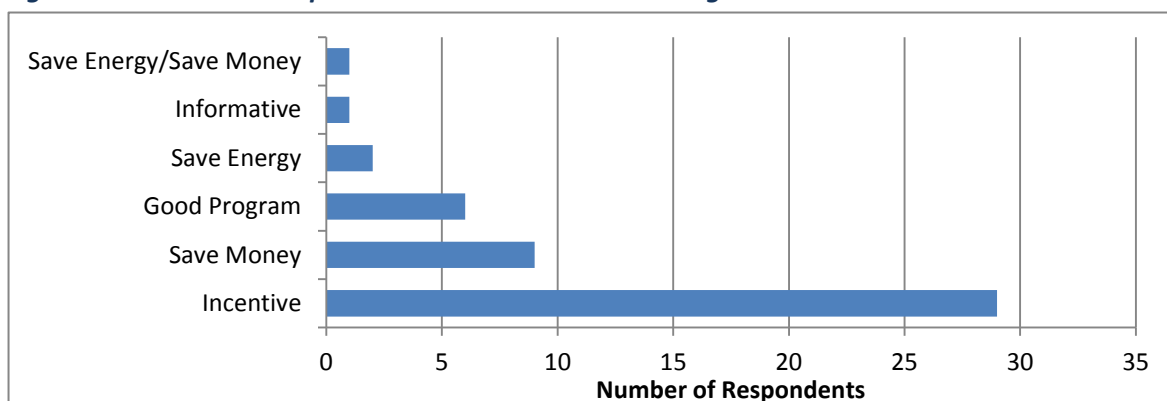


All of the participating customers surveyed would recommend installing a high efficient heat pump in a mobile home for the following reasons:

- Save money (50 percent)
- Heat pump works well (22 percent)
- Save energy and money (13 percent)
- Save energy (9 percent).

Ninety-eight (98) percent of participating customers surveyed would recommend the program to others. The primary reason for recommending the program is the customer incentive followed by saving money.

Figure 36 Reasons Participant Would Recommend the Program



⁴⁴ An initial review of the program log found that 30 participant entries were missing the HSPF rating. Kentucky Power reviewed the corresponding rebate applications and corrected the participant entries.

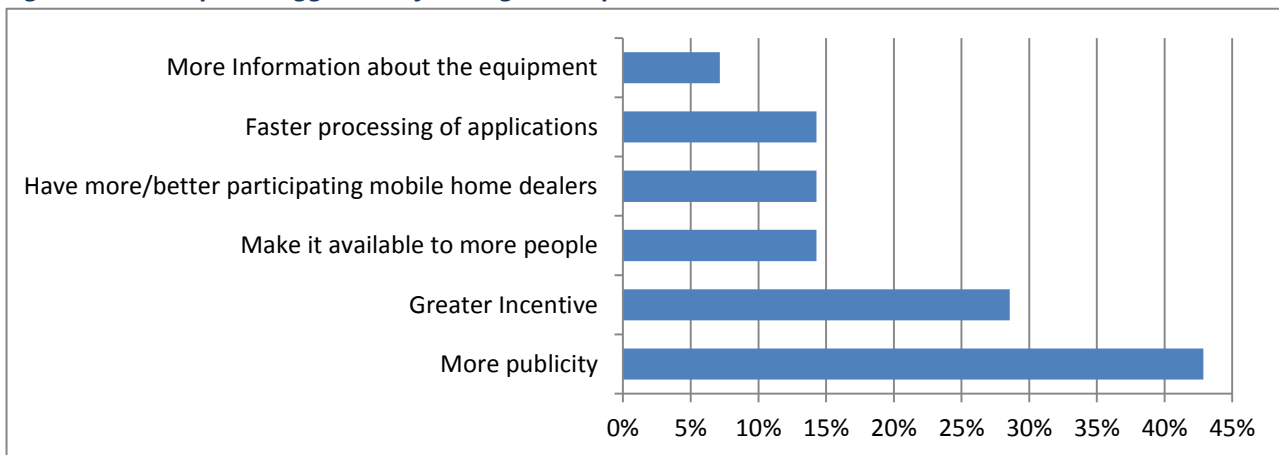
Based on the participant survey, participants are very satisfied with their Manufactured Home Dealer, the incentive offered and the incentive processing time. Program participants often don't complete the rebate application or interact with KPCO program staff. Therefore, responses to those questions are primarily neutral. Overall, 89 percent of customers were very satisfied with the program overall.

Table 91 Participant Satisfaction with the Program (n=54)

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Manufactured Home Dealer	76%	11%	4%	4%	6%
Incentive processing time	81%	8%	8%	0%	4%
Incentive offered	91%	6%	4%	0%	0%
Interaction with Kentucky Program staff	9%	9%	79%	3%	0%
Response times/assistance on forms	12%	6%	79%	0%	3%
Program overall	89%	6%	6%	0%	0%

Most participating customers surveyed did not recommend any changes (74 percent) to the Mobile Home New Construction Program. Participating customers surveyed were asked their opinion on how the program could be improved. Of the 14 participants that suggested changes to the program, the primary recommendations were increasing publicity and increasing the incentive.

Figure 37 Participant Suggestions for Program Improvement



Manufactured Home Dealer participation is a key element to the Mobile Home New Construction Program. The participating Manufactured Home Dealers interviewed are satisfied with the program and their interaction with Kentucky Power staff. The Dealers noted that the customer and Dealer incentives are good and that the application is easy. According to a Manufactured Home Dealer,

The incentives are a tremendous selling tool.

Customers seeking to purchase a new mobile home are often worried about costs. The Kentucky Power incentive helps Manufactured Home Dealers upsell customers from central air conditioner systems to efficient heat pump systems. The rebate covers most of the cost difference between a central air conditioner system and an efficient heat pump system.

The three participating Manufactured Home Dealers interviewed noted that all of the mobile homes they sell come standard with Zone 3 insulation. While the state of Kentucky is within Zone 2, Ohio is

within Zone 3.⁴⁵ A number of Manufactured Home Dealers sell and install mobile homes within neighboring states as well as Kentucky.

7.4 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

7.4.1 Gross Energy and Demand Savings

AEG conducted an engineering analysis of the Mobile Home New Construction Program to assess gross energy and demand savings based on the IPMVP Option A. AEG conducted the engineering analysis using the *Illinois Statewide Technical Reference Manual for Energy Efficiency* ("IL TRM") as the source for engineering equations. Energy and demand savings were estimated using the following equations:

$$\Delta kWh = \left(\frac{(FLH_{cool} \times Capacity_{cool} \times (\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}))}{1000} \right) + \left(\frac{(FLH_{heat} \times Capacity_{heat} \times (\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}))}{1000} \right)$$

$$\Delta kW_{Summer} = \left(\frac{(Capacity_{cool} \times (\frac{1}{EER_{base}} - \frac{1}{EER_{ee}}))}{1000} \right) \times CF$$

$$\Delta kW_{Winter} = \left(\frac{(Capacity_{heat} \times (\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}))}{1000} \right)$$

Where:

FLH _{cool}	= Full load hours of air conditioning
FLH _{heat}	= Full load hours of heating
Capacity _{cool}	= Cooling capacity of heat pump (Btu/h)
Capacity _{heat}	= Heating capacity of heat pump (Btu/h)
SEER _{base}	= Seasonal Energy Efficiency Ratio of baseline system (kBtu/kWh)
SEER _{ee}	= Seasonal Energy Efficiency Ratio of efficient heat pump (kBtu/kWh)
EER _{base}	= Energy Efficiency Ratio of baseline system (kBtu/kW)
EER _{ee}	= Energy Efficiency Ratio of efficient heat pump (kBtu/kW)
HSPF _{base}	= Heating Seasonal Performance Factor of baseline system (kBtu/kWh)
HSPF _{ee}	= Heating Seasonal Performance Factor of efficient heat pump (kBtu/kWh)
CF	= Summer System Peak Coincidence Factor

According to program rules, participants must install a heat pump system that meets SEER ≥ 13 and HSPF ≥ 7.7. The main variable driving savings is the difference between the efficiency rating of the rebated unit to a baseline. Rebated units were compared to a baseline of SEER 10 and HSPF 6.8.

⁴⁵ According to the Manufactured Housing Institute, there are three thermal zones for manufactured homes. Refer to www.manufacturedhousing.org/lib/showtemp_detail_print.asp?id=205

Engineering analysis variables were adapted to Kentucky Power's service territory. For example, AEG used standard assumptions for full load heating and cooling hours based on information from the US Environmental Protection Agency.⁴⁶ The table below summarizes the key variables used in the engineering analysis.

Table 92 Engineering Analysis Variables

Variable	Value	Description
FLH _{cool}	1,080	Assumed value for Lexington, KY from ENERGY STAR savings calculator
FLH _{heat}	2,027	
Capacity _{cool}	Application	Unit size in tons (1 ton = 12,000 Btu/h)
Capacity _{heat}	Application	
SEER _{base}	10	Federal minimum standard (pre-2006)
HSPF _{base}	6.8	Federal minimum standard (pre-2006)
SEER _{ee}	Application	SEER of rebated unit
HSPF _{ee}	Application	HSPF of rebated unit
CF	91.5%	IL TRM

The savings per unit is calculated as the weighted average unit savings for measures installed in program years 2012 and 2013. The results of the engineering analysis are shown in the following table.

Table 93 Gross Energy and Demand Savings per Participant

Program Year	Gross Energy Savings (kWh)	Gross Summer Demand Savings (kW)	Gross Winter Demand Savings (kW)
2012	1,848	0.64	0.57
2013	2,215	0.77	0.68
Program Total	2,012	0.70	0.62

Table 94 Total Gross Energy and Demand Savings

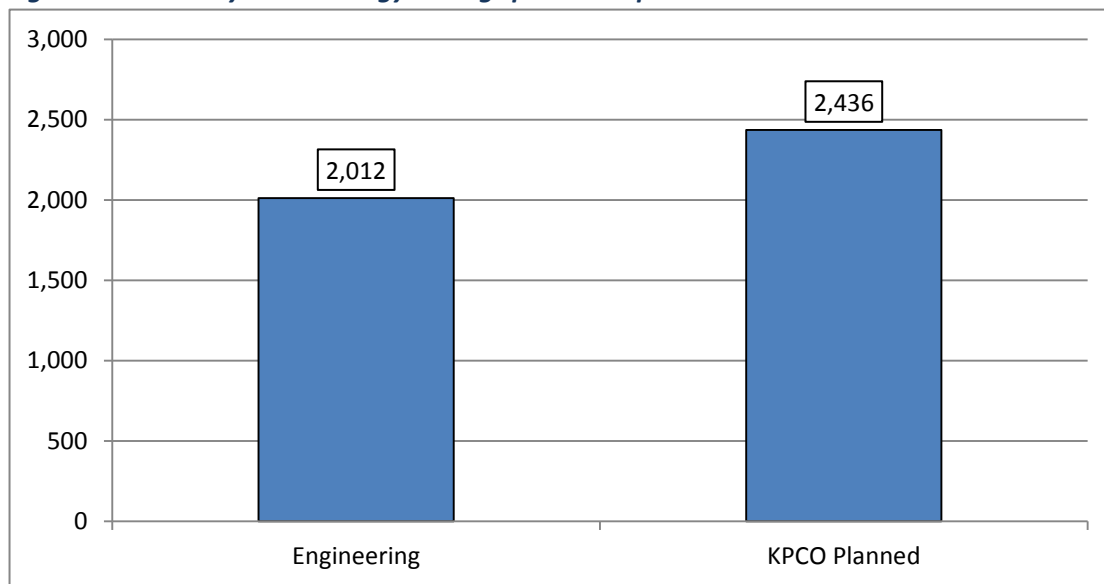
Program Year	Gross Energy Savings (kWh)	Gross Summer Demand Savings (kW)	Gross Winter Demand Savings (kW)
2012	286,395	99	89
2013	279,049	98	86
Program Total	565,444	197	175

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. Figure 38 compares the gross energy savings per participant for the engineering analysis and planned savings assumptions.

⁴⁶ http://www.energystar.gov/buildings/sites/default/uploads/files/ASHP_Sav_Calc.xls

Figure 38 Summary Gross Energy Savings per Participant



7.4.2 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after accounting for free ridership and spillover. Free ridership refers to those participants who would have purchased a mobile home with an efficient heat pump and Zone 3 insulation without the program influence. Spillover refers to additional savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - \text{Free ridership} + \text{Spillover}$$

AEG conducted a survey of participants to evaluate the effects of free ridership and spillover. Results are statistically significant at a 90 percent confidence level and a margin of error of +/- 10 percent.

Free Ridership

Three questions in the participant survey were designed to assess the effects of free ridership.

- **Question 1:** Prior to learning about this program, were you planning to purchase a high efficiency heat pump?
- **Question 2:** How important was the Kentucky Power incentive in your decision to upgrade to a high efficiency heat pump?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the exact same heat pump?

Each response was assigned a probability that that respondent was a free rider. The proportion of each response was multiplied by the free ridership probability to calculate the free ridership score.

Table 95 Free Ridership Question 1

FR Probability	Response	Count	Percent	Score
50%	Yes	25	46%	23%
0%	No	29	54%	0%
Question 1 Free Ridership Score				23%

Table 96 Free Ridership Question 2

FR Probability	Response	Count	Percent	Score
10%	Very Important	23	58%	6%
35%	Somewhat Important	8	20%	7%
80%	Not Important	9	23%	18%
Question 2 Free Ridership Score				31%

Table 97 Free Ridership Question 3

FR Probability	Response	Count	Percent	Score
80%	Very likely	27	69%	55%
35%	Somewhat likely	11	28%	10%
10%	Not Likely	1	3%	0%
Question 3 Free Ridership Score				66%

The free ridership score for each question was weighted based on its contribution to the overall free ridership factor. The weighted average of the scores determines the free ridership factor for the program. AEG determined that 36 percent of gross savings are attributable to free ridership.

Table 98 Free Ridership Summary

Free Ridership Question	Score	Weight
Question 1	23%	50%
Question 2	31%	25%
Question 3	66%	25%
Weighted Average Free Ridership Score	36%	

Spillover

Spillover is the ratio of net spillover savings to gross savings of the participant sample.

$$Spillover = \frac{Net\ Spillover\ Savings}{(Program\ Savings\ per\ Participant \times Total\ Respondents) + Total\ Spillover\ Savings}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and spillover score for each respondent

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the participant survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to question one were included in the spillover calculation. The savings from the spillover actions described in question two were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, spillover participants engaged in a

variety of additional energy efficient actions, including upgrading to ENERGY STAR® appliances and installing efficient lighting.

Finally, each respondent was asked how much the program influenced their additional actions. The table below shows the spillover score assigned to each of the responses to question three.

Table 99 Spillover Score

Response	Score
Very likely	10%
Somewhat likely	35%
Not likely	80%
Don't Know/Refused	50%

The net spillover savings from each respondent was determined by applying their spillover score to their gross spillover savings to estimate the spillover savings that were directly attributable to the program. The table below illustrates how the program spillover score was calculated. AEG determined the overall spillover score for the program to be less than 1 percent.

Table 100 Spillover Summary

Line	Variable	Value
A	Total Respondents	54
B	Program Savings per Participant	2,253
C	Program Savings of Sample (A x B)	121,649
D	Gross Spillover Savings of Sample	1,154
E	Total Gross Sample Savings (C + D)	122,803
F	Net Spillover Savings	602
G	Spillover Score (F ÷ E)	0.5%

Next, AEG used the free ridership and spillover estimates to determine the NTG factor for the program. As a result, the NTG factor for the program is 65 percent.

Table 101 Net-to-Gross Factor

Free Ridership	Spillover	NTG
36%	<1%	65%

In order to determine the net savings attributable to the program, AEG applied the NTG factor to the gross savings from engineering analyses. The following table shows the net savings per participant as well as the total net savings of the program.

Table 102 Net Energy and Demand Savings per Participant

Program Year	Net Energy Savings (kWh)	Net Summer Demand Savings (kW)	Net Winter Demand Savings (kW)
2012	1,199	0.42	0.37
2013	1,438	0.50	0.44
Program Total	1,306	0.45	0.40

Table 103 Total Net Energy and Demand Savings

Program Year	Net Energy Savings (kWh)	Net Summer Demand Savings (kW)	Net Winter Demand Savings (kW)
2012	185,894	64	58
2013	181,126	63	56
Program Total	367,020	128	113

7.4.3 Savings per Participant Summary

AEG conducted an engineering analysis of the Mobile Home New Construction Program to assess gross energy and demand savings based on IPMVP Option A. Therefore, AEG recommends utilizing the 2013 engineering analysis savings per participant to determine program savings for program tracking purposes as well as PSC filings. The table below presents the gross and nets savings per participant.

Table 104 Recommended Energy and Demand Savings per Participant

	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Gross Savings per Participant	2,215	0.77	0.68
Net Savings per Participant	1,438	0.50	0.44

7.4.4 Program Site Inspections and Installation Verification

AEG performed site inspections and installation verification on four completed projects to perform quality assurance/quality control, and verify application information. Proper installation was confirmed at all locations. However, the equipment installed at one location did not match the equipment listed on the application. The table below shows the number of completed site inspections in each area.

Table 105 Site Inspection Summary

Area	Count	%
Ashland	1	25%
Pikeville	3	75%
Hazard	0	0%
Total	4	100%

7.4.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the efficient technology improves a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Mobile Home New Construction Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.⁴⁷ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?

⁴⁷ The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

Impact evaluation results are utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, participation and incentives, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

The Mobile Home New Construction Program was found to be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

Table 106 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.59	\$691,602	\$409,823	(\$281,779)
Utility Cost Test	2.67	\$153,327	\$409,823	\$256,497
Participant Test	2.97	\$227,272	\$674,964	\$447,692
Total Resource Cost Test	1.68	\$243,910	\$409,823	\$165,913

Evaluating the program on a prospective basis, the Mobile Home New Construction Program is also cost-effective and should be continued going forward. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The cost-effectiveness results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results are presented in the table below.

Table 107 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.62	\$366,254	\$226,319	(\$139,935)
Utility Cost Test	2.59	\$87,270	\$226,319	\$139,049
Participant Test	3.05	\$113,738	\$347,390	\$233,652
Total Resource Cost Test	1.71	\$132,602	\$226,319	\$93,717

Geothermal and ductless mini-split systems were analyzed for inclusion in the Mobile Home New Construction Program. The measures were found to be not cost-effective at this time, primarily due to high customer capital costs. Therefore, AEG does not recommend that these measures be incorporated into the program at this time.

7.5 Recommendations

AEG has several recommendations on how to improve the program. These include:

Consider Hiring an Implementation Contractor

AEG recommends that Kentucky Power consider hiring an implementation contractor to implement Kentucky Power's residential and small commercial HVAC programs, including, but not limited to, the Residential High Efficiency Heat Pump Program, Mobile Home High Efficiency Heat Pump, and Mobile Home New Construction.

Kentucky Power has a small staff to run and oversee Kentucky Power's numerous energy efficiency programs. Some of the KPCO programs have implementation contractors that perform the day-to-day operations for the program, but the residential and small commercial HVAC programs are run completely by KPCO staff. Therefore, KPCO staff is responsible for marketing activities, engaging Manufactured Home Dealers, processing rebate applications, program tracking and performing QA/QC inspections. Kentucky Power conducted limited inspections to ensure the applications were completed and met the minimum program requirements.

The residential and small commercial HVAC programs share many similar components, including marketing activities and data tracking systems. Utilizing one implementation contractor to implement the HVAC programs will allow the programs to continue capitalizing on their similarities, increase the efficiency of program processes and minimize the QA/QC concerns associated with the program log.

The implementation contractor will have, at a minimum, the following responsibilities:

- Develop marketing activities
- Design and maintain a data tracking system
- Process rebate applications
- Engage and monitor participating Manufactured Home Dealers
- Develop QA/QC procedures and conduct random inspections of completed work

Program Application and Data Tracking

AEG recommends that Kentucky Power consider modifying the rebate application. Data that is not tracked or utilized should be removed from the rebate application to simplify the application process for Manufactured Home Dealers and program tracking for Kentucky Power.

AEG recommends that Kentucky Power improve QA/QC to ensure that the program log contains all information collected on the rebate application. A review of the program log revealed that 30 participant entries were missing the HSPF rating. Kentucky Power reviewed the corresponding rebate applications and corrected all of the participant entries.

Update the Kentucky Power DSM Program Website

AEG recommends that Kentucky Power update the DSM Program website to reflect the current program. The website should provide a list of participating Manufactured Home Dealers, including the address and phone number. KCPO should also remove the statement, "All residential customers who have received electric service from Kentucky Power are eligible to participate." Customer would have to receive a new Kentucky Power electric account number, therefore this statement is inaccurate.

8. Targeted Energy Efficiency Program

The Targeted Energy Efficiency Program provides weatherization and energy efficiency services to qualifying residential customers who need help reducing their energy bills and improving their homes' safety and comfort. Kentucky Power provides funding for this program through Community Action Kentucky, a statewide association representing and assisting a network of 23 community action agencies. Program services can include these items, as applicable:

- Energy audit
- Air infiltration diagnostic test to find air leaks
- Air leakage sealing
- Attic, floor, side-wall insulation
- Duct sealing and insulation
- High efficiency compact fluorescent light
- Domestic electric hot water heating insulation
- Customer education on home energy efficiency

Customers with primary electric heat that use, on average, a minimum of 700 kWh per month or customers with electric water heating that use, on average, a minimum of 700 kWh per month from November through March are eligible to participate. To qualify, a household's income cannot exceed the designated federal poverty guidelines.⁴⁸

The Kentucky PSC approved budget and participation goals.

Table 108 Program Budgets, 2012-2014

	2012	2013	2014
Equipment/Vendor	\$400,000	\$268,000	\$200,250
Evaluation	\$0	\$0	\$20,641
Total Budget	\$400,000	\$268,000	\$220,891

Table 109 Program Participation Goals, 2012-2014

	2012	2013	2014
All Electric	390	185	145
Non-All Electric	35	20	20
Total Participation Goal	425	205	165

8.1 Evaluation Data Collection

The Targeted Energy Efficiency Program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation goals?
- Do the Community Action Agencies have the tools needed to implement the program?
- What marketing/promotional efforts resonate with customers?
- Are auditors sufficiently knowledgeable about the program?
- Are customers satisfied with the program?

⁴⁸ The American Recover and Reinvestment Act ("ARRA") of 2009 provided funding to community action agencies to perform weatherization on homes above the federally designated poverty level.

- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would customers recommend the program?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

Community Action Agency Interview

The Kentucky Community Action Agencies (“Agencies”) implement the program utilizing Kentucky Power funds and Federal Weatherization Assistance Program (WAP) funds. The Agencies are responsible for all program functions, including promotion and weatherization services. There are 5 Agencies operating within Kentucky Power’s service territory:

- LKLP Community Action Council
- Northeast Kentucky Community Action Agency
- Big Sandy Area Community Action Program
- Gateway Community Action Agency
- Middle Kentucky Community Action Partnership

AEG interviewed LKLP Community Action Council in October 2013. The interview provided information on program implementation activities, program data and tracking methods. The interview guide can be found in Appendix A.

Participating Customer Surveys

AEG administered a 10 to 12 minute telephone survey to a random sample of program participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. Kentucky Power provided data for 288 residential customers that participated in the program between January 1, 2012 and September 30, 2013.⁴⁹ AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were randomly selected based on unique identifiers determined by Microsoft Excel’s random number generator. Fifty-five (55) surveys were completed. The survey guide can be found in Appendix C.

AEG also conducted site visits and inspections verify installation and verify application data matched installed measures.

⁴⁹ Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power's initial program filing planned savings were reviewed to compare with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Options A and C of the International Performance Measurement and Verification Protocols ("IPMVP").⁵⁰ AEG performed separate engineering and customer billing analyses to provide a comparison between the two savings methodologies.

Table 110 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

Engineering algorithms from the *Illinois Statewide Technical Reference Manual for Energy Efficiency*, using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts.⁵¹ The billing analysis identified changes in participants' energy usage attributable to the program, comparing energy usage for one year prior to measure installation to one year post measure installation.

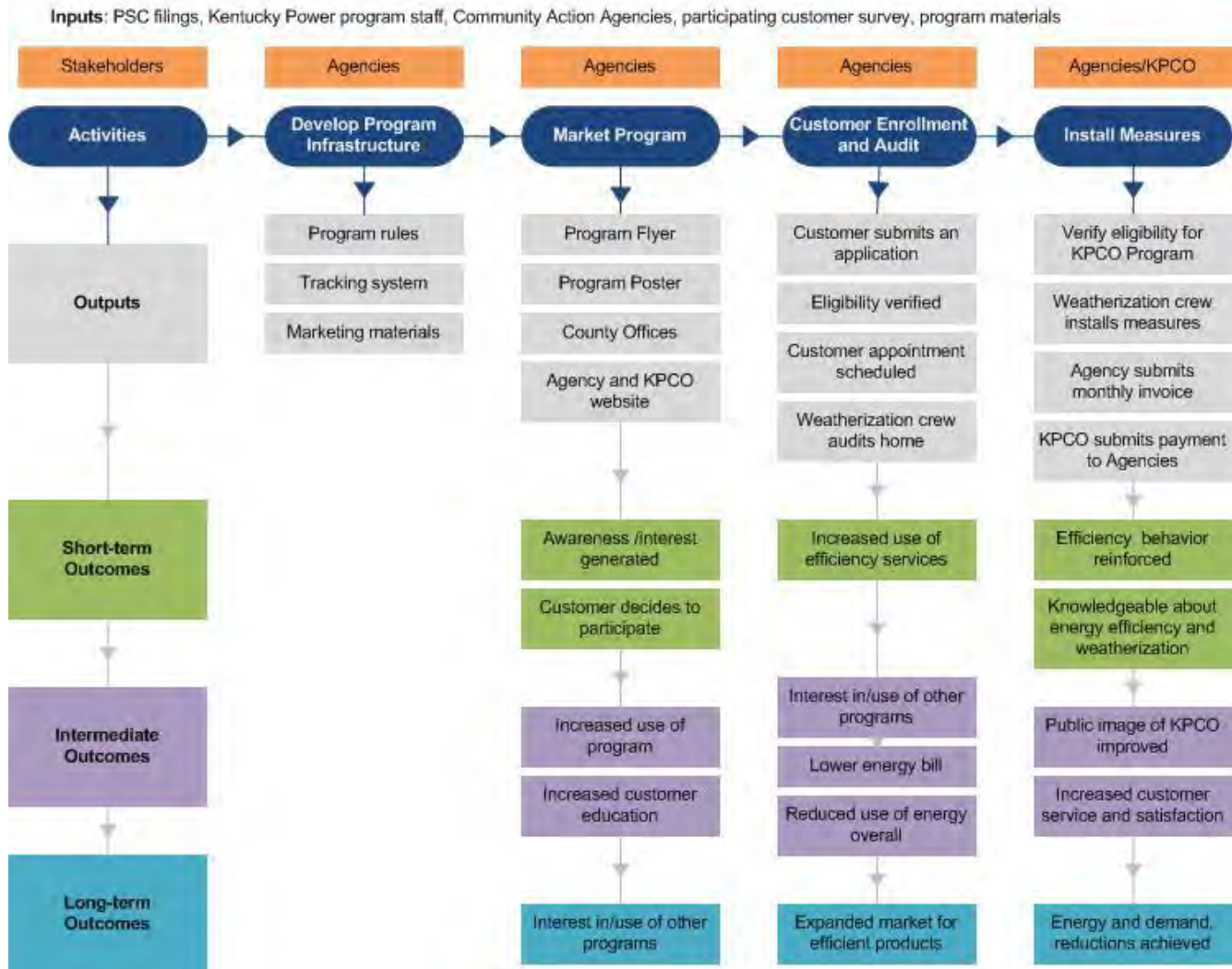
8.2 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program's assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program's performance.

⁵⁰ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

⁵¹ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 39 Program Logic Model



8.2.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program’s intended outcomes. Program activities include:

Develop Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. The program rules, operating structure and marketing approaches were developed based upon direction from the Kentucky Housing Corporation and the U.S. Department of Energy’s Weatherization Assistance Program. The KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Market Program

The Community Action Agencies market the program through program flyers, posters, Agency websites, and county offices. Kentucky Power markets the program through the DSM Program website, bill inserts, and program fact sheets delivered at Company sponsored events.

Customer Enrollment and Audit

Customers contact their local Community Action Agency and complete an application to participate in the Weatherization Program. The Agency reviews the application and supporting documentation to ensure the customer meets the Kentucky Housing Corporation and U.S. Department of Energy's Weatherization Assistance Program requirements and ranks the applications based on customer need. The Agency schedules an appointment with the customer to conduct an audit of the home. Customers determined to have the highest need are audited first. An Agency weatherization crew conducts an audit of the customer's home to identify areas that may be improved.

Install Measures

The Community Action Agency determines if the customer meets the Kentucky Power program requirements.⁵² The Agency schedules an appointment with the customer to install energy efficient measures, as determined by the audit. The crew installs pertinent energy conservation measures, adhering to program rules and the expenditure cap per home. The customer completes a survey, detailing the characteristics of their home, and signs a work order confirming that the work was completed.

The Agencies submit invoices to Kentucky Power for completed projects once a month. Kentucky Power program staff review the invoices and the list of measures installed. Upon review, Kentucky Power submits payment to the Agencies. The Agencies conduct QA/QC post-inspections of every completed project to ensure the measures were correctly installed. KPCO program staff accompanies the Agencies on the QA/QC post-inspections 2 to 4 times per year.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

8.2.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in energy efficiency may increase among customers. Customers may become more knowledgeable about energy efficient equipment/weatherization and have an increased commitment to energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPCO efficiency programs, lower energy bills, and reduced household energy consumption.

Long-term Outcomes

The long-term outcomes may include reduced utility emissions and fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

⁵² Weatherization work is completed for all customers. However, Kentucky Power pays only for qualifying KPCO customers.

8.2.3 External Factors

There are a variety of factors outside the control of KPCO that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Cost, performance and availability of efficient technologies

8.3 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, program tracking and program satisfaction.

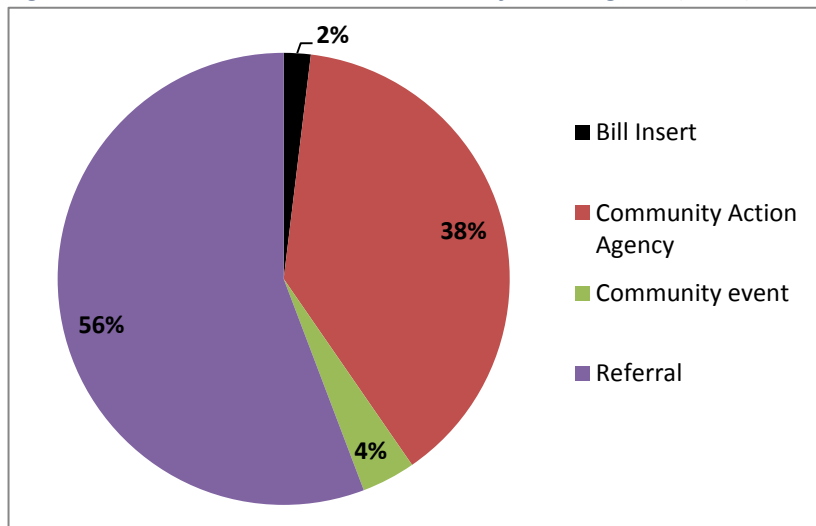
8.3.1 Program Marketing

Kentucky Power marketed the Targeted Energy Efficiency Program through the following:

- **Community Action Agencies.** The Agencies are primarily responsible for marketing the program to customers. The Agencies utilize program flyers, posters, Agency website, and county offices.
- **Bill Inserts.** KPCO distributed bill inserts to residential customers in January and March 2012.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save. A link to the Community Action Kentucky website is available.

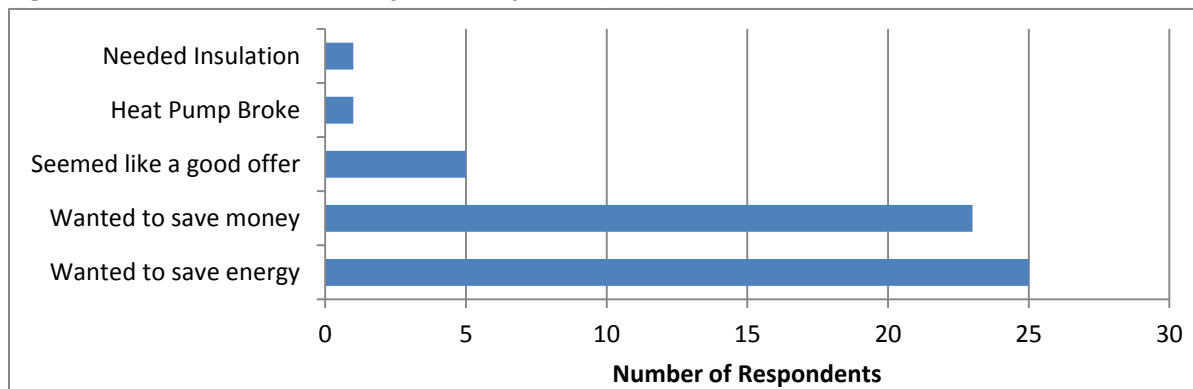
According to customers surveyed, participants most often learned of the program from a friend, family member or neighbor referral (56 percent) or the Community Action Agency (38 percent). Program participants do not interact with Kentucky Power; they work directly with the Agencies.

Figure 40 How Customers First Learned of the Program (n=55)



Forty-five (45) percent of participating customers surveyed cited that their primary reason for participating in the program was that they wanted to save energy. An additional 42 percent of participating customers surveyed noted that saving money was also an important motivator.

Figure 41 Customer Motivation for Participation (n=55)



8.3.2 Program Performance

Three hundred thirty-five (335) customers participated in the Targeted Energy Efficiency Program between January 1, 2012 and December 31, 2013. Eighty-nine (89) percent of participating customers were all electric and 11 percent were non-all electric. Kentucky Power achieved 48 percent of the total 2012 goal and 63 percent of the 2013 goal.

Table 111 Program Participation Achieved, 2012-2013

	2012		2013	
	Participants	% Goal	Participants	% Goal
All Electric	185	47%	113	61%
Non-All Electric	20	57%	17	85%
Total Participation	205	48%	130	63%

Five Community Action Agencies operate within Kentucky Power’s service territory. Thirty-eight (38) percent of the program participants worked with LKLP Community Action Council, followed closely by Big Sandy Area Community Action Program. Gateway Community Action Agency did not submit any invoices to Kentucky Power in 2012 or 2013. Middle Kentucky and Gateway Community Action Agency have a small number of Kentucky Power customers residing within their territory.

Table 112 Program Participation by Community Action Agency

Agency	2012	2013	Total	% of Total
LKLP	71	56	127	38%
Big Sandy	83	40	123	37%
Northeast	48	34	82	24%
Middle Kentucky	3	-	3	1%
Total	205	130	335	100%

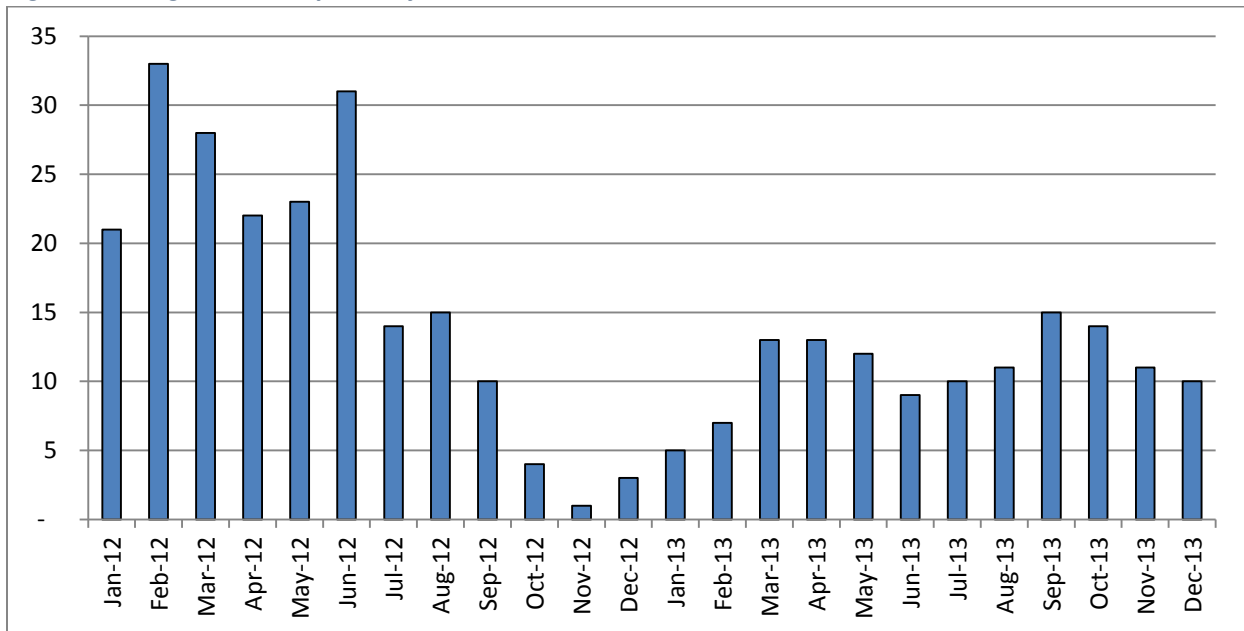
Approximately 55 percent of program participants live in a mobile home and 43 percent live in a site-built home. However, the percentage of mobile home dwellers was slightly higher in 2013 than 2012.

Table 113 Program Participation by Type of Home

	2012	2013	Total
Mobile Home	105	78	183
Site-Built	97	48	145
Modular	1	3	4
Unknown	2	1	3
Total	205	130	335

As shown in the figure below, program participation was fairly evenly distributed throughout the year. The winter months (October through February) typically had the lowest participation rates.

Figure 42 Program Participants by Month, 2012 and 2013



All participants received an audit of their home and an education booklet detailing home energy use and energy savings tips. Kentucky Power funding differed depending on whether the home was all electric

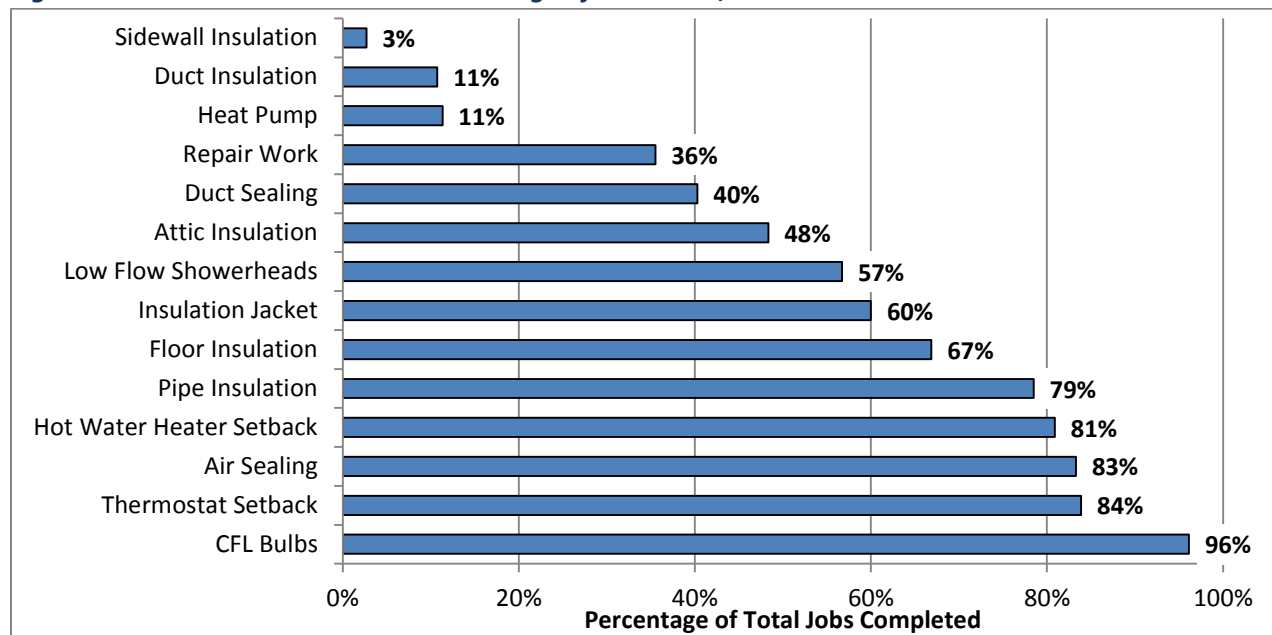
or non-all electric. Non-all electric homes that had an electric hot water heater and natural gas heat were eligible to receive received funding for hot water heater setback, CFL bulbs, pipe insulation, low flow showerheads and water heater tank wraps. Kentucky Power paid 44 percent of the total cost per non-all electric home and 34 percent of the total cost per all electric home. However, approximately only one percent of total funding was allocated to non-all electric homes.

Program participants received measures based upon the audit of the home. Table 114 presents the number of participants that received the measure listed and Figure 43 presents the percentage of participants that received each measure.

Table 114 Number of Participants by Measure Installed

Measure	2012	2013	Total
CFL Bulbs	197	125	322
Thermostat Setback	173	108	281
Air Sealing	172	107	279
Hot Water Heater Setback	174	97	271
Pipe Insulation	167	96	263
Floor Insulation	145	79	224
Insulation Jacket	133	68	201
Low Flow Showerheads	118	72	190
Attic Insulation	109	53	162
Duct Sealing	80	55	135
Repair Work	89	30	119
Heat Pump	31	7	38
Duct Insulation	24	12	36
Sidewall Insulation	6	3	9

Figure 43 Measures Installed as a Percentage of Total Jobs, 2012-2013



The table below presents the budget and cost per participant as compared to the actual expenditures and cost per participant. The actual 2012 cost per participant was slightly higher than budgeted while the actual 2013 cost per participant was slightly lower than budgeted.

Table 115 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
Equipment/Vendor	\$400,000	\$264,662	\$268,000	\$137,674
Evaluation	\$0	\$0	\$0	\$3,974
WAP	N/A	\$483,591	N/A	\$265,724
Total Cost	\$400,000	\$748,253	\$268,000	\$407,372
Participation	425	205	205	130
Cost (\$) per Participant (KPCO only)	\$941	\$1,291	\$1,307	\$1,090
Cost (\$) per Participant (with WAP)	N/A	\$3,650	N/A	\$3,134

8.3.3 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.⁵³ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

The Community Action Agencies track program participation for each agency/company providing funding. The Agencies collect the following data for the participants that receive funding from the Kentucky Power Targeted Energy Efficiency Program:

- **General:** Name, address, and phone number, Agency, application date, completion date
- **Housing Information:** Housing type, primary and secondary heat, primary and secondary heating system, percentage of energy supplied by electricity, number of HVAC systems (window units, CAC, heat pump), HVAC system Information (SEER, HSPF, cooling capacity), number of occupants, number of conditioned rooms, floor area
- **Weatherization:** Blower door, pre-weatherization, post-weatherization
- **Measures Installed**
 - HVAC filter replacement
 - Air leakage sealing (CFM reduction)
 - Duct sealing (CFM reduction)
 - Insulation – attic, sidewall, floor (areas insulated)
 - Ducts/boilers/pipes insulated (diameter, length, location and R-value installed)
 - Heating system replaced (size, SEER, HSPF)
 - Thermostat (original/new day and night setting, hours day and night setback)
 - Hot water measures (fuel type, tank capacity, tank age, original and setback temperature)
 - Pipe insulation (feet installed)
 - Insulation jacket (reason)
 - Low-flow showerhead (quantity)
 - Compact fluorescent light bulbs (wattage installed, wattage replaced, hours, location)

⁵³ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

The Community Action Agencies invoice Kentucky Power for services rendered on a monthly basis. The invoice details the data collected above as well as the total cost of Kentucky Power measures installed. Kentucky Power staff reviews the invoices for completeness and submits payment.

8.3.4 Program Satisfaction

Overall, customers are very satisfied with the Targeted Energy Efficiency Program. Ninety-six (96) percent of participants surveyed would recommend the program to others. Ninety-three (93) percent of participants have already recommended the program to their family, friends and/or neighbors. Participants were quite satisfied with the energy auditor, 80 percent noted that they were very knowledgeable about energy savings techniques.

Table 116 Participant Satisfaction (n=55)

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Scheduling the appointment	84%	9%	2%	4%	2%
Energy auditor	84%	11%	2%	2%	2%
Measures installed	78%	16%	2%	2%	2%
Educational materials	84%	11%	2%	2%	2%
Community Action Agency	78%	15%	2%	2%	2%
Response times to requests for information	76%	11%	9%	2%	2%
Program overall	84%	11%	2%	2%	2%

One participant was very dissatisfied with the program and noted that the items installed in their home were no longer working. All other customers were generally satisfied, noting that the program helped them to save money.

8.4 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

8.4.1 Gross Energy and Demand Savings

AEG conducted engineering and billing analyses of the Targeted Energy Efficiency Program to assess gross energy and demand savings based on the IPMVP Options A and C.

Engineering Analysis

AEG conducted the engineering analysis using equations from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”) as the source of engineering equations. AEG determined the gross savings per participant for each measure type using program tracking data and assumptions specific to the Kentucky Power service territory.

The tables below present the engineering analysis savings on a per participant basis. The measures installed at a participant’s home depend upon the heating type eligibility.

Table 117 Gross Energy (kWh) Savings per Participant

Heating Type	2012	2013	Total Program
All Electric	3,720	2,685	3,325
Non-All Electric	528	514	522
Program Total	3,408	2,418	3,024

Table 118 Gross Summer Demand (kW) Savings per Participant

Heating Type	2012	2013	Total Program
All Electric	0.89	0.87	0.88
Non-All Electric	0.05	0.05	0.05
Program Total	0.81	0.77	0.79

Table 119 Gross Winter Demand (kW) Savings per Participant

Heating Type	2012	2013	Total Program
All Electric	1.01	0.60	0.85
Non-All Electric	0.05	0.05	0.05
Program Total	0.91	0.53	0.76

The overall savings per participant and total program savings are shown in the tables below.

Table 120 Total Gross Energy (kWh) Savings

Heating Type	2012	2013	Total Program
All Electric	688,164	306,070	994,234
Non-All Electric	10,562	8,221	18,748
Program Total	698,726	314,292	1,013,018

Table 121 Total Gross Summer Demand (kW) Savings

Heating Type	2012	2013	Total Program
All Electric	165.2	98.7	263.8
Non-All Electric	1.0	0.8	1.8
Program Total	166.2	99.5	265.7

Table 122 Total Gross Winter Demand (kW) Savings

Heating Type	2012	2013	Total Program
All Electric	186.5	67.9	254.4
Non-All Electric	1.0	0.8	1.8
Program Total	187.6	68.7	256.3

Billing Analysis

A billing analysis estimates the change in billed energy usage of a participant sample for one year before and after participation using a paired sample t-test. The t-test is used to determine whether there was a significant difference in average energy usage before and after program participation. The t-test compares the average annual energy usage of the participant sample before and after the measure(s) was installed. Kentucky Power provided approximately four years of billing data for all customers via AEP's corporate file transfer protocol, including monthly interval billed energy usage for all customers.

The following steps were taken to develop the participant sample:

- Participants were matched to the Kentucky Power billing data using their account number. If an account number could not be matched, the participant was removed from the sample.
- Customers that participated in multiple Kentucky Power programs were identified and removed from the sample.⁵⁴
- Only sample participants with exactly 12 monthly intervals before and after the installation interval were included in the sample.

⁵⁴ Note that account numbers were not available for the Residential Efficient Products program and could not be removed from the sample. However, the interactive effects from this program are considered minimal.

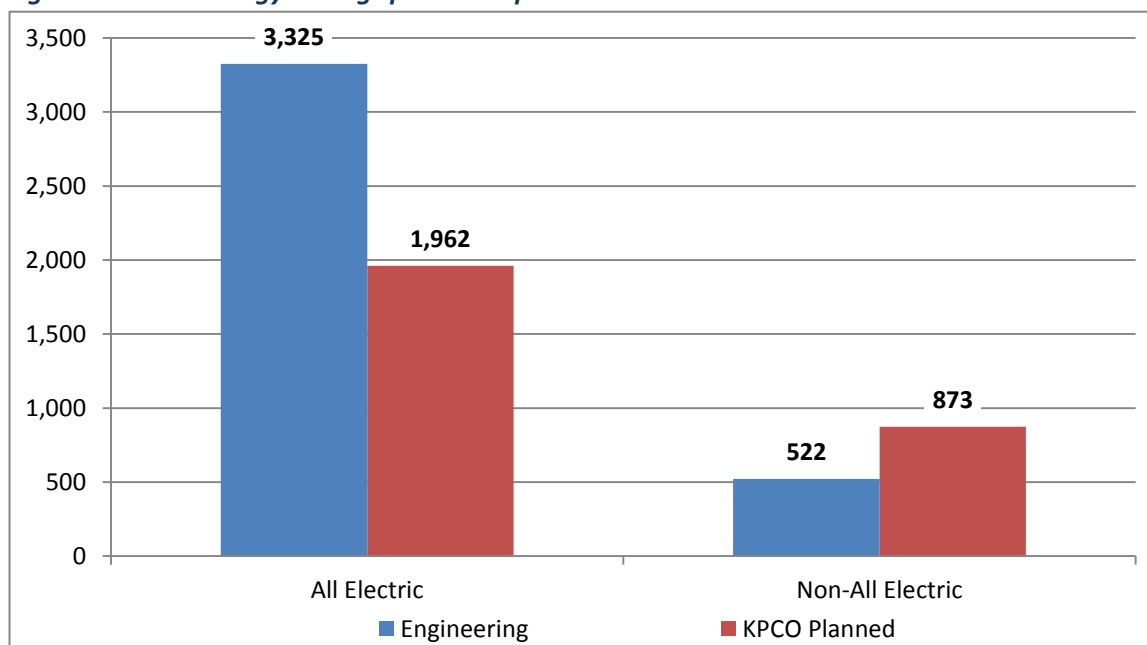
- An outlier screen was applied to the sample participants to remove outliers and other anomalous cases. Participants with an average pre-program annual energy usage greater than two standard deviations from the mean were removed from the sample to limit potential bias.

After screening for outliers and applying other sample validation criteria, the participant sample was significantly reduced and did not represent the program population. Therefore, AEG was unable to determine statistically significant results from the participant sample for the billing analysis.

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. The figure below compares the energy savings per participant from the engineering analysis to the Planned Kentucky Power savings assumptions.

Figure 44 Gross Energy Savings per Participant



8.4.2 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after accounting for free ridership and spillover. Free ridership refers to those participants who would have installed the efficient measures even without the program influence. Spillover refers to additional savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - Free\ ridership + Spillover$$

AEG conducted a survey of program participants to evaluate the effects of free ridership and spillover. Survey results are based on a random sample of participants with an overall statistical significance of 90 percent and a margin of error of +/- 10 Percent.

Free Ridership

Two questions in the participant survey were designed to assess the effects of free ridership.

- **Question 1:** Prior to participating in the program, were you planning to purchase and install the measures installed through the program?
- **Question 2:** If you had not participated in the program, how likely is it that you would have purchased and installed the measures you described?

The response to each free ridership questions was assigned a probability that that respondent was a free rider. The free ridership probability reflects the likelihood that a respondent would have installed the measures absent the program. The proportion of each response was multiplied by the free ridership probability to calculate the free ridership score.

Table 123 Free Ridership Question 1

Response	FR Probability	Count	Percent	Free Rider Score
Yes	50%	24	44%	22%
No	0%	31	56%	0%
Question 1 Free Ridership Score				22%

Table 124 Free Ridership Question 2

Response	FR Probability	Count	Percent	Free Rider Score
Very likely	80%	3	6%	5%
Somewhat likely	35%	8	15%	5%
Not likely	10%	10	19%	2%
Would Not Install	0%	31	60%	0%
Question 2 Free Ridership Score				12%

The free ridership score for each question was weighted based on its contribution to the overall free ridership factor. Weights were based on the assumption that survey responses may not reflect the actual behavior of respondents (i.e. social desirability bias). The weighted average of the scores determines the free ridership factor for the program.

Table 125 Free Ridership Question Summary

Question	Weight	Score
Question 1	50%	22%
Question 2	50%	12%
Free Ridership Score		17%

Based on the responses to the survey questions, free ridership is estimated at 17 percent.

Spillover

Spillover factor is the ratio of net spillover savings to gross savings of the participant sample.

$$\text{Spillover} = \frac{\text{Net Spillover Savings}}{(\text{Program Savings per Participant} \times \text{Total Respondents}) + \text{Total Spillover Savings}}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and spillover score for each respondent

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the participant survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to Question 1 were included in the spillover calculation. The savings from the spillover actions described in Question 2 were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, spillover participants engaged in a additional energy efficient actions such as upgrading to ENERGY STAR® appliances.

Finally, each respondent was asked how much the program influenced their additional actions. The table below shows the spillover score assigned to each of the responses to question three.

Table 126 Spillover Score

Response	Score
Very likely	10%
Somewhat likely	35%
Not likely	80%
Don't Know/Refused	50%

The net spillover savings from each respondent was determined by applying their spillover score to their gross spillover savings to estimate the spillover savings that were directly attributable to the program. The table below illustrates how the program spillover score was calculated. AEG determined the overall spillover score for participants is 1 percent.

Table 127 Spillover Calculation Summary

Line	Variable	Value
A	Total Respondents	55
B	Program Savings per Participant	3,008
C	Program Savings of Sample (A x B)	165,429
D	Gross Spillover Savings of Sample	2,392
E	Total Gross Sample Savings (C + D)	167,821
F	Net Spillover Savings	1,871
G	Spillover Score (F ÷ E)	1%

Next, AEG used the free ridership and spillover estimates to determine the NTG factor for each group. As a result, the NTG factor for the program is 84 percent.

Table 128 Net-to-Gross Factor

Free Ridership	Spillover	Net-to-Gross
17%	1%	84%

Net Savings Results

The NTG factor was applied to the unit savings to determine the net energy and demand savings. The engineering analysis savings are shown in the tables below.

Table 129 Net Energy Savings (kWh) per Participant

Heating Type	2012	2013	Total
All Electric	3,134	2,262	2,801
Non-All Electric	445	433	440
Program Total	2,871	2,037	2,547

Table 130 Net Summer Demand Savings (kW) per Participant

Heating Type	2012	2013	Total
All Electric	0.75	0.73	0.74
Non-All Electric	0.04	0.04	0.04
Program Total	0.68	0.64	0.67

Table 131 Net Winter Demand Savings (kW) per Participant

Heating Type	2012	2013	Total
All Electric	0.85	0.50	0.72
Non-All Electric	0.04	0.04	0.04
Program Total	0.77	0.45	0.64

Table 132 Total Net Energy (kWh) Savings

Heating Type	2012	2013	Total
All Electric	579,699	257,829	837,528
Non-All Electric	8,898	6,926	15,823
Program Total	588,596	264,755	853,351

Table 133 Total Net Summer Demand (kW) Savings

Heating Type	2012	2013	Total
All Electric	139.1	83.1	222.3
Non-All Electric	0.9	0.7	1.5
Program Total	140.0	83.8	223.8

Table 134 Total Net Winter Demand (kW) Savings

Heating Type	2012	2013	Total
All Electric	157.1	57.2	214.3
Non-All Electric	0.9	0.7	1.5
Program Total	158.0	57.9	215.9

8.4.3 Savings Summary

AEG was unable to determine statistically significant results from the participant sample for the billing analysis. Therefore, AEG recommends utilizing the 2013 engineering analysis energy and demand savings per participant to determine program savings for program tracking purposes as well as PSC filings. The tables below present the gross and net savings per participant.

Table 135 Gross Savings per Participant

Heating Type	Gross Energy Savings per Participant (kWh)	Gross Summer Demand Savings per Participant (kW)	Gross Winter Demand Savings per Participant (kW)
All Electric	2,685	0.87	0.60
Non-All Electric	514	0.05	0.05
Program Total	2,418	0.77	0.53

Table 136 Net Savings per Participant

Heating Type	Net Energy Savings per Participant (kWh)	Net Summer Demand Savings per Participant (kW)	Net Winter Demand Savings per Participant (kW)
All Electric	2,262	0.73	0.50
Non-All Electric	433	0.04	0.04
Program Total	2,037	0.64	0.45

8.4.4 Program Site Inspections and Installation Verification

AEG performed site inspections and installation verifications on two fully installed projects to perform quality assurance/quality control and verify application information of the installed equipment. AEG was unable to schedule site inspections in Pikeville due to participants' scheduling conflicts. Proper installation verification was confirmed at all locations. The table below shows the number of completed site inspections in each area.

Table 137 Site Inspection Summary

Area	Count	%
Ashland	1	50%
Pikeville	0	0%
Hazard	1	50%
Total	2	100%

8.4.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the equipment improves a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Targeted Energy Efficiency Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.⁵⁵ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

Impact evaluation results were utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates,

⁵⁵ The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

and participation, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

Two scenarios were evaluated for 2012-13 and prospective cost-effectiveness analysis: (1) accounted only for KPCO program costs and (2) accounted for KPCO and the Weatherization Assistance Program (“WAP”) costs (i.e. full program costs). This was done to account for all expenses incurred for items installed for program participants, regardless of the funding source. The Targeted Energy Efficiency Program was found to be cost-effective for the 2012-2013 program years when only KPCO dollars are analyzed. The second scenario was not cost-effective for the 2012-2013 program years when accounting for the full program costs, however, the program also provides services which are supplemental to weatherization, such as improved health and community benefits. Cost-effectiveness results are presented in the tables below.

Table 138 Cost Effectiveness Results (KPCO), 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.49	\$1,436,996	\$711,191	(\$725,806)
Utility Cost Test	1.79	\$397,739	\$711,191	\$313,451
Participant Test	n/a	\$0	\$1,039,257	\$1,039,257
Total Resource Cost Test	1.79	\$397,739	\$711,191	\$313,451

Table 139 Cost Effectiveness Results (KPCO + WAP), 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.32	\$2,194,882	\$711,191	(\$1,483,692)
Utility Cost Test	0.62	\$1,155,625	\$711,191	(\$444,435)
Participant Test	n/a	\$0	\$1,039,257	\$1,039,257
Total Resource Cost Test	0.62	\$1,155,625	\$711,191	(\$444,435)

Evaluating the program on a prospective basis, the Targeted Energy Efficiency Program is also cost-effective when only including KPCO dollars. The program should be continued going forward. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results are presented in the tables below.

Table 140 Cost Effectiveness Results (KPCO), Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.54	\$669,939	\$362,903	(\$307,036)
Utility Cost Test	1.86	\$194,970	\$362,903	\$167,933
Participant Test	n/a	\$0	\$474,969	\$474,969
Total Resource Cost Test	1.86	\$194,970	\$362,903	\$167,933

Table 141 Cost Effectiveness Results (KPCO + WAP), Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.40	\$904,481	\$362,903	(\$541,578)
Utility Cost Test	0.84	\$429,512	\$362,903	(\$66,609)
Participant Test	n/a	\$0	\$474,969	\$474,969
Total Resource Cost Test	0.84	\$429,512	\$1,044,261	\$614,748

8.5 Program Recommendations

AEG has recommendations on how to improve the program. These include:

Continue to Actively Support the Community Action Agencies

AEG recommends that Kentucky Power continue to actively support the Community Action Agencies. The majority of program participants are satisfied with the program and the program supports the local community in Kentucky Power's service territory. Kentucky Power should continue to work closely with the Community Action Agencies to determine if there are any other measures that Kentucky Power could incentivize or any other support Kentucky Power could provide.

Review Program Offerings

AEG recommends that Kentucky Power work with the Community Action Agencies to determine the mix of measures offered to customers and the Kentucky Power portion of the measure cost. For example, Kentucky Power is offering \$1,600 for the installation of a high efficiency heat pump. DSM Program staff should discuss with the Agencies to determine if the offering should be increased or decreased.

Consider Customer Survey

AEG recommends that Kentucky Power consider eliminating the customer survey. The survey gathers demographic and saturation information. The survey should be utilized as an evaluation tool to inform program design and issued to a random sample of residential customers every two to five years.

9. Residential and Small Commercial HVAC Diagnostic and Tune-Up Program

The HVAC Diagnostic and Tune-Up Program offers residential and small commercial customers diagnostic performance check and tune-up services for their heat pump and air central conditioner systems.⁵⁶ The services include testing and correcting inefficiencies in the HVAC system due to air-restricted indoor or outdoor coils. HVAC systems with coil inefficiencies are marginally operational and experience long run times. Repairs reduce energy and demand use, improve customer comfort and extend the serviceable life of the unit.

Residential and small commercial (less than 100 kW) customers are eligible for a \$30 incentive for receiving services from a participating HVAC Dealer. Participating HVAC Dealers, state-licensed contractors, are eligible for a \$25 incentive for services performed upon approval of the rebate application(s). Customers are limited to one rebate every three years for each eligible unit.

The diagnostic and tune-up services ensure customer HVAC systems:

- Are running at peak efficiency to help reduce operating costs.
- Contain the correct amount of refrigerant.
- Maintain efficient operation of indoor and outdoor coils.
- Receive periodic inspection to minimize unexpected equipment repairs.

The Kentucky PSC approved the budget and participation goals.

Table 142 Program Budget Goals, 2012-2014

	2012	2013	2014
Equipment/Vendor	\$58,500	\$18,525	\$6,600
Customer Incentive	\$62,750	\$22,225	\$7,920
Promotion	\$9,000	\$5,000	\$1,700
Program Development & Administration	\$6,300	\$2,500	\$0
Evaluation	\$22,092	\$0	\$21,298
Total Budget	\$158,642	\$48,250	\$37,518

Table 143 Participation Goals, 2012-2014

	2012	2013	2014
Residential CAC	250	-	-
Residential HP	750	650	240
Small Commercial CAC	55	-	-
Small Commercial HP	115	85	24
Total Participant Goal	1,170	735	264

9.1 2011 HVAC Diagnostic and Tune-Up Program Evaluation

AEG conducted a process, market and impact evaluation of the 2011 HVAC Diagnostic and Tune-Up Program, submitted in July 2012. The program was modified based on the evaluation findings to improve program cost-effectiveness and reduce free ridership.

⁵⁶ Central air conditioner system diagnostic and tune-up services were removed from the program offering beginning in 2013.

Program cost-effectiveness was negatively affected by the incentives paid to participating HVAC Dealers and the inclusion of central air conditioner tune-ups. The residential and small commercial programs were found to be cost-effective if the participating HVAC Dealer incentive was reduced and central air conditioner tune-ups removed from the program. Residential free ridership was estimated at 60 percent. To reduce free ridership, the following program modifications were recommended:

- Modify customer eligibility to every 5 years rather than the current 3 years.
- Require the customer to submit the rebate application. Other than receiving the diagnostic and tune-up service, the customer does not have to take any action to receive the incentive.
- KPCO should market the program directly to residential customers and encourage HVAC dealers to market to customers that do not consistently receive these tune-up services.

Based on the recommendations, Kentucky Power removed central air conditioner tune-ups from the program offering, decreased customer rebates and required customer to submit the rebate application. These program modifications went into effect in 2013 and are described in this evaluation.

Table 144 Program Incentive Modifications

	2012	2013
Residential	\$50	\$30
Small Commercial	\$75	\$30
HVAC Dealer	\$50	\$25

9.2 Evaluation Data Collection

The program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation?
- What marketing/promotional efforts resonate with customers? HVAC Dealers?
- Are HVAC Dealers sufficiently knowledgeable about the Kentucky Power Program?
- Are customers/HVAC Dealers satisfied with the program?
- Are rebate applications processed, approved and paid on a timely basis?
- Is the rebate processing system effective in managing the application and rebate payment process?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would customers recommend the program?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

HVAC Dealer Interviews

AEG administered telephone interviews to a sample of participating HVAC Dealers. The interviews identified potential areas for improvement and provided insight about customer attitudes toward energy efficiency and application processes. The interview guide can be found in Appendix B.

The Kentucky Power HVAC Dealers can participate in the following programs:

- Residential and Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential Home High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Program

One-hundred and two (102) HVAC Dealers participated in at least one Kentucky Power DSM Program between January 1, 2012 and December 31, 2013. AEG interviewed 16 participating HVAC Dealers.

Participating Customer Surveys

AEG administered a 10 to 12 minute telephone survey to a sample of program participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. Kentucky Power provided data for 1,220 participants that received a rebate between January 1, 2012 and September 30, 2013,⁵⁷ of which there were 58 unique small commercial and 1,008 unique residential electric accounts (as identified by account number and address). AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were randomly selected based on unique identifiers determined by Microsoft Excel's random number generator.

Sixty-four (64) residential surveys and 18 small commercial surveys were completed. The surveyors attempted to contact small commercial participants on multiple occasions and were unable to reach the sample size target of 32. Therefore, results from the commercial sector have an error margin of +/- 19 percent. The survey guide can be found in Appendix C.

AEG also conducted site visits of two residential participants during the diagnostic and tune-up service to observe the work conducted.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power's initial program filing savings were reviewed to ensure consistence with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Option A of the International Performance Measurement and Verification Protocols ("IPMVP").⁵⁸

⁵⁷ Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

⁵⁸ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

Table 145 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

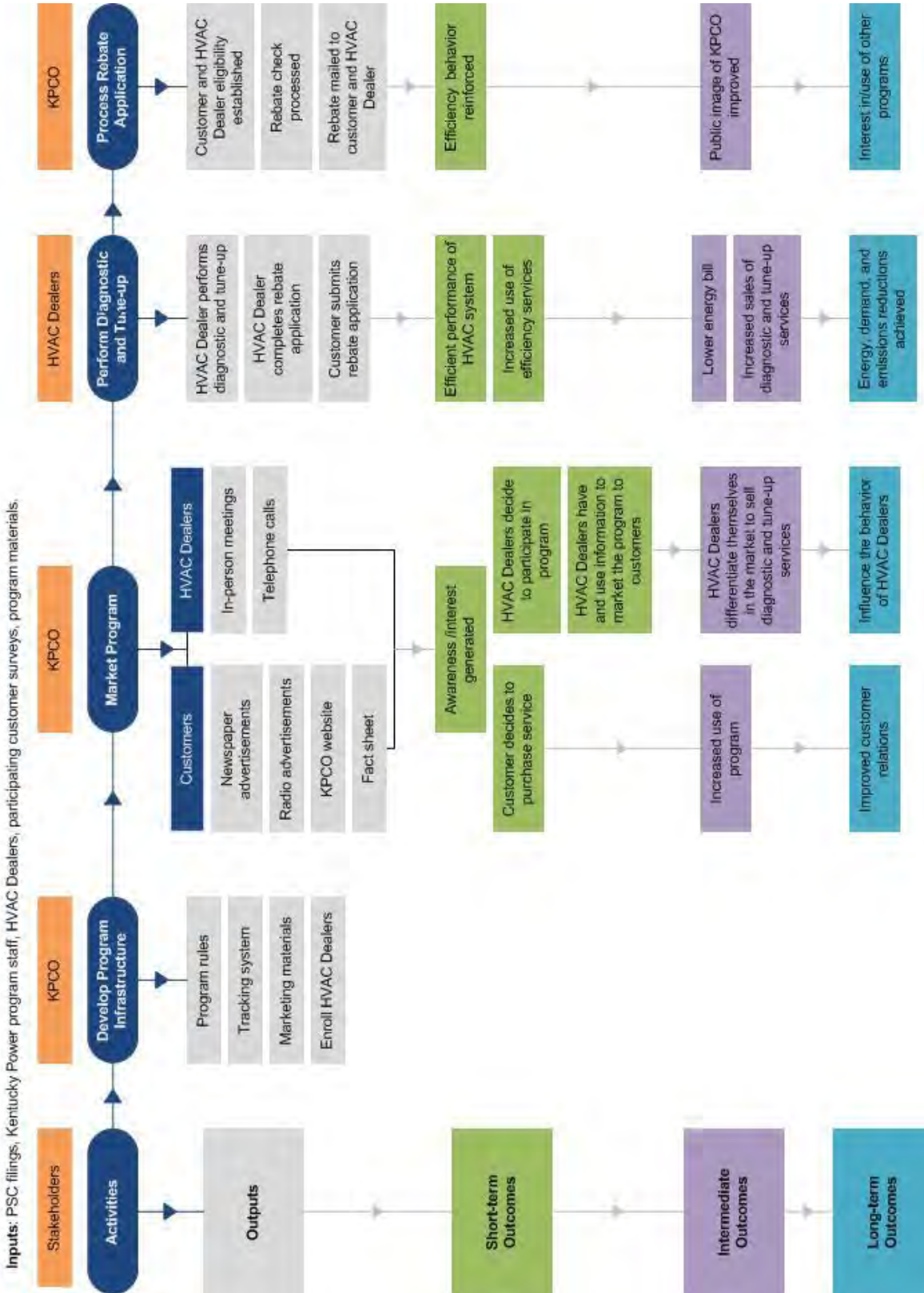
Engineering algorithms from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”), using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts.⁵⁹

9.3 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

⁵⁹ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 45 Program Logic Model



9.3.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program's intended outcomes. Program activities include:

Develop Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power program staff, with input from AEP, designed the program, including the rebate applications and data tracking system.

Kentucky Power program staff maintains relationships with participating HVAC Dealers through periodic telephone calls and in-person visits. Kentucky Power educates HVAC Dealers on the program, including customer eligibility and rebate forms. A list of participating HVAC Dealers is maintained on the KPCO DSM Program website. The KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Market Program

Marketing activities are targeted towards HVAC Dealers via telephone calls and in-person meetings. Participating HVAC Dealers are encouraged to promote the program to eligible customers. The program is marketed to customers through newspaper advertisements, radio advertisements, the KPCO website, and program fact sheets.

Perform Diagnostic and Tune-Up

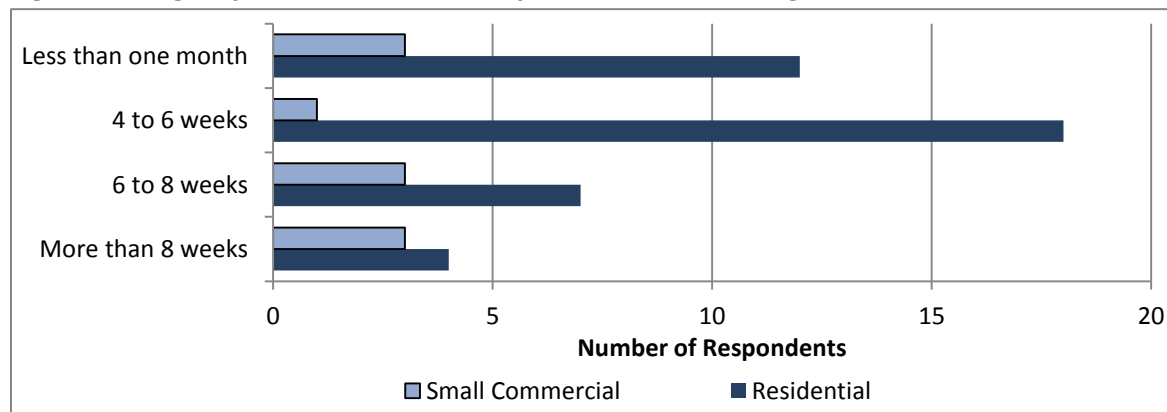
The participating HVAC Dealer performs the diagnostic and tune-up services on the customer's heat pump. The HVAC Dealer completes the rebate application and the customer mails to Kentucky Power.

Process Rebate Application

Customer rebates are processed by Kentucky Power program staff. Staff verifies customer and HVAC Dealer eligibility and checks for application completeness. The application data is entered into the program tracking system and a payment request submitted for review. Once approved, customer and HVAC Dealer data is submitted to AEP's Accounting Group where rebate checks are issued and mailed.

Kentucky Power program staff aim to process customer rebate applications within 4 to 6 weeks. According to participating customers surveyed, applications are typically processed within six weeks.

Figure 46 Length of Time between Tune-Up Service and Receiving Rebate Check



Kentucky Power maintains the right to conduct inspections. Kentucky Power reviewed applications to ensure they were completed and met the minimum program efficiency requirements.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

9.3.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in diagnostic and tune-up services may increase among customers and HVAC Dealers. Customers may become more knowledgeable about diagnostic and tune-up services and the HVAC Dealers may have information to market the program to customers. The program may lead to an increased commitment to energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPCO efficiency programs, increased diagnostic and tune-up services and reduced energy consumption.

Long-term Outcomes

The long-term outcomes may include reduced utility emissions and fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

9.3.3 External Factors

There are a variety of factors outside the control of KPCO that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Economic conditions
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Competition among targeted HVAC contractors
- Cost and performance of HVAC diagnostic and tune-up services

9.4 Process and Market Evaluation Findings

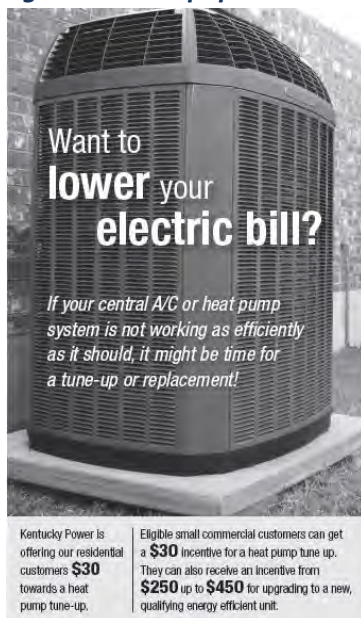
This section provides key process evaluation findings, including marketing, program performance, HVAC Dealer participation, program tracking and program satisfaction.

9.4.1 Program Marketing

Kentucky Power marketed the HVAC Diagnostic and Tune-Up Program through the following:

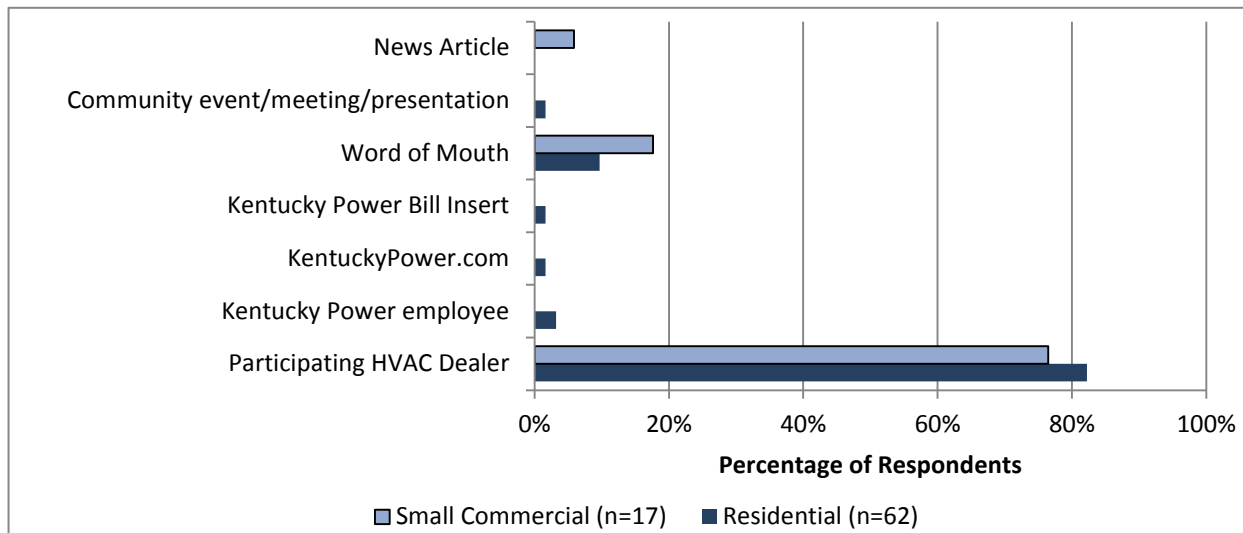
- **HVAC Dealer Outreach.** Kentucky Power staff promoted the programs directly to HVAC Dealers via telephone calls or in-person meetings with prospective and current dealers. The HVAC Dealers are mailed letters with program information and new rebate forms on an annual basis.
- **Newspaper Advertisements.** Kentucky Power jointly advertised the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive and the HVAC Diagnostic and Tune-Up Programs. In 2012, Kentucky Power ran 32 newspaper advertisements in eight local newspapers over a three week period. In September 2013, nine newspaper advertisements were run in three local newspapers over a three week period.
- **Radio Advertisements.** In 2013, Kentucky Power advertised the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive and the HVAC Diagnostic and Tune-Up Programs with local radio channels WLGC, WBVB and WAMX.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save. Customers have the ability to search for participating HVAC Dealers by geographic location on the KPCO DSM Program website.

Figure 47 Newspaper Advertisement



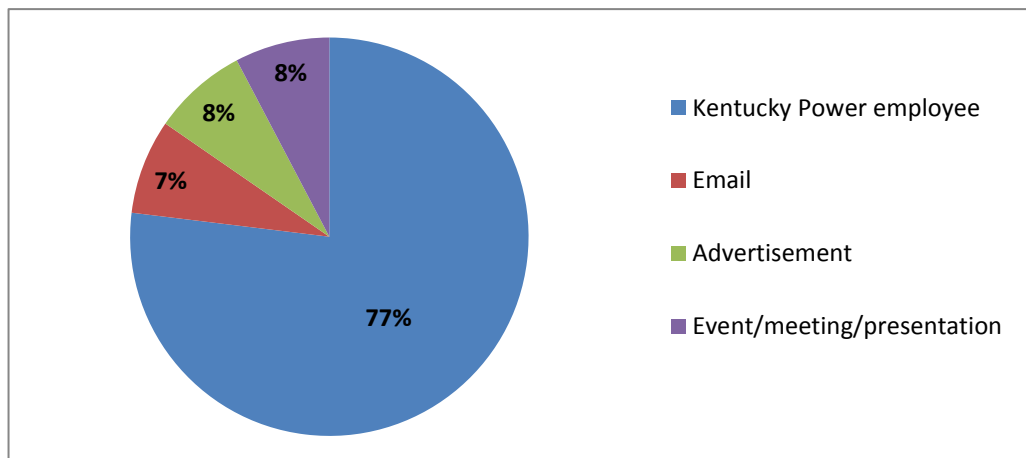
The program was designed such that the Kentucky Power program staff markets the program to participating HVAC Dealers. In turn, the HVAC Dealers were encouraged to promote the program to eligible customers. According to the participating customers surveyed, participants most often learned of the program from the HVAC Dealer.

Figure 48 How Customers First Learned of the Program



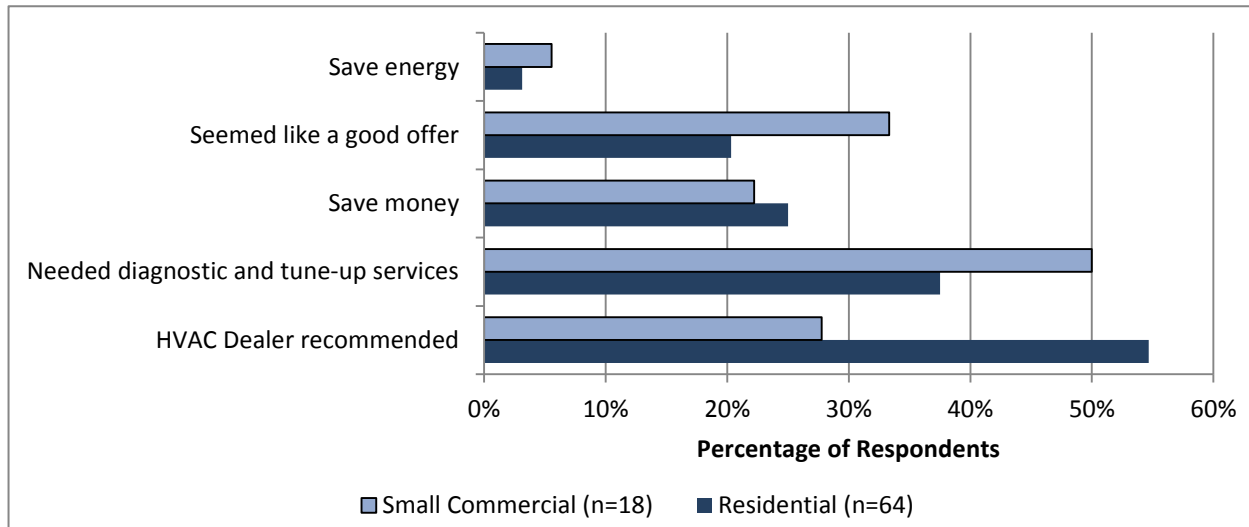
Participating HVAC Dealers most often learned about the program from a Kentucky Power employee.

Figure 49 How Participating HVAC Dealers First Learned of the Program (n=13)



Eighty-seven (87) percent of residential participants and 56 percent of small commercial participants surveyed noted that the information provided by the HVAC Dealer was very important in the decision to receive the diagnostic and tune-up services. Thirty-eight (38) percent of residential participants and 50 percent of small commercial participants surveyed cited that their primary reason for participating in the HVAC Diagnostic and Tune-Up Program was that they needed diagnostic and tune-up services for their HVAC equipment.

Figure 50 Customer Motivation for Participation



The majority of participating HVAC Dealers surveyed stated that their primary reason for participating in the Kentucky Power programs was that the program was good for business. Participating HVAC Dealers prefer to be contacted by Kentucky Power staff via the following channels:

- Emails (45 percent)
- Telephone Calls (40 percent)
- Mail (10 percent)
- In-Person Visits (5 percent)

9.4.2 Program Performance

Between January 1, 2012 and December 31, 2013, 1,293 residential and small commercial HVAC systems were rebated through the HVAC Diagnostic and Tune-Up Program. Kentucky Power rebated 1,121 HVAC systems in 2012, achieving 96 percent of the participant goal, and 172 HVAC systems in 2013, achieving 23 percent of the participant goal. Seventy-seven (77) rebate applications were denied.

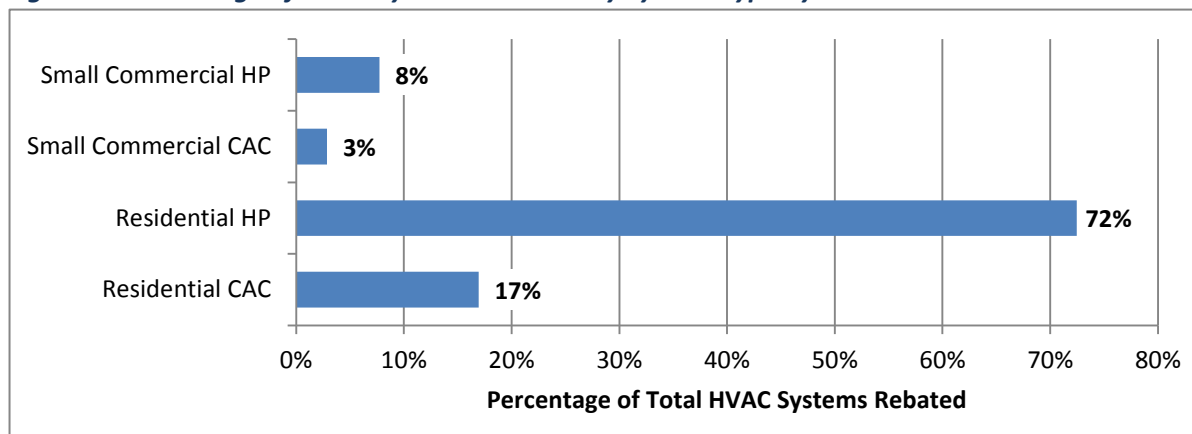
Table 146 Program Participation⁶⁰

	2012	2013	Total
Residential CAC	219	0	219
Residential HP	781	156	937
Commercial CAC	37	0	37
Commercial HP	84	16	100

Seventy-two (72) percent of the systems were residential heat pumps, 17 percent residential central air conditioners, 8 percent small commercial heat pumps and 3 percent small commercial central air conditioners.

⁶⁰ The 2012 program participation differs from Kentucky Power’s Demand Side Management Status Report (December 31, 2012). The Status Report participation was estimated due to a rebate processing backlog. Multiple administrative personnel assisted with rebate processing, which may have accounted for some errors. The correct 2012 program participation is presented in the evaluation.

Figure 51 Percentage of HVAC Systems Rebated by System Type by Sector



Routine diagnostic and tune-up services typically occur year round, but generally follow a seasonal pattern. Central air conditioner tune-ups were highest in April and May, before the summer months when air conditioning systems are frequently used. Customers primarily request diagnostic and tune-up services for their heat pump systems during the spring and fall seasons in preparation for the summer and winter seasons. Program participation reflects this seasonal pattern.

Figure 52 Central Air Conditioner Systems Rebated by Month, 2012

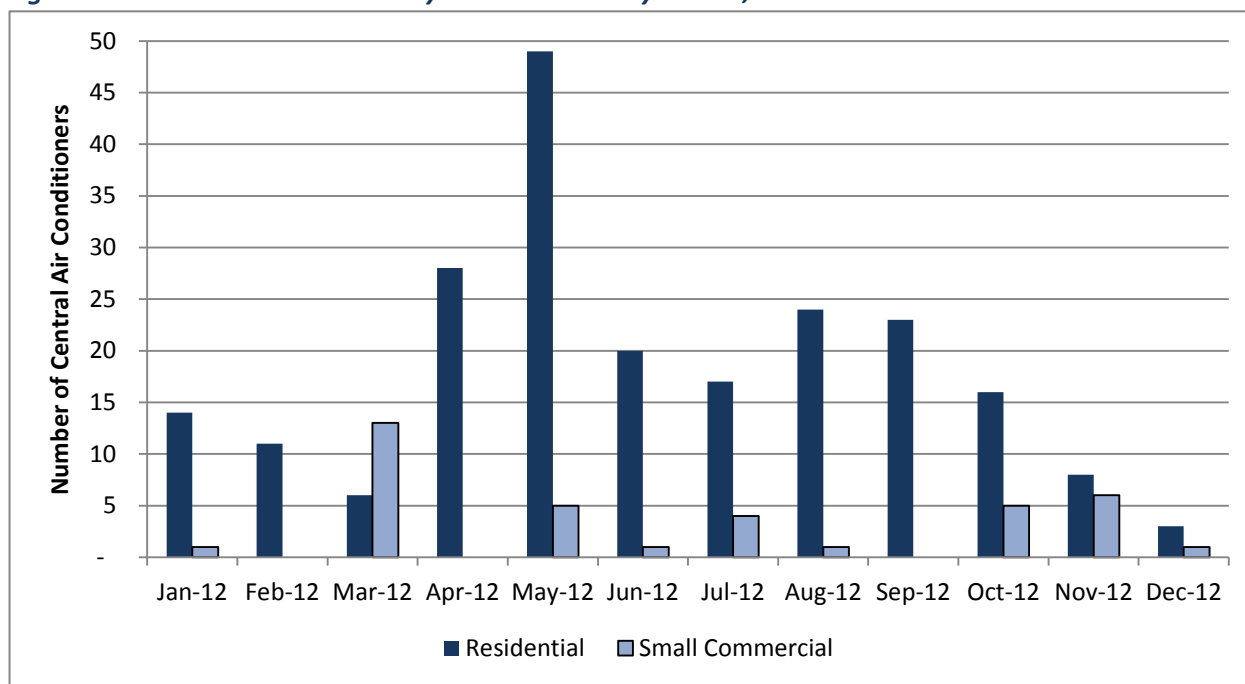
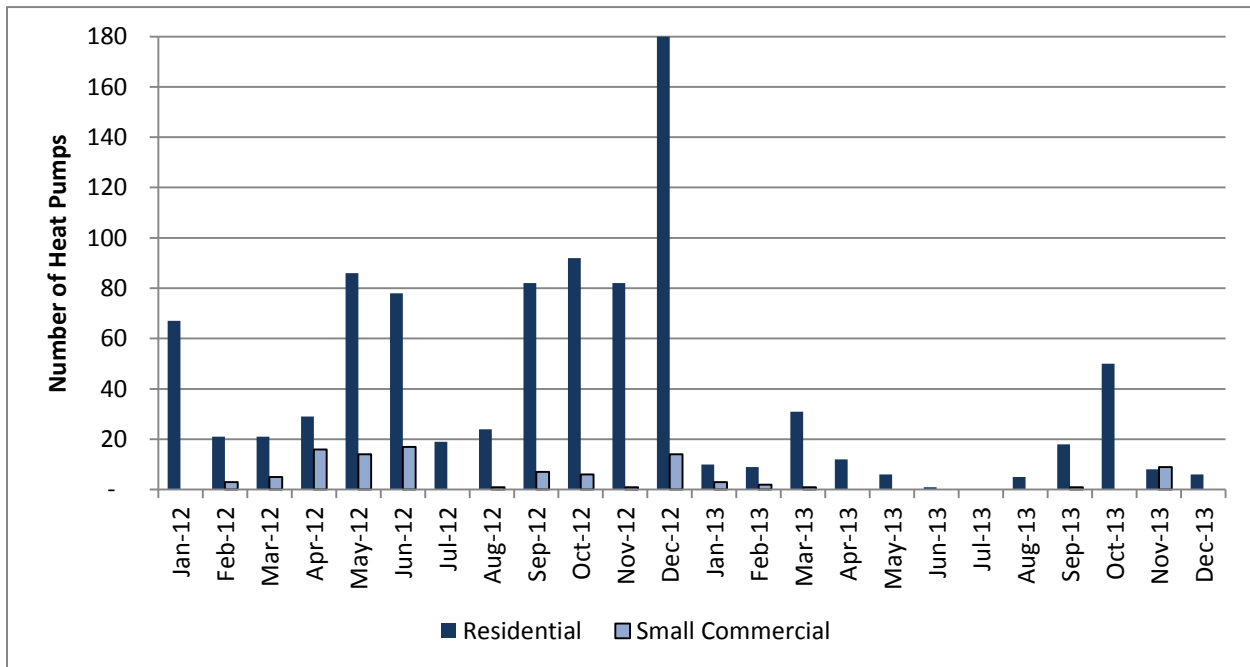


Figure 53 Heat Pump Systems Rebated by Month, 2012 and 2013



The table below presents the budget and cost per participant as compared to the actual expenditures and cost per participant. The actual 2012 cost per participant was lower than originally budgeted, but the actual 2013 cost per participant significantly exceeded the original budget.⁶¹

Table 147 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
Equipment/Vendor	\$58,500	\$54,050	\$18,525	\$9,350
Customer Incentive	\$62,750	\$56,975	\$22,225	\$10,325
Promotion	\$9,000	\$9,381	\$5,000	\$6,055
Program Development & Administration	\$6,300	\$0	\$2,500	\$0
Evaluation	\$22,090	\$23,557	\$0	\$4,131
Total Cost (\$)	\$158,640	\$143,963	\$48,250	\$29,861
Participation	1,170	1,142	735	172
Cost (\$) per Participant	\$136	\$126	\$66	\$174

9.4.3 HVAC Dealers

The Kentucky Power HVAC Dealers can participate in the following programs:

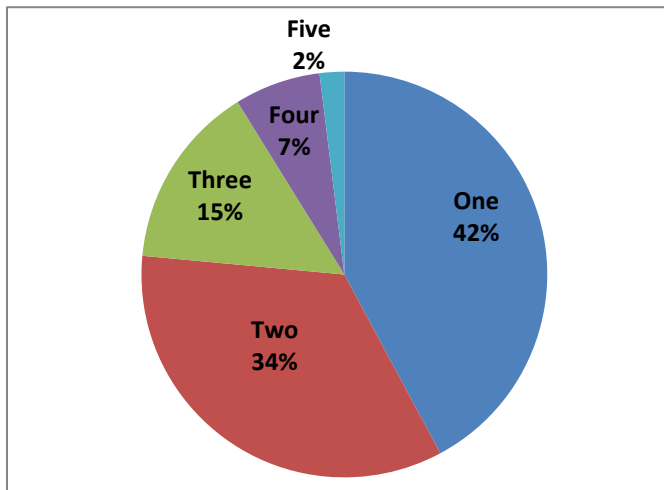
- Residential and Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential Home High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Program

One-hundred and two (102) HVAC Dealers participated in at least one Kentucky Power DSM Program between January 1, 2012 and December 31, 2013. Eighty-seven (87) of the HVAC Dealers are currently

⁶¹ The 2013 cost per participant is likely due to the following: (1) at the end of 2012 there was a backlog of participants (2) higher 2012 rebates were paid out to backlog customers in 2013 and (3) evaluation expenses were not included in the budget.

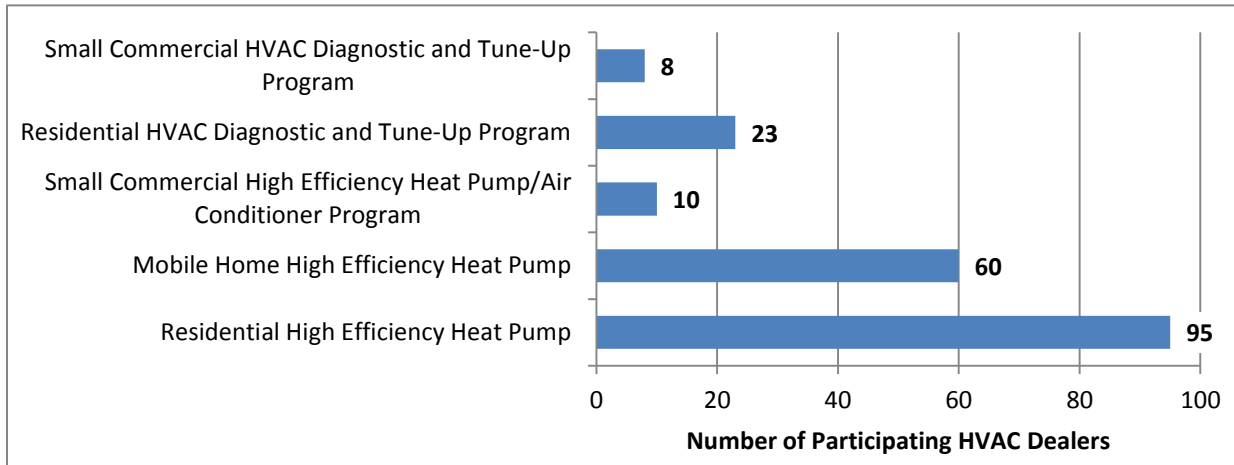
listed on the DSM Program website and 15 need to be added as HVAC Dealers. Approximately 75 percent of the participating HVAC Dealers received a rebate for participating in one or two DSM Programs and 2 percent received a rebate for participating in all of the DSM Programs.

Figure 54 Participating HVAC Dealers, Number of Programs



A significant majority of participating HVAC Dealers received a rebate through the Residential High Efficiency Heat Pump Program while the Small Commercial HVAC Diagnostic and Tune-Up Program had the fewest number of participating HVAC Dealers receive a rebate.

Figure 55 Participating HVAC Dealers, Number of Approved Rebates by Program



Twenty-three (23) HVAC Dealers participated in the HVAC Diagnostic and Tune-Up Program in 2012 or 2013. Two HVAC Dealers performed 50 percent of the HVAC diagnostic and tune-up services.

Table 148 HVAC Diagnostic and Tune-Up Program Most Active HVAC Dealers

Contractor	Commercial	Residential	Total Systems	% of Total
Bobby Howard & Sons	26	404	430	33%
Appalachian Refrigeration	77	180	257	20%
CADCO Heating & Air Conditioning	10	193	203	16%
Aire Serv	19	136	155	12%

9.4.4 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.⁶² The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

Rebate applications are processed by Kentucky Power program staff. Staff reviews and validates the applications for completeness, including customer and HVAC Dealer eligibility. Applications are reviewed based on the date received and the DSM Program. Each customer application is assigned a unique identifier. The hard-copy rebate applications are labeled with the assigned unique identifier and payment request number, then grouped and archived in a binder.

Kentucky Power's program tracking system is comprised of three databases:

KCPO Customer Records (MACCS) is an internal intranet-based database. A note is entered in the customer record with the DSM Program and the date the rebate application was received. KCPO Customer Operations Center can access the note if a customer calls about their rebate status. KCPO program staff utilizes the data to monitor program performance.

Program Log is an Excel- or Access-based database that contains data from the rebate application. Each DSM Program has a program log, which is available on a shared drive to specific KCPO staff.

Kentucky Power collects the following data on the rebate application:

- **Customer Information:** name, account number, address (service and mailing), contact person, phone number, home vs. business.
- **Cooling/Heating Unit Information:** system type (split/ packaged), size, SEER, EER, HSPF, approximate age of system, indoor evaporator model number, furnace model number.
- **HVAC Performance Diagnostic and Tune-Up:** Outdoor ambient temperature, Discharge/suction pressure (before/after), discharge/suction line temperatures (before/after), refrigerant added/removed (detail reason), total system charge, refrigerant type, indoor blower volts, outdoor compressor volts, compressor amps (before/after), condenser fan amps (before/after), evaporator coil cleaned, condenser coil cleaned, indoor air filter replaced.
- **Technician Information:** inspection date/time, technician name or initials.
- **Dealer Information:** name, HVAC license number, Tax ID number, mailing address.
- **Dates:** customer signature date, HVAC Dealer signature date.

Electronic Payment Request (PeopleSoft). Each rebate application has two payment requests, one customer and one HVAC Dealer. The request includes the accounting code, unique identification number, customer/Dealer name and address, dealer Federal Tax ID and rebate amount.

⁶² In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

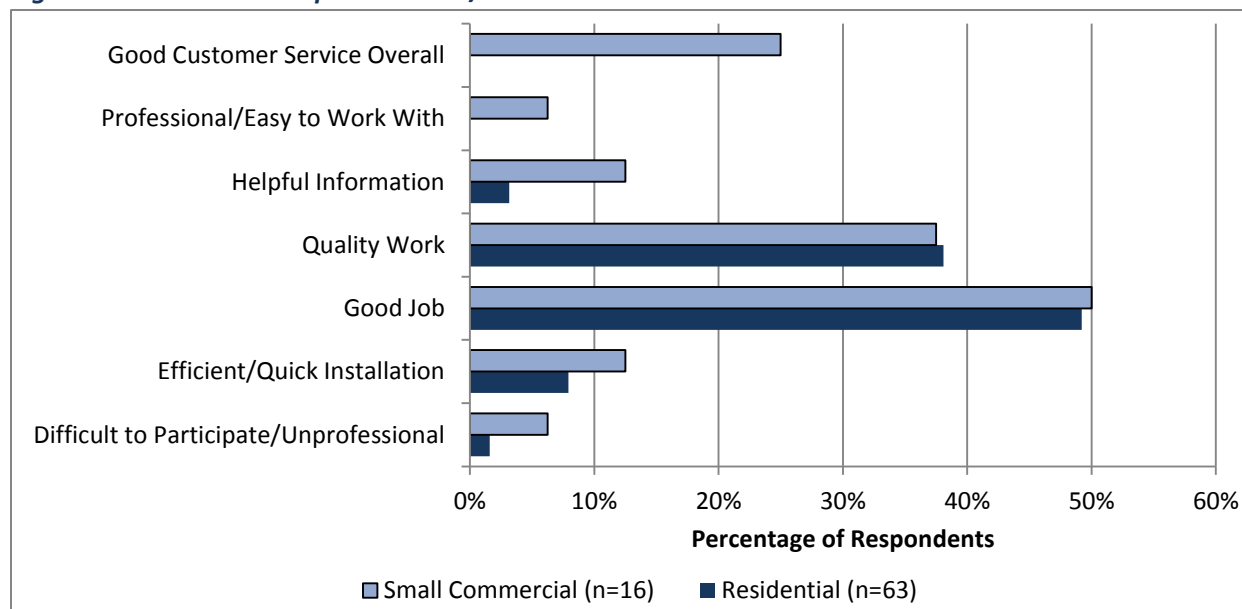
Prior to approval, the Electronic Payment Request is reviewed by the Kentucky Power program coordinator. The coordinator ensures the account number, program account, rebate amount and unique identifier are correct. Once approved, the Electronic Payment Request is submitted electronically to the AEP Accounting Group in Canton, Ohio and a rebate check issued and mailed.

The Program Log contains all of the data collected on the rebate application. Of the data tracked, there are a number of data entries missing information collected on the application. For example, 12 entries are missing the size of the HVAC system that received the diagnostic and tune-up services. The Program Log does not track the inspection date.

9.4.5 Program Satisfaction

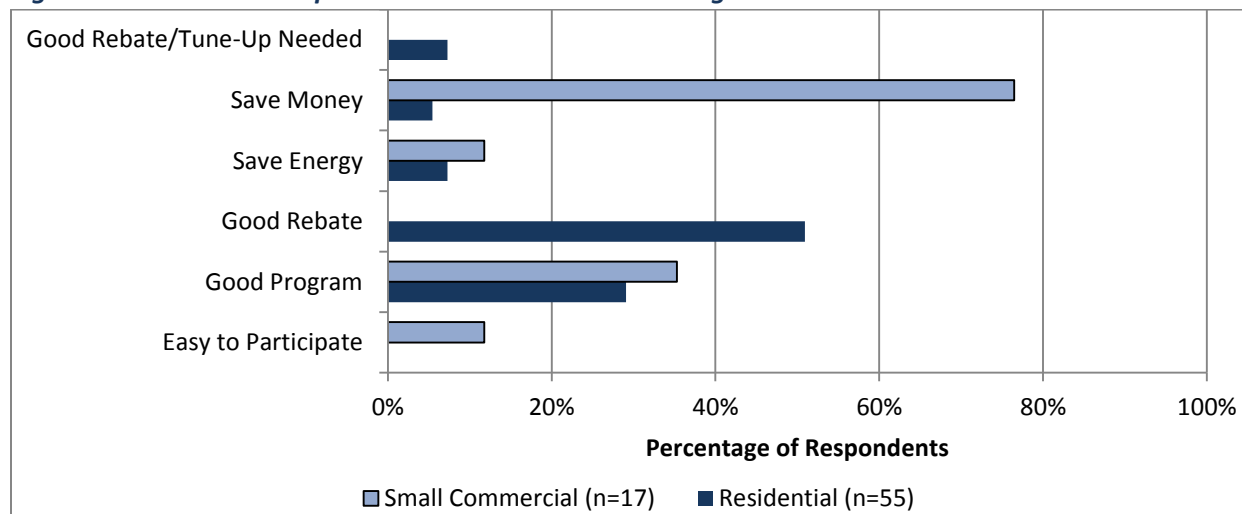
Ninety-eight (98) percent of residential participants and 89 percent of small commercial participants surveyed would recommend their HVAC Dealer to someone else. Three participants surveyed would not recommend their HVAC Dealer to others. Some reasons for recommending the program were quality work and good customer service.

Figure 56 Reasons Participants Would/Would Not Recommend the HVAC Dealer



Eighty-six (86) percent of residential participants and 94 percent of small commercial participants surveyed would recommend the program to others. Some reasons for recommending the program are the rebate and saving money and energy.

Figure 57 Reasons Participant Would Recommend the Program



Overall, customers are very satisfied with the HVAC Diagnostic and Tune-Up Program. Customers that were dissatisfied with program components were primarily concerned about the incentive processing time and communication about the program. One residential customer surveyed had not received their rebate and had issues working with the HVAC Dealer and Kentucky Power to obtain.

Figure 58 Residential Participant Satisfaction

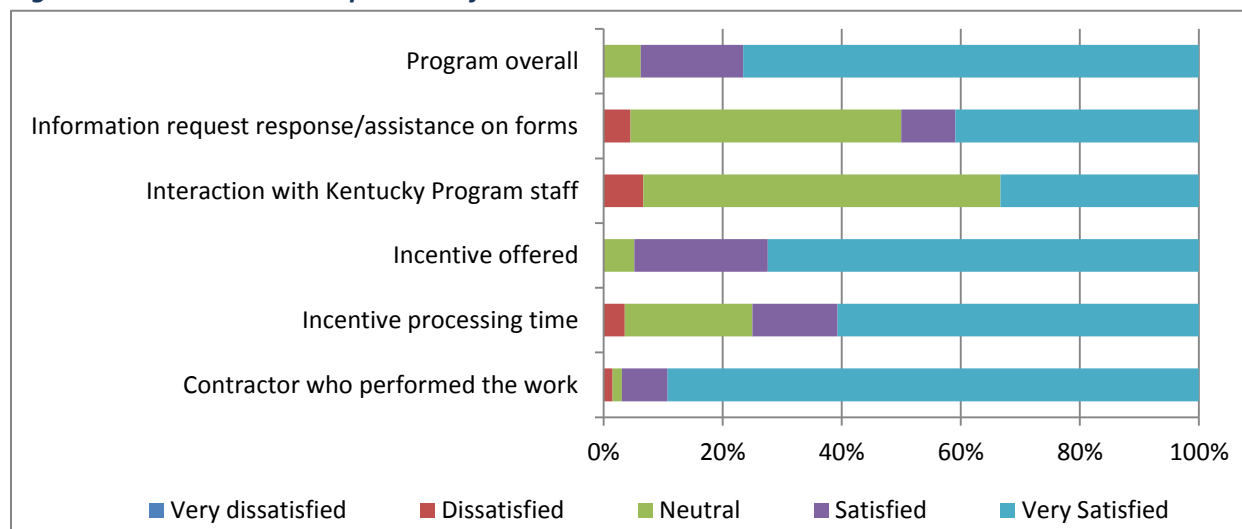
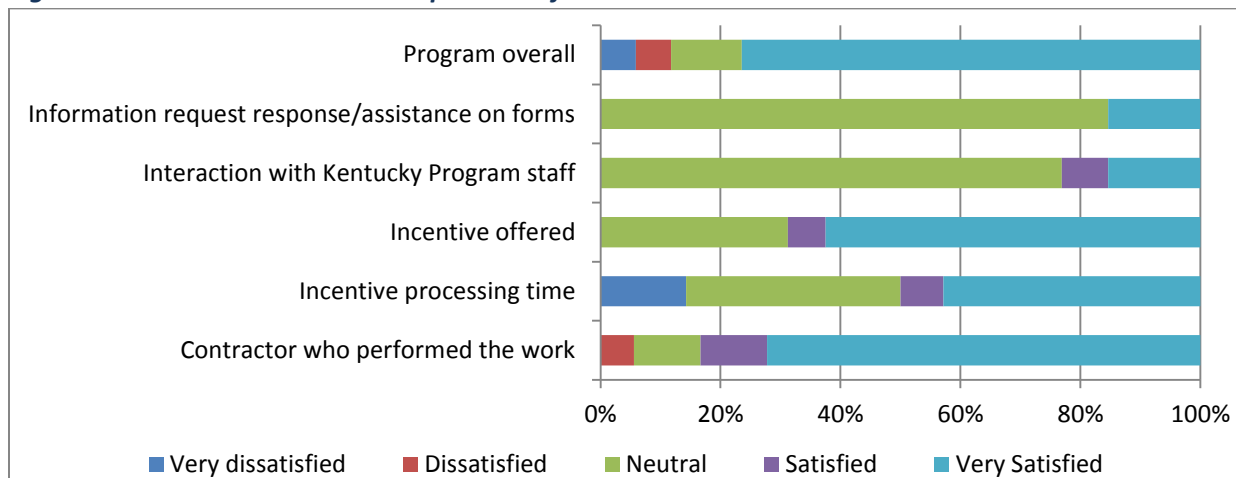


Figure 59 Small Commercial Participant Satisfaction



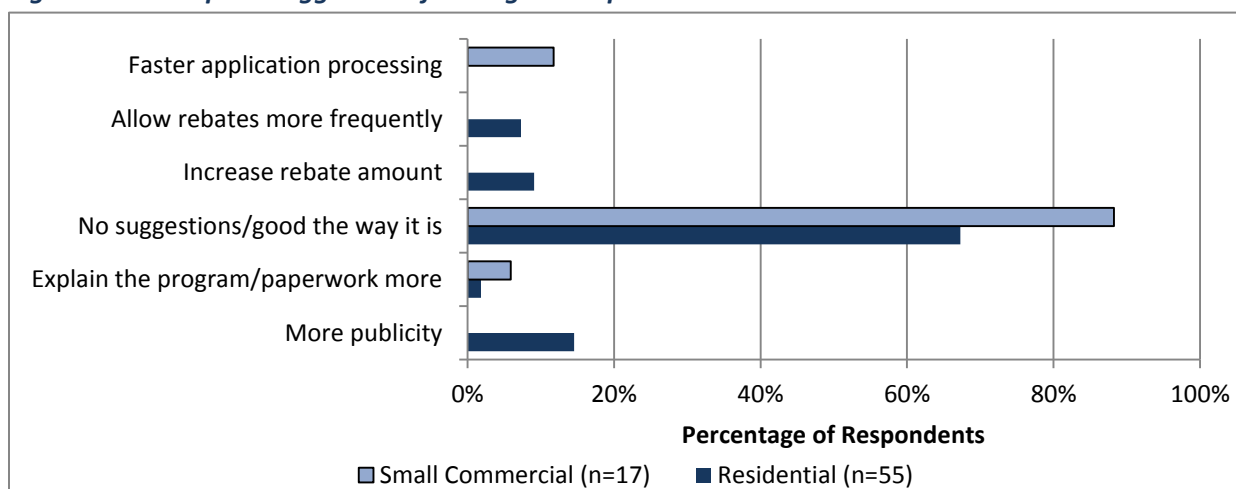
Overall, the participating HVAC Dealers surveyed are satisfied with the program.

Table 149 HVAC Dealer Satisfaction (n=14)

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Incentives offered	-	-	1	1	12
Equipment included the program	-	-	1	3	10
Application requirements	-	1	-	3	10
Incentive processing	1	-	-	1	12
Customer service	-	-	-	2	12
Interaction with Kentucky Power staff	-	-	1	1	12
Program overall	1	-	-	1	12

Most participating customers surveyed noted that the program is good the way it is (67 percent residential and 88 percent small commercial). Participating customers surveyed were asked their opinion on how the program could be improved. Participant suggestions included increasing publicity and increasing the rebate amount.

Figure 60 Participant Suggestions for Program Improvement



It is very important to HVAC Dealers that they are listed on the KPSC website as a participating HVAC Dealer. The HVAC Dealers were asked their opinion on how the program could be improved; they

recommended increasing advertising and offering co-operative advertising with the HVAC Dealers and increasing the rebate levels

9.5 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

9.5.1 Gross Energy and Demand Savings

AEG conducted engineering and billing analyses of the HVAC Diagnostic and Tune-Up Program to assess gross energy and demand savings based on the IPMVP Option A.

Engineering Analysis

AEG conducted the engineering analysis using engineering equations from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* ("IL TRM"). Central air conditioner diagnostic and tune-up energy savings were estimated using the following equation:

$$\Delta kWh = \left(\frac{\left(FLH_{cool} \times Capacity_{cool} \times \left(\frac{1}{SEER_{CAC}} \right) \right)}{1000} \right) \times MF_E$$

Heat pump diagnostic and tune-up energy savings were estimated using the following:

$$\Delta kWh = \left(\frac{\left(FLH_{cool} \times Capacity_{cool} \times \left(\frac{1}{SEER_{HP}} \right) \right)}{1000} \right) \times MF_E + \left(\frac{\left(FLH_{heat} \times Capacity_{heat} \times \left(\frac{1}{HSPF_{HP}} \right) \right)}{1000} \right) \times MF_E$$

The summer and winter demand savings were determined using the following equations:

$$\Delta kW_{Summer} = \left(\frac{\left(Capacity_{cool} \times \left(\frac{1}{EER} \right) \right)}{1000} \right) \times MF_D \times CF$$

$$\Delta kW_{Winter} = \left(\frac{\left(Capacity_{heat} \times \left(\frac{1}{HSPF} \right) \right)}{1000} \right) \times MF_D$$

Where:

SEER	= Seasonal Energy Efficiency Ratio of unit (kBtu/kWh)
EER	= Energy Efficiency Ratio of unit (kBtu/kW)
HSPF	= Heating Seasonal Performance Factor of unit (kBtu/kWh)
FLH _{cool}	= Full load hours of air conditioning
FLH _{heat}	= Full load hours of heating
Capacity _{cool}	= Cooling capacity of heat pump (Btu/h)
Capacity _{heat}	= Heating capacity of heat pump (Btu/h)
MF _E	= Maintenance energy savings factor
MF _D	= Maintenance demand savings factor
CF	= Summer System Peak Coincidence Factor

Engineering analysis variables were adapted to Kentucky Power's service territory. For example, AEG used standard assumptions for full load heating and cooling hours based on information from the US Environmental Protection Agency.⁶³ The table below summarizes the key variables used in the engineering analysis.

Table 150 Engineering Analysis Variables

Variable	Value	Description
FLH _{cool}	1,080	Assumed values for Lexington, KY from EPA Study 2002
FLH _{heat}	2,027	
Capacity _{cool}	Application	Unit size in tons (1 ton = 12,000 Btu/h)
Capacity _{heat}	Application	
SEER	Application	Missing values assumed average of sector and measure type
EER	Application	
HSPF	Application	
MF _E	0.05	IL TRM
MF _D	0.02	
CF	91.5%	IL TRM

The savings per participant was calculated as the average savings for diagnostic and tune-ups performed by sector in 2012 and 2013. The sector totals are the weighted averages, reflecting the proportion of participants receiving heat pump or central air conditioner diagnostic and tune-up services.

The gross savings per participant engineering analysis results are shown in the following tables.

Table 151 Gross Energy (kWh) Savings per Participant, Engineering Analysis

Program Year	Residential Heat Pump	Residential CAC	Residential Total	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial Total
2012	621	188	526	866	314	697
2013	618	-	618	869	-	869
Program	621	188	539	866	314	717

Table 152 Gross Summer Demand (kW) Savings per Participant, Engineering Analysis

Program Year	Residential Heat Pump	Residential CAC	Residential Total	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial Total
2012	0.04	0.05	0.04	0.06	0.09	0.07
2013	0.04	-	0.04	0.06	-	0.06
Program	0.04	0.05	0.04	0.06	0.09	0.07

Table 153 Gross Winter Demand (kW) Savings per Participant, Engineering Analysis

Program Year	Residential Heat Pump	Residential CAC	Residential Total	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial Total
2012	0.09	0.09	0.09	0.13	0.09	0.11
2013	0.09	-	0.09	0.13	-	0.13
Program	0.09	0.09	0.09	0.13	0.09	0.12

⁶³ www.energystar.gov/buildings/sites/default/uploads/files/ASHP_Sav_Calc.xls

The total gross program savings are shown in the following tables.

Table 154 Total Gross Energy (kWh) Savings, Engineering Analysis

Program Year	Residential Heat Pump	Residential CAC	Residential Total	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial Total
2012	485,187	41,174	526,361	72,718	11,618	84,336
2013	96,348	-	96,348	13,912	-	13,912
Total	581,534	41,174	622,708	86,630	11,618	98,248

Table 155 Total Gross Summer Demand (kW) Savings, Engineering Analysis

Program Year	Residential Heat Pump	Residential CAC	Residential Total	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial Total
2012	33.3	10.6	43.9	4.9	3.2	8.1
2013	6.6	-	6.6	0.9	-	0.9
Total	39.9	10.6	50.5	5.8	3.2	9.0

Table 156 Total Gross Winter Demand (kW) Savings, Engineering Analysis

Program Year	Residential Heat Pump	Residential CAC	Residential Total	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial Total
2012	70.2	20.4	90.7	10.6	3.3	13.8
2013	13.9	-	13.9	2.0	-	2.0
Total	84.2	20.4	104.6	12.6	3.3	15.9

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPSCO in reports submitted to the Kentucky PSC. The figures below compare the gross energy savings per participant for the engineering analysis and planned savings assumptions.

Figure 61 Summary Gross Energy Savings per Residential Participant

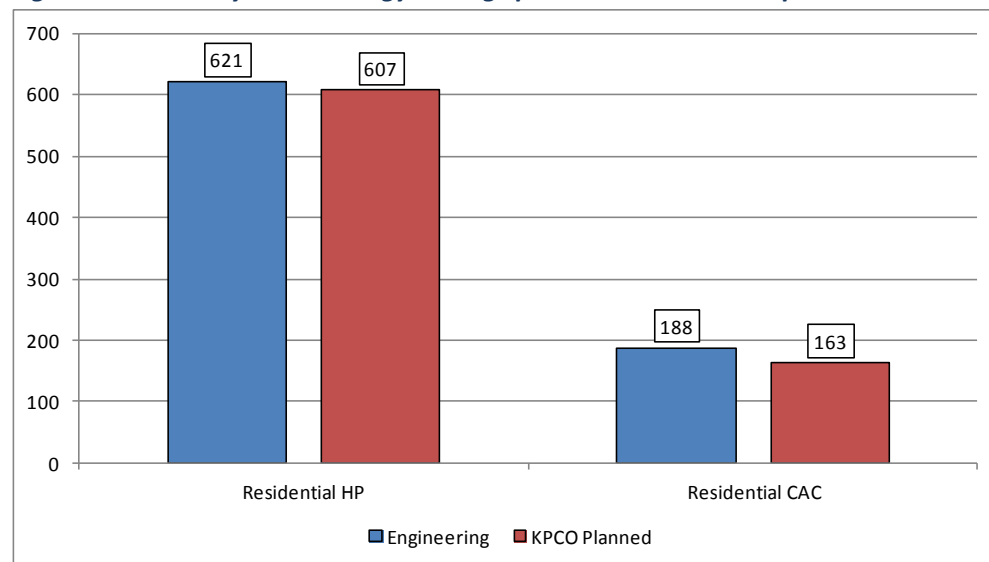
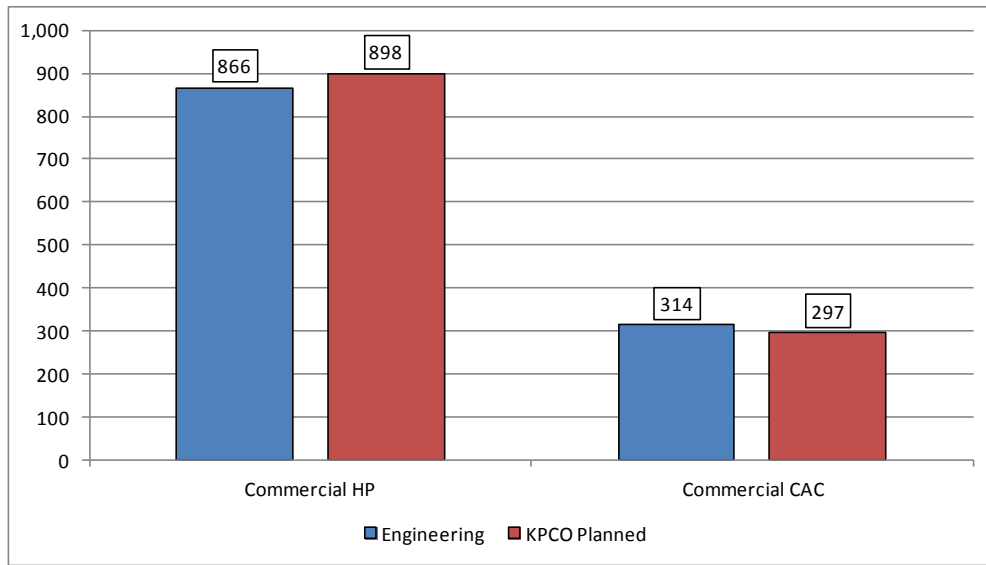


Figure 62 Summary Gross Energy Savings per Commercial Participant



9.5.2 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after taking into account free ridership and spillover. Free ridership refers to those participants who would have received diagnostic and tune-up services without the program influence. Spillover refers to the savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is shown in the following equation:

$$NTG = 1 - Free\ ridership + Spillover$$

AEG conducted surveys of participants to evaluate the effects of free ridership and spillover. The residential results have a margin of error of +/- 10 percent and small commercial results +/- 19 percent.

Free Ridership

Three questions in the participant survey were designed to assess the effects of free ridership.

- **Question 1:** Prior to learning about this program, did you have specific plans to schedule a diagnostic and tune-up of your heat pump or air conditioner?
- **Question 2:** How important was the Kentucky Power incentive in your decision to have this diagnostic and tune-up service performed?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have had this service performed on your equipment?

Each response to the free ridership question was assigned a probability that that respondent was a free rider. The free ridership probability reflects the likelihood that a respondent would have received diagnostic and tune-up services absent the program. The proportion of each response was multiplied by the free ridership probability to calculate the free ridership score.

Table 157 Free Ridership Question 1

Probability	Response	Residential Respondents	Small Commercial Respondents	Residential Score	Small Commercial Score
50%	Yes	86%	67%	43%	33%
0%	No	14%	33%	0%	0%
Question 1 Free Ridership Score				43%	33%

Table 158 Free Ridership Question 2

Probability	Response	Residential Respondents	Small Commercial Respondents	Residential Score	Small Commercial Score
10%	Very important	23%	56%	2%	6%
35%	Somewhat important	5%	22%	2%	8%
80%	Not important	72%	22%	58%	18%
Question 2 Free Ridership Score				62%	31%

Table 159 Free Ridership Question 3

Probability	Response	Residential Respondents	Small Commercial Respondents	Residential Score	Small Commercial Score
80%	Very likely	82%	62%	65%	49%
35%	Somewhat likely	12%	23%	4%	7%
10%	Not likely	6%	15%	1%	3%
Question 3 Free Ridership Score				70%	59%

The free ridership score for each question was weighted based on its contribution to the overall free ridership factor. Weights were based on the assumption that survey responses may not reflect the actual behavior of respondents (i.e. social desirability bias). The weighted average of the scores determines the free ridership factor for the program.

Table 160 Free Ridership Summary

Free Ridership Question	Weight	Residential	Small Commercial
Question 1	50%	43%	33%
Question 2	25%	62%	31%
Question 3	25%	70%	59%
Weighted Average Free Ridership Score		54%	39%

AEG determined that 54 percent of gross residential savings and 39 percent of gross small commercial savings were attributable to free ridership. The majority of program participants, particularly residential participants, would have received diagnostic and tune-up services without the Kentucky Power program.

Spillover

Spillover is calculated as the ratio of net spillover savings to gross savings of the participant sample.

$$Spillover = \frac{Net\ Spillover\ Savings}{(Program\ Savings\ per\ Participant \times Total\ Respondents) + Total\ Spillover\ Savings}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and respondent spillover score

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the participant survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to question one were included in the spillover calculation. The savings from the spillover actions described in question two were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, spillover participants engaged in a variety of additional energy efficient actions, including upgrading to ENERGY STAR® appliances and installing efficient lighting.

Finally, each respondent was asked how much the program influenced their additional actions. The table below shows the spillover score assigned to each of the responses to question three.

Table 161 Spillover Probability

Response	Score
Very likely	10%
Somewhat likely	35%
Not likely	80%
Don't Know	50%

The net spillover savings from each respondent was determined by applying their spillover score to their gross spillover savings to estimate the spillover savings that were directly attributable to the program. The table below illustrates how the spillover score was calculated. AEG determined the overall spillover to be 0.5 percent for the residential program and 16 percent for the small commercial program.

Table 162 Spillover Calculation Summary

Line	Variable	Residential	Small Commercial
A	Total Respondents	65	18
B	Program Savings per Participant	539	717
C	Program Savings of Sample (A x B)	35,014	12,908
D	Gross Spillover Savings of Sample	1,496	16,799
E	Total Gross Sample Savings (C + D)	36,510	29,708
F	Net Spillover Savings	183	4,779
G	Spillover Score (F ÷ E)	0.5%	16%

AEG used the free ridership and spillover estimates to determine the NTG factor for each sector. The NTG factor is 46 percent for the residential program and 77 percent for the small commercial program.

Table 163 Net-to-Gross Factor

Program	Free Ridership	Spillover	Net-to-Gross
Residential	54%	<1%	46%
Small Commercial	39%	16%	77%

AEG determined the net savings attributable to participants by applying the NTG factor to the gross savings. The net savings per participant engineering analysis results are shown in the following tables.

Table 164 Net Energy (kWh) Savings per Participant

Program Year	Residential Heat Pump	Residential CAC	Residential	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial
2012	286	87	242	665	241	536
2013	284	-	284	668	-	668
Program Total	286	87	248	666	241	551

Table 165 Net Summer Demand (kW) Savings per Participant

Program Year	Residential Heat Pump	Residential CAC	Residential	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial
2012	0.02	0.02	0.02	0.04	0.07	0.05
2013	0.02	-	0.02	0.04	0.00	0.04
Program Total	0.02	0.02	0.02	0.04	0.07	0.05

Table 166 Net Winter Demand (kW) Savings per Participant

Program Year	Residential Heat Pump	Residential CAC	Residential	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial
2012	0.04	0.04	0.04	0.10	0.07	0.09
2013	0.04	-	0.04	0.10	0.00	0.10
Program Total	0.04	0.04	0.04	0.10	0.07	0.09

The total net program savings are shown in the following tables.

Table 167 Total Net Energy (kWh) Savings

Program Year	Residential Heat Pump	Residential CAC	Residential	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial
2012	223,355	18,955	242,309	55,873	8,927	64,800
2013	44,353	-	44,353	10,689	-	10,689
Program Total	267,708	18,955	286,663	66,562	8,927	75,489

Table 168 Total Net Summer Demand (kW) Savings

Program Year	Residential Heat Pump	Residential CAC	Residential	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial
2012	15.3	4.9	20.2	3.8	2.5	6.2
2013	3.0	-	3.0	0.7	-	0.7
Program Total	18.4	4.9	23.3	4.4	2.5	6.9

Table 169 Total Net Winter Demand (kW) Savings

Program Year	Residential Heat Pump	Residential CAC	Residential	Small Commercial Heat Pump	Small Commercial CAC	Small Commercial
2012	32.3	9.4	41.7	8.1	2.5	10.6
2013	6.4	-	6.4	1.6	-	1.6
Program Total	38.7	9.4	48.1	9.7	2.5	12.2

9.5.3 Savings Summary

AEG recommends utilizing the 2013 engineering analysis energy and demand savings per participant to determine program savings for program tracking purposes as well as PSC filings. The tables below present the gross and net savings per participant.

Table 170 Gross Savings per Participant

	Gross Energy Savings per Participant (kWh)	Gross Summer Demand Savings per Participant (kW)	Gross Winter Demand Savings per Participant (kW)
Residential Heat Pump	618	0.04	0.09
Small Commercial Heat Pump	869	0.06	0.13

Table 171 Net Savings per Participant

	Gross Energy Savings per Participant (kWh)	Gross Summer Demand Savings per Participant (kW)	Gross Winter Demand Savings per Participant (kW)
Residential Heat Pump	284	0.02	0.04
Small Commercial Heat Pump	668	0.04	0.10

9.5.4 Program Site Inspections and Installation Verification

AEG was able to observe an HVAC technician perform diagnostic and tune-up services for two residential participants in Pikeville. The observations were conducted to ensure that the diagnostic and tune-up services were performed according to proper protocols and program rules. Both were found to satisfy these conditions and no major issues were identified.

9.5.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment or services with those of a baseline. Cost-effectiveness analysis indicates whether the efficient service improves a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Residential and Small Commercial HVAC Diagnostic and Tune-up Programs utilizing four standard cost-effectiveness tests from the *California Standard Practices Manual*.⁶⁴ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

⁶⁴ The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

Impact evaluation results were utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, participation and incentives, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

The 2011 Residential and Small Commercial HVAC Diagnostic and Tune-Up Program evaluation found that the program was not cost-effective. Program cost-effectiveness was negatively affected by the incentives paid to participating HVAC Dealers and the inclusion of central air conditioner tune-ups. The residential and small commercial programs were found to be cost-effective if the participating HVAC Dealer incentive was reduced and central air conditioner tune-ups removed from the program. The program was modified to improve program cost-effectiveness and reduce free ridership. Program modifications included removing central air conditioner tune-ups from the program offering, decreasing customer rebates and requiring customer to submit the rebate application.

The Residential and Small Commercial HVAC Diagnostic and Tune-Up Programs were found to not be cost-effective for the 2012-2013 program years. The measure lifetime utilized in the 2011 evaluation was reduced from 5 years to 3 years, based on documentation from the IL TRM.⁶⁵ Cost-effectiveness results, by sector, are presented in the tables below.

Table 172 Residential Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.16	\$196,229	\$31,334	(\$164,895)
Utility Cost Test	0.28	\$112,341	\$31,334	(\$81,008)
Participant Test	2.24	\$52,782	\$118,284	\$65,502
Total Resource Cost Test	0.24	\$130,726	\$31,334	(\$99,392)

Table 173 Small Commercial Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.16	\$54,055	\$8,508	(\$45,547)
Utility Cost Test	0.27	\$31,479	\$8,508	(\$22,971)
Participant Test	2.55	\$10,452	\$26,657	\$16,205
Total Resource Cost Test	0.22	\$37,850	\$8,508	(\$29,342)

Evaluating the program on a prospective basis, the Residential and Small Commercial HVAC Diagnostic and Tune-Up Program is also not cost-effective. Recommendations regarding this program are addressed in the following section. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The cost-effectiveness results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results, by sector, are presented in the tables below.

⁶⁵ In the 2011 evaluation, there was no concrete source for measure life for diagnostic services, so a measure life of 5 years was used due to program rules allowing participants to participate every five years. This measure life was replaced with an available referenced source.

Table 174 Residential Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.20	\$42,082	\$8,594	(\$33,488)
Utility Cost Test	0.37	\$23,246	\$8,594	(\$14,653)
Participant Test	2.58	\$9,752	\$25,190	\$15,438
Total Resource Cost Test	0.32	\$26,643	\$8,594	(\$18,049)

Table 175 Small Commercial Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.14	\$14,347	\$2,042	(\$12,305)
Utility Cost Test	0.21	\$9,869	\$2,042	(\$7,827)
Participant Test	3.14	\$1,628	\$5,114	\$3,486
Total Resource Cost Test	0.19	\$10,861	\$2,042	(\$8,819)

9.6 Recommendations

AEG recommends the Residential and Small Commercial HVAC Diagnostic and Tune-Up Program be discontinued going forward. A combination of factors contributes to this recommendation:

1. Extremely low 2012-2013 program year cost-effectiveness. The program modifications implemented based upon the 2011 evaluation to improve program cost-effectiveness and reduce free ridership were not found to be cost-effective based on the 2012-2013 program evaluation. Despite efforts to improve program cost-effectiveness, the program was not cost-effective from 2010 through 2013.
2. Extremely low prospective cost-effectiveness. Multiple scenarios were evaluated where measure lifetime, measure savings, and program costs were adjusted to determine if the program could become cost-effective. All scenarios yielded cost-effectiveness ratios below 1.0.
3. Declining program net-to-gross ratio.
4. Program participants surveyed, particularly residential participants, indicated they would have received diagnostic and tune-up services without the Kentucky Power incentive.

AEG recommends the project budget from the Residential and Small Commercial Diagnostic and Tune-Up Program be directed to more cost-effective and successful programs.

10. Residential High Efficiency Heat Pump Program

The Residential High Efficiency Heat Pump Program encourages residential customers to reduce their electric consumption by replacing older, less efficient electric heating systems with high efficiency heat pumps. Residential customers with site-built homes that upgrade a central electric resistance heating system or electric heat pump system with a new efficient heat pump system are eligible for a \$400 incentive. The heat pump system must be installed by a participating KPCO HVAC Dealer.

Table 176 Minimum Heat Pump System Requirements

System Upgraded	SEER	HSPF
Central Electric Resistance Heating System	13	7.7
Electric Heat Pump System	14	8.2

Participating HVAC Dealers, state-licensed contractors, are eligible for a \$50 incentive for each installation, upon approval of the rebate application. The Kentucky PSC approved budget and participation goals.

Table 177 Program Budgets, 2012-2014

	2012	2013	2014
Equipment/Vendor	\$37,500	\$29,750	\$29,750
Incentives	\$300,000	\$238,000	\$238,000
Promotion	\$0	\$2,000	\$7,500
Evaluation	\$0	\$0	\$20,680
Total Budget	\$337,500	\$269,750	\$295,930

Table 178 Participation Goals, 2012-2014

System Upgraded	2012	2013	2014
Resistance Heat	275	165	165
Heat Pump	475	430	430

10.1 Evaluation Data Collection

The Residential High Efficiency Heat Pump Program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation?
- What marketing/promotional efforts resonate with customers? HVAC Dealers?
- Are HVAC Dealers sufficiently knowledgeable about the Kentucky Power Program?
- Are customers/HVAC Dealers satisfied with the program?
- Are rebate applications processed, approved and paid on a timely basis?
- Is the rebate processing system effective in managing the application and rebate payment process?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would customers/HVAC Dealers recommend the program?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

HVAC Dealer Interviews

AEG administered telephone interviews to a sample of participating HVAC Dealers. The interviews provided an assessment of the availability of qualifying HVAC equipment, identified potential areas for improvement and provided insight on customer attitudes toward energy efficiency and application processes. The interview guide can be found in Appendix B.

The Kentucky Power HVAC Dealers can participate in the following programs:

- Residential and Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential Home High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Program

One-hundred and two (102) HVAC Dealers participated in at least one Kentucky Power DSM Program between January 1, 2012 and December 31, 2013. AEG interviewed 16 participating HVAC Dealers.

Participating Customer Surveys

AEG administered a 10 to 12 minute telephone survey to a random sample of program participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. Kentucky Power provided data for 1,003 program participants that received a rebate between January 1, 2012 and September 30, 2013.⁶⁶ AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were randomly selected based on unique identifiers determined by Microsoft Excel's random number generator. Sixty-four (64) surveys were completed. The survey guide can be found in Appendix C.

AEG also conducted site visits and inspections of four participants to verify installation, ensure equipment eligibility, and verify application data matches installed equipment.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power's initial program filing savings were reviewed to ensure consistence with the impact evaluation results.

⁶⁶ Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Options A and C of the International Performance Measurement and Verification Protocols (“IPMVP”).⁶⁷ AEG performed separate engineering and customer billing analyses to provide a comparison between the two savings methodologies.

Table 179 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

Engineering algorithms from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”), using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts.⁶⁸ The billing analysis identified changes in participants’ energy usage attributable to the program, comparing energy usage for one year prior to measure installation to one year post measure installation.

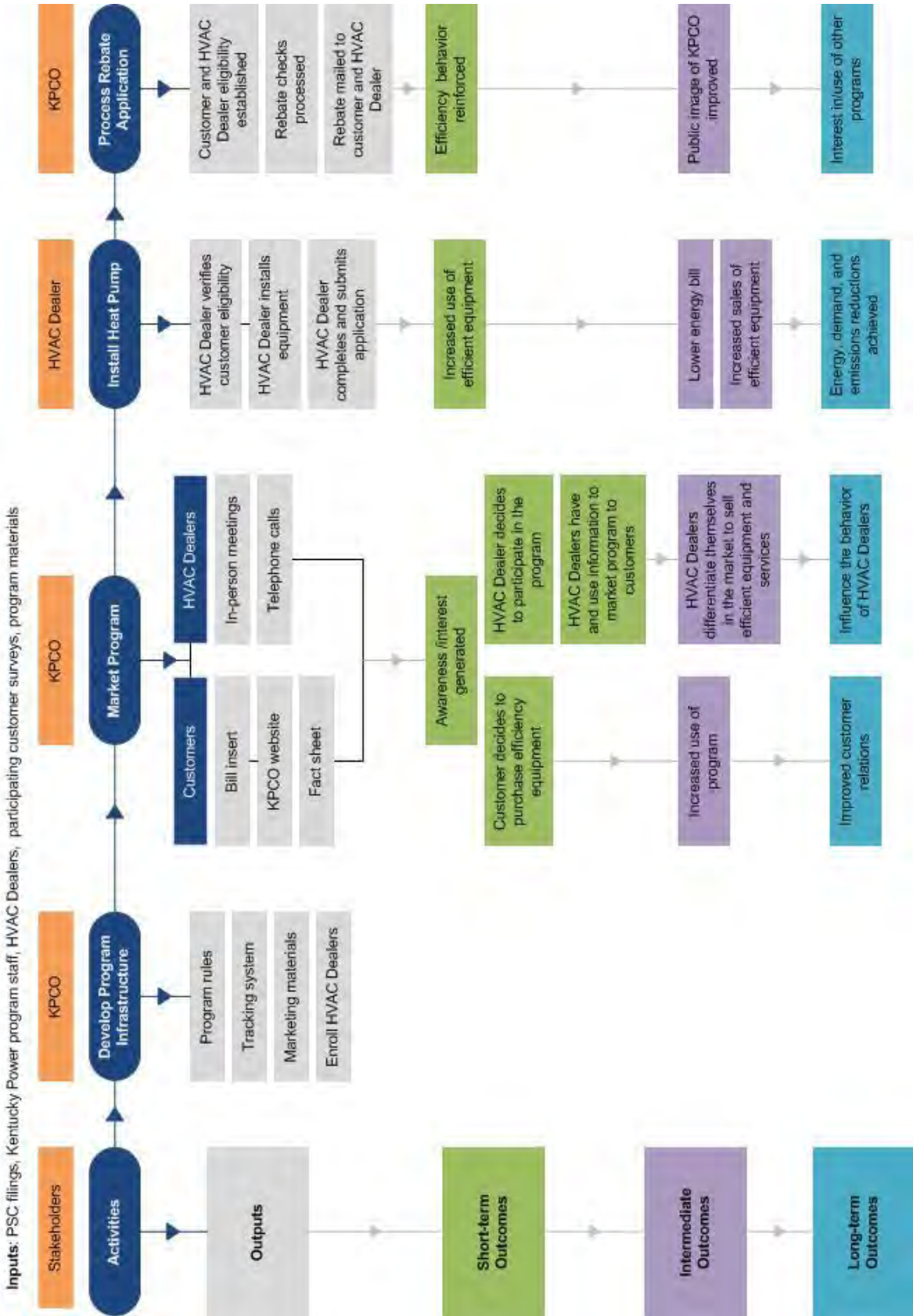
10.2 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

⁶⁷ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

⁶⁸ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 63 Program Logic Model



10.2.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program's intended outcomes. Program activities include:

Develop Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power program staff, with input from AEP, designed the program, including the rebate applications and data tracking system.

Kentucky Power program staff maintains relationships with participating HVAC Dealers through periodic telephone calls and in-person visits. Kentucky Power educates HVAC Dealers on the program, including customer eligibility, qualifying equipment and rebate forms. A list of participating HVAC Dealers is maintained on the KPCO DSM Program website. The KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Market Program

Marketing activities are targeted towards HVAC Dealers via telephone calls and in-person meetings. Participating HVAC Dealers are encouraged to promote the program to eligible customers. The program was marketed to customers through bill inserts, the KPCO website and program fact sheets.

Install Heat Pump

The participating HVAC Dealer verbally verifies that the customer has been a KPCO electric customer for at least 12 months. The customer purchases a qualifying heat pump system and has it installed by the HVAC Dealer. The HVAC Dealer completes and faxes the rebate application to Kentucky Power.

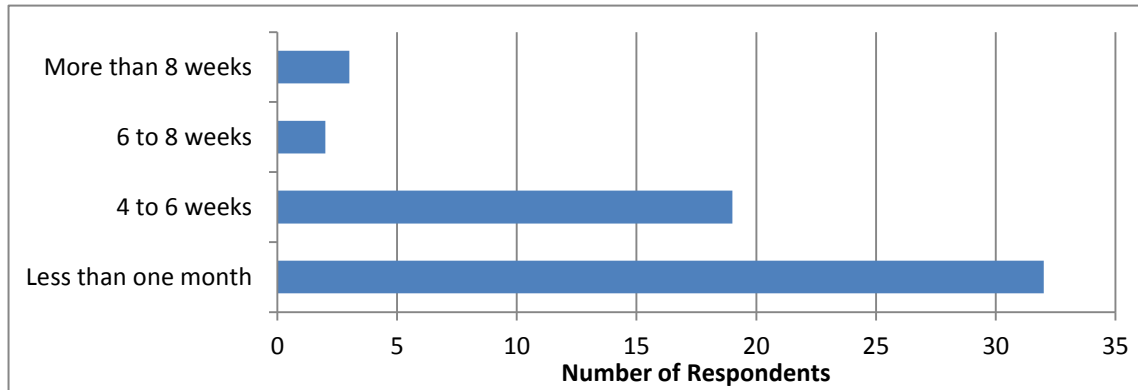
Process Rebate Application

Customer rebates are processed by Kentucky Power program staff. Staff verifies customer and HVAC Dealer eligibility and checks for application completeness. Heat pump system eligibility is verified with the Air Conditioning, Heating and Refrigeration Institute ("AHRI") database.⁶⁹ The application data is entered into the program tracking system and a payment request submitted for review. Once approved, the customer and HVAC Dealer data is submitted to AEP's Accounting Group where rebate checks are issued and mailed.

Kentucky Power program staff aim to process customer rebate applications within 4 to 6 weeks. According to participating customers surveyed, applications are typically processed within one month.

⁶⁹ Primarily review system eligibility for new HVAC Dealers.

Figure 64 Length of Time between Installing Equipment and Receiving Rebate Check (n=56)



Kentucky Power maintains the right to conduct inspections. Kentucky Power reviewed applications to ensure they were completed and met the minimum program efficiency requirements.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

10.2.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in efficient HVAC equipment may increase among customers and local, licensed HVAC contractors. Customers may become more knowledgeable about energy efficient equipment. The HVAC Dealers may have information to market the program to customers. The program may lead to an increased commitment to energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPSC efficiency programs, increased sales of energy efficient HVAC equipment and reduced household energy consumption.

Long-term Outcomes

The long-term outcomes may include influencing the behavior of HVAC contractors, and an expanded market for efficient HVAC equipment. Additional outcomes include reduced utility emissions, fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

10.2.3 External Factors

There are a variety of factors outside the control of KPSC that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Economic conditions
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Competition among targeted HVAC contractors
- Cost, performance and availability of efficient technologies

10.2.4 Market Barriers

HVAC Dealers play an important role in this program by encouraging customers to make energy efficient upgrades. HVAC contractors are often the primary source of information and the first point of contact for customers in need of HVAC equipment. Therefore, it is critical that contractors have accurate and up-to-date information about the benefits of energy efficient equipment and are able to effectively communicate these benefits to customers.

Key barriers to achieving greater market penetration and quality installations include:

- Lowest bid quotes typically drive the HVAC equipment sales industry. Customers are often price-sensitive, especially during a weak economy.
- Lack of consumer awareness. The majority of equipment sales take place in the replacement market where consumers need to make quick decisions.

Kentucky Power's program tries to address these barriers through a combination of education, training, and financial incentives to customers and HVAC Dealers. This approach has helped to build customer support for high efficiency equipment in the market while educating and providing tools to contractors to market and install high efficiency systems.

10.3 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, HVAC Dealer participation, program tracking and program satisfaction.

10.3.1 Program Marketing

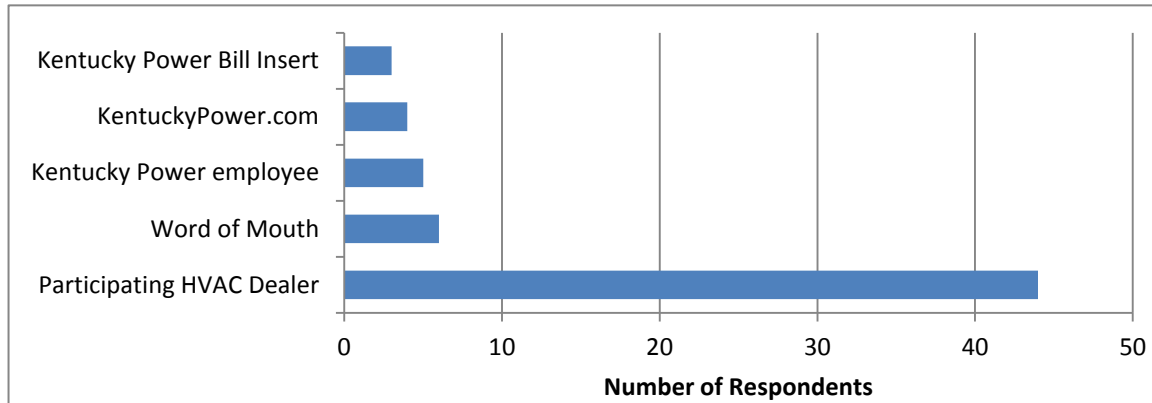
Kentucky Power marketed the Residential High Efficiency Heat Pump Program through the following:

- **HVAC Dealer Outreach.** Kentucky Power staff promoted the programs directly to HVAC Dealers via telephone calls or in-person meetings with prospective and current dealers. The HVAC Dealers are mailed letters with program information and new rebate forms on an annual basis.
- **Bill Inserts.** Kentucky Power distributed bill inserts to customers in January and March 2012.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save. Customers can search for participating HVAC Dealers by geographic location on the KPCO DSM Program website.

The program was designed such that the Kentucky Power program staff markets the program to HVAC Dealers. In turn, participating HVAC Dealers were encouraged to promote the program to eligible

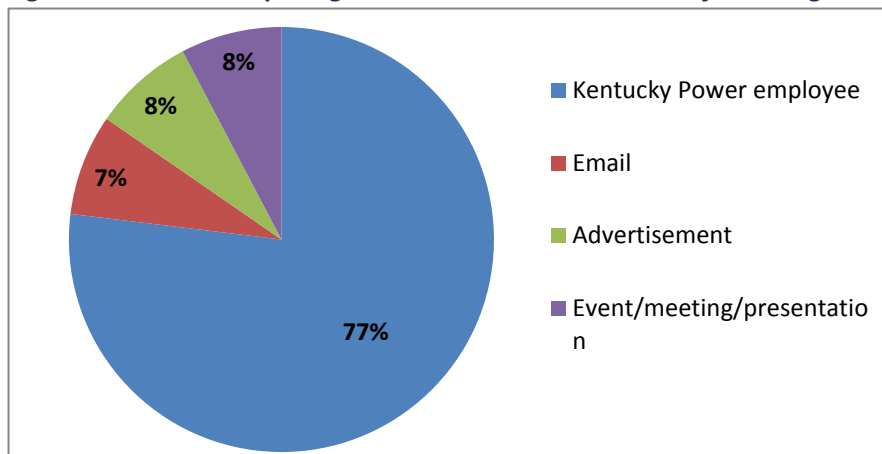
customers. According to participating customers surveyed, participants most often learned of the program from the HVAC Dealer.

Figure 65 How Customers First Learned of the Program (n=64)



Participating HVAC Dealers most often learned about the program from a Kentucky Power employee.

Figure 66 How Participating HVAC Dealers First Learned of the Program (n=13)



The participating HVAC Dealers surveyed noted that their primary source of information on energy efficient HVAC equipment is HVAC distributors (57 percent) followed by online sources (43 percent) and AHRI/Manual J (21 percent).

Seventy-two (72) percent of participating customers surveyed noted that the information provided by the HVAC Dealer was very important in the decision to install the high efficiency heat pump. Forty-seven (47) percent of participating customers surveyed cited that their primary reason for participating in the Residential High Efficiency Heat Pump Program was that they wanted to save money on their bills. The participating HVAC Dealer survey confirmed that the main customer motivation for participating in the program was electric bill savings, followed by energy savings.

Figure 67 Customer Motivation for Participation (n=64)

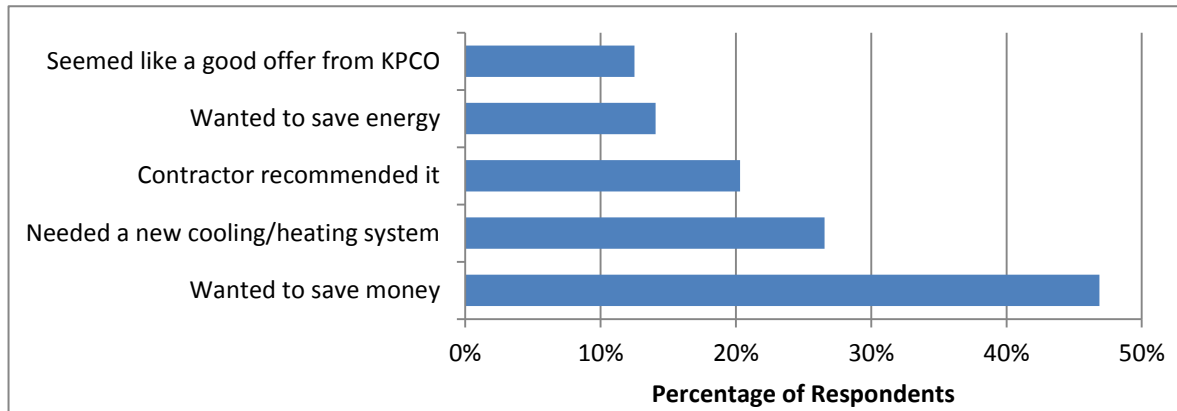
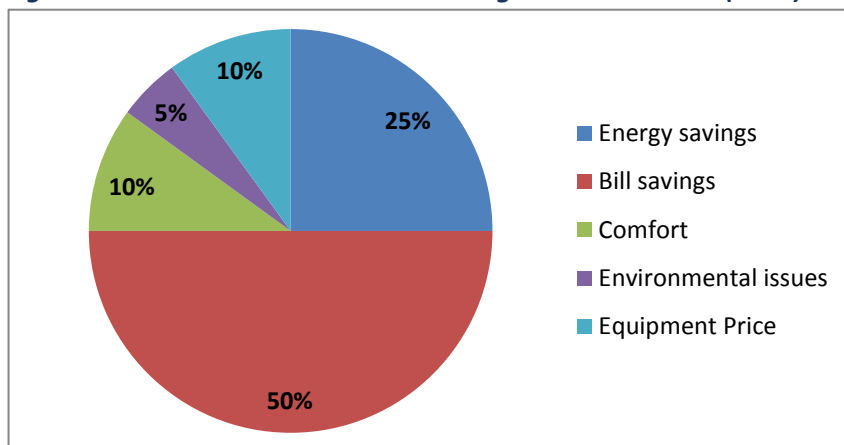


Figure 68 Customer Motivation According to HVAC Dealers (n=16)



The majority of participating HVAC Dealers surveyed stated that their primary reason for participating in the Kentucky Power programs was that the programs are good for business. Participating HVAC Dealers prefer to be contacted by Kentucky Power staff via the following channels:

- Emails (45 percent)
- Telephone Calls (40 percent)
- Mail (10 percent)
- In-Person Visits (5 percent)

10.3.2 Program Performance

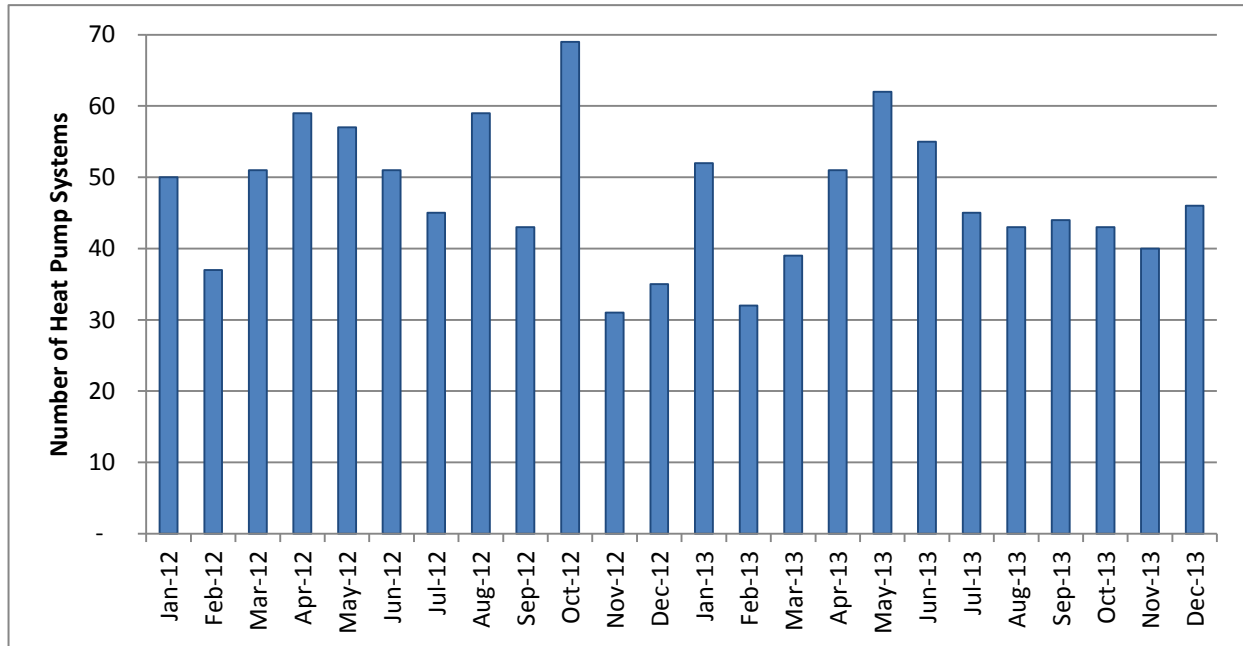
Between January 1, 2012 and December 31, 2013, 1,139 residential heat pump systems were rebated to 1,089 customers through the Residential High Efficiency Heat Pump Program. Kentucky Power rebated 587 heat pumps in 2012, achieving 78 percent of the goal, and 552 heat pumps in 2013, achieving 93 percent of the goal. Thirty-seven (37) rebate applications were denied. Approximately 30 percent of customers replaced a central electric resistance heating system and 70 percent replaced an electric heat pump system.

Table 180 Program Participation by System Replaced

	2012	2013	Total
Replace Resistance Heat	170	174	344
Replace Heat Pump	417	378	795

Heat pumps provide cooling and heating to customers. Therefore, customers will purchase and install heat pumps year round, but primarily during the spring and fall seasons in preparation for the summer and winter seasons. As shown in the figure below, heat pump rebate applications were slightly higher in late spring and early fall.

Figure 69 Heat Pump Systems Rebated by Month



The Residential High Efficiency Heat Pump Program requires that customers with an existing central electric resistance heating system install a heat pump that meets a minimum SEER ≥ 13 and HSPF ≥ 7.7 and that customers with an existing electric heat pump system install a heat pump that meets a minimum SEER ≥ 14 and HSPF ≥ 8.2 . Ninety-eight (98) percent of the central electric resistance heating systems replaced and 94 percent of the heat pump systems replaced met the minimum program requirements. Six (6) rebate applications did not contain the SEER and/or HSPF ratings, so system efficiency could not be verified. The remaining 50 heat pump systems did not meet the required system efficiency levels.⁷⁰

Of the 338 central electric resistance heat systems replaced that met the program requirements, approximately half of the heat pump installations exceeded the minimum program SEER and/or HSPF requirements.

Table 181 Replace Resistance Heat - Heat Pump Efficiency

	7.7 < 8.2 HSPF	8.2 < 8.5 HSPF	8.5 < 9.0 HSPF	≥ 9.0 HSPF
13 < 14 SEER	49.4%	5.7%	1.8%	0.3%
14 < 15 SEER	3.6%	10.4%	3.3%	0.9%
15 < 16 SEER	2.7%	2.7%	7.7%	6.3%
≥ 16 SEER	0.0%	0.3%	0.3%	4.8%

⁷⁰ An initial review of the program log found that 16 participant entries were missing the SEER and/or HSPF rating and 61 participant entries did not meet the minimum program requirements. Kentucky Power reviewed the corresponding rebate applications and corrected 21 participant entries.

Of the 745 heat pump systems replaced that met the program requirements, approximately 75 percent exceeded the minimum program SEER and/or HSPF requirements and 25 percent met the minimum program requirements.

Table 182 Replace Heat Pump - Heat Pump Efficiency

	8.2 < 8.5 HSPF	8.5 < 9.0 HSPF	≥ 9.0 HSPF
14 < 15 SEER	23.3%	12.3%	2.8%
15 < 16 SEER	3.1%	24.8%	25.1%
≥ 16 SEER	0.1%	0.9%	7.5%

The table below presents the budget and budgeted cost per participant as compared to the actual expenditures and actual cost per participant. The actual 2012 and 2013 expenditures were slightly less than budgeted and the cost per participant was very close to the budgeted amount.

Table 183 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
Equipment/Vendor	\$37,500	\$29,400	\$29,750	\$27,350
Incentives	\$300,000	\$235,200	\$238,000	\$219,260
Promotion	\$0	\$0	\$2,000	\$178
Evaluation	\$0	\$0	\$0	\$3,981
Total Cost (\$)	\$337,500	\$264,600	\$269,750	\$250,769
Participation	750	587	595	552
Cost (\$) per Participant	\$450	\$451	\$453	\$454

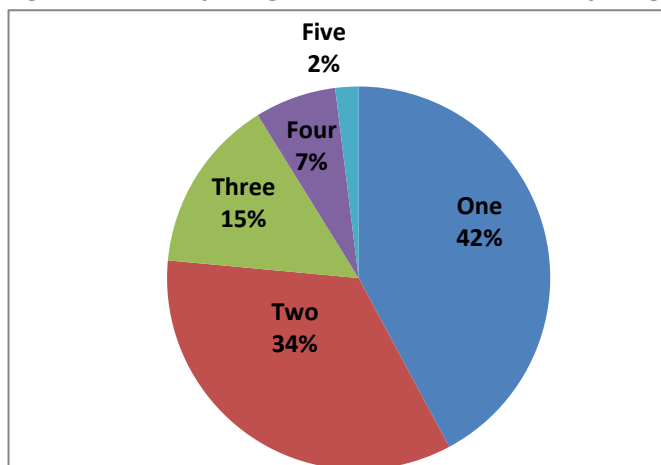
10.3.3 HVAC Dealers

The HVAC Dealers can participate in the following programs:

- Residential and Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential Home High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Program

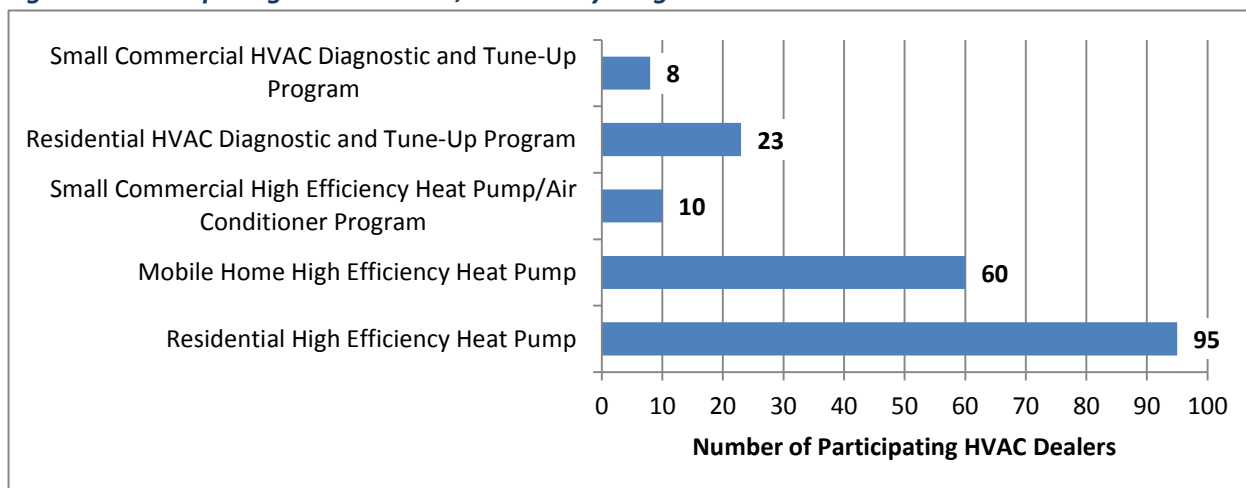
One-hundred and two (102) HVAC Dealers participated in at least one Kentucky Power DSM Program between January 1, 2012 and December 31, 2013. Eighty-seven (87) of the HVAC Dealers are currently listed on the DSM Program website and 15 need to be added as HVAC Dealers. Approximately 75 percent of the participating HVAC Dealers received a rebate for participating in one or two DSM programs and 2 percent received a rebate for participating in all of the DSM Programs.

Figure 70 Participating HVAC Dealers, Number of Programs



A significant majority of participating HVAC Dealers received a rebate through the Residential High Efficiency Heat Pump Program while the Small Commercial HVAC Diagnostic and Tune-Up Program had the fewest number of participating HVAC Dealers receive a rebate.

Figure 71 Participating HVAC Dealers, Number by Program



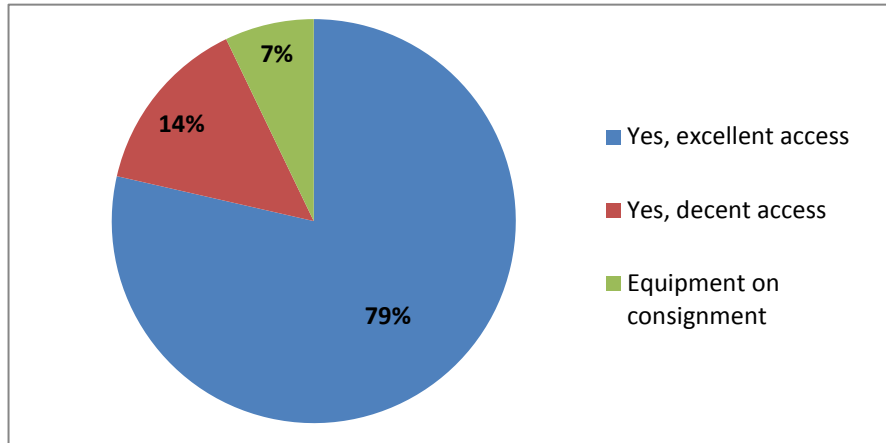
Ninety-five (95) HVAC Dealers participated in the Residential High Efficiency Heat Pump Program in 2012 or 2013. Nine (9) HVAC Dealers performed 50 percent of the Residential High Efficiency Heat Pump Program heat pump installations.

Table 184 Residential High Efficiency Heat Pump Program Most Active HVAC Dealers

HVAC Dealer	Systems Rebated	% of Total
Appalachian Refrigeration	153	13%
General Heating & A/C	137	12%
American Heating & Cooling	61	5%
Big Sandy Heating & Cooling	61	5%
Aire Serv	52	5%
Elliott Supply & Glass	49	4%
Ashland Furnace	44	4%
Kentucky Wide Heating & Cooling	33	3%
Bobby Howard & Sons	30	3%

The HVAC Dealers interviewed noted that they have good access to energy efficient HVAC equipment.

Figure 72 Participating HVAC Dealer Access to Equipment (n=14)



10.3.4 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.⁷¹ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

Rebate applications are processed by Kentucky Power program staff. Staff reviews and validates the applications for completeness, including customer and HVAC Dealer eligibility. Applications are reviewed based on the date received and the DSM Program. Each customer application is assigned a unique identifier. Hard-copy rebate applications are labeled with the assigned unique identifier and payment request number, then grouped and archived in a binder.

Kentucky Power’s program tracking system is comprised of three databases:

KCPO Customer Records (MACCS) is an internal intranet-based database. A note is entered in the customer record with the DSM Program and the date the rebate application was received. KPCO Customer Operations Center can access the note if a customer calls about their rebate status. KPCO program staff utilizes the data to monitor program performance.

Program Log is an Excel- or Access-based database that contains data from the rebate application. Each DSM Program has a program log, which is available on a shared drive to specific KPCO staff.

Kentucky Power collects the following data on the rebate application:

- Customer Information: name, account number, address (service and mailing), social security number, home square footage, replaced unit type, electric furnace size (kW).
- Existing Resistant Heat Equipment: system type (central split/central packaged/window units), manufacturer, total cooling capacity, model number, electric furnace manufacturer.

⁷¹ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. See Case 2012-00367.

- Existing Heat Pump Equipment: manufacturer, tons, SEER, HSPF.
- New Equipment: system type (split/package), total cooling capacity, supplemental heat, manufacturer, outdoor unit model number, indoor unit model number, SEER, HSPF.
- Dealer Information: name, master HVAC license number, Tax ID number, mailing address.
- Dates: customer signature date, HVAC Dealer signature date, received date.

Electronic Payment Request (PeopleSoft). Each rebate application has two payment requests, one for the customer and one for the HVAC Dealer. The payment request includes the accounting code, unique identification number, customer/Dealer name and address, dealer Federal Tax ID and rebate amount.

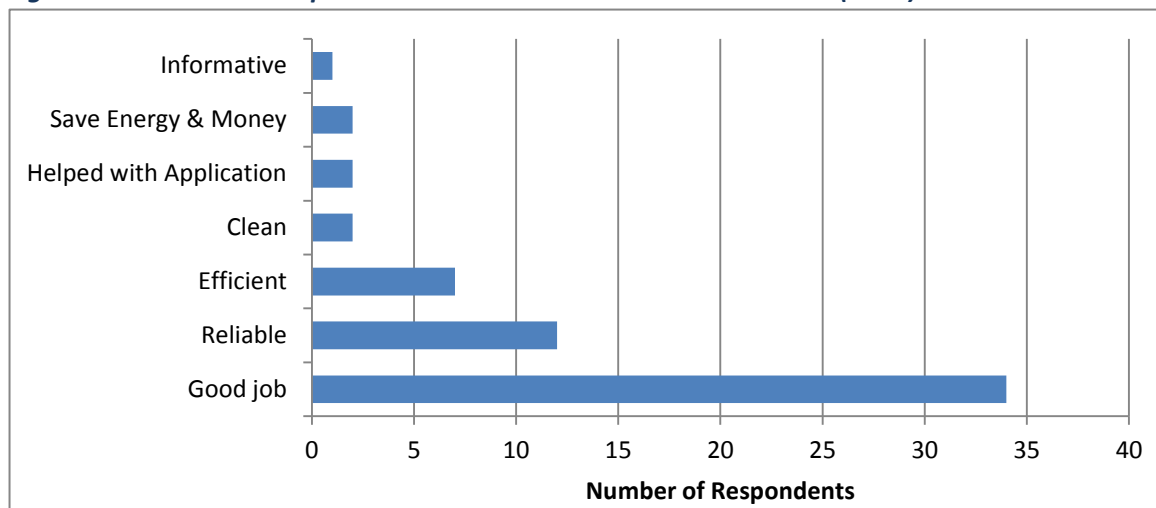
Prior to approval, the Electronic Payment Request is reviewed by the Kentucky Power program coordinator. The coordinator ensures the account number, program account, rebate amount and unique identifier were correct. Once approved, the Electronic Payment Request is submitted electronically to the AEP Accounting Group in Canton, Ohio and rebate checks are issued and mailed.

The program log does not contain all data collected from the rebate application. Of the data tracked, there are a number of data entries missing information. For example, 6 rebate applications did not contain the SEER and/or HSPF ratings and one rebate application was missing the HVAC Dealer, both of which are required to receive a rebate.⁷²

10.3.5 Program Satisfaction

Ninety-five (95) percent of participants surveyed would recommend their HVAC Dealer to someone else. Two participants surveyed would not recommend their HVAC Dealer to others. One participant felt that the contractor was slow and the other had to install ductwork, which they did not want.

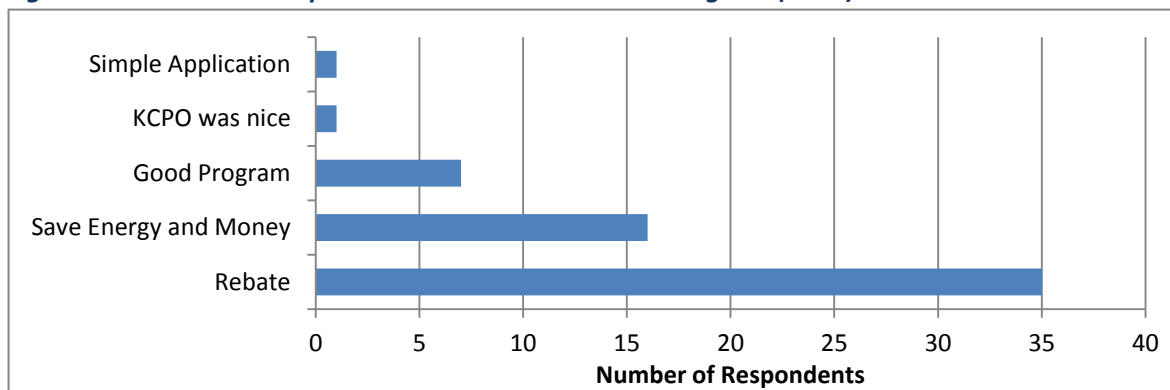
Figure 73 Reasons Participants Would Recommend the HVAC Dealer (n=64)



Ninety-seven (97) percent of participants surveyed would recommend the program to others. Some reasons for recommending the program are the equipment incentive and that efficient equipment saving money and energy.

⁷² An initial review of the program log found that 16 participant entries were missing the SEER and/or HSPF rating and 61 participant entries did not meet the minimum program requirements. Kentucky Power reviewed the corresponding rebate applications and corrected 21 participant entries.

Figure 74 Reasons Participant Would Recommend the Program (n=64)

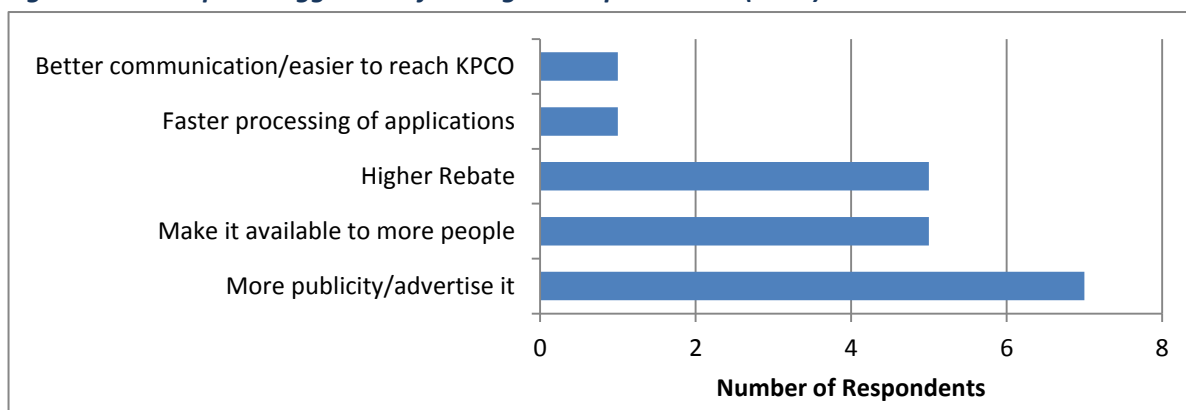


Overall, customers are very satisfied with the Residential High Efficiency Heat Pump Program. Participating customers were asked their opinion on how the program could be improved. Eighty (80) percent of customers did not have any suggestions. Participant suggestions included increasing publicity and increasing the rebate amount.

Table 185 Participant Satisfaction (n=64)

Program Component	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Contractor who performed the work		1	2	1	60
Incentive processing time	1	2	1	2	53
Incentive offered		1		3	53
Interaction with Kentucky Program staff			1	2	5
Response times/assistance on forms			2	1	1
Program overall	1		2	4	57

Figure 75 Participant Suggestions for Program Improvement (n=64)



HVAC Dealer participation was a key element to the program. Participating HVAC Dealers promoted the program to eligible customers and installed the efficient heat pumps. Seventy-two (72) percent of participants surveyed noted that the HVAC Dealer provided information that was a crucial factor in deciding to purchase and install the efficient equipment. It is very important to HVAC Dealers that they are listed on the KPCO website as a participating HVAC Dealer.

Overall, the participating HVAC Dealers surveyed are satisfied with the program. The HVAC Dealers were asked their opinion on how the program could be improved, they recommended:

- Increasing advertising and offering co-operative advertising with the HVAC Dealers
- Increasing the rebate levels
- Offering incentives for central air conditioner equipment
- Working with HVAC distributors

Table 186 HVAC Dealer Satisfaction (n=14)

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Incentives offered	-	-	1	1	12
Equipment included the program	-	-	1	3	10
Application requirements	-	1	-	3	10
Incentive processing	1	-	-	1	12
Customer service	-	-	-	2	12
Interaction with Kentucky Power staff	-	-	1	1	12
Program overall	1	-	-	1	12

10.4 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

10.4.1 Gross Energy and Demand Savings

AEG conducted engineering and billing analyses of the Residential High Efficiency Heat Pump Program to assess gross energy and demand savings based on the IPMVP Options A and C.

Engineering Analysis

AEG conducted the engineering analysis using the *Illinois Statewide Technical Reference Manual for Energy Efficiency* ("IL TRM") as the source of engineering equations. Energy and demand savings were estimated using the following equations:

$$\Delta kWh = \left(\frac{\left(FLH_{cool} \times Capacity_{cool} \times \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}} \right) \right)}{1000} \right) + \left(\frac{\left(FLH_{heat} \times Capacity_{heat} \times \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}} \right) \right)}{1000} \right)$$

$$\Delta kWh_{Summer} = \left(\frac{\left(Capacity_{cool} \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee}} \right) \right)}{1000} \right) \times CF$$

$$\Delta kWh_{Winter} = \left(\frac{\left(Capacity_{heat} \times \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}} \right) \right)}{1000} \right)$$

Where:

- FLH_{cool} = Full load hours of air conditioning
- FLH_{heat} = Full load hours of heating
- Capacity_{cool} = Cooling capacity of heat pump (Btu/h)
- Capacity_{heat} = Heating capacity of heat pump (Btu/h)
- SEER_{base} = Seasonal Energy Efficiency Ratio of baseline system (kBtu/kWh)

- SEER_{ee} = Seasonal Energy Efficiency Ratio of efficient heat pump (kBtu/kWh)
- EER_{base} = Energy Efficiency Ratio of baseline system (kBtu/kW)
- EER_{ee} = Energy Efficiency Ratio of efficient heat pump (kBtu/kW)
- HSPF_{base} = Heating Seasonal Performance Factor of baseline system (kBtu/kWh)
- HSPF_{ee} = Heating Seasonal Performance Factor of efficient heat pump (kBtu/kWh)
- CF = Summer System Peak Coincidence Factor

According to program rules, customers with an existing central electric resistance heating system must install a heat pump that meets SEER ≥ 13 and HSPF ≥ 7.7 and customers with an existing electric heat pump system must install a heat pump that meets SEER ≥ 14 and HSPF ≥ 8.2 . The main variable driving savings is the difference between the efficiency rating of the rebated system to a baseline, based on the existing heating system replaced. The baseline for customers that replaced a central electric resistance heating system was SEER 13 and HSPF 3.41. The baseline for customers that replaced an existing heat pump system was SEER 13 and HSPF 7.7.

Engineering analysis variables were adapted to Kentucky Power's service territory. For example, AEG used standard assumptions for full load heating and cooling hours based on information from the US Environmental Protection Agency.⁷³ The table below summarizes the key variables.

Table 187 Engineering Analysis Variables

Variable	Value	Description
FLH _{cool}	1,080	Assumed value for Lexington, KY from ENERGY STAR savings calculator
FLH _{heat}	2,027	
Capacity _{cool}	Application	Unit size in tons (1 ton = 12,000 Btu/h)
Capacity _{heat}	Application	
SEER _{base}	13 heat pump	Federal Minimum Baseline
HSPF _{base}	3.41 resistance heat 7.7 heat pump	Dependent on heat type being replaced
SEER _{ee}	Application	SEER of rebated unit
HSPF _{ee}	Application	HSPF of rebated unit
CF	91.5%	IL TRM

Participants that did not meet the program requirements were assigned zero energy and demand savings. The savings per participant is the weighted average savings for measures installed in program years 2012 and 2013, reflecting the proportion of participants replacing resistance heat and heat pumps. The results of the engineering analysis are shown in the following tables.

Table 188 Gross Energy (kWh) Savings per Participant, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	8,660	1,278	3,303
2013	9,156	1,498	3,912
Program Total	8,918	1,382	3,598

Table 189 Gross Summer Demand (kW) Savings per Participant, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	-0.26	0.22	0.09
2013	-0.28	0.26	0.09
Program Total	-0.27	0.24	0.09

⁷³ www.energystar.gov/buildings/sites/default/uploads/files/ASH_P_Sav_Calc.xls

Table 190 Gross Winter Demand (kW) Savings per Participant, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	5.54	0.47	1.86
2013	5.88	0.54	2.23
Program Total	5.71	0.50	2.04

The following tables show the total gross program savings.

Table 191 Total Gross Energy (kWh) Savings, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	1,472,266	533,123	2,005,389
2013	1,593,106	566,267	2,159,373
Program Total	3,067,687	1,098,461	4,166,148

Table 192 Total Gross Summer Demand (kW) Savings, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	-44	92	48
2013	-48	98	50
Program Total	-92	189	97

Table 193 Total Gross Winter Demand (kW) Savings, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	941	195	1,136
2013	1,023	206	1,228
Program Total	1,965	400	2,366

Participants who replaced resistance heat generated more savings on a per-participant basis than participants who replaced an existing heat pump. However, participants replacing a heat pump accounted for the majority of total gross savings due to higher program participation.

Billing Analysis

The billing analysis estimated the change in billed energy usage of a participant sample for one year before and after heat pump installation of the measure using a paired sample t-test. The t-test was used to determine whether there was a significant difference in average energy usage before and after installation. The t-test compared the average annual energy usage of the participant sample before and after the heat pump(s) was installed.

The billing analysis utilized program tracking data and Kentucky Power customer billing data. Kentucky Power provided approximately four years of billing data for all customers via AEP's corporate file transfer protocol, including monthly interval billed energy usage for all customers. Due to the quantity of data points, Microsoft Access was used to develop samples, which were exported to Microsoft Excel to perform the billing analysis.

The following steps were taken to develop the participant sample:

1. Participants were matched to the Kentucky Power billing data using their nine digit customer account number. Account numbers with extra digits were shortened to meet the nine digit validation criteria. Participants with matched account numbers were verified by name and

service address. If an account number was unable to be matched; the participants was removed from the sample.

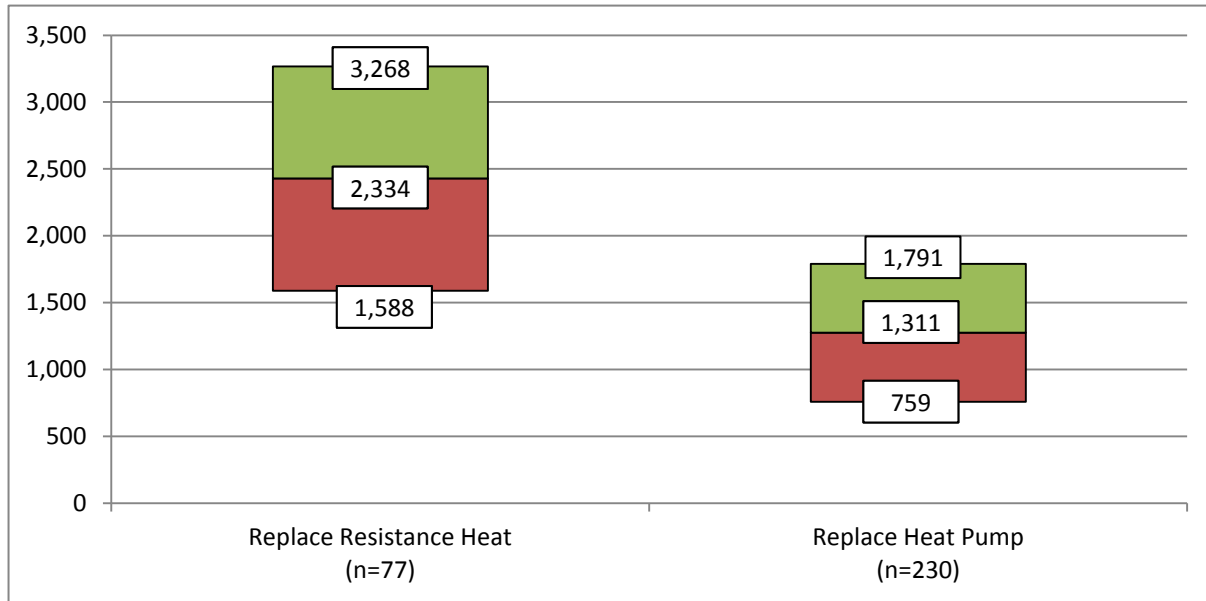
2. Sample accounts that participated in multiple Kentucky Power programs were identified and removed from the sample.⁷⁴ The potential interactive effects of other programs could skew the results of the analysis; removing these participants isolates the impacts attributable to the program.
3. The installation date associated with each participant was used to identify the billing intervals before and after the heat pump installation. If a participant did not have an installation date in the Program Log, an average date was applied based on the participant sample. The interval during which the measure was installed, or “black out” interval, was not included in the analysis.
4. Only sample participants with exactly 12 monthly intervals before and after the installation interval were included in the sample. The 12 monthly intervals ensured approximately a full year of billing data before and after the installation. Changes in the customer population (i.e. new accounts) resulted in some participants with intervals that did not meet the 12 interval criteria and were removed from the participant sample.
5. An outlier screen was applied to the sample participants to remove outliers and other anomalous cases. Participants with an average pre-program annual energy usage greater than two standard deviations from the mean before the installation were removed from the analysis to limit potential bias.

The actual energy usage in the 12 intervals before and after the heat pump installation was converted to average daily energy usage by dividing the sum of billed energy usage by the number of usage days. The average daily usage was multiplied by a factor of 365.25 days per year to reflect the average annual energy usage for each customer account. Energy savings were estimated as the difference in average annual energy usage before and after the implementation of the program, assessed for statistical significance using a 95% confidence interval.

Figure 76 shows the upper-, lower-, and mid-range per participant savings estimates at a 95 percent confidence interval. The upper- and lower-range estimates were calculated by adding and subtracting the confidence interval, respectively. Similar to the engineering analysis, AEG determined the savings per participant by existing heating system. Note that the analysis shows a wider range of savings estimate; this is expected as the sample size decreases due to data cleaning and outlier screening.

⁷⁴ Note that account numbers were not available for the Residential Efficient Products program and could not be removed from the sample. However, the interactive effects from this program are considered minimal.

Figure 76 Billing Analysis Gross Energy Savings (kWh) per Participant at 95% Confidence



For the purposes of this analysis, AEG used the mid-range estimates to determine the savings attributable to the program. Although the billing analysis did not directly estimate the demand savings, demand savings were extrapolated based on the ratio of kW to kWh savings from the engineering analysis.

Table 194 Gross Energy and Demand Savings per Participant, Billing Analysis

Group	Gross Energy Savings per Participant (kWh)	Summer Gross Demand Savings per Participant (kW)	Winter Gross Demand Savings per Participant (kW)
Replace Resistance Heat	2,334	-0.07	1.50
Replace Heat Pump	1,311	0.23	0.48
Program Overall	1,564	0.04	0.89

The savings per participant were multiplied by the total number of participants in each group to determine the total gross energy and demand savings.

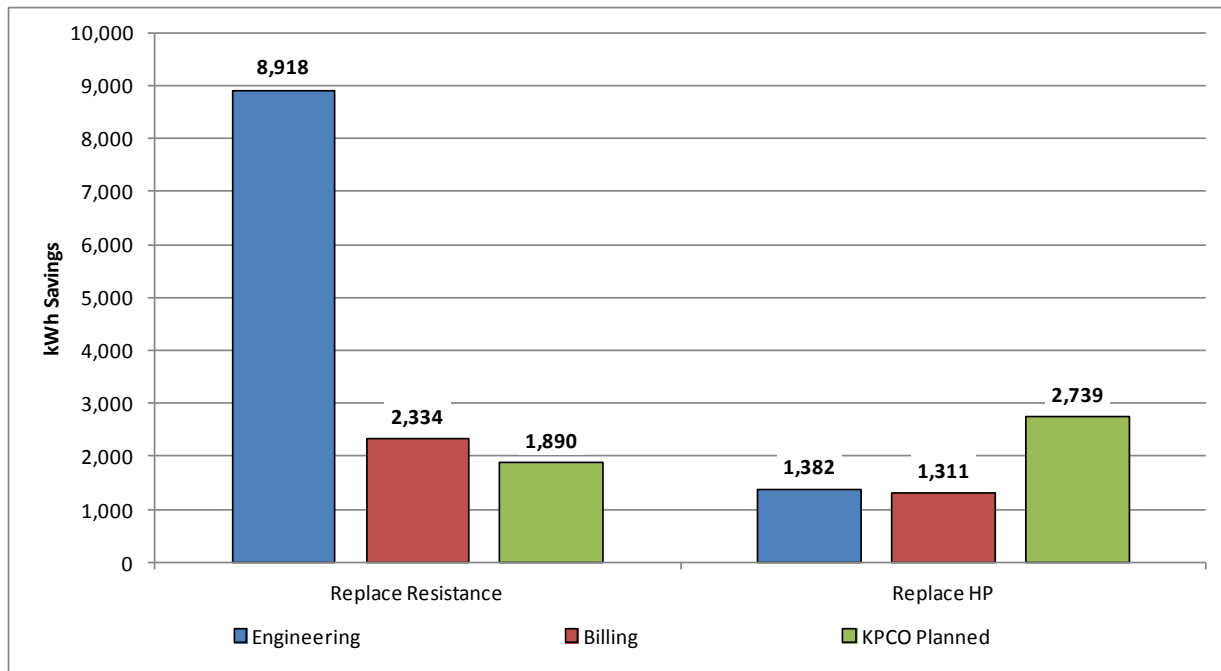
Table 195 Total Gross Energy and Demand Savings, Billing Analysis

Group	Gross Energy Savings (kWh)	Summer Gross Demand Savings (kW)	Winter Gross Demand Savings (kW)
Replace Resistance Heat	803,003	-24	514
Replace Heat Pump	1,042,217	179	380
Program Total	1,845,220	155	894

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. Figure 61 compares the gross energy savings per participant for the engineering analysis and the billing analysis to the planned savings assumptions.

Figure 77 Summary Gross Energy Savings per Participant



The large differential between the engineering and billing analysis savings estimates for participants who replaced central resistance heat is expected. The large difference is due to the assumed baseline for central electric resistance heat in the engineering analysis. The billing analysis is a more accurate determinant of savings due to the comparison of energy usage pre- and post-measure installation.

10.4.2 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after accounting for free ridership and spillover. Free ridership refers to those participants who would have installed an efficient heat pump without the program influence. Spillover refers to additional savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - Free\ ridership + Spillover$$

AEG conducted a survey of program participants to evaluate the effects of free ridership and spillover. The program-level survey results are based on a random sample of participants with a margin of error of +/- 10 percent. AEG also analyzed the free ridership and spillover by the type of heating replaced as an additional task after the sampling was complete, causing the sample by type of heating replaced to fall below the threshold for a margin of error +/- 10 percent. As a result, the margin of error by the type of heating is greater than the program-level sample. Results for participants who replaced resistance heat have a margin of error of +/- 17 percent and +/- 13 percent for participants who replaced heat pumps.

Free Ridership

Three questions in the participant survey were designed to assess the effects of free ridership.

- **Question 1:** Prior to learning about this program, did you have specific plans to install an efficient heat pump?

- **Question 2:** How important was the Kentucky Power incentive in your decision to buy the efficient heat pump?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the exact same equipment?

Each response to the free ridership question was assigned a probability that that respondent was a free rider. The free ridership probability reflects the likelihood that a respondent would have installed the efficient heat pump absent the program. The proportion of each response was multiplied by the free ridership probability to calculate the free ridership score.

Table 196 Free Ridership Question 1

Probability		Yes 50%	No 0%
Count	Replace Resistance Heat	19	4
	Replace Heat Pump	29	12
	Program	48	16
Percent	Replace Resistance Heat	83%	17%
	Replace Heat Pump	71%	29%
	Program	75%	25%
Question 1 Free Ridership Score	Replace Resistance Heat	41%	
	Replace Heat Pump	35%	
	Program	38%	

Table 197 Free Ridership Question 2

Probability		Very Important 10%	Somewhat Important 35%	Not Important 80%	Unsure 50%
Count	Replace Resistance Heat	14	4	5	0
	Replace Heat Pump	19	13	8	1
	Program	33	17	13	1
Percent	Replace Resistance Heat	61%	17%	22%	0%
	Replace Heat Pump	46%	32%	20%	2%
	Program	52%	27%	20%	2%
Question 2 Free Ridership Score	Replace Resistance Heat	30%			
	Replace Heat Pump	33%			
	Program	31%			

Table 198 Free Ridership Question 3

Probability		Very likely 80%	Somewhat likely 35%	Not likely 10%
Count	Replace Resistance Heat	19	1	3
	Replace Heat Pump	31	7	3
	Program	50	8	6
Percent	Replace Resistance Heat	83%	4%	13%
	Replace Heat Pump	76%	17%	7%
	Program	78%	13%	9%
Question 3 Free Ridership Score	Replace Resistance Heat	69%		
	Replace Heat Pump	67%		
	Program	68%		

The free ridership score for each question was weighted based on its contribution to the overall free ridership factor. Weights were based on the assumption that survey responses may not reflect the

actual behavior of respondents (i.e. social desirability bias). The weighted average of the scores determines the free ridership factor for the program.

Table 199 Free Ridership Question Summary

Question	Weight	Replace Resistance Heat	Replace Heat Pump	Program Score
Question 1	50%	41%	35%	38%
Question 2	25%	30%	33%	31%
Question 3	25%	69%	67%	68%
Free Ridership		45%	43%	44%

Based on the responses to the survey questions, free ridership was estimated at 43 percent for participants replacing heat pumps and 45 percent for participants replacing resistance heat. The overall program free ridership score was 44 percent. A free ridership score in this range is expected due to the program design. The program incentivizes heat pumps that meet the federal minimum efficiency standard, which increases free ridership.

Spillover

Spillover is the ratio of net spillover savings to gross savings of the participant sample.

$$Spillover = \frac{Net\ Spillover\ Savings}{(Program\ Savings\ per\ Participant \times Total\ Respondents) + Total\ Spillover\ Savings}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and spillover score for each respondent

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the participant survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to question one were included in the spillover calculation. The savings from the spillover actions described in question two were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, spillover participants engaged in a variety of additional energy efficient actions, including upgrading to ENERGY STAR® appliances and installing efficient lighting.

Finally, each respondent was asked how much the program influenced their additional actions by answering question three. The table below shows the spillover score assigned to each of the responses.

Table 200 Spillover Score

Response	Score
Very likely	10%
Somewhat likely	35%
Not likely	80%
Don't Know/Refused	50%

The net spillover savings from each respondent was determined by applying their spillover score to their gross spillover savings to estimate the spillover savings that were directly attributable to the program. The table below illustrates how the program spillover score was calculated. AEG determined the overall spillover score for replacing resistance heat is 0 percent and replacing heat pumps is 2 percent.

Table 201 Spillover Calculation Summary

Line	Variable	Replace Resistance Heat	Replace Heat Pump	Program
A	Total Respondents	23	41	64
B	Program Savings per Participant	8,918	1,382	3,598
C	Program Savings of Sample (A x B)	205,107	56,650	230,283
D	Gross Spillover Savings of Sample	243	3,550	3,793
E	Total Gross Sample Savings (C + D)	205,350	60,222	234,076
F	Net Spillover Savings	24	1,024	1,048
G	Spillover Score (F ÷ E)	0.01%	2%	0%

AEG used the free ridership and spillover estimates to determine the NTG factor for each group. The NTG factor for the replacing resistance heat is 55 percent compared to 59 percent for replacing heat pumps. The overall NTG factor for the program is 57 percent. AEG has determined that there is no statistical significance in the difference between the free ridership values for different replaced units.

Table 202 Net-to-Gross Factor

Group	Free Ridership	Spillover	Net-to-Gross
Replace Resistance Heat	45%	0%	55%
Replace Heat Pump	43%	2%	59%
Program Total	44%	1%	57%

The NTG factor was applied to the unit savings to determine the net energy and demand savings. The engineering analysis and billing analysis savings are shown in the tables below.

Table 203 Net Energy (kWh) Savings per Participant, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	4,741	755	1,881
2013	5,012	885	2,228
Program Total	4,882	816	2,049

Table 204 Net Summer Demand (kW) Savings per Participant, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	-0.14	0.13	0.05
2013	-0.15	0.15	0.05
Program Total	-0.15	0.14	0.05

Table 205 Net Winter Demand (kW) Savings per Participant, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	3.03	0.28	1.06
2013	3.22	0.32	1.27
Program Total	3.13	0.30	1.16

The total net energy and demand program savings are shown in the tables below.

Table 206 Total Net Energy (kWh) Savings, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	805,920	314,963	1,120,883
2013	872,068	334,545	1,206,612
Program Total	1,679,255	648,959	2,328,214

Table 207 Total Net Summer Demand (kW) Savings, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	-24	54	30
2013	-26	58	31
Program Total	-50	112	62

Table 208 Total Net Winter Demand (kW) Savings, Engineering Analysis

Program Year	Replace Resistance Heat	Replace Heat Pump	Program Total
2012	515	115	630
2013	560	121	681
Program Total	1,076	236	1,312

The table below shows net savings from the billing analysis.

Table 209 Net Energy and Demand Savings per Participant, Billing Analysis

Group	Net Energy Savings per Participant (kWh)	Net Summer Demand Savings per Participant (kW)	Net Winter Demand Savings per Participant (kW)
Replace Resistance Heat	1,278	-0.04	0.82
Replace Heat Pump	775	0.13	0.28

Table 210 Total Net Energy and Demand Savings, Billing Analysis

Group	Net Energy Savings (kWh)	Net Summer Demand Savings (kW)	Net Winter Demand Savings (kW)
Replace Resistance Heat	439,565	-13	282
Replace Heat Pump	615,731	106	224
Program Total	1,055,295	93	506

10.4.3 Savings per Participant Summary

AEG conducted engineering and billing analyses of the Residential High Efficiency Heat Pump Program to assess gross energy and demand savings based on IPMVP Options A and C. AEG recommends utilizing the 2012-2013 billing analysis energy and demand savings per participant to determine program savings for program tracking purposes as well as PSC filings. The billing analysis is a more accurate determinant of savings due to the comparison of energy usage pre- and post-measure installation versus the engineering analysis which utilizes an assumed baseline.

The tables below present the gross and nets savings per participant.

Table 211 Recommended Gross Energy and Demand Savings per Participant

Group	Gross Energy Savings per Participant (kWh)	Summer Gross Demand Savings per Participant (kW)	Winter Gross Demand Savings per Participant (kW)
Replace Resistance Heat	2,334	-0.07	1.50
Replace Heat Pump	1,311	0.23	0.48
Program Overall	1,564	0.04	0.89

Table 212 Recommended Net Energy and Demand Savings per Participant

Group	Net Energy Savings per Participant (kWh)	Net Summer Demand Savings per Participant (kW)	Net Winter Demand Savings per Participant (kW)
Replace Resistance Heat	1,278	-0.04	0.82
Replace Heat Pump	775	0.13	0.28
Program Overall	891	0.02	0.50

10.4.4 Program Site Inspections and Installation Verification

AEG performed site inspections and installation verification on five completed projects to verify application information. At two locations, the AEG inspector was only able to inspect the outdoor unit.⁷⁵ Proper installation verification was confirmed at all locations. However, the equipment installed at one location did not match the equipment listed on the application. The table below shows the number of completed site inspections in each area.

Table 213 Residential Heat Pump Site Inspections

Area	Count	Percentage
Ashland	2	40%
Pikeville	2	40%
Hazard	1	20%
Total	5	100%

10.4.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the efficient technology improves a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Residential High Efficiency Heat Pump Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.⁷⁶ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?

⁷⁵ A tenant would not allow access to the premises and one homeowner was not responsive upon appointment confirmation.

⁷⁶ The California Standard Practices Manual details cost-effectiveness guidelines and procedures for standardized cost-effectiveness evaluations.

- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

Impact evaluation results were utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, participation and incentives, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

Measure-level cost-effectiveness was calculated utilizing the Total Resource Cost Test. Measure-level cost-effectiveness does not program administrative costs (administration, marketing, etc.) because they are spent at the program-level and cannot be allocated to specific measure. Measure-level cost-effectiveness results are presented in the table below.

Table 214 Measure-Level Cost Effectiveness Results

Measure	TRC
Replace Resistance Heat	1.18
Replace Heat Pump	1.52

The Residential High Efficiency Heat Pump Program was found to be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

Table 215 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.39	\$1,905,197	\$748,936	(\$1,156,261)
Utility Cost Test	1.49	\$501,244	\$748,936	\$247,692
Participant Test	3.50	\$527,292	\$1,846,195	\$1,318,903
Total Resource Cost Test	1.28	\$586,295	\$748,936	\$162,641

Evaluating the program on a prospective basis, the Residential High Efficiency Heat Pump program is also cost-effective and should be continued going forward. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results are presented in the table below.

Table 216 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.41	\$942,187	\$386,512	(\$555,675)
Utility Cost Test	1.48	\$261,204	\$386,512	\$125,308
Participant Test	3.60	\$247,790	\$891,055	\$643,266
Total Resource Cost Test	1.29	\$298,922	\$386,512	\$87,590

Geothermal and ductless mini-split systems were analyzed for inclusion in the Residential High Efficiency Heat Pump Program. The measures were found to be not cost-effective at this time, primarily due to high customer capital costs. Therefore, AEG does not recommend that these measures be incorporated into the program at this time.

10.5 Program Recommendations

AEG has several recommendations on how to improve the program. These include:

Consider Hiring an Implementation Contractor

AEG recommends that Kentucky Power consider hiring an implementation contractor to implement Kentucky Power's residential and small commercial HVAC programs, including the Residential and Small Commercial HVAC Diagnostic and Tune-Up Program, Small Commercial Heat Pump/Air Conditioner Incentive Program, Residential High Efficiency Heat Pump Program, Mobile Home High Efficiency Heat Pump, and Mobile Home New Construction.

Kentucky Power has a small staff to run and oversee Kentucky Power's numerous energy efficiency programs. Some of the KPCO programs have implementation contractors that perform the day-to-day operations, but the residential and small commercial HVAC programs are run completely by KPCO staff. Therefore, KPCO staff is responsible for marketing activities, engaging HVAC Dealers, processing rebate applications, program tracking and performing QA/QC inspections. Due to limited resources, Kentucky Power conducted limited inspections to ensure applications were completed and met the program requirements.

The residential and small commercial HVAC programs share many similar components, including marketing activities and data tracking systems as well as participating HVAC Dealers. Utilizing one implementation contractor to implement the HVAC programs will allow the programs to continue capitalizing on their similarities, increase the efficiency of program processes and minimize the QA/QC concerns associated with HVAC Dealer and customer eligibility.

The implementation contractor will have, at a minimum, the following responsibilities:

- Develop marketing activities
- Design and maintain a data tracking system
- Process rebate applications, including verification of HVAC Dealer and equipment eligibility
- Engage and monitor participating HVAC Dealers
- Develop QA/QC procedures and conduct random inspections of completed work

Consider Program Modifications

AEG recommends two program modifications

- (1) Combine with the Mobile Home High Efficiency Heat Pump Program. The programs would continue to be tracked and reported separately but would appear to be one program from the customer and participating HVAC Dealer perspective.
- (2) Consider offering enhanced rebates for higher efficiency equipment. Of the customer applications that met program requirements, approximately half of the central electric resistance heat systems replaced and 75 percent of the heat pump systems replaced exceeded the minimum program

SEER and/or HSPF requirements. Therefore, AEG recommends that Kentucky Power consider offering incentives for 2 Tiers for each type of replaced equipment, as shown in the table below.

Table 217 Recommended Minimum Requirements and Incentives

System	Tier	SEER	HSPF	Incentive
Replace Resistance Heating	Tier 1	13	7.7	\$300
	Tier 2	14	8.2	\$500
Replace Heat Pump	Tier 1	14	8.2	\$300
	Tier 2	15	8.5	\$500

Program Application and Data Tracking

AEG recommends that Kentucky Power consider merging the rebate application with the Mobile Home High Efficiency Heat Pump Program rebate application and remove data that is not tracked or utilized. One rebate application for the Mobile Home High Efficiency Heat Pump and Residential High Efficiency Heat Pump Programs will simplify the application process for HVAC Dealers and program tracking for Kentucky Power program staff.

AEG recommends that Kentucky Power improve QA/QC to ensure that the Program Log contains all information collected on the rebate application. A review of the Program Log revealed that 16 participant entries were missing the SEER and/or HSPF rating and 61 heat pump systems did not meet the required system efficiency levels. Kentucky Power reviewed the corresponding rebate applications and corrected 21 participant entries. Therefore, 6 rebate applications did not contain the SEER and/or HSPF ratings and 50 heat pump systems did not meet the required system efficiency levels.

Engage Participating HVAC Dealers

AEG recommends that Kentucky Power engage actively participating HVAC dealers. HVAC Dealer participation is crucial to the program as they promote the program directly to customers. Kentucky Power should increase HVAC Dealer outreach, telephoning or emailing participating HVAC Dealers at least once a quarter to provide program updates and answer any questions and/or concerns. Kentucky Power should also consider exploring cooperative marketing with participating HVAC Dealers, leveraging HVAC Dealer marketing may provide an opportunity to shift additional marketing activities to the HVAC Dealers.

AEG recommends that the participating HVAC Dealer list available on the Kentucky Power DSM Program website is updated at least once a quarter. Fifteen (15) participating HVAC Dealers that participated in a Kentucky Power program in 2012 or 2013 are not currently listed as participating HVAC Dealers on the Kentucky Power DSM Program website.

11. Mobile Home High Efficiency Heat Pump Program

The Mobile Home High Efficiency Heat Pump Program encourages residential customers to reduce their electric consumption by replacing older, less efficient electric heating systems with high efficiency heat pumps. Residential customers that live in a mobile home that replace their central electric resistance heating system with a new efficient heat pump system are eligible for a \$400 rebate. The new heat pump must have a minimum rating of 13 SEER and 7.7 HSPF and must be installed by a participating HVAC Dealer.

Participating HVAC Dealers are eligible for a \$50 incentive for each system installed, upon approval of the rebate application. All Kentucky Power participating HVAC Dealers are state-licensed contractors. Incentives are limited to residential customers that have received electric service from Kentucky Power for the past 12 months and live in a mobile home with a central electric resistance heating system.

The Kentucky PSC approved budget and participation goals.

Table 218 Detailed Program Budgets and Participation Goals, 2012-2014

	2012	2013	2014
Equipment/Vendor	\$10,500	\$11,000	\$11,000
Customer Incentive	\$84,000	\$88,000	\$88,000
Promotion	\$0	\$1,500	\$2,000
Evaluation	\$0	\$0	\$13,098
Total Budget	\$94,500	\$100,500	\$114,098
Participation Goal	210	220	220

11.1 Evaluation Data Collection

The Mobile Home High Efficiency Heat Pump Program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation goals?
- What marketing/promotional efforts resonate with customers? HVAC Dealers?
- Are HVAC Dealers sufficiently knowledgeable about the Kentucky Power Program?
- Are customers/HVAC Dealers satisfied with the program?
- Are rebate applications processed, approved and paid on a timely basis?
- Is the rebate processing system effective in managing the application and rebate payment process?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would customers/HVAC Dealers recommend the program?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

HVAC Dealer Interviews

AEG administered telephone interviews to a sample of participating HVAC Dealers. The interviews provided an assessment of the availability of qualifying HVAC equipment, identified potential areas for improvement and provided insight on customer attitudes toward energy efficiency and application processes. The interview guide can be found in Appendix B.

The Kentucky Power HVAC Dealers can participate in the following programs:

- Residential and Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential Home High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Program

One-hundred and two (102) HVAC Dealers participated in at least one Kentucky Power DSM Programs between January 1, 2012 and December 31, 2013. AEG interviewed 16 participating HVAC Dealers.

Participating Customer Surveys

AEG administered a 10 to 12 minute telephone survey to a random sample of program participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. Kentucky Power provided data for 379 program participants that received a rebate between January 1, 2012 and September 30, 2013.⁷⁷ AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were randomly selected based on unique identifiers determined by Microsoft Excel's random number generator. Fifty-eight (58) surveys were completed. The participant survey guide can be found in Appendix C.

AEG also conducted site visits and inspections of three participants to verify installation, ensure equipment eligibility, and verify application data matches installed equipment.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power's initial program filing savings were reviewed to ensure consistence with the impact evaluation results.

⁷⁷ Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Options A and C of the International Performance Measurement and Verification Protocols (“IPMVP”).⁷⁸ AEG performed separate engineering and customer billing analyses to provide a comparison between the two savings methodologies.

Table 219 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

Engineering algorithms from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”), using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts.⁷⁹ The billing analysis identified changes in participants’ energy usage attributable to the program, comparing energy usage for one year prior to measure installation to one year post measure installation.

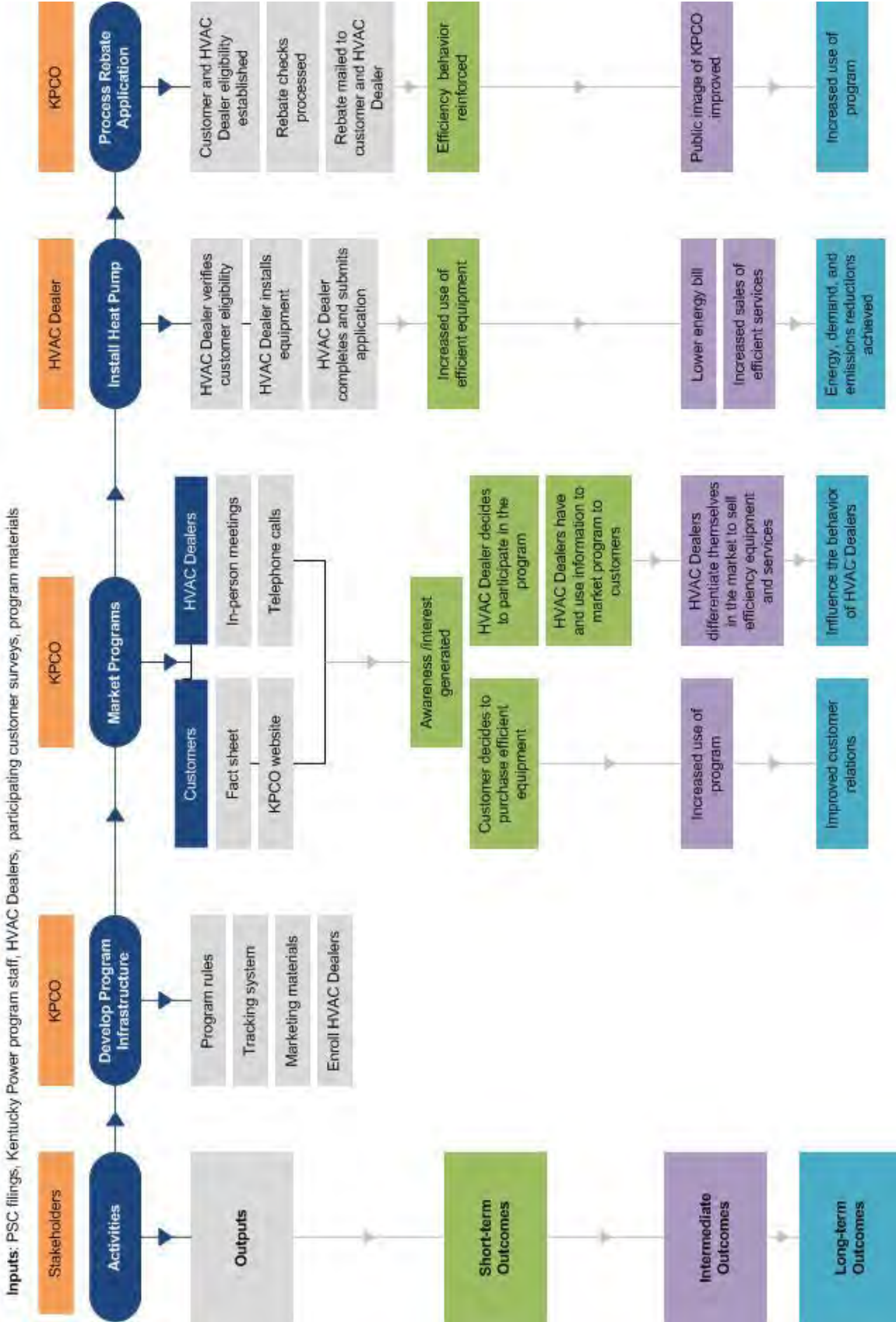
11.2 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

⁷⁸ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

⁷⁹ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 78 Program Logic Model



11.2.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program's intended outcomes. Program activities include:

Develop Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power staff, with input from AEP, designed the program, including rebate applications, data tracking system and marketing materials. Kentucky Power program staff maintains relationships with participating HVAC Dealers through periodic telephone calls and in-person visits. KPCO educates HVAC Dealers on the program, including customer eligibility, qualifying equipment and rebate forms. A list of participating HVAC Dealers is maintained on the DSM Program website. The Customer Operations Center has descriptions of all DSM Programs to assist with customer inquiries.

Market Program

Marketing activities are targeted towards HVAC Dealers via telephone calls and in-person meetings. Participating HVAC Dealers are encouraged to promote the program to eligible customers. The program was marketed to customers through the KPCO website and program fact sheets.

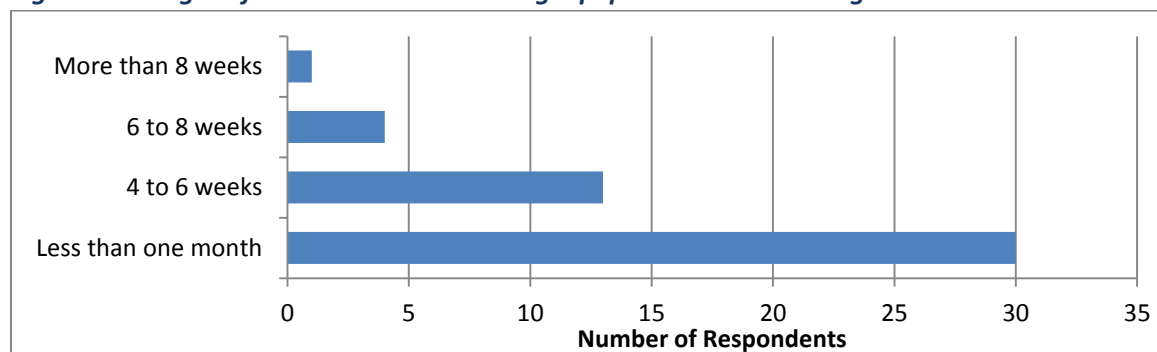
Install Heat Pump

The HVAC Dealer verbally verifies that the customer resides in a mobile home with central electric resistance heating and has been a KPCO electric customer for at least 12 months. The customer purchases a qualifying heat pump system and has it installed by the HVAC Dealer. The HVAC Dealer completes and faxes the rebate application to Kentucky Power.

Process Rebate Application

Customer rebates are processed by KPCO program staff. Staff verifies customer and HVAC Dealer eligibility and checks for application completeness. The application data is entered into the tracking system and a payment request submitted for review. Upon approval, the customer and HVAC Dealer data is submitted to AEP's Accounting Group where rebate checks are issued and mailed. Kentucky Power program staff aim to process customer rebate applications within 4 to 6 weeks. According to participating customers surveyed, applications are typically processed within one month.

Figure 79 Length of Time between Installing Equipment and Receiving Rebate Check



Kentucky Power maintains the right to conduct inspections. KPCO reviewed applications to ensure they were completed and met the minimum program efficiency requirements.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

11.2.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in efficient HVAC equipment may increase among customers and local, licensed HVAC contractors. Customers may become more knowledgeable about energy efficient equipment. The HVAC Dealers may have information to market the program to customers. The program may lead to an increased commitment in energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPCO efficiency programs, increased sales of energy efficient HVAC equipment and reduced household energy consumption.

Long-term Outcomes

The long-term outcomes may include influencing the behavior of HVAC contractors and an expanded market for efficient HVAC equipment. Additional outcomes include reduced utility emissions and fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

11.2.3 External Factors

There are a variety of factors outside the control of KPCO that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Economic conditions
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Competition among targeted HVAC contractors
- Cost, performance and availability of efficient technologies

11.2.4 Market Barriers

HVAC Dealers play an important role in this program by encouraging customers to make energy efficient upgrades. HVAC contractors are often the primary source of information and the first point of contact

for customers in need of HVAC equipment. Therefore, it is critical that contractors have accurate and up-to-date information about the benefits of energy efficient equipment and are able to effectively communicate these benefits to customers.

Key barriers to achieving greater market penetration and quality installations include:

- Lowest bid quotes typically drive the HVAC equipment sales industry. Customers are often price-sensitive, especially during a weak economy. Contractors often lack the resources and tools to effectively educate the customers on the benefits of high efficiency equipment.
- Lack of consumer awareness. The majority of equipment sales take place in the replacement market where consumers need to make quick decisions.

Kentucky Power’s program tries to address these barriers through a combination of education, training, and financial incentives to customers and HVAC Dealers. This approach has helped to build customer support for high efficiency equipment in the market while educating and providing tools to contractors to market and install high efficiency systems.

11.3 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, HVAC Dealer participation and program tracking.

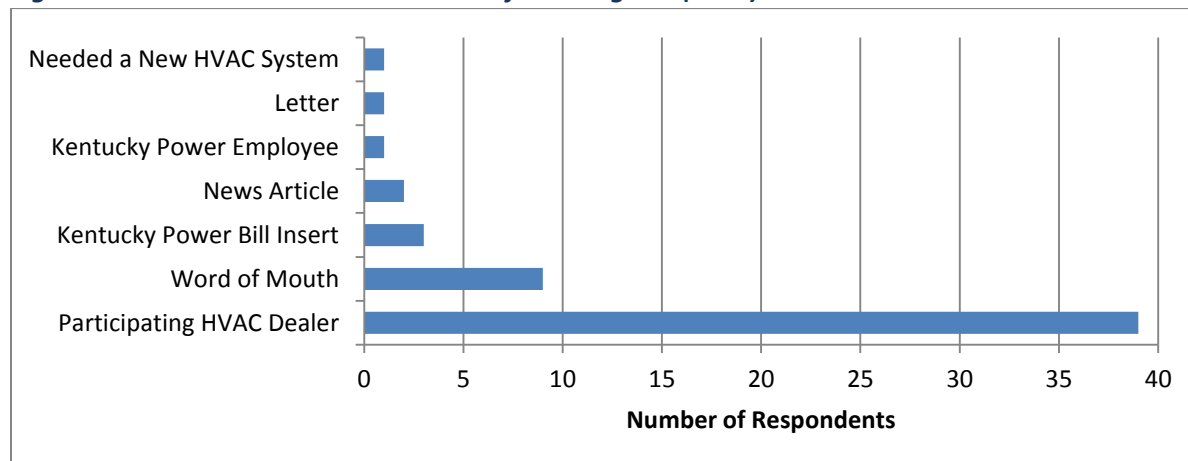
11.3.1 Program Marketing

Kentucky Power marketed the program through the following:

- **HVAC Dealer Outreach.** Kentucky Power staff promoted the programs directly to HVAC Dealers via telephone calls or in-person meetings with prospective and current dealers. The HVAC Dealers are mailed letters with program information and new rebate forms.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save. Customers can search for participating HVAC Dealers by geographic location on the KPCO DSM Program website.

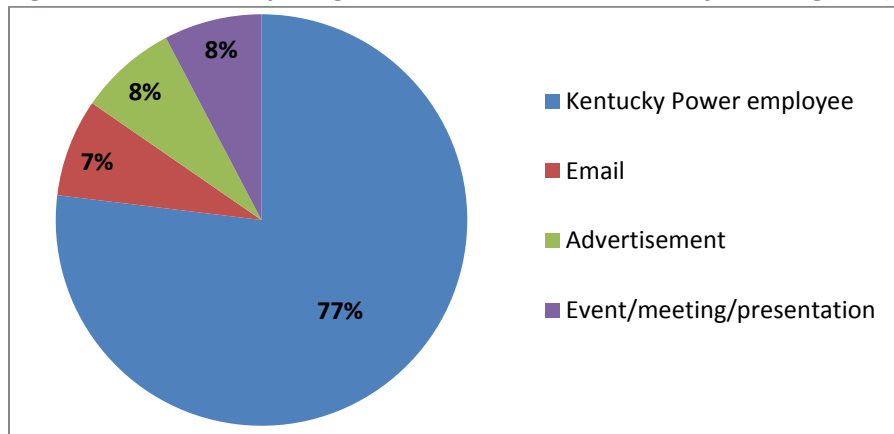
The program was designed such that the KPCO program staff markets the program to HVAC Dealers. In turn, the participating HVAC Dealers were encouraged to promote the program to eligible customers. According to survey respondents, customers most often learned of the program from the HVAC Dealer.

Figure 80 How Customers First Learned of the Program (n=56)



Participating HVAC Dealers most often learned about the program from a Kentucky Power employee.

Figure 81 How Participating HVAC Dealers First Learned of the Program (n=13)



The participating HVAC Dealers surveyed noted that their primary source of information on efficient HVAC equipment is HVAC distributors (57 percent) followed by online sources (43 percent) and AHRI/Manual J (21 percent).

Approximately 28 percent of customers surveyed cited that the primary reason for participating in the program was that they needed a new HVAC system or to save money. Additionally, 19 percent of customers noted that information from the HVAC Dealer was a crucial factor in their decision to purchase and install the efficient equipment. The participating HVAC Dealers interviewed noted that the main customer motivation for participating in the program was bill savings, followed by energy savings.

Figure 82 Customer Motivation for Participation (n=45)

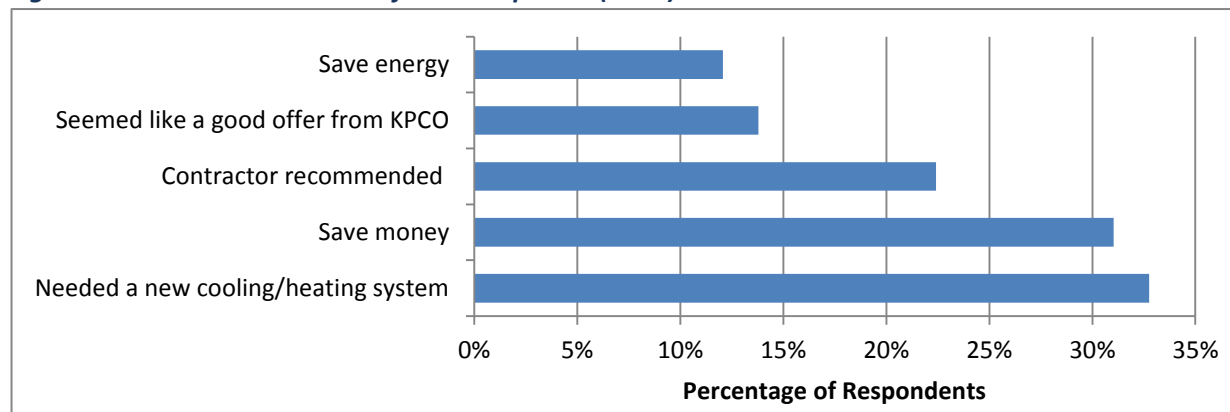
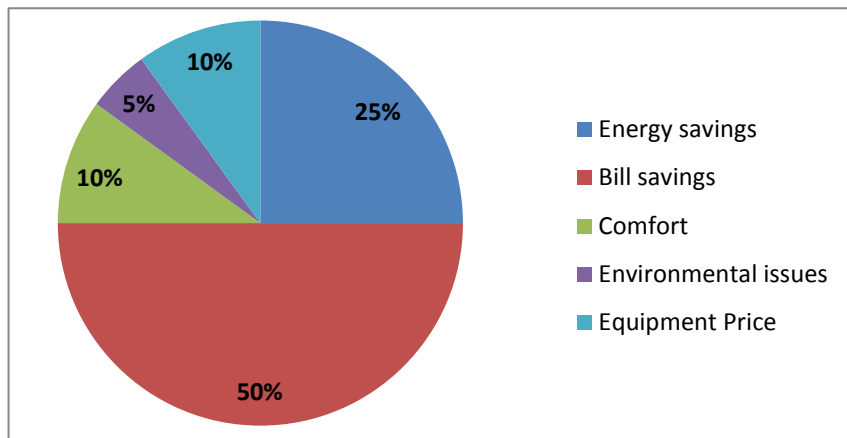


Figure 83 Customer Motivation According to HVAC Dealers (n=16)



The majority of participating HVAC Dealers surveyed stated that the program was good for business. Participating HVAC Dealers prefer to be contacted by Kentucky Power staff via the following channels:

- Emails (45 percent)
- Telephone Calls (40 percent)
- Mail (10 percent)
- In-Person Visits (5 percent)

11.3.2 Program Performance

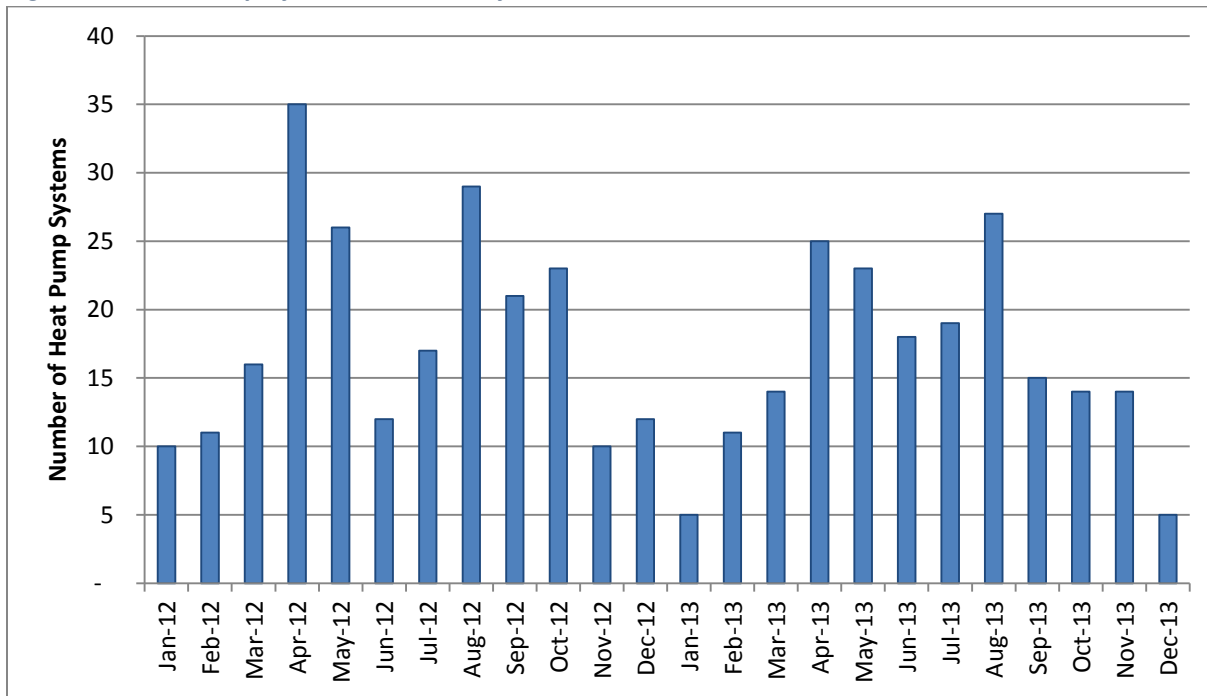
Between January 1, 2012 and December 31, 2013, 412 customer heat pump systems were rebated under the Mobile Home High Efficiency Heat Pump Program. Kentucky Power rebated 222 heat pumps in 2012, achieving 106 percent of the goal, and 190 heat pumps in 2013, achieving 86 percent of the goal. Seven rebate applications were denied.

Table 220 Program Participation

	2012	2013
Participation Goal	210	220
Actual	222	190

Heat pumps provide cooling and heating to customers. Therefore, customers will purchase and install heat pumps year round, but primarily during the spring and fall seasons in preparation for the summer and winter seasons. As shown in the figure below, heat pump rebates spiked in the spring and late summer/early fall.

Figure 84 Heat Pump Systems Rebated by Month



The Mobile Home High Efficiency Heat Pump Program requires that the heat pump system meet a minimum SEER ≥ 13 and HSPF ≥ 7.7 . All of the heat pump systems rebated met the requirements.⁸⁰ Approximately 35 percent of the rebated systems exceeded the SEER and/or HSPF requirements.

Table 221 Heat Pump Installations by Efficiency

	7.7 < 8.0 HSPF	8.0 < 8.5 HSPF	8.5 < 9.0 HSPF	≥ 9.0 HSPF
13 < 14 SEER	62.4%	13.3%	1.5%	0.2%
14 < 15 SEER	0.2%	5.3%	5.1%	0.7%
15 < 16 SEER	n/a	2.9%	4.9%	1.7%
≥ 16 SEER	n/a	n/a	0.5%	1.2%

The actual 2012 expenditures exceeded the budget and the cost per participant was slightly higher than budgeted. The actual 2013 expenditures were slightly less than the budget and the cost per participant was slightly higher.

Table 222 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
Equipment/Vendor	\$10,500	\$11,400	\$11,000	\$9,600
Customer Incentive	\$84,000	\$91,200	\$88,000	\$78,000
Promotion	\$0	\$0	\$1,500	\$1,553
Evaluation	\$0	\$0	\$0	\$2,533
Total Cost (\$)	\$94,500	\$102,600	\$100,500	\$91,686
Participation	210	222	220	190
Cost (\$) per Participant	\$450	\$462	\$457	\$483

⁸⁰ An initial review of the program log found that three participant entries did not meet the minimum program requirements. Kentucky Power reviewed the corresponding rebate applications and corrected the participant entries.

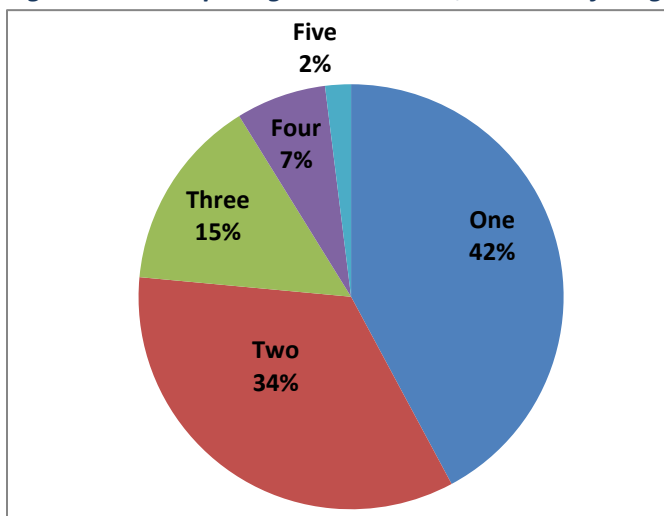
11.3.3 HVAC Dealers

The HVAC Dealers can participate in the following programs:

- Residential and Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential Home High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Program

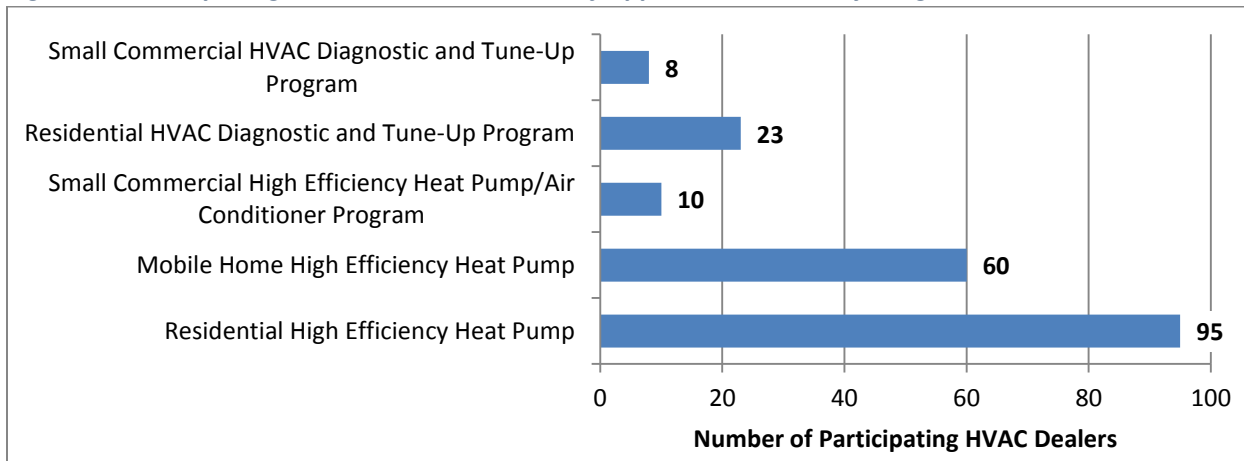
One-hundred and two (102) HVAC Dealers participated in at least one Kentucky Power DSM Program between January 1, 2012 and December 31, 2013. Eighty-seven (87) of the HVAC Dealers are currently listed on the DSM Program website and 15 need to be added as HVAC Dealers. Approximately 75 percent of the participating HVAC Dealers received a rebate for participating in one or two DSM Programs and 2 percent received a rebate for participating in all of the DSM Programs.

Figure 85 Participating HVAC Dealers, Number of Programs



A significant majority of participating HVAC Dealers received a rebate through the Residential High Efficiency Heat Pump Program while the Small Commercial HVAC Diagnostic and Tune-Up Program had the fewest number of participating HVAC Dealers receive a rebate.

Figure 86 Participating HVAC Dealers, Number of Approved Rebates by Program



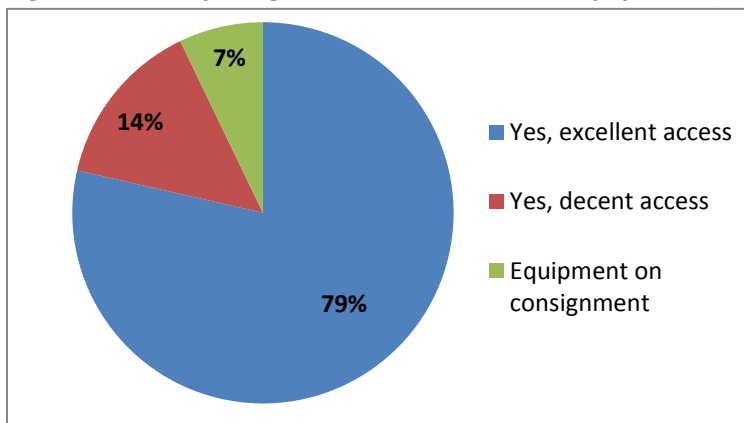
Sixty (60) HVAC Dealers participated in the Mobile Home High Efficiency Heat Pump Program in 2012 or 2013. Seven (7) HVAC Dealers performed 50 percent of the heat pump installations.

Table 223 Mobile Home High Efficiency Heat Pump Program Most Active HVAC Dealers

Contractor	Systems Rebated	% of Total
Elliott Supply & Glass	50	12%
Appalachian Refrigeration	42	10%
American Heating & Cooling	37	9%
Big Sandy Heating & Cooling	26	6%
Bobby Howard & Sons	25	6%
Patterson Repair Services	14	3%
Scurlock Heating & Cooling	13	3%

The HVAC Dealers interviewed noted that they have good access to energy efficient HVAC equipment.

Figure 87 Participating HVAC Dealer Access to Equipment (n=14)



11.3.4 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.⁸¹ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

Rebate applications are processed by Kentucky Power program staff. Staff reviews and validates the applications for completeness, including customer and HVAC Dealer eligibility. Applications are reviewed based on the date received and the DSM Program. Each customer application is assigned a unique identifier. Hard-copy rebate applications are labeled with the assigned unique identifier and payment request number, then grouped and archived in a binder.

Kentucky Power's program tracking system is comprised of three databases:

KCPO Customer Records (MACCS) is an internal intranet-based database. A note is entered in the customer record with the DSM Program and the date the rebate application was received. KPCCO

⁸¹ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

Customer Operations Center can access the note if a customer calls about their rebate status. KPCO program staff utilizes the data to monitor program performance.

Program Log is an Excel- or Access-based database that contains data from the rebate application. Each DSM Program has a program log, which is available on a shared drive to specific KPCO staff.

Kentucky Power collects the following data on the rebate application:

- Customer Information: name, account number, address (service and mailing), social security number, KPCO account number.
- Existing Equipment: system type (central split/central packaged/window units), total cooling capacity, manufacturer, model number, electric furnace manufacturer, electric furnace size.
- New Equipment: system type (split/packaged), total cooling capacity, supplemental heat, manufacturer, outdoor unit model number, indoor unit model number, SEER, HSPF.
- Dealer Information: name, master HVAC license number, Tax ID number, mailing address.
- Dates: customer signature date, HVAC Dealer signature date.

Electronic Payment Request (PeopleSoft). Each rebate application has two payment requests, one for the customer and one for the HVAC Dealer. The payment request includes the accounting code, unique identification number, customer/dealer name and address, dealer Federal Tax ID and rebate amount.

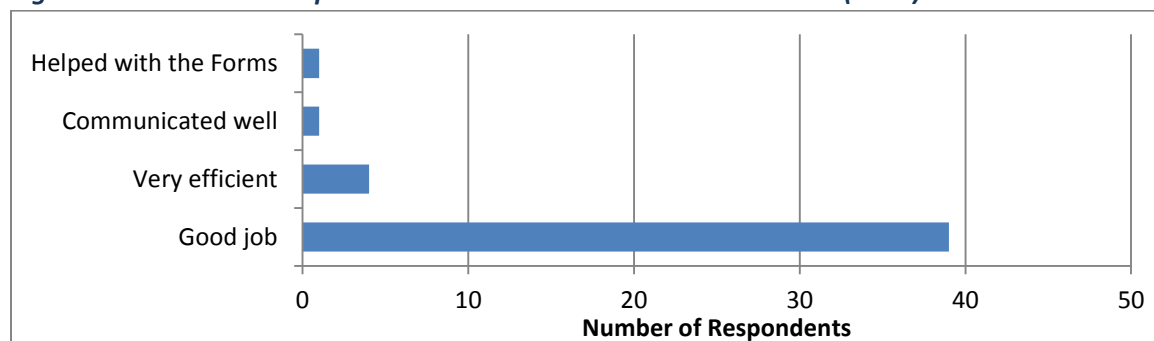
Prior to approval, the Electronic Payment Request is reviewed by the Kentucky Power program coordinator. The coordinator ensures the account number, program account, rebate amount and unique identifier are correct. Once approved, the Electronic Payment Request is submitted electronically to the AEP Accounting Group in Canton, Ohio and rebate checks are issued and mailed.

The program log does not contain all data collected from the rebate application. For example, one rebate application was missing the HVAC Dealer, which is required to receive a rebate.⁸²

11.3.5 Program Satisfaction

Ninety-one (91) percent of participants surveyed would recommend their HVAC Dealer to someone else. Six (6) participants surveyed had already recommended their HVAC Dealer to others. Five (5) participants surveyed would not recommend their HVAC Dealer to others. One participant did not feel the HVAC Dealer did good work and two participants don't like the heat pump.

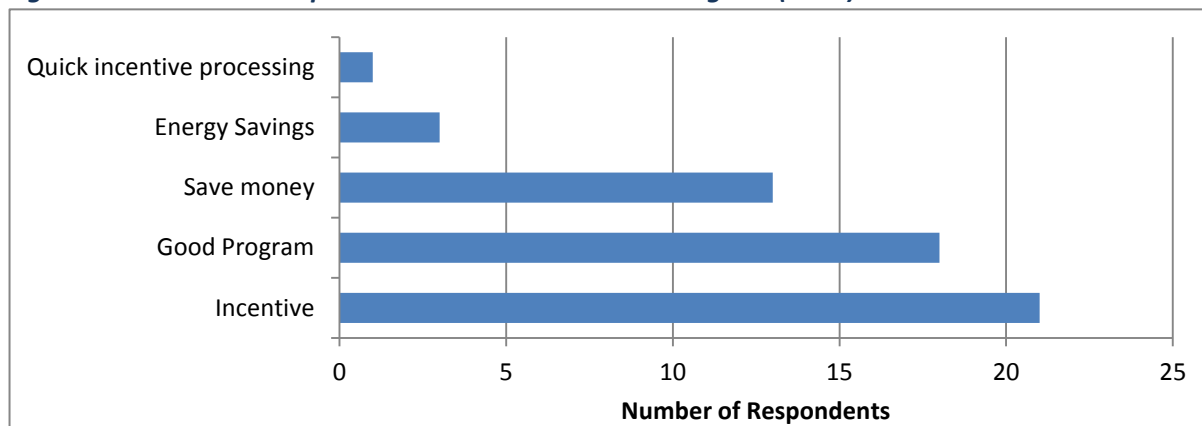
Figure 88 Reasons Participants Would Recommend the HVAC Dealer (n=45)



⁸² An initial review of the program log found that three participant entries did not meet the minimum program requirements. Kentucky Power reviewed the corresponding rebate applications and corrected the participant entries.

Ninety-five (95) percent of participants surveyed would recommend the program to others. Some reasons for recommending the program are the incentive and that the equipment saves money.

Figure 89 Reasons Participant Would Recommend the Program (n=58)

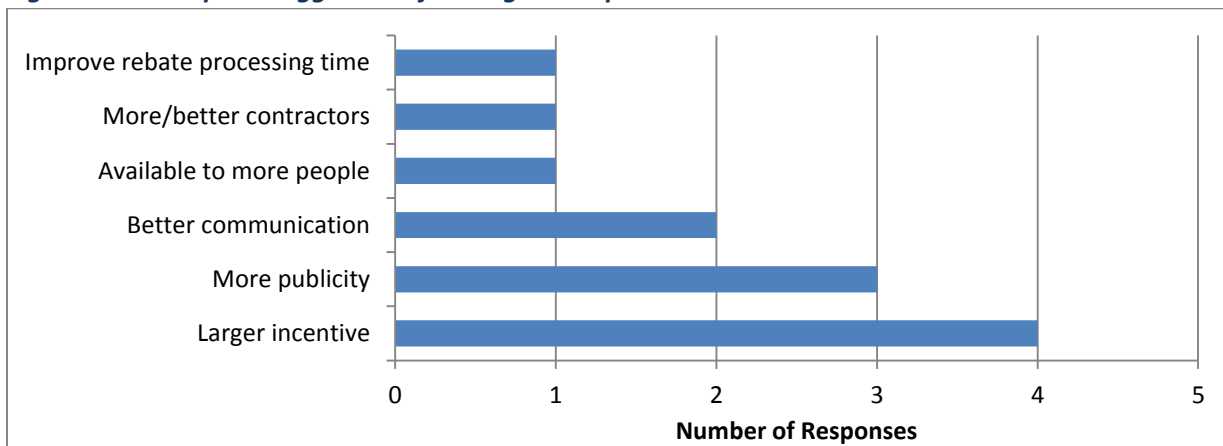


Overall, customers are very satisfied with the program. Participating customers surveyed were asked their opinion on how the program could be improved. Twenty-six (26) percent of participants provided suggestions, including increasing the rebate amount and increasing publicity.

Table 224 Participant Satisfaction with the Program (n=58)

Program Component	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
HVAC Dealer	88%	7%	3%	0%	2%
Incentive Processing	72%	14%	3%	0%	2%
Incentive Amount	86%	3%	2%	2%	0%
Interaction with KPCO staff	29%	0%	0%	0%	2%
Response times/assistance on forms	34%	2%	2%	0%	0%
Program Overall	88%	3%	2%	0%	0%

Figure 90 Participant Suggestions for Program Improvement



HVAC Dealer participation was a key element to the program. Participating HVAC Dealers promoted the program to eligible customers and installed the efficient heat pumps. Seventy-two (72) percent of participants surveyed noted that the HVAC Dealer provided information that was a crucial factor in deciding to purchase and install the efficient equipment. It is very important to HVAC Dealers that they are listed on the KPCO website as a participating HVAC Dealer.

Overall, the participating HVAC Dealers surveyed are satisfied with the program. The HVAC Dealers were asked their opinion on how the program could be improved, they recommended:

- Increasing advertising and offering co-operative advertising with the HVAC Dealers
- Increasing the rebate levels
- Offering incentives for central air conditioner equipment
- Working with HVAC distributors

Table 225 HVAC Dealer Satisfaction (n=14)

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Incentives offered	-	-	1	1	12
Equipment included the program	-	-	1	3	10
Application requirements	-	1	-	3	10
Incentive processing	1	-	-	1	12
Customer service	-	-	-	2	12
Interaction with Kentucky Power staff	-	-	1	1	12
Program overall	1	-	-	1	12

11.4 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

11.4.1 Gross Energy and Demand Savings

AEG conducted engineering and billing analyses of the Mobile Home High Efficiency Heat Pump Program to assess gross energy and demand savings based on the IPMVP Options A and C.

Engineering Analysis Methodology

AEG conducted the engineering analysis using the *Illinois Statewide Technical Reference Manual for Energy Efficiency* ("IL TRM") as the source of engineering equations. Energy and demand savings were estimated using the following equations:

$$\Delta kWh = \left(\frac{(FLH_{cool} \times Capacity_{cool} \times (\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}))}{1000} \right) + \left(\frac{(FLH_{heat} \times Capacity_{heat} \times (\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}))}{1000} \right)$$

$$\Delta kW_{Summer} = \left(\frac{(Capacity_{cool} \times (\frac{1}{EER_{base}} - \frac{1}{EER_{ee}}))}{1000} \right) \times CF$$

$$\Delta kW_{Winter} = \left(\frac{(Capacity_{heat} \times (\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}))}{1000} \right)$$

Where:

- FLH_{cool} = Full load hours of air conditioning
- FLH_{heat} = Full load hours of heating
- Capacity_{cool} = Cooling capacity of heat pump (Btu/h)

- Capacity_{heat} = Heating capacity of heat pump (Btu/h)
- SEER_{base} = Seasonal Energy Efficiency Ratio of baseline system (kBtu/kWh)
- SEER_{ee} = Seasonal Energy Efficiency Ratio of efficient heat pump (kBtu/kWh)
- EER_{base} = Energy Efficiency Ratio of baseline system (kBtu/kW)
- EER_{ee} = Energy Efficiency Ratio of efficient heat pump (kBtu/kW)
- HSPF_{base} = Heating Seasonal Performance Factor of baseline system (kBtu/kWh)
- HSPF_{ee} = Heating Seasonal Performance Factor of efficient heat pump (kBtu/kWh)
- CF = Summer System Peak Coincidence Factor

According to program rules, participants must install a heat pump system that meets SEER ≥ 13 and HSPF ≥ 7.7. The main variable driving savings is the difference between the efficiency rating of the rebated unit to a baseline, which was based on the existing heating system replaced. Rebated units were compared to a baseline efficiency of SEER 10 and HSPF 3.41, the equivalent efficiency rating for a central electric resistance heating system.

Engineering analysis variables were adapted to Kentucky Power’s service territory. For example, AEG used standard assumptions for full load heating and cooling hours based on information from the US Environmental Protection Agency.⁸³ The table below summarizes the key variables used in the engineering analysis.

Table 226 Engineering Analysis Variables

Variable	Value	Description
FLH _{cool}	1,080	Assumed values for Lexington, KY from ENERGY STAR savings calculator
FLH _{heat}	2,027	
Capacity _{heat}	Application	Unit size in tons (1 ton = 12,000 Btu/h)
Capacity _{cool}	Application	
SEER _{base}	10	Baseline efficiency for Resistance Heating
HSPF _{base}	3.41	Baseline efficiency for Resistance Heating
SEER _{ee}	Application	SEER of rebated unit
HSPF _{ee}	Application	HSPF of rebated unit
CF	91.5%	IL TRM

The savings per participant were calculated as the weighted average participant savings for measures installed in 2012 and 2013. The results of the engineering analysis are shown in the following tables.

Table 227 Gross Energy and Demand Savings per Participant, Engineering Analysis

Group	Gross Energy Savings (kWh)	Summer Gross Demand Savings (kW)	Winter Gross Demand Savings (kW)
2012	9,526	-0.30	6.17
2013	9,383	-0.29	6.08
Program Total	9,460	-0.29	6.13

Table 228 Total Gross Energy and Demand Savings, Engineering Analysis

Group	Gross Energy Savings (kWh)	Summer Gross Demand Savings (kW)	Winter Gross Demand Savings (kW)
2012	2,114,704	-66	1,370
2013	1,782,864	-56	1,155
Program Total	3,897,370	-121	2,524

⁸³ www.energystar.gov/buildings/sites/default/uploads/files/ASHP_Sav_Calc.xls

Billing Analysis

The billing analysis estimated the change in billed energy usage of a participant sample for one year before and after heat pump installation of the measure using a paired sample t-test. The t-test was used to determine whether there was a significant difference in average energy usage before and after installation. The t-test compared the average annual energy usage of the participant sample before and after the heat pump(s) was installed.

The billing analysis utilized program tracking data and Kentucky Power customer billing data. Kentucky Power provided approximately four years of billing data for all customers via AEP's corporate file transfer protocol, including monthly interval billed energy usage for all customers. Due to the quantity of data points, Microsoft Access was used to develop samples, which were exported to Microsoft Excel to perform the billing analysis.

The following steps were taken to develop the participant sample:

1. Participants were matched to the Kentucky Power billing data using their nine digit customer account number. Account numbers with extra digits were shortened to meet the nine digit validation criteria. Participants with matched account numbers were verified by name and service address. If an account number was unable to be matched; the participants was removed from the sample.
2. Sample accounts that participated in multiple Kentucky Power programs were identified and removed from the sample.⁸⁴ The potential interactive effects of other programs could skew the results of the analysis; removing these participants isolates the impacts attributable to the program.
3. The installation date associated with each participant was used to identify the billing intervals before and after the heat pump installation. If a participant did not have an installation date in the Program Log, an average date was applied based on the participant sample. The interval during which the measure was installed, or "black out" interval, was not included in the analysis.
4. Only sample participants with exactly 12 monthly intervals before and after the installation interval were included in the sample. The 12 monthly intervals ensured approximately a full year of billing data before and after the installation. Changes in the customer population (i.e. new accounts) resulted in some participants with intervals that did not meet the 12 interval criteria and were removed from the participant sample.
5. An outlier screen was applied to the sample participants to remove outliers and other anomalous cases. Participants with an average pre-program annual energy usage greater than two standard deviations from the mean before the installation were removed from the analysis to limit potential bias.

The actual energy usage in the 12 intervals before and after the heat pump installation was converted to average daily energy usage by dividing the sum of billed energy usage by the number of usage days. The average daily usage was multiplied by a factor of 365.25 days per year to reflect the average annual energy usage for each customer account. Energy savings were estimated as the difference in average

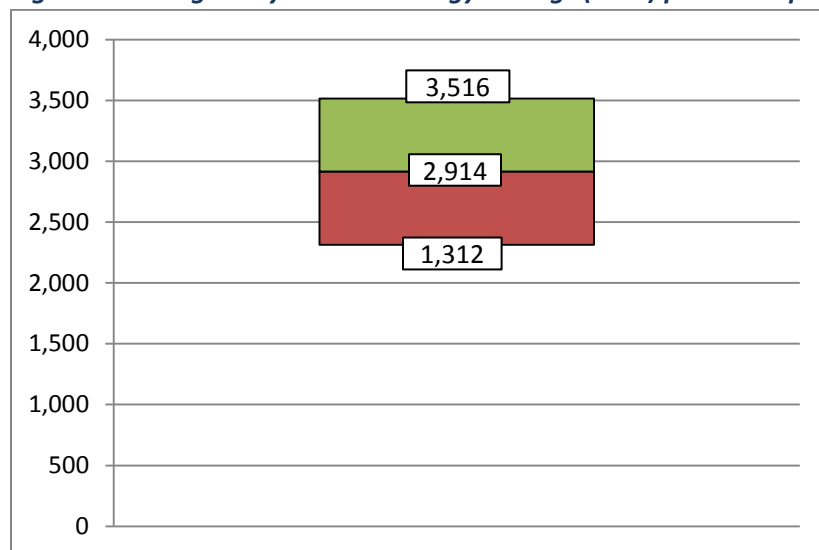
⁸⁴ Note that account numbers were not available for the Residential Efficient Products program and could not be removed from the sample. However, the interactive effects from this program are considered minimal.

annual energy usage before and after the implementation of the program, assessed for statistical significance using a 95% confidence interval.

The billing analysis results were assessed for statistical significance using a 95% confidence interval. While the results were statistically significant, the participant sample did not include a sufficient number of participants per program year to provide statistically significant billing analysis results by program year. Therefore, AEG was only able to provide statistically significant results at the total program level.

Figure 91 shows the upper-, lower-, and mid-range per participant savings estimates at a 95 percent confidence interval. The upper- and lower-range estimates were calculated by adding and subtracting the confidence interval, respectively.

Figure 91 Billing Analysis Gross Energy Savings (kWh) per Participant at 95% Confidence



For the purposes of this analysis, AEG used the mid-range estimates to determine the savings attributable to the program. Although the billing analysis did not directly assess the demand savings, demand savings were extrapolated based on the ratio of kW to kWh savings from the engineering analysis. The table below shows gross savings from the program.

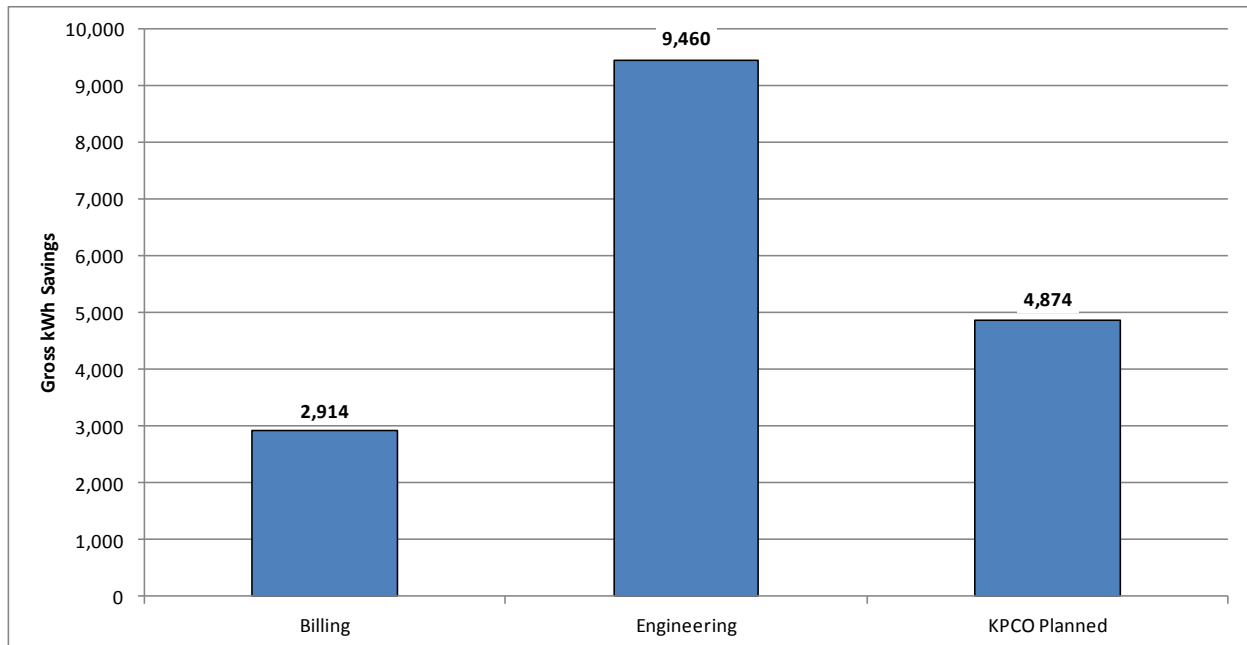
Table 229 Gross Energy and Demand Savings, Billing Analysis

Group	Gross Energy Savings (kWh)	Summer Gross Demand Savings (kW)	Winter Gross Demand Savings (kW)
Gross Savings per Participant	2,914	-0.09	1.89
Total Gross Savings	1,200,619	-37	778

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. Figure 92 compares the gross energy savings per participant for the engineering analysis and the billing analysis to the planned savings assumptions. The billing analysis is a more accurate determinant of savings due to the comparison of energy usage pre- and post-measure installation versus the engineering analysis which utilizes an assumed baseline. The billing analysis takes into account measure baseline and changes in equipment usage.

Figure 92 Summary Gross Energy Savings per Participant



11.4.2 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after accounting for free ridership and spillover. Free ridership refers to those participants who would have installed an efficient heat pump without the program influence. Spillover refers to additional savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - Free\ ridership + Spillover$$

AEG conducted a survey of program participants to evaluate the effects of free ridership and spillover. Results of the survey are statistically significant at the 90 percent confidence level and a margin of error of +/- 10 percent.

Free Ridership

Three questions in the participant survey were designed to assess the effects of free ridership.

- **Question 1:** Prior to learning about this program, did you have specific plans to install an efficient heat pump?
- **Question 2:** How important was the Kentucky Power incentive in your decision to buy the efficient heat pump?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the exact same equipment?

Each response to the free ridership questions was assigned a probability that that respondent was a free rider. The free ridership probability reflects the likelihood that a respondent would have installed the efficient heat pump absent the program. The proportion of each response was multiplied by the free ridership probability to calculate the free ridership score.

Table 230 Question 1 Free Ridership

Response	Count	Percent	Free Ridership Probability	Free Ridership Score
Yes	43	74%	50%	37%
No	15	26%	0%	0%
Question 1 Free Ridership Score				37%

Table 231 Question 2 Free Ridership

Response	Count	Percent	Free Ridership Probability	Free Ridership Score
Very important	25	43%	10%	4%
Somewhat important	18	31%	35%	11%
Not important	15	26%	80%	21%
Question 2 Free Ridership Score				36%

Table 232 Question 3 Free Ridership

Response	Count	Percent	Free Ridership Probability	Free Ridership Score
Very likely	38	68%	80%	54%
Somewhat likely	13	23%	35%	8%
Not likely	5	9%	10%	1%
Question 3 Free Ridership Score				63%

The free ridership score for each question was weighted based on its contribution to the overall free ridership factor. Weights were based on the assumption that survey responses may not reflect the actual behavior of respondents (i.e. social desirability bias). The weighted average of the scores determines the free ridership factor for the program.

Table 233 Free Ridership Summary

Free Ridership Question	Score	Weight
Question 1	37%	50%
Question 2	36%	25%
Question 3	63%	25%
Weighted Average Free Ridership Score	43%	

Based on the responses to the survey questions, free ridership was estimated at 43 percent. A free ridership score in this range is expected due to the program design. The program incentivizes heat pumps that meet the federal minimum efficiency standard, which increases free ridership.

Spillover

Spillover is the ratio of net spillover savings to gross savings of the participant sample.

$$Spillover = \frac{Net\ Spillover\ Savings}{(Program\ Savings\ per\ Participant \times Total\ Respondents) + Total\ Spillover\ Savings}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and spillover score for each respondent

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the participant survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to question one were included in the spillover calculation. The savings from the spillover actions described in question two were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, spillover participants engaged in a variety of additional energy efficient actions, including upgrading to ENERGY STAR® appliances and installing insulation.

Finally, each respondent was asked how much the program influenced their additional actions by answering question three. The table below shows the spillover score assigned to each of the responses.

Table 234 Spillover Score

Response	Score
Very likely	10%
Somewhat likely	35%
Not likely	80%
Don't Know	50%

The net spillover savings from each respondent was determined by applying their spillover score to their gross spillover savings to estimate the spillover savings that were directly attributable to the program. The table below illustrates how the program spillover score was calculated. AEG determined the overall spillover score for the program to be 1 percent.

Table 235 Spillover Calculation Summary

Line	Variable	Value
A	Total Respondents	58
B	Program Savings per Participant	9,460
C	Program Savings of Sample (A x B)	548,659
D	Gross Spillover Savings of Sample	9,054
E	Total Sample Savings (C + D)	557,713
F	Net Spillover Savings	3,214
G	Spillover Score (F ÷ E)	1%

Next, AEG used the free ridership and spillover estimates to determine the NTG factor for the program. As a result, the NTG factor for the program is 57 percent.

Table 236 Net-to-Gross Results

Free Ridership	Spillover	NTG
43%	1%	57%

In order to determine the net savings attributable to the program, AEG applied the NTG factor to the gross savings results from both the billing and engineering analyses. The following tables show the net savings per participant as well as the total net savings of the program.

Table 237 Net Savings per Participant, Engineering Analysis

Group	Net Energy Savings (kWh)	Net Summer Demand Savings (kW)	Net Winter Demand Savings (kW)
2012	5,453	-0.17	3.53
2013	5,372	-0.17	3.48
Program Total	5,416	-0.17	3.51

Table 238 Total Net Savings, Engineering Analysis

Group	Net Energy Savings (kWh)	Net Summer Demand Savings (kW)	Net Winter Demand Savings (kW)
2012	1,210,676	-38	784
2013	1,020,697	-32	661
Program Total	2,231,260	-69	1,445

As noted above, the billing analysis participant sample did not include a sufficient number of participants per program year to provide significant billing analysis results by program year.

Table 239 Net Savings, Billing Analysis

Group	Net Energy Savings (kWh)	Net Summer Demand Savings (kW)	Net Winter Demand Savings (kW)
Net Savings per Participant	1,668	-0.05	1.08
Total Net Savings	687,359	-21	445

11.4.3 Savings per Participant Summary

AEG conducted engineering and billing analyses of the Mobile Home High Efficiency Heat Pump Program to assess gross energy and demand savings based on IPMVP Options A and C. AEG recommends utilizing the 2012-2013 billing analysis savings per participant to determine program savings for program tracking purposes as well as PSC filings. The billing analysis is a more accurate determinant of savings due to the comparison of energy usage pre- and post-measure installation versus the engineering analysis which utilizes an assumed baseline.

The table below present the gross and nets savings per participant.

Table 240 Recommended Energy and Demand Savings per Participant

Group	Gross Energy Savings (kWh)	Summer Gross Demand Savings (kW)	Winter Gross Demand Savings (kW)
Gross Savings per Participant	2,914	-0.09	1.89
Net Savings per Participant	1,668	-0.05	1.08

11.4.4 Program Site Inspections and Installation Verification

AEG performed site inspections and installation verification on three completed projects to verify application information. Proper installation verification was confirmed at all locations. However, the equipment installed at one location did not match the equipment listed on the application. One homeowner expressed dissatisfaction with the participating HVAC Dealer. A state HVAC inspector failed the homeowner's installation and while the HVAC Dealer replaced the mismatched compressor, the homeowner was not satisfied with the performance of the heat pump system. The customer discussed the issue with Kentucky Power program staff who recommended the customer contact the equipment manufacturer and follow-up with Kentucky Power if there are additional questions. No additional customer questions were received.

Table 241 Site Inspection Summary

Area	Count	%
Ashland	1	33%
Pikeville	0	0%
Hazard	2	67%
Total	3	100%

11.4.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness indicates whether the equipment improves a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Mobile Home High Efficiency Heat Pump Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.⁸⁵ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

Impact evaluation results were utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, participation and incentives, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollars to accurately compare future benefits with current costs.

The Mobile Home High Efficiency Heat Pump Program was found to be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

⁸⁵ The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

Table 242 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.36	\$1,099,930	\$392,447	(\$707,483)
Utility Cost Test	2.13	\$184,460	\$392,447	\$207,987
Participant Test	3.28	\$327,537	\$1,075,672	\$748,135
Total Resource Cost Test	1.12	\$351,795	\$392,447	\$40,652

Evaluating the program on a prospective basis, the Mobile Home Heat Pump Program is also cost-effective and should be continued. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The cost-effectiveness results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results are presented in the table below.

Table 243 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.37	\$560,274	\$206,128	(\$354,146)
Utility Cost Test	2.05	\$100,709	\$206,128	\$105,419
Participant Test	3.38	\$158,806	\$537,239	\$378,433
Total Resource Cost Test	1.13	\$181,841	\$206,128	\$24,287

Geothermal and ductless mini-split systems were analyzed for inclusion in the Mobile Home High Efficiency Heat Pump Program. The measures were found to be not cost-effective at this time, primarily due to high customer capital costs. Therefore, AEG does not recommend that these measures be incorporated into the program at this time.

11.5 Recommendations

AEG has several recommendations on how to improve the program. These include:

Consider Hiring an Implementation Contractor

AEG recommends that Kentucky Power consider hiring an implementation contractor to implement Kentucky Power's residential and small commercial HVAC programs, including, but not limited to, the Residential High Efficiency Heat Pump Program, Mobile Home High Efficiency Heat Pump, and Mobile Home New Construction.

Kentucky Power has a small staff to run and oversee Kentucky Power's numerous energy efficiency programs. Some of the KPCO programs have implementation contractors that perform the day-to-day operations, but the residential and small commercial HVAC programs are run completely by KPCO staff. Therefore, KPCO staff is responsible for marketing activities, engaging HVAC Dealers, processing rebate applications, program tracking and performing QA/QC inspections. Due to limited resources, Kentucky Power conducted limited inspections to ensure applications were completed and met the program requirements.

The residential and small commercial HVAC programs share many similar components, including marketing activities and data tracking systems as well as participating HVAC Dealers. Utilizing one implementation contractor to implement the HVAC programs will allow the programs to continue capitalizing on their similarities, increase the efficiency of program processes and minimize the QA/QC concerns associated with HVAC Dealer and customer eligibility.

The implementation contractor will have, at a minimum, the following responsibilities:

- Develop marketing activities
- Design and maintain a data tracking system
- Process rebate applications
- Engage and monitor participating HVAC Dealers
- Develop QA/QC procedures and conduct random inspections of completed work

Consider Program Modifications

AEG recommends three program modifications:

- (1) Combine with the Residential High Efficiency Heat Pump Program. The programs would continue to be tracked and reported separately but would appear to be one program from the customer and participating HVAC Dealer perspective.
- (2) Consider offering incentives for the replacement of a heat pump.
- (3) Consider offering enhanced rebates for higher efficiency equipment. Of the customer applications that met program requirements, approximately forty percent systems installed exceeded the minimum program SEER and/or HSPF requirements. Therefore, AEG recommends that Kentucky Power consider offering incentives for 2 Tiers, as shown in the table below.

Table 244 Recommended Minimum Requirements and Incentives

System	Tier	SEER	HSPF	Incentive
Replace Resistance Heating	Tier 1	13	7.7	\$300
	Tier 2	14	8.2	\$500
Replace Heat Pump		14	8.2	\$300

Program Application and Data Tracking

AEG recommends that Kentucky Power consider merging the rebate application with the Residential High Efficiency Heat Pump Program rebate application and remove data that is not tracked or utilized. One rebate application for the Mobile Home High Efficiency Heat Pump and Residential High Efficiency Heat Pump Programs will simplify the application process for HVAC Dealers and program tracking for Kentucky Power program staff.

AEG recommends that Kentucky Power improve QA/QC to ensure that the Program Log contains all information collected on the rebate application. A review of the Program Log revealed that 3 participant entries were missing the HSPF rating. Kentucky Power reviewed the corresponding rebate applications and corrected the participant entries.

Engage Participating HVAC Dealers

AEG recommends that Kentucky Power engage actively participating HVAC dealers. HVAC Dealer participation is crucial to the program as they promote the program directly to customers. Kentucky Power should increase HVAC Dealer outreach, telephoning or emailing participating HVAC Dealers at least once a quarter to provide program updates and answer any questions and/or concerns. Kentucky Power should also consider exploring cooperative marketing with participating HVAC Dealers, leveraging HVAC Dealer marketing may provide an opportunity to shift additional marketing activities to the HVAC Dealers.

AEG recommends that the participating HVAC Dealer list available on the Kentucky Power DSM Program website is updated at least once a quarter. Fifteen (15) HVAC Dealers that participated in a Kentucky Power program in 2012 or 2013 are not currently listed as participating HVAC Dealers on the DSM Program website.

12. Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program

The Small Commercial High Efficiency Heat Pump/Air Conditioner Program encourages the purchase of energy efficient central air conditioner and heat pump systems. Small commercial customers (less than 100 kW) are eligible for financial incentives for upgrading to a new qualifying central air conditioner or heat pump system, up to a 5 ton unit. The system, installed by a participating HVAC Dealer, must, at a minimum, meet the Consortium for Energy Efficiency (“CEE”) guidelines for energy efficiency.

Table 245 CEE HVAC System Efficiency Guidelines

Equipment Type	SEER	EER	HSPF
Central Air Conditioner, Split System	14	12	n/a
Central Air Conditioner, Single Package	14	11.6	n/a
Heat Pump, Split System	14	12	8.5
Heat Pump, Single Package	14	11.6	8

Participating HVAC Dealers are eligible for a \$50 incentive for each system installed, upon approval of the rebate application. All Kentucky Power participating HVAC Dealers are state-licensed contractors. Heat pump system incentives are limited to customers whose primary heating source is electricity.

Table 246 HVAC System Incentives

Equipment Type	Incentive
Air Conditioner	
≤36,000 Btu/h	\$250
36,000 ≤ 65,000 Btu/h	\$400
Heat Pump	
≤36,000 Btu/h	\$300
36,000 ≤ 65,000 Btu/h	\$450

The Kentucky PSC approved budget and participation goals.

Table 247 Program Budget Goals, 2012-2014

	2012	2013	2014
Equipment/Vendor	\$3,000	\$1,300	\$750
Incentives	\$25,500	\$11,400	\$6,500
Promotion	\$10,000	\$1,000	\$1,000
Evaluation	\$11,974	\$0	\$9,481
Total Budget	\$50,474	\$13,700	\$17,731

Table 248 Participation Goals, 2012-2014

	2012	2013	2014
Central Air Conditioner	20	6	5
Heat Pump	40	20	10

12.1 2011 Program Evaluation

AEG conducted a process, market and impact evaluation of the 2011 Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program, submitted July 2012 to the Kentucky Public Service Commission. The evaluation recommendations included, but were not limited, increasing rebate

processing oversight to ensure compliance with program requirements. Based on the recommendation, Kentucky Power program staff modified the program log in July 2012 to ensure that the equipment efficiency data was correctly recorded and tracked. The program entry issues an 'error response' if the equipment efficiency data is not completed or does not qualify for a rebate.

12.2 Evaluation Data Collection

The program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Is the program achieving participation goals?
- What marketing/promotional efforts resonate with customers? HVAC Dealers?
- Are HVAC Dealers sufficiently knowledgeable about the Kentucky Power Program?
- Are customers/HVAC Dealers satisfied with the program?
- Are rebate applications processed, approved and paid on a timely basis?
- Is the rebate processing system effective in managing the application and rebate payment process?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would customers/ HVAC Dealers recommend the program?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

HVAC Dealer Interviews

AEG administered telephone interviews to a sample of participating HVAC Dealers. The interviews provided an assessment of the availability of qualifying HVAC equipment, identified potential areas for improvement and provided insight on customer attitudes toward energy efficiency and application processes. The interview guide can be found in Appendix B.

The Kentucky Power HVAC Dealers can participate in the following programs:

- Residential and Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential Home High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Program

One-hundred and two (102) Kentucky Power HVAC Dealers participated in at least one of Kentucky Power's DSM programs between January 1, 2012 and December 31, 2013. AEG interviewed 16 participating HVAC Dealers.

Participating Customer Surveys

AEG administered a 10 to 12 minute telephone survey to a random sample of program participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. Kentucky Power provided data for 32 participants that received a rebate between January 1, 2012 and September 30, 2013,⁸⁶ of which there were 22 unique electric accounts (as identified by account number). AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were randomly selected based on unique identifiers determined by Microsoft Excel's random number generator.

The surveyors attempted to contact participants on multiple occasions and were unable to reach the sample size target of 17. Five surveys were completed for an error margin of 35 percent (impacts only the net-to-gross values). The survey guide can be found in Appendix C.

AEG also conducted site visits and inspections of three participants to verify installation, ensure equipment eligibility, and verify application data matches installed equipment.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power's initial program filing savings were reviewed to ensure consistency with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Options A and C of the International Performance Measurement and Verification Protocols ("IPMVP").⁸⁷ AEG performed separate engineering and customer billing analyses to provide a comparison between the two savings methodologies.

Table 249 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

⁸⁶ Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

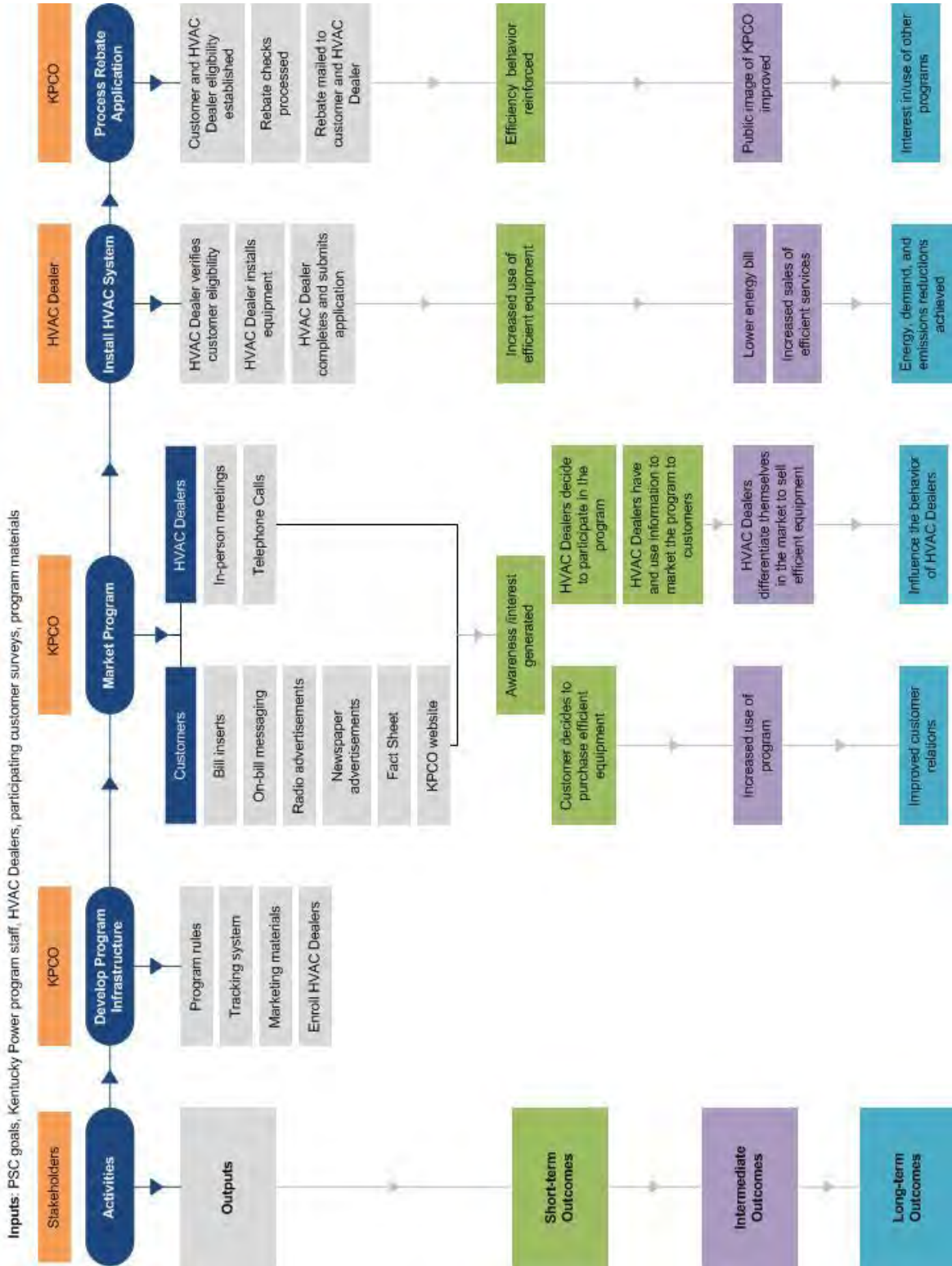
⁸⁷ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

Engineering algorithms from the *State of Illinois Technical Reference Manual*, using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts. The billing analysis identified changes in participants' energy usage attributable to the program, comparing energy usage for one year prior to measure installation to one year post measure installation.

12.3 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program's assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program's performance.

Figure 93 Program Logic Model



12.3.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program's intended outcomes. Program activities include:

Develop Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power program staff, with input from AEP, designed the program, including the rebate applications and data tracking system.

Kentucky Power program staff maintains relationships with participating HVAC Dealers through periodic telephone calls and in-person visits. Kentucky Power educates HVAC Dealers on the program, including customer eligibility, qualifying equipment and rebate forms. A list of participating HVAC Dealers is maintained on the KPCO DSM Program website. The KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Market Program

Marketing activities are targeted towards HVAC Dealers via telephone calls and in-person meetings. Participating HVAC Dealers are encouraged to promote the program to eligible customers. The program was marketed to customers through bill inserts, on-bill messaging, radio advertising, newspaper advertisements, the KPCO website, and program fact sheets.

Install HVAC System

The participating HVAC Dealer verbally verifies that the customer had a maximum peak demand less than 100 kW over the previous 12 months and is a KPCO electric customer. The customer purchases a qualifying heat pump or central air conditioner system and has it installed by the participating HVAC Dealer. The HVAC Dealer completes and faxes the rebate application to KPCO program staff.

Process Rebate Application

Customer rebates are processed by KPCO program staff. Staff verifies customer and HVAC Dealer eligibility and checks for application completeness. A sample of HVAC systems are verified with the Air Conditioning, Heating and Refrigeration Institute ("AHRI") database.⁸⁸ The application data is entered into the program tracking system and a payment request submitted for review. Once approved, the customer and HVAC Dealer data is submitted to AEP's Accounting Group where rebate checks are issued and mailed. KPCO program staff aim to process customer rebate applications within 2 to 4 weeks.

According to participating customers surveyed, applications are typically processed within two months.

Kentucky Power maintains the right to conduct inspections. Kentucky Power reviewed applications to ensure they were completed and met the minimum program efficiency requirements.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for improvements are generated for KPCO and fed back into program design.

⁸⁸ Primarily review system eligibility for new HVAC Dealers.

12.3.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, awareness and interest in efficient HVAC equipment may increase among customers and local, licensed HVAC contractors. Customers may become more knowledgeable about energy efficient equipment. The HVAC Dealers may have information to market the program to customers. The program may lead to an increased commitment to energy efficiency.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPCO efficiency programs, increased sales of energy efficient HVAC equipment and reduced household energy consumption.

Long-term Outcomes

The long-term outcomes may include influencing the behavior of HVAC contractors and an expanded market for efficient HVAC equipment. Additional outcomes include reduced utility emissions and fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

12.3.3 External Factors

There are a variety of factors outside the control of KPCO that may influence the program. Documenting these external factors helps improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Energy prices and regulation
- Economic conditions
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Competition among targeted HVAC contractors
- Cost, performance and availability of efficient technologies

12.3.4 Market Barriers

HVAC Dealers play an important role in this program by encouraging customers to make energy efficient upgrades. HVAC contractors are often the primary source of information and the first point of contact for customers in need of HVAC equipment. Therefore, it is critical that contractors have accurate and up-to-date information about the benefits of installing energy efficient equipment and are able to effectively communicate these benefits to customers.

Key barriers to achieving greater market penetration and quality installations include:

- Lowest bid quotes typically drive the HVAC equipment sales industry. Customers are often price-sensitive, especially during a weak economy.
- Lack of consumer awareness. The majority of equipment sales take place in the replacement market where consumers need to make quick decisions.

Kentucky Power's program tries to address these barriers through a combination of education, training, and financial incentives to customers and contractors. This approach has helped to build customer support for high efficiency equipment in the market while educating and providing tools to contractors to market and install high efficiency systems.

12.4 Process and Market Evaluation Findings

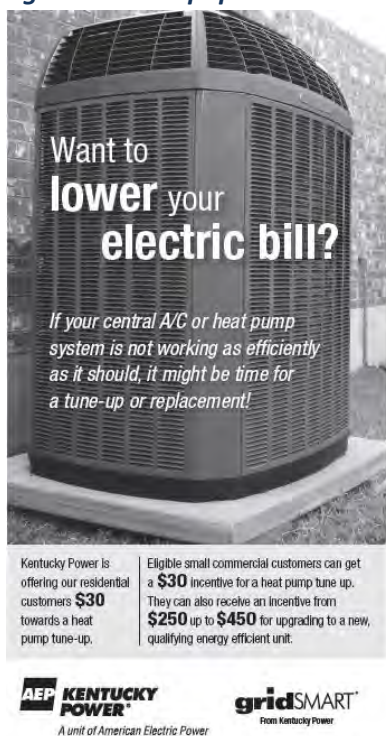
This section provides key process evaluation findings, including marketing, program performance, HVAC Dealer participation, program tracking and program satisfaction.

12.4.1 Program Marketing

Kentucky Power marketed the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program through the following:

- **HVAC Dealer Outreach.** Kentucky Power staff promoted the program directly to HVAC Dealers via telephone calls or in-person meetings with prospective and current dealers. The HVAC Dealers are mailed letters with program information and new rebate forms.
- **Bill Inserts.** Bill inserts were distributed to small commercial customers in July 2013.
- **Bill Messaging.** On-bill messaging was utilized to promote heat pump and air conditioner system upgrades in December 2012 and 2013.
- **Newspaper Advertisements.** Kentucky power advertised the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive and the HVAC Diagnostic and Tune-Up Programs. In 2012, Kentucky Power ran 32 newspaper advertisements in eight local newspapers over a three week period. In September 2013, nine newspaper advertisements were run in three local newspapers over a three week period.
- **Radio Advertisements.** In 2013, Kentucky Power advertised the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive and the HVAC Diagnostic and Tune-Up Programs with local radio channels WLGC, WBVB and WAMX.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save. Customers can search for participating HVAC Dealers by geographic location on the KPCO DSM Program website.

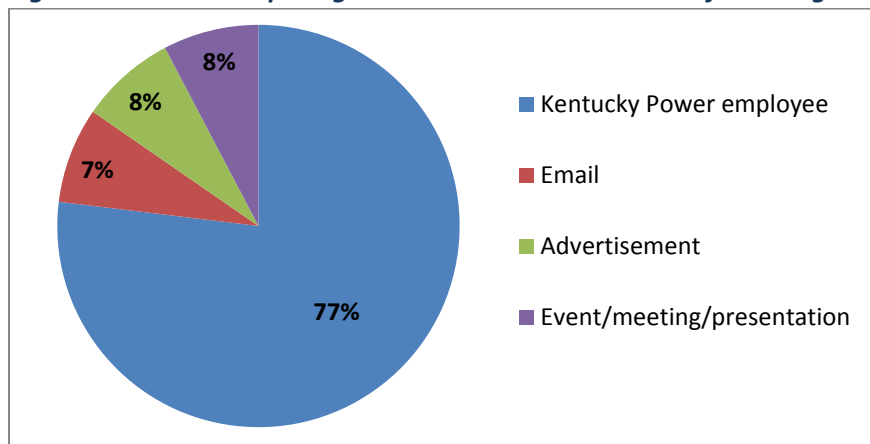
Figure 94 Newspaper Advertisement



The program was designed such that the Kentucky Power program staff markets the program to HVAC Dealers. In turn, the participating HVAC Dealers are encouraged to promote the program to eligible customers. According to participating customers surveyed, participants most often learned of the program from the HVAC Dealer (80 percent) followed by word of mouth (20 percent).

Participating HVAC Dealers most often learned about the program from a Kentucky Power employee.

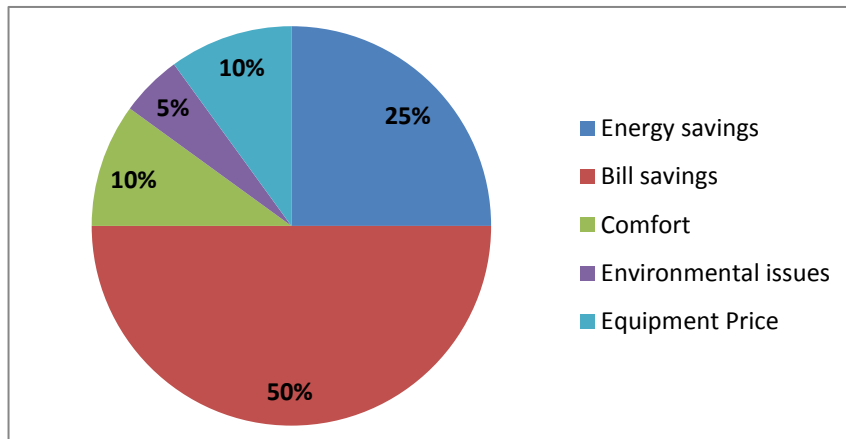
Figure 95 How Participating HVAC Dealers First Learned of the Program (n=13)



The participating HVAC Dealers surveyed noted that their primary source of information on energy efficient HVAC equipment is HVAC distributors (57 percent) followed by online sources (43 percent) and AHRI/Manual J (21 percent).

Sixty (60) percent of participating customers surveyed noted that the information provided by the HVAC Dealer was very important in the decision to install the high efficiency heat pump. Forty-seven (47) percent of customers surveyed cited that their primary reason for participating in the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program was that they needed a new cooling or heating system. One participant noted that their primary reason for participating was that the HVAC Dealer recommended it. The participating HVAC Dealer survey confirmed that the main customer motivation for participating in the program was electric bill savings, followed by energy savings.

Figure 96 Customer Motivation According to HVAC Dealers (n=16)



The majority of participating HVAC Dealers surveyed stated that their primary reason for participating in the Kentucky Power programs was that the program was good for business. Participating HVAC Dealers prefer to be contacted by Kentucky Power program staff via the following channels:

- Emails (60 percent)
- Telephone Calls (53 percent)
- Mail (13 percent)
- In-Person Visits (7 percent)

12.4.2 Program Performance

Between January 1, 2012 and December 31, 2013, 31 heat pump systems and one central air conditioner system were rebated to 22 customers through the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program. Kentucky Power rebated 20 heat pumps and 1 central air conditioner in 2012, achieving 50 percent and 5 percent of the participant goals, respectively. In 2013, Kentucky Power rebated 11 heat pumps, achieving 55 percent of the participant goal. Four rebate applications were denied.

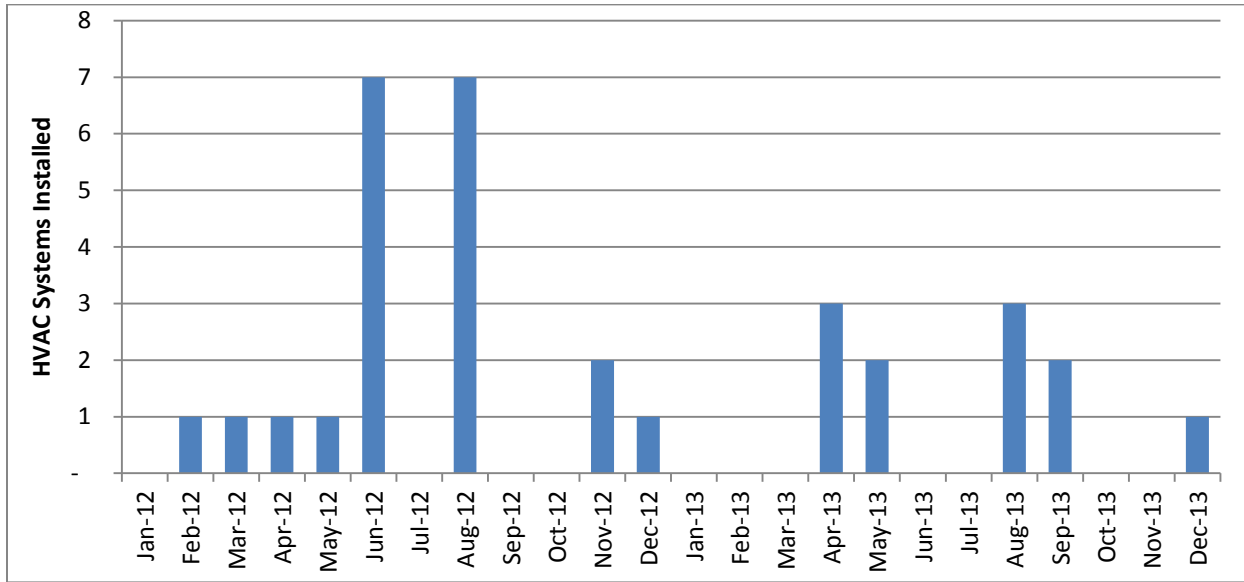
Table 250 Program Participation by Equipment Type

	2012	2013	Total
Central Air Conditioner	1	-	1
Heat Pump	20	11	31

Rebate applications were typically highest in the spring and summer months, from April to September. There was very little program activity in the fall and winter months.

Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program

Figure 97 Equipment Rebated by Month



The Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program requires that the HVAC systems meet, at a minimum, the CEE guidelines. CEE guidelines stipulate that a central air conditioner must meet the SEER or EER requirements and heat pumps must meet the SEER or EER as well as the HSPF requirements. The CEE guidelines are shown in the table below.

Table 251 CEE HVAC System Efficiency Guidelines

Equipment Type	SEER	EER	HSPF
Central Air Conditioner, Split System	14	12	n/a
Central Air Conditioner, Single Package	14	11.6	n/a
Heat Pump, Split System	14	12	8.5
Heat Pump, Single Package	14	11.6	8

Fifteen (15) percent of the HVAC systems installed did not meet the efficiency requirements, including one central air conditioner and three heat pumps.⁸⁹ These rebates were issued prior to July 2012, when Kentucky Power program staff modified the program log to ensure that the equipment efficiency data was correctly recorded and tracked. Of the heat pump systems that met the program requirements, approximately 85 percent exceeded the efficiency requirements.

Table 252 Heat Pump System Efficiency

	8.5 HSPF	8.5 < 9.0 HSPF	≥ 9.0 HSPF
14 SEER	2	-	-
14 < 16 SEER	-	3	-
15 < 16 SEER	2	3	1
≥ 16 SEER	-	2	15

The table below presents the budget and cost per participant as compared to the actual expenditures and cost per participant. The actual 2012 and 2013 expenditures were less than budgeted while the actual cost per participant was higher than budgeted.

⁸⁹ An initial review of the program log found that five participant entries did not meet the minimum program requirements. Kentucky Power reviewed the corresponding rebate applications and corrected one participant entry.

Table 253 Cost per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
Equipment/Vendor	\$3,000	\$1,050	\$1,300	\$550
Incentives	\$25,500	\$7,750	\$11,400	\$4,500
Promotion	\$10,000	\$9,440	\$1,000	\$3,980
Evaluation	\$11,974	\$13,170	\$0	\$1,843
Total Cost (\$)	\$50,474	\$31,410	\$13,700	\$10,873
Participation	60	21	26	11
Cost (\$) per Participant	\$841	\$1,496	\$527	\$988

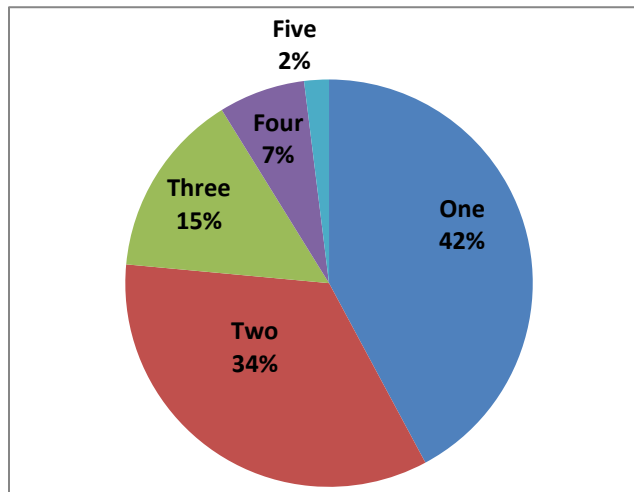
12.4.3 HVAC Dealers

The HVAC Dealers can participate in the following programs:

- Residential and Small Commercial HVAC Diagnostic and Tune-Up Program
- Residential Home High Efficiency Heat Pump Program
- Mobile Home High Efficiency Heat Pump Program
- Small Commercial High Efficiency Heat Pump/Air Conditioner Program

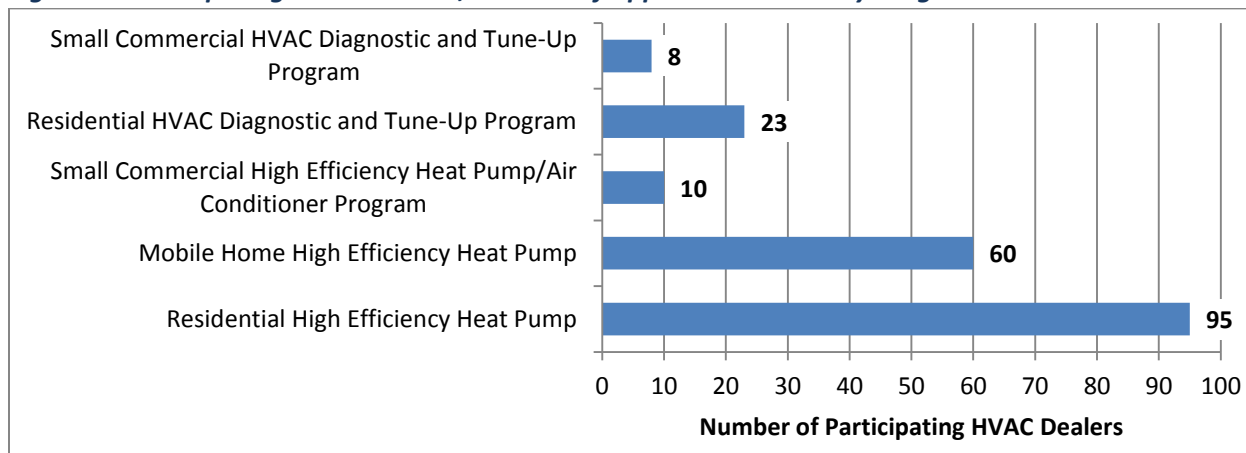
One-hundred and two (102) HVAC Dealers participated in at least one Kentucky Power DSM Program between January 1, 2012 and December 31, 2013. Eighty-seven (87) of the HVAC Dealers are currently listed on the DSM Program website and 15 need to be added as HVAC Dealers. Approximately 75 percent of the participating HVAC Dealers received a rebate for participating in one or two DSM Programs and 2 percent received a rebate for participating in all of the DSM programs.

Figure 98 Participating HVAC Dealers, Number of Programs



A significant majority of participating HVAC Dealers received a rebate through the Residential High Efficiency Heat Pump Program while the Small Commercial HVAC Diagnostic and Tune-Up Program had the fewest number of participating HVAC Dealers receive a rebate.

Figure 99 Participating HVAC Dealers, Number of Approved Rebates by Program



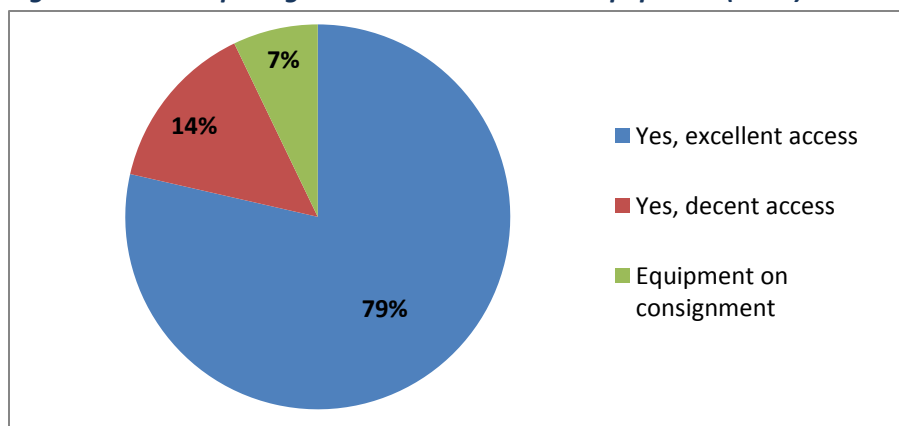
Nine (9) HVAC Dealers participated in the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program in 2012 or 2013. Eight (8) of the HVAC Dealers are currently listed on the DSM Program website and one needs to be added to the DSM Program website as an HVAC Dealer. Two HVAC Dealers performed 50 percent of the installations.

Table 254 Most Active HVAC Dealers

HVAC Dealer	Systems Rebated	% of Total
Breathitt Mechanical	9	28%
Appalachian Refrigeration	7	22%
Arronco Comfort Air	6	19%
Scurlock Heating & Cooling	4	13%
Aire Serv	1	3%
G&W Heating & Cooling	1	3%
General Heating & A/C	1	3%
Pike's Heating & Cooling	1	3%
Smith Heating, Cooling & Electric	1	3%
Webb's Heating & Cooling	1	3%

The HVAC Dealers interviewed noted that they have good access to energy efficient HVAC equipment.

Figure 100 Participating HVAC Dealer Access to Equipment (n=14)



12.4.4 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.⁹⁰ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

Rebate applications are processed by Kentucky Power program staff. Staff reviews and validates the applications for completeness, including customer and HVAC Dealer eligibility. Applications are reviewed based on the date received and the DSM Program. Each customer application is assigned a unique identifier. Hard-copy rebate applications are labeled with the assigned unique identifier and payment request number, then grouped and archived in a binder.

Kentucky Power's program tracking system is comprised of three databases:

KCPO Customer Records (MACCS) is an internal intranet-based database. A note is entered in the customer record with the DSM Program and the date the rebate application was received. KCPO Customer Operations Center can access the note if a customer calls about their rebate status. KCPO program staff utilizes the data to monitor program performance.

Program Log is an Excel- or Access-based database that contains data from the rebate application. Each DSM Program has a program log, which is available on a shared drive to specific KCPO staff.

Kentucky Power collects the following data on the rebate application:

- **Customer Information:** billing account name, account number, address (service and mailing), contact person, customer title, phone number, Tax ID number, total square feet of AC equipment zone, weekly hours of operation, programmable thermostat, peak demand.
- **New Equipment:** system type (split/package), ARI reference number, brand, outdoor unit model number, indoor unit model number, size (tons), SEER, EER, HSPF, furnace model number.
- **Dealer Information:** name, master HVAC license number, Tax ID number, mailing address.
- **Dates:** customer signature date, HVAC Dealer signature date, received date.

Electronic Payment Request (PeopleSoft). Each rebate application has two payment requests, one for the customer and one for the participating HVAC Dealer. The payment request includes the accounting code, unique identification number, customer/HVAC Dealer name and address, dealer Federal Tax ID and rebate amount.

Prior to approval, the Electronic Payment Request is reviewed by the Kentucky Power program coordinator. The coordinator ensures the account number, program account, rebate amount and unique identifier were correct. Once approved, the Electronic Payment Request is submitted electronically to the AEP Accounting Group in Canton, Ohio and rebate checks are issued and mailed.

⁹⁰ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

12.4.5 Program Satisfaction

All participants surveyed would recommend their HVAC Dealer and the program to others. The reasons for recommending the program are that the efficient equipment saves electricity (2) and money (4) and the equipment incentive (2). The reasons customers would recommend the HVAC Dealer include:

- Quality Work (3)
- Good Customer Service (2)
- Professional (1)
- Timely/Courteous (1)

Participants are very satisfied with the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program. Participating customers surveyed were asked their opinion on how the program could be improved. The only participant suggestion was to increase the rebate amount and make the program available to more people.

Table 255 Participant Satisfaction (n=5)

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
HVAC Dealer	100%	n/a	n/a	n/a	n/a
Incentive Processing	80%	n/a	20%	n/a	n/a
Incentive Amount	40%	40%	20%	n/a	n/a
Interaction with KPCO staff	n/a	n/a	100%	n/a	n/a
Response times/ assistance on forms	n/a	n/a	100%	n/a	n/a
Program Overall	80%	20%	n/a	n/a	n/a

HVAC Dealer participation was a key element to the program. Participating HVAC Dealers promoted the program to eligible customers and installed the efficient heat pumps. Sixty (60) percent of participants surveyed noted that the HVAC Dealer provided information that was a crucial factor in deciding to purchase and install the efficient equipment. It is very important to HVAC Dealers that they are listed on the KPCO website as a participating HVAC Dealer.

Overall, the participating HVAC Dealers surveyed are satisfied with the program. The HVAC Dealers were asked their opinion on how the program could be improved, they recommended:

- Improving application process and application requirements
- Increasing advertising and offering co-operative advertising with the HVAC Dealers
- Increasing the rebate levels
- Offering incentives for central air conditioner equipment
- Working with HVAC distributors

Table 256 HVAC Dealer Satisfaction (n=14)

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Incentives offered	-	-	1	1	12
Equipment included the program	-	-	1	3	10
Application requirements	-	1	-	3	10
Incentive processing	1	-	-	1	12
Customer service	-	-	-	2	12
Interaction with Kentucky Power staff	-	-	1	1	12
Program overall	1	-	-	1	12

12.5 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

12.5.1 Gross Energy and Demand Savings

AEG conducted engineering and billing analyses of the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program to assess gross energy and demand savings based on the IPMVP Options A and C.

Engineering Analysis

AEG conducted the engineering analysis using the *Illinois Statewide Technical Reference Manual for Energy Efficiency* ("IL TRM") as the source of engineering equations.⁹¹ Heat pump energy and demand savings were estimated using the following equations:

$$\Delta kWh = \left(\frac{(FLH_{cool} \times Capacity_{cool} \times (\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}))}{1000} \right) + \left(\frac{(FLH_{heat} \times Capacity_{heat} \times (\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}))}{1000} \right)$$

$$\Delta kW_{Summer} = \left(\frac{(Capacity_{cool} \times (\frac{1}{EER_{base}} - \frac{1}{EER_{ee}}))}{1000} \right) \times CF$$

$$\Delta kW_{Winter} = \left(\frac{(Capacity_{heat} \times (\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}))}{1000} \right)$$

Where:

FLH _{cool}	= Full load hours of cooling
FLH _{heat}	= Full load hours of heating
Capacity _{cool}	= Cooling capacity of heat pump (Btu/h)
Capacity _{heat}	= Heating capacity of heat pump (Btu/h)
SEER _{base}	= Seasonal Energy Efficiency Ratio of baseline system (kBtu/kWh)
SEER _{ee}	= Seasonal Energy Efficiency Ratio of efficient heat pump (kBtu/kWh)
EER _{base}	= Energy Efficiency Ratio of baseline system (kBtu/kW)
EER _{ee}	= Energy Efficiency Ratio of efficient heat pump (kBtu/kW)
HSPF _{base}	= Heating Seasonal Performance Factor of baseline system (kBtu/kWh)
HSPF _{ee}	= Heating Seasonal Performance Factor of efficient heat pump (kBtu/kWh)
CF	= Summer System Peak Coincidence Factor

The engineering analysis variables were adapted to Kentucky Power's service territory. For example, AEG used standard assumptions for full load heating and cooling hours based on information from the

⁹¹ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

US Environmental Protection Agency.⁹² The table below summarizes the key variables used in the engineering analysis.

Table 257 Engineering Analysis Variables

Variable	Value	Description
FLH _{cool}	1,080	Assumed value for Lexington, KY from ENERGY STAR savings calculator
FLH _{heat}	2,027	
Capacity _{cool}	Application	Unit size in tons (1 ton = 12,000 Btu/h)
Capacity _{heat}	Application	
SEER _{base}	13	Minimum efficiency requirement for split and packaged systems less than 65 kBTU/h
HSPF _{base}	7.7	Minimum efficiency requirement for split and packaged systems less than 65 kBTU/h
SEER _{ee}	Application	SEER of rebated unit
HSPF _{ee}	Application	HSPF of rebated unit
CF	91.3%	IL TRM

Participants that did not meet the program requirements were assigned zero energy and demand savings. The only central air conditioner installed in 2012 or 2013 did not meet the program requirements. Therefore, AEG calculated the expected savings from a split system air conditioning unit using specifications from the minimum eligibility requirements of the program. The engineering algorithm and the inputs for this calculation are summarized below.

$$\Delta kWh = kBTUh \times \left[\left(\frac{1}{SEER_{base}} \right) - \left(\frac{1}{SEER_{ee}} \right) \right] \times FLH_{cool}$$

$$\Delta kW_{summer} = kBTUh \times \left[\left(\frac{1}{EER_{base}} \right) - \left(\frac{1}{EER_{ee}} \right) \right] \times CF$$

Where:

- kBTUh = Cooling capacity of central air conditioner (kBTU/h)
- SEER_{base} = Seasonal Energy Efficiency Ratio of the baseline system (kBtu/kWh)
- SEER_{ee} = Seasonal Energy Efficiency Ratio of the efficient air conditioner (kBtu/kWh)
- EER_{base} = Energy Efficiency Ratio of the baseline system (kBtu/kW)
- EER_{ee} = Energy Efficiency Ratio of the efficient air conditioner (kBtu/kW)
- FLH_{cool} = Full load hours of cooling
- CF = Summer System Peak Coincidence Factor

The table below summarizes the inputs used to calculate the expected savings from a central air conditioning unit.

Table 258 Input Assumptions for Air Conditioner Savings

Variable	Value	Description
kBTUh	36	Assumed system with 3-ton cooling capacity
SEER _{base}	13	Post-2006 minimum federal baseline efficiency level
SEER _{ee}	14	Minimum efficiency level meeting CEE Tier 1 specifications according to program rules
FLH _{cooling}	1080	Assumed value for Lexington, KY from ENERGY STAR savings calculator
EER _{base}	11.82	Post-2006 minimum federal baseline efficiency level (EER = SEER/1.1)
EER _{ee}	12.00	Minimum efficiency level meeting CEE Tier 1 specifications according to program rules
CF	91.50%	IL TRM

⁹² http://www.energystar.gov/buildings/sites/default/uploads/files/ASHP_Sav_Calc.xls

Using the inputs summarized in the table above, AEG determined that expected energy savings for a 36 kBTU/h system to be 214 kWh with a summer demand savings of 0.04 kW. The anticipated energy and demand savings from a larger 65 kBTU/h system would be 386 kWh and 0.08 kW, respectively.

The tables below present the gross savings per participant attributable to the program.

Table 259 Gross Energy Savings (kWh) per Participant, Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	1,692	2,931	2,142
2013	1,307	1,789	1,439
Total Program	1,574	2,550	1,900

Table 260 Gross Summer Demand Savings (kW) per Participant, Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	0.81	1.55	1.09
2013	1.07	1.43	1.17
Total Program	0.93	1.51	1.11

Table 261 Gross Winter Demand Savings (kW) per Participant, Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	0.58	1.07	0.80
2013	0.45	0.66	0.51
Total Program	0.54	0.93	0.70

The total program gross and energy savings are shown in the tables below.

Table 262 Total Gross Energy Savings (kWh), Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	18,614	26,375	44,989
2013	10,457	5,367	15,825
Total Program	29,071	31,743	60,814

Table 263 Total Gross Summer Demand Savings (kW), Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	8.9	13.9	22.8
2013	8.6	4.3	12.8
Total Program	17.5	18.2	35.7

Table 264 Total Gross Winter Demand Savings (kW), Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	6.4	9.6	16.1
2013	3.6	2.0	5.6
Total Program	10.0	11.6	21.7

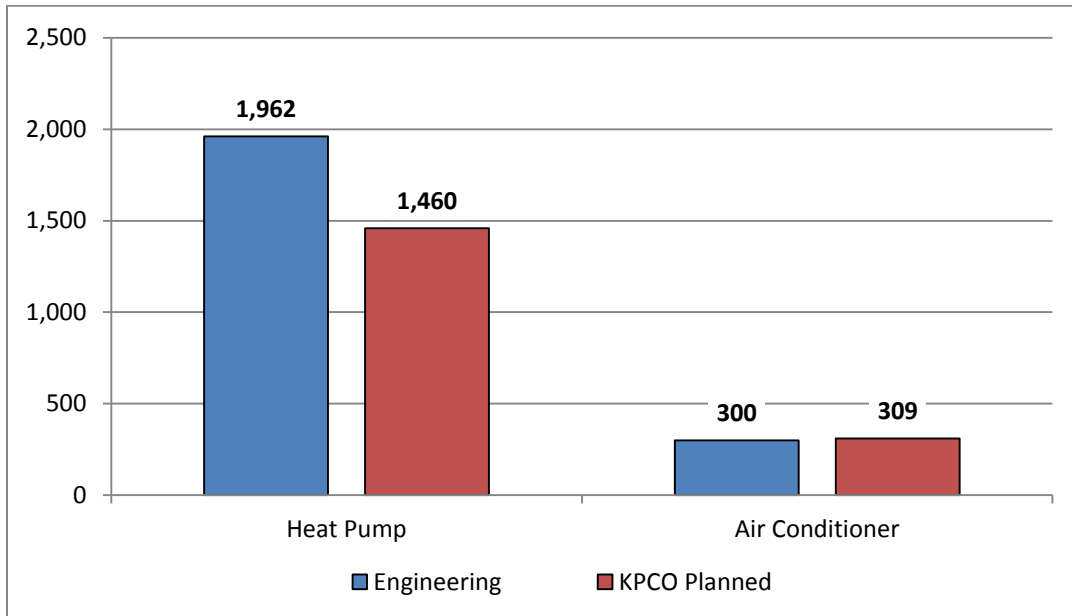
Billing Analysis

AEG was unable to determine statistically significant results from the participant sample using the above methodology. The original sample of program participants was very small, with only 19 unique account numbers to extract from the billing data. After data cleaning and removing outliers the sample size was reduced to only 6 participants. As a result, accurate billing analysis savings could not be calculated.

Gross Energy Savings Comparison

The planned savings per participant reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. The figure below compares the gross energy savings per participant for the engineering analysis and planned savings assumptions. The engineering analysis values shown below are for 2012 and 2013 heat pump participants and a split system air conditioning system that meets the minimum efficiency requirements.

Figure 101 Summary Gross Energy Savings per Participant, Heat Pump



12.5.2 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after accounting for free ridership and spillover. Free ridership refers to those participants who would have installed an efficient HVAC system without program influence. Spillover refers to additional savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - \text{Free ridership} + \text{Spillover}$$

AEG conducted a survey of program participants to evaluate the effects of free ridership and spillover. NTG is depending on survey results and participant answers of the survey, which vary by program year and evaluation cycle. The survey sample was based on a random sample of participants with an overall statistical significance of 90 percent and a margin of error of +/- 10 Percent. However, AEG was only able to contact five participants. As a result, the margin of error for the survey increased to approximately 35 percent.

Free Ridership

Three questions in the participant survey were designed to assess the effects of free ridership.

- **Question 1:** How important was the Kentucky Power incentive in your decision to buy the efficient equipment?
- **Question 2:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the exact same TYPE OF equipment?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the exact same QUANTITY of equipment?

Each response to the free ridership questions was assigned a probability that that respondent was a free rider. The free ridership probability reflects the likelihood that a respondent would have installed the efficient HVAC system absent the program. The proportion of each response was multiplied by the free ridership probability to calculate the free ridership score.

Table 265 Question 1 Free Ridership

Response	Count	Percent	Probability	Score
Very important	3	60%	20%	12%
Somewhat important	0	0%	40%	0%
Neutral	0	0%	60%	0%
Not very important	2	40%	80%	32%
Not at all important	0	0%	0%	0%
Question 1 Free Ridership Score				44%

Table 266 Question 2 Free Ridership

Response	Count	Percent	Probability	Score
Very likely	4	80%	80%	64%
Somewhat likely	0	0%	30%	0%
Not likely	1	20%	20%	4%
Question 2 Free Ridership Score				68%

Table 267 Question 3 Free Ridership

Response	Count	Percent	Probability	Score
Very likely	4	80%	80%	64%
Somewhat likely	1	20%	30%	6%
Not likely	0	0%	20%	0%
Question 3 Free Ridership Score				70%

The free ridership score for each question was weighted based on its contribution to the overall free ridership factor. Weights were based on the assumption that survey responses may not reflect the actual behavior of respondents (i.e. social desirability bias). The weighted average of the scores determines the free ridership factor for the program.

Table 268 Free Ridership Summary

Free Ridership Question	Score	Weight
Question 1	44%	50%
Question 2	68%	25%
Question 3	70%	25%
Weighted Average Free Ridership Score	57%	

Based on the responses to the survey questions, free ridership was estimated at 57 percent.

Spillover

Spillover is the ratio of net spillover savings to gross savings of the participant sample.

$$Spillover = \frac{Net\ Spillover\ Savings}{(Program\ Savings\ per\ Participant \times Total\ Respondents) + Total\ Spillover\ Savings}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and spillover score for each respondent

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the participant survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your business purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to question one were included in the spillover calculation. The savings from the spillover actions described in question two were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, only one participant was reported installing energy efficient lighting measures as a result of the program.

The net spillover savings was determined by applying the spillover score to the gross spillover savings to estimate the spillover savings directly attributable to the program. The ratio of net savings to the gross program savings determined the overall spillover score. The table below illustrates how the program spillover score was calculated. AEG determined a program spillover score of approximately 1 percent.

Table 269 Spillover Calculation Summary

Line	Variable	Value
A	Total Respondents	5
B	Program Savings per Participant	1,962
C	Program Savings of Sample (A x B)	9,809
D	Gross Spillover Savings of Sample	151
E	Total Sample Savings (C + D)	9,960
F	Net Spillover Savings	136
G	Spillover Score (F ÷ E)	1%

Next, AEG used the free ridership and spillover estimates to determine the NTG factor for the program. As a result, the NTG factor for the program is 45 percent.

Table 270 Net-to-Gross Results

Free Ridership	Spillover	NTG
57%	1%	45%

In order to determine the net savings attributable to the program, AEG applied the NTG factor to the gross savings results from the engineering analysis. The following tables show the net savings per participant as well as the total net savings of the program.

Table 271 Net Energy Savings (kWh) per Participant, Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	759	1,315	961
2013	586	803	645
Total Program	706	1,144	853

Table 272 Net Summer Demand Savings (kW) per Participant, Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	0.36	0.69	0.49
2013	0.48	0.64	0.52
Total Program	0.42	0.68	0.50

Table 273 Net Winter Demand Savings (kW) per Participant, Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	0.26	0.48	0.34
2013	0.20	0.30	0.23
Total Program	0.24	0.42	0.30

The total program gross and energy savings are shown in the tables below.

Table 274 Total Net Energy Savings (kWh), Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	8,351	11,833	20,184
2013	4,692	2,408	7,100
Total Program	13,043	14,241	27,284

Table 275 Total Net Summer Demand Savings (kW), Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	4.0	6.2	10.2
2013	3.8	1.9	5.8
Total Program	7.8	8.2	16.0

Table 276 Total Net Winter Demand Savings (kW), Engineering Analysis

	Heat Pump ≤36 kBTU/h	Heat Pump 36 ≤ 65 kBTU/h	Program Total
2012	2.9	4.3	7.2
2013	1.6	0.9	2.5
Total Program	4.5	5.2	9.7

12.5.3 Savings per Participant Summary

AEG conducted engineering and billing analyses of the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program to assess gross energy and demand savings based on IPMVP Options A and C. AEG recommends utilizing the 2013 engineering analysis energy and demand savings per participant to determine program savings for program tracking purposes as well as PSC filings.

The tables below present the gross and nets savings per participant.

Table 277 Gross Energy and Demand Savings per Participant

Group	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Heat Pump ≤ 36 kBTU/h	1,307	1.07	0.45
Heat Pump 36 ≤ 65 kBTU/h	1,789	1.43	0.66
Air Conditioner ≤ 36 kBTU/h	214	0.45	-
Air Conditioner 36 ≤ 65 kBTU/h	386	0.82	-

Table 278 Net Energy and Demand Savings per Participant

Group	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Heat Pump ≤ 36 kBTU/h	586	0.48	0.20
Heat Pump 36 ≤ 65 kBTU/h	803	0.64	0.30
Air Conditioner ≤ 36 kBTU/h	96	0.20	-
Air Conditioner 36 ≤ 65kBTU/h	173	0.37	-

12.5.4 Program Site Inspections and Installation Verification

AEG performed site inspections and installation verifications on three fully installed projects to perform quality assurance/quality control and verify application information of the installed equipment. Proper installation verification was confirmed at all locations. Limited program participation and scheduling conflicts hindered AEG's ability to inspect projects across Kentucky Power's service territory.

Table 279 Site Inspection Summary

Area	Count	%
Ashland	0	0%
Pikeville	0	0%
Hazard	3	100%
Total	3	100%

12.5.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline equipment. Cost-effectiveness analysis indicates whether the efficient technology(s) improve a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program utilizing four standard cost-effectiveness tests taken from the *California Standard Practices Manual*.⁹³ Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

Impact evaluation results were utilized in the four cost-effectiveness tests, taken from the *California Standard Practices Manual*. Kentucky Power specific inputs, including avoided costs, discounts rates, participation and incentives, were used to conduct the cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollar values in order to accurately compare future benefits with current costs.

Measure-level cost-effectiveness was calculated utilizing the Total Resource Cost Test. Measure-level cost-effectiveness does not program administrative costs (administration, marketing, etc.) because they are spent at the program-level and cannot be allocated to specific measure. Measure-level cost-effectiveness results are presented in the table below.

Table 280 Measure-Level Cost Effectiveness Results

Measure	TRC
Heat Pump ≤ 36 kBTU/h	2.84
Heat Pump 36 ≤ 65 kBTU/h	2.15
Air Conditioner ≤ 36 kBTU/h	0.81
Air Conditioner 36 ≤ 65 kBTU/h	0.88

The Small Commercial High Efficiency Heat Pump/Central Air Conditioner Incentive Program was found to not be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

⁹³ The California Standard Practices Manual details cost-effectiveness guidelines and procedures for standardized cost-effectiveness evaluations.

Table 281 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.41	\$73,255	\$29,805	(\$43,450)
Utility Cost Test	0.74	\$40,520	\$29,805	(\$10,715)
Participant Test	4.09	\$10,660	\$43,608	\$32,948
Total Resource Cost Test	0.74	\$40,308	\$29,805	(\$10,502)

The program was not cost-effective due to participation falling well below program goals. If participation goals were achieved, or if the free ridership was significantly reduced, the program would have been cost-effective.

Evaluating the program on a prospective basis, the Small Commercial High Efficiency Heat Pump/Central Air Conditioner Incentive Program is also not cost-effective as currently planned. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The cost-effectiveness results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The main factor driving the difference in cost-effectiveness is the level of participation of heat pumps. In past programs, participation was heavily skewed towards heat pumps (with approximately 90-100% heat pumps). In the 2014 planning values, heat pumps make up approximately 66% of program measures, which lowers the cost-effectiveness compared to past program years.

Table 282 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.49	\$23,724	\$11,595	(\$12,129)
Utility Cost Test	0.77	\$14,988	\$11,595	(\$3,394)
Participant Test	2.51	\$5,512	\$13,811	\$8,298
Total Resource Cost Test	0.75	\$15,425	\$11,595	(\$3,831)

If heat pumps make up 100% of projected program participation, the program will be cost-effective going forward. The prospective program year cost-effectiveness results are presented in the table below.

Table 283 Cost Effectiveness Results, Prospective with Heat Pumps Only

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.44	\$20,991	\$9,287	(\$11,704)
Utility Cost Test	0.70	\$13,223	\$9,287	(\$3,936)
Participant Test	3.35	\$3,306	\$11,078	\$7,772
Total Resource Cost Test	0.70	\$13,219	\$9,287	(\$3,932)

12.6 Recommendations

AEG has several recommendations on how to improve the program. These include:

Merge with the Commercial Incentive Program

AEG recommends that Kentucky Power utilize DNV GL, the Commercial Incentive Program implementation contractor, to implement the Small Commercial High Efficiency Heat Pump/Central Air Conditioner Incentive Program. Some of the KPCO programs have implementation contractors that perform the day-to-day operations of the programs, but the residential and small commercial HVAC programs are run completely by KPCO staff. Therefore, KPCO staff is responsible for marketing and promotional activities, including visiting participating and potential HVAC dealers across the KPCO

territory, processing rebate applications, program tracking and performing QA/QC inspections. Kentucky Power has not yet conducted an inspection to ensure qualifying systems are being installed.

The Commercial Incentive Program currently offers customer incentives for HVAC equipment. AEG recommends that Kentucky Power work with DNV GL to merge the Small Commercial High Efficiency Heat Pump/Central Air Conditioner Incentive Program with the Commercial Incentive Program. Kentucky Power should work with DNV GL to determine if the incentive levels should be modified to improve the program.

Consider Program Modifications

AEG recommends that Kentucky Power consider modifying the program in order to increase cost-effectiveness. The program has failed to achieve cost-effectiveness in the past three program years due to low participation compared to program goals. Achieving program participation goals is vital for the program to be cost-effective. In order to reach participation goals Kentucky Power should consider increasing marketing efforts and/or more actively engaging HVAC Dealers.

13. Commercial Incentive Program

The Commercial Incentive Program provides financial incentives to business customers who purchase and install energy efficient technologies in existing and new construction facilities. The program is available to all commercial customers within KPCO's retail electric service territory. The Commercial Incentive Program consists of three (3) separate sub-programs: Retrofit Program, New Construction Program, and Express Program. Each sub-program is described below.

Retrofit Program. Prescriptive and custom incentives are available for a variety of efficient technologies. The maximum incentive per project is 50% of incremental equipment costs, up to \$20,000 annually per project and per customer account. The Retrofit Program has two separate incentive types:

Prescriptive Incentives are intended to encourage business customers to purchase and install a standard set of high efficiency measures. Incentives are available for:

- Lighting
- Heating, Ventilation and Air Conditioning ("HVAC")
- Food Service and Refrigeration

Custom Incentives are intended to encourage business customers to purchase and install high efficiency measures not covered by a prescriptive incentive. Incentives are based on measure-specific energy savings and paid at 8 cents per unit of electricity (kWh) saved.

New Construction Program provides incentives to customers that are designing new additions, planning major renovations or building new facilities can receive incentives for installing energy efficient measures above the current building energy code.

Express Install Program provides incentives to small business customers (less than 100 kW) for the installation of qualifying high efficient lighting and refrigeration. Measures must be installed by an Express Install contractor. Incentives are limited to \$20,000.

The Kentucky PSC approved budget and participation goals for the Commercial Incentive Program.

Table 284 Program Budget and Participation Goals, 2012-2014

	2012	2013	2014
Contractor Administration	\$682,643	\$425,685	\$679,393
Customer Incentives	\$885,800	\$699,950	\$675,000
Promotion	\$10,000	\$10,000	\$46,000
Evaluation	\$52,282	\$0	\$59,445
Total Budget	\$1,630,725	\$1,135,635	\$1,459,838
Participation Goal	172	200	250

13.1 2011 Commercial Incentive Program Evaluation

AEG conducted a process, market and impact evaluation of the 2011 Commercial Incentive Program, submitted in July 2012 to the Kentucky Public Service Commission. The evaluation recommendations included, but were not limited, to:

- Implementation Contractor increase local staff
- Streamline participation process

- Conduct random inspections of at least 15 to 20 percent of pre- and post-installation projects
- Examine the customer incentive reservation period

Based on the recommendations, DNV GL hired one additional field representative, reduced Retrofit pre- and post-installation inspections to 25 percent, and reduced the Retrofit reservation period to 90 days.

13.2 Evaluation Data Collection

The Commercial Incentive Program evaluation was guided by the following key researchable issues:

- Is the tracking system effective for documenting and reporting program progress?
- Are the programs achieving participation and energy savings goals?
- What marketing/promotional efforts resonate with participants?
- Are participating contractors sufficiently knowledgeable about the Express Program? The Retrofit Program?
- Are customers receiving adequate support from the Contractors/Kentucky Power/Implementation Contractor?
- Are rebate applications processed, approved and paid on a timely basis?
- Is the Implementation Contractor inspecting a sufficient number of projects? Are the inspections conducted on a timely basis?
- Is the tracking system effective in managing customer applications, inspections, and the rebate payment process? Is the tracking system effective in tracking customer status?
- Is the tracking system effective at documenting participation?
- Are customers satisfied with the program? The participation process?
- What are the areas for improvement?
- What are the barriers to program participation? How can those barriers be overcome?
- Would customers recommend the program?
- Has program participation generated interest in other Kentucky Power programs? In other energy efficiency actions?

To arrive at the final recommendations, AEG reviewed program materials, assessed program flow, reviewed the program tracking system and undertook the following data collection activities:

Kentucky Power Staff Interview

AEG conducted a comprehensive group interview with Kentucky Power program staff in October 2013. The purpose of the interview was to get staff impressions of program implementation activities, program performance, marketing and customer awareness of the program, program data and tracking mechanisms, and opportunities for program improvements.

Implementation Contractor Interview

The program is implemented by DNV GL (formerly KEMA Services, Inc.) is responsible for managing the program on a day-to-day basis providing customer service, managing Direct Install contractors, processing customer applications, tracking program data and conducting QA/QC inspections. AEG interviewed DNV GL in September 2013. The interview provided information on program implementation activities, program data and tracking methods. The interview guide can be found in Appendix A.

Contractor Interviews

AEG administered telephone interviews to a sample of participating contractors. The interviews provided an assessment of the availability of qualifying equipment, identified potential areas for improvement and provided insight on customer attitudes toward energy efficiency and application processes. AEG interviewed 2 contractors that participated in the Retrofit and Express Install programs.⁹⁴ The interview guide can be found in Appendix B.

Participating Customer Surveys

AEG administered an internet survey to a random sample of Retrofit participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. AEG also conducted 10 to 12 minute telephone surveys with Retrofit participants in an effort to increase the number of completed surveys. Between January 1, 2012 and September 30, 2013,⁹⁵ Kentucky Power rebated 267 Retrofit projects to 97 unique customers. DNV GL provided data for all 267 projects rebated, including business name, account number, telephone number and measures rebated. AEG scrubbed the project data to account for customers that received more than one rebate. The scrubbed data included 97 participants, as identified by participant account number, address and contact. AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were randomly selected based on unique identifiers determined by Microsoft Excel's random number generator.

Thirty-three (33) Retrofit surveys were completed, for an error margin of 14 percent. Surveyors contacted all Direct Install and New Construction participants and were able to complete 1 Direct Install survey. Survey guides can be found in Appendix C. AEG also conducted site visits and inspections to verify installation and verify application data.

Review Planned Savings

AEG reviewed the planned program energy and demand impacts. Kentucky Power's initial program filing savings were reviewed to compare with the impact evaluation results.

Gross Energy and Demand Impacts

AEG determined the gross energy and demand savings of a representative sample based on Options A and C of the International Performance Measurement and Verification Protocols ("IPMVP").⁹⁶ AEG performed separate engineering and customer billing analyses to provide a comparison between the two savings methodologies.

⁹⁴ The Express Install Program had four contractors.

⁹⁵ Due to time constraints, the sample included customers that participated between January 1, 2012 and September 30, 2013. The results were applied to the full 2012 and 2013 participants.

⁹⁶ IPMVP provides best practice techniques for verifying results of energy efficiency projects, i.e. verifying savings attributed to energy efficiency projects.

Table 285 Overview of IPMVP Options

IPMVP M&V Option	Measure Performance Characteristics	Data Requirements
Option A: Engineering calculations using spot or short-term measurements, and/or historical data	Constant performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • Spot measurements • Run-time hour measurements
Option B: Engineering calculations using metered data.	Constant or variable performance	<ul style="list-style-type: none"> • Verified installation • Nameplate or stipulated performance parameters • End-use metered data
Option C: Analysis of utility meter (or sub-meter) data using techniques from simple comparison to multivariate regression analysis.	Variable performance	<ul style="list-style-type: none"> • Verified installation • Utility metered or end-use metered data • Engineering estimate of savings input to SAE model
Option D: Calibrated energy simulation/modeling; calibrated with hourly or monthly utility billing data and/or end-use metering	Variable performance	<ul style="list-style-type: none"> • Verified installation • Spot measurements, run-time hour monitoring, and/or end-use metering to prepare inputs to models • Utility billing records, end-use metering, or other indices to calibrate models

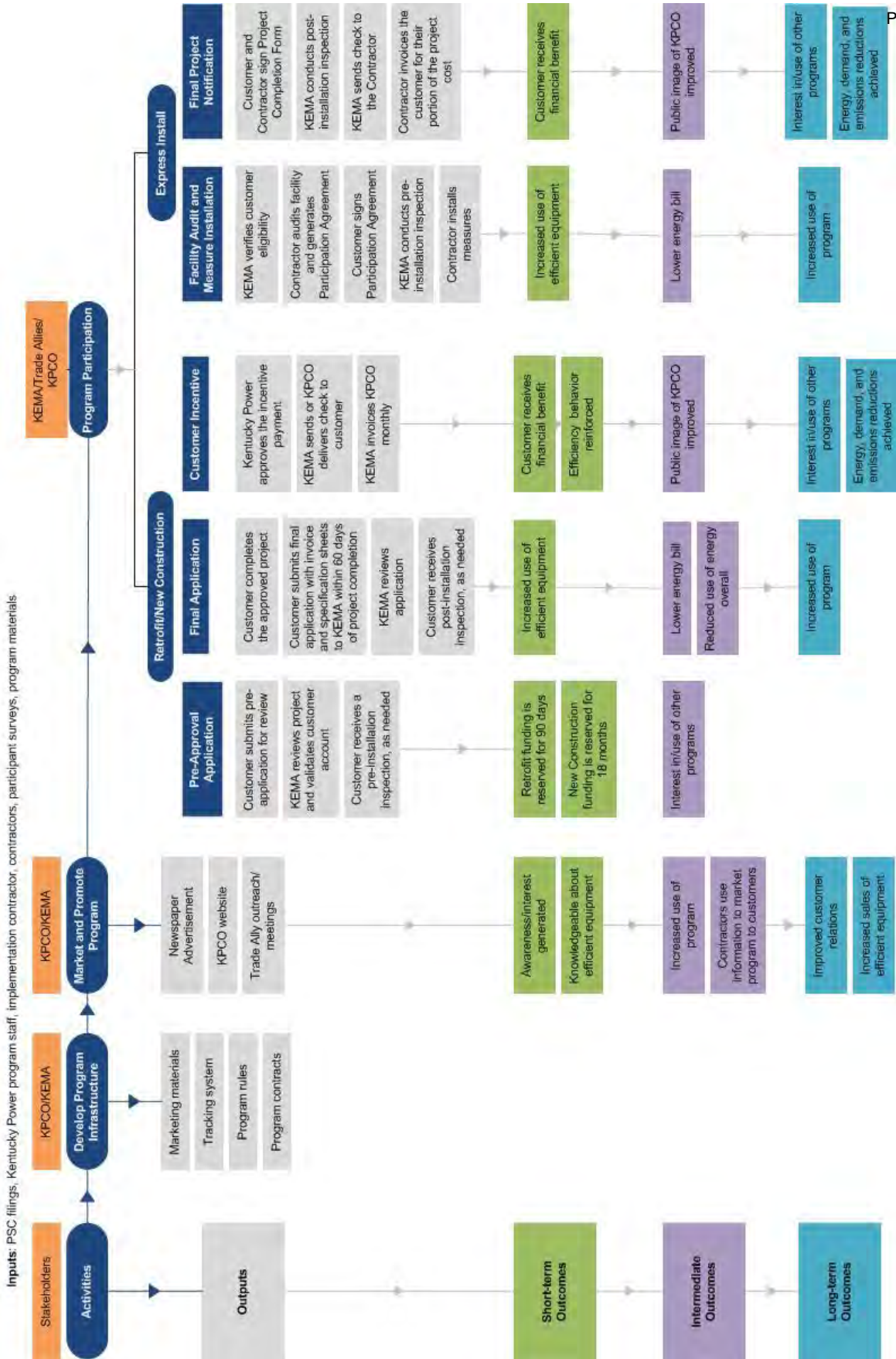
Engineering algorithms from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”), using Kentucky Power specific inputs, were utilized to calculate gross energy and demand impacts.⁹⁷ The billing analysis identified changes in participants’ energy usage attributable to the program, comparing energy usage for one year prior to measure installation to one year post measure installation.

13.3 Program Activities and Market Barriers

Logic models are graphic representations of a program and its processes. Logic models make the program’s assumptions explicit, showing the causal relationships or linkages among the problem or situation the program is designed to address, the intervention (inputs and outputs), and program impact (short, medium and long-term outcomes). Logic models also serve to identify processes and relationships that are critical to the program’s performance.

⁹⁷ *Illinois Statewide Technical Reference Manual for Energy Efficiency*, Version 2, June 7, 2013.

Figure 102 Program Logic Model



13.3.1 Program Activities

The program activities and their corresponding outputs help to establish linkages between the situation the program is designed to address and the program's intended outcomes. Program activities include:

Program Infrastructure

Activities include gathering market knowledge, setting program goals, designing the program, establishing program rules, developing marketing approaches and content, and establishing an operating structure. Kentucky Power program staff and DNV GL, with input from AEP, designed the program, including eligible measures and incentive levels, rebate applications and application processes, data tracking system and marketing materials. The KPCO Customer Operations Center has descriptions of all KPCO DSM Programs to assist with customer inquiries.

Market Program

Marketing activities are targeted towards Trade Allies, businesses and individuals likely to have direct contact with eligible customers. The program was marketed through newspaper advertisements, training events, local meetings, the KPCO website, and program fact sheets.

Program Participation

The participation process differs depending on whether the customer is participating in the Retrofit, New Construction or Express Install Program.

Retrofit and New Construction Program Participation

Pre-Approval Application

The customer completes and submits a pre-approval application to DNV GL via mail, email or fax prior to purchasing equipment or committing to a project. DNV GL reviews the application for completeness and verifies customer eligibility. Kentucky Power provided DNV GL with a list of eligible customers and updates the list periodically. If new construction customers do not have an AEP electric account, DNV GL checks with Kentucky Power program staff prior to approving the application.

Approximately 25 percent of Retrofit customers receive a pre-installation inspection.⁹⁸ Upon approval of the application, the customer receives a letter confirming the funding reservation and detailing program terms and conditions. The reservation period is 90 days for Retrofit projects and 18 months for New Construction projects, during which time the project must be completed.

Final Application

The customer completes and submits the final application to DNV GL within 60 days of project completion. Customers must note any work/measures that vary from the pre-approval application, sign the application and provide any supporting documentation. DNV GL reviews the application and conducts a post-installation inspection of 25 percent of Retrofit projects and 100 percent of New Construction projects.⁹⁹

Customer Incentive

Kentucky Power program staff review completed projects and approve customer payment. DNV GL processes customer incentives and issues incentive checks. Kentucky Power maintains the right to

⁹⁸ No New Construction customers receive pre-approval inspections.

⁹⁹ The Retrofit projects are not selected randomly for inspection, but by project type, contractor, etc.

conduct random inspections to verify the services are being performed properly and to determine customer satisfaction. No inspections have been conducted to-date. DNV GL conducted inspections of all Retrofit projects in 2012 and 52 percent of Retrofit projects in 2013.

Table 286 Retrofit Project Inspections, 2012 and 2013

	2012	2013
Pre-Inspection	2	17
Post-Inspection	3	26
Pre- and Post-Inspection	123	36
Total	128	79

Express Install Program Participation

Facility Audit and Measure Installation

Customers may enroll in the program one of two ways:

- The customer contacts DNV GL directly
- An Express Install lighting contractor approaches the customer

DNV GL verifies customer eligibility utilizing a customer list provided by Kentucky Power. An Express Install contractor conducts an audit of the facility, at no cost to the customer.

The Express Install contractor enters customer information and facility equipment into a DNV GL web-based program and generates a report of expected facility savings and project costs. The customer signs a Participation Agreement detailing the project cost, anticipated energy savings and customer incentive. A pre-installation inspection is conducted to ensure all proposed measures are feasible. The Contractor schedules the installation and installs the measures per the Participation Agreement.

Final Project Notification

Upon project completion, the customer and contractor sign a Project Completion Form. A post-installation inspection is conducted to ensure all measures were correctly installed. DNV GL pays the incentive to the contractor and the contractor invoices the customer for their portion of the project cost. Kentucky Power maintains the right to conduct random inspections to verify the services are being performed and determine customer satisfaction. No inspections have been conducted to-date.

Evaluate Program

Evaluation activities include process, market and impact studies. Once evaluations are conducted, recommendations for program improvements are generated for Kentucky Power and fed back into program design.

13.3.2 Outcomes

Outcomes are the result of program partners and target audiences responding to the outputs of the program. There are short-term, intermediate, and long-term outcomes of the program.

Short-term Outcomes

When the program is marketed and promoted, customer awareness and interest in more efficient equipment may increase. Other short-term outcomes include increased awareness of environmental and energy issues, reinforcement of efficiency behavior and financial benefits from participation.

Intermediate Outcomes

Intermediate outcomes may include increased use of the program, interest in, and use of, other KPCO efficiency programs and reduced energy consumption.

Long-term Outcomes

The long-term outcomes may include reduced utility emissions and fewer greenhouse gases emitted. Kentucky Power may enhance its public image as a utility that responds to customer needs without sacrificing consideration of environmental issues.

13.3.3 External Factors

There are a variety of factors outside the control of KPCO that may influence the program. Documenting these external factors help improve program planning by identifying important program partners, factors the program can realistically influence, which evaluation tactics will accurately reflect project outcomes, and other needs that must be met to address the issue. Some external factors include:

- Changes in political priorities (e.g. codes and standards, state and local regulations, federal policies, perceptions of energy and climate change)
- Weather and associated impacts on customer actions and energy bills
- Economic conditions
- Energy prices and regulation
- Changes in utility rate structures
- Perceptions in the value of energy efficiency
- Competing interests among demand side customers
- Cost, performance and availability of efficient technologies

13.4 Process and Market Evaluation Findings

This section provides key process evaluation findings, including marketing, program performance, program tracking and program satisfaction.

13.4.1 Program Marketing

Kentucky Power marketed the Commercial Incentive Program through the following:

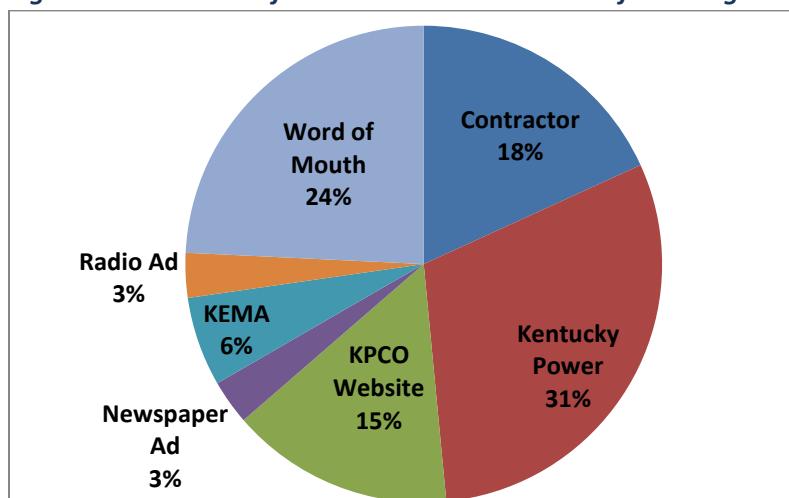
- **Newspaper Advertisements.** In October and November 2013, Kentucky Power ran 15 newspaper advertisements in five local newspapers.
- **Internet.** Kentucky Power marketed the program through kentuckypower.com/save.
- **Training Events.** DNV GL held training events for customers and contractors over three days in early 2013 in Ashland, Pikeville and Hazard. DNV GL held software training for Express Install lighting contractors in March, May and July 2013.
- **Trade Ally Outreach.** The DNV GL representative promoted the program to Trade Allies, businesses and individuals likely to have direct contact with eligible customers.

Table 287 Trade Ally Outreach

	Target Audience	Attendance
Green Energy Management	Electrical Contractors	Bi-monthly
Computer and Technology Applications	Electrical/HVAC Contractors	Aug./Sept. 2013
Rotary International Business Meetings	Customers	Weekly
Kiwanis Business Meetings	Customers	Weekly
East Kentucky Association of Electricians	Electrical Contractors	Monthly
NEC Updates (Hazard Community and Technical College)	Customers	Monthly
Business Law for General Contractors	Trade Allies	Monthly
Ashland Community and Technical College	Trade Allies	2013

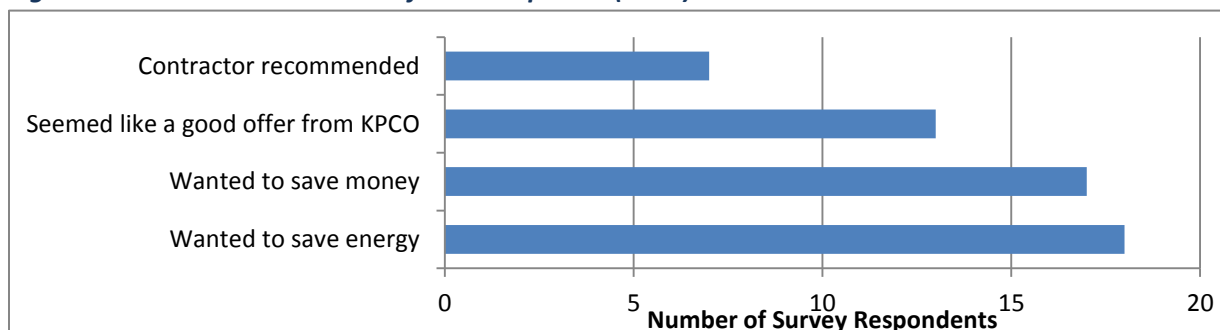
According to Retrofit customers surveyed, participants most often learned of the program from a KPCO representative (31 percent) followed by word of mouth (24 percent). Express Install participants learned of the program from the contractor. Approximately 67 percent of customers met with the DNV GL local representative prior to submitting the pre-approval application. According to the customers surveyed, the representative completed the pre-approval application for approximately 80 percent of participants.

Figure 103 How Retrofit Customers First Learned of the Program (n=33)



The Retrofit customers surveyed cited that the primary reason for participating in the Commercial Incentive Program was saving energy and money. The Express Install customers noted that the primary reason for participating in the program was savings money and the program seemed like a good offer from Kentucky Power.

Figure 104 Customer Motivation for Participation (n=33)



13.4.2 Program Performance

Between January 1, 2012 and December 31, 2013, 279 applications were rebated through the Commercial Incentive Program. Kentucky Power achieved 74 percent of the 2012 participation goal and 76 percent of the 2013 participation goal. DNV GL has two field representatives that promote the program to potential customers, review program applications, and conduct project inspections. Both representatives work out of the northern part of Kentucky Power's service territory.

In 2012, 117 Retrofit participants completed the 128 projects. In 2013, 122 Retrofit participants completed 139 projects. Express Install and New Construction projects were all completed by individual participants.

Table 288 Commercial Incentive Projects by Year

	2012	2013	Total
Retrofit	128	139	267
Express Install	-	8	8
New Construction	-	4	4
Total Projects	128	151	279

Table 289 Commercial Incentive Participants by Year

	2012	2013	Total
Retrofit	117	122	239
Express Install	-	8	8
New Construction	-	4	4
Total Customers	117	134	251

Projects were typically comprised of more than one measure. On average, a Retrofit and Express Install project included four measures and New Construction projects included two measures.

Table 290 Total Measures Installed, 2012 and 2013

	2012	2013	Total
Retrofit Prescriptive	428	431	859
Retrofit Custom	34	116	150
Express Install	-	34	34
New Construction	-	8	8
Total Measures	462	589	1,051

The majority of Retrofit measures installed were efficient lighting, followed by lighting controls and custom measures.

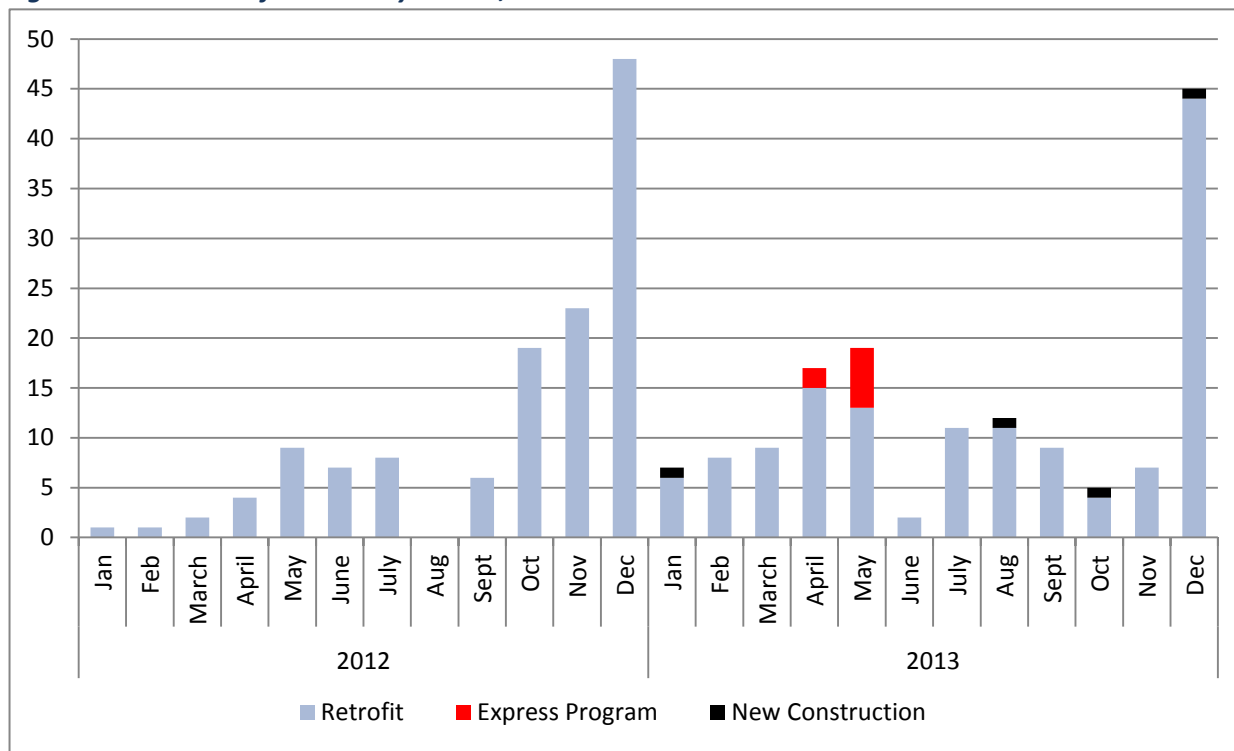
Table 291 Retrofit Measures Installed, 2012 and 2013

	Measures	Percentage of Total Projects
Refrigeration	46	6%
HVAC	35	4%
VSD	16	3%
Lighting Controls	65	14%
Lighting	648	52%
Miscellaneous	49	8%
Custom	150	12%

The New Construction and Express Install programs were added to the Commercial incentive Program in 2013. In 2012 and 2013, the Commercial Incentive Program experienced a significant increase in

rebates received in December, accounting for 38 percent of 2012 projects and 30 percent of 2013 projects.

Figure 105 Number of Rebates by Month, 2012 and 2013



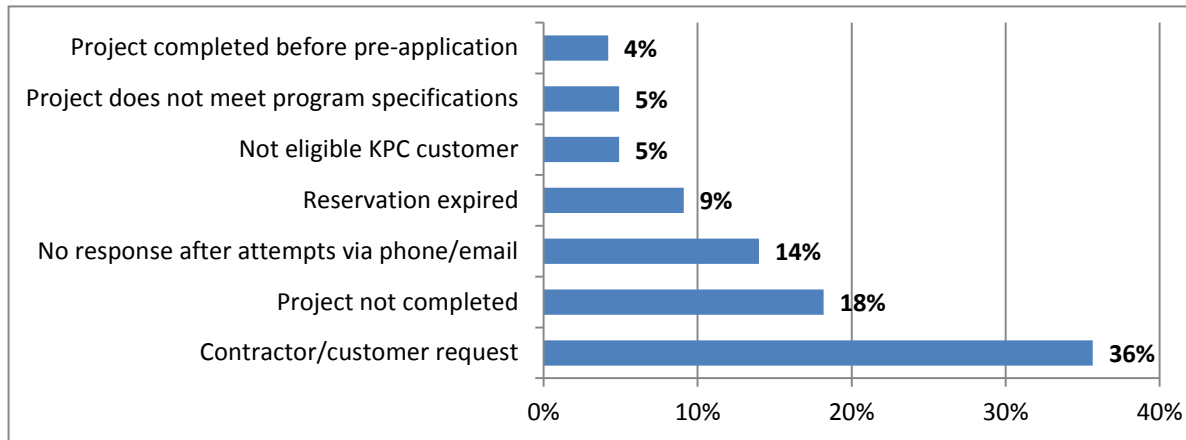
Approximately 25 percent of Retrofit projects were performed at retail/service facilities, followed by schools and offices. Few hotels or restaurants participated in the Retrofit program in 2012 or 2013.

Table 292 Participant Building Type, 2012 and 2013

Business Type	2012	2013	Total
Retail/Service	32	40	72
K-12 School	19	27	46
Office	19	21	40
Miscellaneous	19	20	39
Grocery	8	14	22
Medical	7	15	22
College/University	16	6	22
Unconditioned Warehouse	3	6	9
Conditioned Warehouse	5	0	5
Hotel/Motel	0	1	1
Restaurant	0	1	1
Total	128	151	279

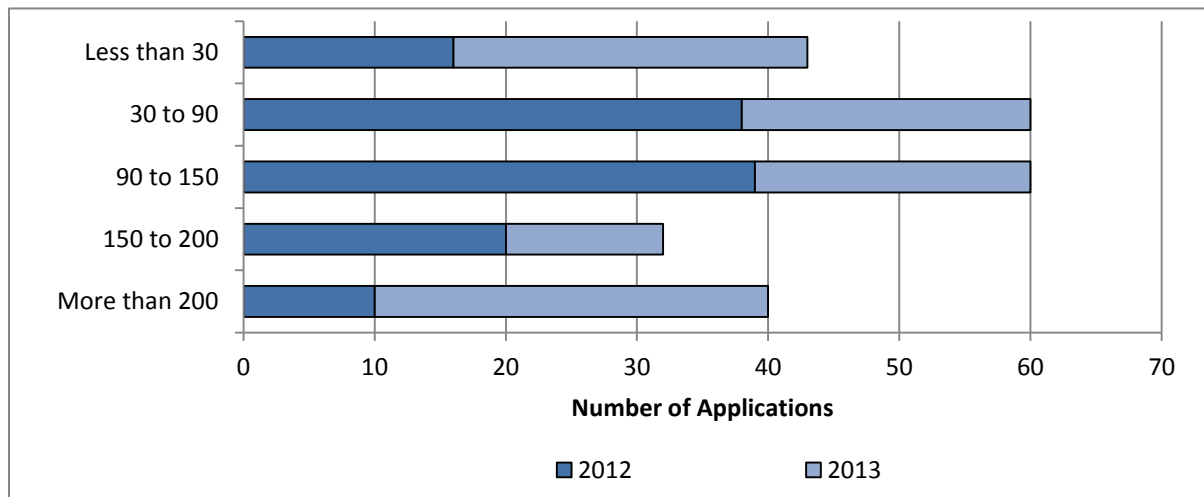
One hundred forty-three (143) retrofit applications were cancelled in 2012 and 2013. The primary reason a project was cancelled was that the contractor or customer requested the cancellation (36 percent) followed by the project not being completed (18 percent).

Figure 106 Reason for Cancelling Retrofit Application



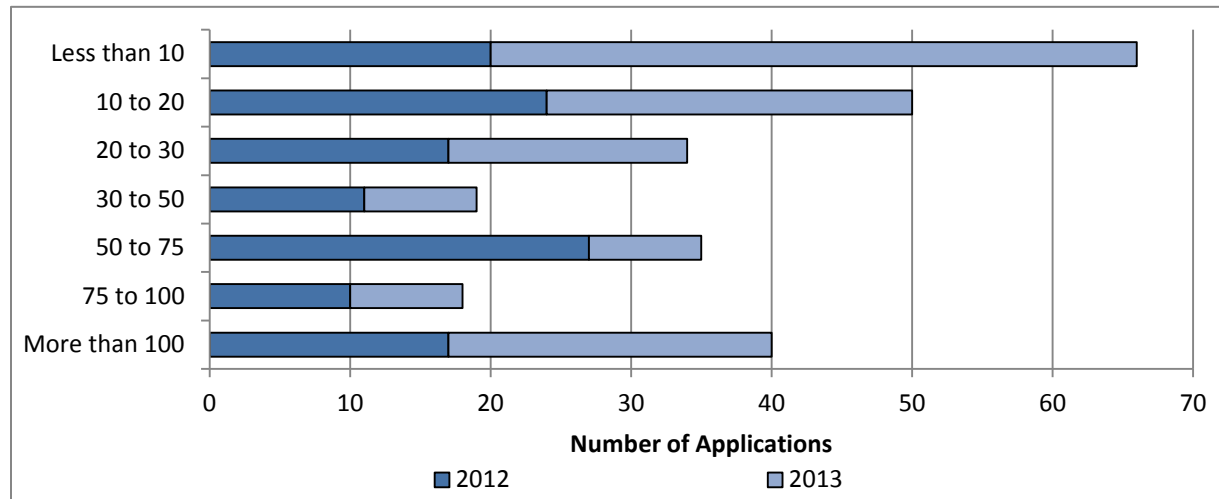
On average, it took 122 days to complete a Retrofit project from the time the final application was received and the pre-approval application was received.

Figure 107 Number of Days to Complete a Project



On average, it took 50 days to process a Retrofit project incentive from the time the final application and the customer payment was approved.

Figure 108 Number of Days to Process a Retrofit Incentive



The table below presents the budget and budgeted cost per project and per participant as compared to the actual expenditures and actual cost per project and per participant. The actual 2012 cost per project and per participant were slightly lower than the budgeted amount while the 2013 cost per project and per participant were higher than the budgeted amount.

Table 293 Cost per Project and per Participant, Budgeted and Actual

	2012		2013	
	Budgeted	Actual	Budgeted	Actual
Contractor Administration	\$682,643	\$626,872	\$425,685	\$353,839
Customer Incentives	\$885,800	\$408,591	\$699,950	\$576,125
Promotion	\$10,000	\$2,738	\$10,000	\$6,989
Evaluation	\$52,282	\$54,072	\$0	\$11,385
Total Budget	\$1,630,725	\$1,092,272	\$1,135,635	\$948,338
Project Goal	172	128	200	151
Budgeted Cost (\$) per Project	\$9,481	\$8,533	\$5,678	\$6,280
Participant Goal	172	117	200	134
Budgeted Cost (\$) per Participant	\$9,481	\$9,336	\$5,678	\$7,077

13.4.3 Tracking System

Kentucky Power submits an annual DSM Status Report to the Kentucky PSC documenting program performance, including participation, estimated energy and demand savings, and budget.¹⁰⁰ The utility reviews the DSM Status Report as well as actual, projected and summary program data with the DSM Collaborative on a semi-annual basis. The purpose of the tracking system is to manage DSM operations and generate the DSM Status Report.

¹⁰⁰ In a year when there are DSM Program evaluations or proposed expanded or new programs filed with the Commission, Kentucky Power should file an application by August 15th. In a year when there are no DSM Program evaluations or proposed expanded or new DSM Programs filed with the Commission, Kentucky Power should file by November 15th using the Commission electronic Tariff Filing System. Reference Case 2012-00367.

DNV GL's in-house program tracking systems are comprised of a single server database that contains 40 to 50 tables of customer application data. There are two systems, one for Retrofit and New Construction and one for Express Install. The Retrofit/New Construction system tracks the individual that reviewed, inspected and approved the application as well as the status of the project from pre-application through incentive payment. Kentucky Power program staff review final customer applications and approve incentives through DNV GL's Dashboard, a web-based interface.

DNV GL collects the following data from the Retrofit and New Construction applications:

- Customer Information: business name, account number, address (mailing and installation), tax status, business type, taxpayer ID, square footage of building, building operating hours
- Customer Contact: contact name, title, phone, fax, email
- Contractor Information: company name, contact name, title, address, fax, email
- Incentives Requested: total incremental cost, total incentives requested
- Equipment Information

The Express Install lighting contractor enters customer information and facility equipment into a DNV GL web-based program. Kentucky Power has read-only rights to all files within DNV GL's Dashboard.

DNV GL supplies KPCO with periodic updates and data extracts. Monthly operations reports summarize:

- The local representative promotional activities.
- Total projects, incentives, and energy and demand savings by project type.
- Program performance

13.4.4 Program Satisfaction

Overall, participants are satisfied with the Commercial Incentive Program. However, customers surveyed noted concerns with the rebate processing time and the amount of time it took to gain information.

Table 294 Retrofit Participant Satisfaction (n=33)

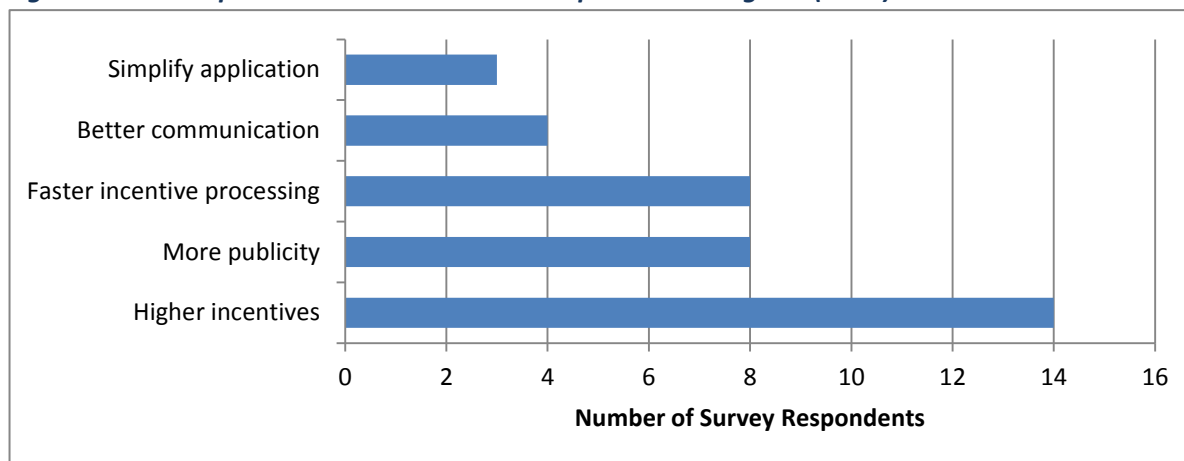
	Very Satisfied	Satisfied	Neutral	Dissatisfied
Rebate Application	64%	27%	6%	3%
Participation Process	61%	27%	9%	3%
Incentive Offered	45%	39%	9%	6%
Rebate Processing Time	45%	36%	12%	3%
Performance of New Equipment	70%	30%	0%	0%
Field Representative	64%	24%	9%	3%
Program Overall	64%	33%	0%	3%

Table 295 Express Program Participant Satisfaction (n=2)

	Very Satisfied	Satisfied	Neutral	Dissatisfied
Lighting Contractor	100%	0%	0%	0%
Field Representative	50%	0%	50%	0%
Incentives offered	100%	0%	0%	0%
Rebate processing time	100%	0%	0%	0%
Performance of the new equipment	100%	0%	0%	0%
Response times to requests for information	50%	0%	50%	0%
Program overall	100%	0%	0%	0%

Ninety-seven (97) percent of customers surveyed would recommend the program to others. Participating customers surveyed were asked their opinion on how the program could be improved. Participating customers suggested increasing equipment incentives, increasing publicity/advertising and improving the rebate processing time.

Figure 109 Participant Recommendations to Improve the Program (n=35)



Contractors interviewed noted that they have access to efficient lighting equipment and primarily learn about energy efficient equipment through distributors and online publications. The Contractors noted that the data collection requirements are time consuming and program participation is difficult. The Contractors were asked their opinion on how the program could be improved, they recommended an increase in incentives and to be more informed of program requirements/program implementation concerns.

13.5 Impact Evaluation Findings

This section provides detailed impact evaluation findings, including gross and net energy and demand savings, cost-effectiveness and site visits.

13.5.1 Gross Energy and Demand Savings

AEG conducted engineering and billing analyses of the Commercial Incentive Program to assess gross energy and demand savings based on IPMVP Options A and C.

Engineering Analysis

AEG conducted the engineering analysis using equations from the *Illinois Statewide Technical Reference Manual for Energy Efficiency* (“IL TRM”). AEG determined the gross savings per project and per participant for each measure type using program tracking data and engineering analysis variables adapted to Kentucky Power’s service territory (e.g. full load heating and cooling hours for HVAC equipment are specific to Kentucky).

As previously noted, Commercial Incentive Program projects are typically comprised of more than one measure. The following tables present the results of the engineering analysis for each program segment on a per project basis.

Table 296 Gross Energy (kWh) Savings per Project, Engineering Analysis

Participant	2012	2013	Total
Retrofit	48,266	63,019	55,946
Direct Install	-	25,510	25,510
New Construction	-	9,729	9,729
Program Total	48,266	59,620	54,411

Table 297 Gross Summer Demand (kW) Savings per Project, Engineering Analysis

Participant	2012	2013	Total
Retrofit	8.0	9.4	8.7
Direct Install	-	4.0	4.0
New Construction	-	2.6	2.6
Program Total	8.0	9.0	8.5

Table 298 Gross Winter Demand (kW) Savings per Project, Engineering Analysis

Participant	2012	2013	Total
Retrofit	7.6	9.0	8.4
Direct Install	-	4.0	4.0
New Construction	-	1.6	1.6
Program Total	7.6	8.6	8.2

The following tables present the results of the engineering analysis for each program segment on a per participant basis.

Table 299 Gross Energy (kWh) Savings per Participant, Engineering Analysis

Participant	2012	2013	Total
Retrofit	52,804	71,800	62,501
Direct Install	-	25,510	25,510
New Construction	-	9,729	9,729
Program Total	52,804	67,184	60,481

Table 300 Gross Summer Demand (kW) Savings per Participant, Engineering Analysis

Participant	2012	2013	Total
Retrofit	8.7	10.8	9.8
Direct Install	-	4.0	4.0
New Construction	-	2.6	2.6
Program Total	8.7	10.1	9.4

Table 301 Gross Winter Demand (kW) Savings per Participant, Engineering Analysis

Participant	2012	2013	Total
Retrofit	8.4	10.3	9.4
Direct Install	-	4.0	4.0
New Construction	-	1.6	1.6
Program Total	8.4	9.7	9.1

The total gross program savings are shown in the tables below.

Table 302 Total Gross Energy (kWh) Savings

Project Type	2012	2013	Total
Retrofit	6,178,055	8,759,609	14,937,664
Express Install	-	204,081	204,081
New Construction	-	38,917	38,917
Total	6,178,055	9,002,607	15,180,662

Table 303 Total Gross Summer Demand (kW) Savings

Project Type	2012	2013	Total
Retrofit	1,020	1,312	2,332
Express Install	-	32	32
New Construction	-	10	10
Total	1,020	1,354	2,374

Table 304 Total Gross Winter Demand (kW) Savings

Project Type	2012	2013	Total
Retrofit	979	1,258	2,237
Express Install	-	32	32
New Construction	-	6	6
Total	979	1,296	2,275

Billing Analysis

The billing analysis estimated the change in billed energy usage of a participant sample for one year before and after the installation of the measure using a paired sample t-test. The t-test was used to determine whether there was a significant difference in average energy usage before and after measure installation. The t-test compared the average annual energy usage of the participant sample before and after the measure(s) was installed.

The billing analysis utilized program tracking data and Kentucky Power billing data. Kentucky Power provided approximately four years of billing data for all customers via AEP's corporate file transfer protocol, including monthly interval billed energy usage for all customers. Due to the quantity of data points, Microsoft Access was used to develop samples, which were exported to Microsoft Excel to perform the billing analysis.

The following steps were taken to develop the participant sample:

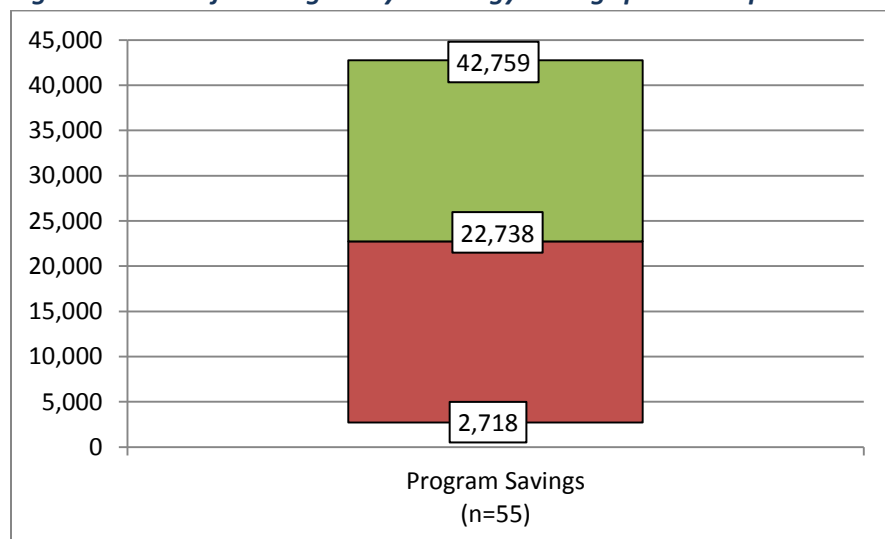
1. Participants were matched to the Kentucky Power billing data using their nine digit customer account number. Account numbers with extra digits were shortened to meet the nine digit validation criteria. Participants with matched account numbers were verified by name and service address. If an account number was unable to be matched; the project was removed from the sample.
2. Sample accounts that participated in multiple Kentucky Power programs were identified and removed from the sample. The potential interactive effects of other programs could skew the results of the analysis; removing these participants isolates the impacts attributable to the program.
3. The installation date associated with each project was used to identify the billing intervals before and after the measure installation. If a participant did not have an installation date in the Program Log, an average date was applied based on the sample. The interval during which the measure was installed, or "black out" interval, was not included in the analysis.
4. Only sample participants with exactly 12 monthly intervals before and after the installation interval were included in the sample. The 12 monthly intervals ensured approximately a full year of billing data before and after the installation. Changes in the customer population (i.e. new accounts) resulted in some participants with intervals that did not meet the 12 interval criteria and were removed from the participant sample.

- An outlier screen was applied to the sample participants to remove outliers and other anomalous cases. Participants with an average pre-program annual energy usage greater than two standard deviations from the mean before the installation were removed from the analysis to limit potential bias.

The actual energy usage in the 12 intervals before and after measure installation was converted to average daily energy usage by dividing the sum of billed energy usage by the number of usage days. Average daily usage was multiplied by a factor of 365.25 days per year to reflect average annual energy usage for each customer account. Energy savings was estimated as the difference in average annual energy usage before and after participation, assessed for statistical significance using a 95% confidence interval.

Figure 110 shows the upper-, lower-, and mid-range per participant savings estimates at a 95 percent confidence interval. The upper- and lower-range estimates were calculated by adding and subtracting the confidence interval, respectively.

Figure 110 Retrofit Billing Analysis Energy Savings per Participant at 95% Confidence



For the purposes of this analysis, AEG used the mid-range estimates to determine the savings attributable to the Retrofit program. Although the billing analysis did not directly estimate the demand savings, demand savings were extrapolated based on the ratio of kW to kWh savings from the engineering analysis.

Table 305 Retrofit Gross Savings, Billing Analysis¹⁰¹

	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Gross Savings per Participant	22,738	3.75	3.60
Total Gross Savings	6,071,108	1,003	962

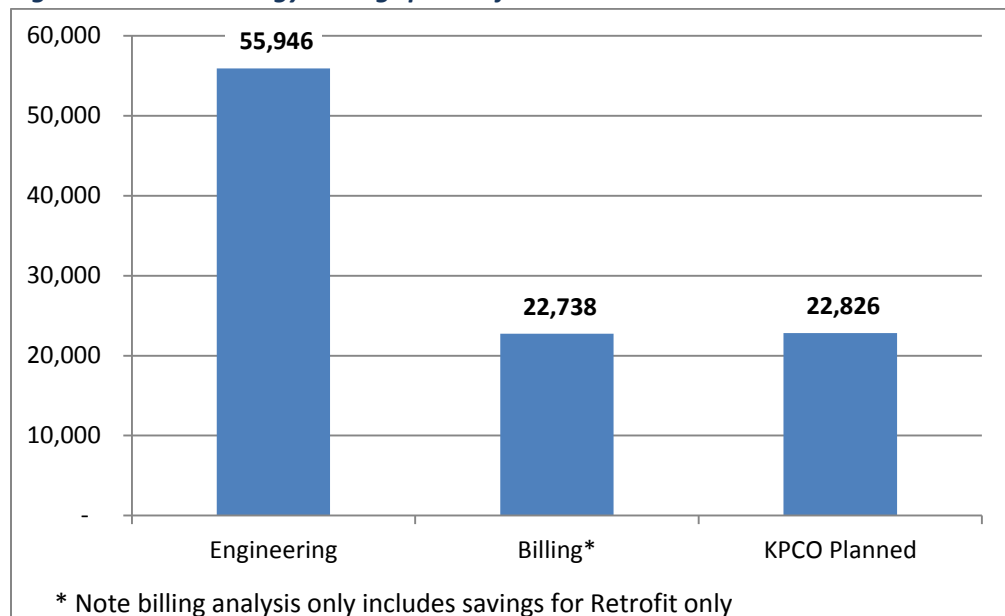
¹⁰¹ Note: The Billing Analysis only included Retrofit participants. New Construction and Express Install participants were not included in that portion of the analysis due to very small participation size. Due to the small participation size samples could not be drawn and the results were not representative of an entire population.

Gross Energy Savings Comparison

The planned savings per project reflects the values utilized by KPCO in reports submitted to the Kentucky PSC. The figure below compares the gross energy savings for the engineering analysis and the billing analysis to the planned savings assumptions.

The engineering analysis provides the savings for all measures installed, not taking into account the interactive effects of multiple measure installations or change in equipment usage (e.g. increased usage of efficient HVAC equipment). The billing analysis is a more accurate determinant of savings due to the comparison of energy usage pre- and post-measure installation. The billing analysis takes into account interactive effects of multiple measure installation, measure baseline and changes in equipment usage.

Figure 111 Gross Energy Savings per Project



13.5.2 Net Energy and Demand Savings

Net savings refers to the amount of savings attributable to the program after accounting for free ridership and spillover. Free ridership refers to those participants who would have installed the efficient equipment without the program influence. Spillover refers to additional savings achieved as a result of the program, but that were not directly included in the program. The Net-to-Gross (“NTG”) factor is calculated by the following equation:

$$NTG = 1 - Free\ ridership + Spillover$$

AEG conducted a survey of Retrofit program participants to evaluate the effects of free ridership and spillover. Survey results are based on a random sample of participants with an overall statistical significance of 90 percent and a margin of error of +/- 14 percent, since the actual number of completed surveys was less than expected.

Free Ridership

Two questions in the participant survey were designed to assess the effects of free ridership.

- **Question 1:** Had you been planning to install equipment with the EXACT SAME efficiency before you participated in the program?

- **Question 2:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the exact same equipment?

Each response to the free ridership question was assigned a probability that that respondent was a free rider. The free ridership probability reflects the likelihood that a given respondent would have installed the measures absent the influence of the program. The proportion of each response was multiplied by the free ridership probability to calculate the free ridership score.

Table 306 Free Ridership Question 1

Response	FR Probability	Count	Percent	Free Rider Score
Yes	50%	11	33%	17%
No	0%	22	67%	0%
Question 1 Free Ridership Score				17%

Table 307 Free Ridership Question 2

Response	FR Probability	Count	Percent	Free Rider Score
Very likely	80%	2	6%	5%
Somewhat likely	60%	9	27%	16%
Neither likely nor unlikely	40%	0	0%	0%
Somewhat unlikely	20%	7	21%	4%
Not likely	0%	15	45%	0%
Question 2 Free Ridership Score				25%

The free ridership score for each question was weighted based on its contribution to the overall free ridership factor. Weights were based on the assumption that survey responses may not reflect the actual behavior of respondents (i.e. social desirability bias). The weighted average of the scores determines the free ridership factor for the program.

Table 308 Free Ridership Question Summary

Question	Weight	Score
Question 1	75%	17%
Question 2	25%	25%
Free Ridership Score		19%

Based on the responses to the survey questions, free ridership is estimated at 19 percent.

Spillover

Spillover is the ratio of net spillover savings to gross savings of the participant sample.

$$Spillover = \frac{Net\ Spillover\ Savings}{(Program\ Savings\ per\ Participant \times Total\ Respondents) + Total\ Spillover\ Savings}$$

Where:

Net Spillover Savings = Sum product of gross spillover savings and spillover score for each respondent

Program Savings per Participant = Average per unit savings

Total Respondents = Total survey respondents

Total Spillover Savings = Sum of gross spillover savings for all spillover respondents

Three questions in the participant survey were designed to assess the effects of spillover.

- **Question 1:** Since receiving the Kentucky Power incentive, has your business purchased additional energy efficient equipment?
- **Question 2:** What type of equipment have you purchased?
- **Question 3:** If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?

Only those respondents who purchased additional energy efficient equipment in response to question one were included in the spillover calculation. The savings from the spillover actions described in question two were estimated using algorithms and assumptions for the corresponding measure characterization in the IL TRM. According to the survey results, spillover participants engaged in a variety of additional energy efficient actions, including installing efficient lighting.

Finally, each respondent was asked how much the program influenced their additional actions by answering question three. The table below shows the spillover score assigned to each of the responses to question three.

Table 309 Spillover Score

Response	Score
Very likely	10%
Somewhat likely	35%
Not likely	80%
Don't Know/Refused	50%

The net spillover savings from each respondent was determined by applying their spillover score to their gross spillover savings to estimate the spillover savings that were directly attributable to the program. The table below illustrates how the program spillover score was calculated. AEG determined the overall spillover score for participants is 2 percent.

Table 310 Spillover Calculation Summary

Line	Variable	Value
A	Total Respondents	33
B	Program Savings per Participant	55,946
C	Program Savings of Sample (A x B)	1,846,228
D	Gross Spillover Savings of Sample	70,691
E	Total Gross Sample Savings (C + D)	1,916,919
F	Net Spillover Savings	44,622
G	Spillover Score (F ÷ E)	2%

Next, AEG used the free ridership and spillover estimates to determine the NTG factor for each group. As a result, the NTG factor for the program is 83 percent.

Table 311 Net-to-Gross Factor

Free Ridership	Spillover	Net-to-Gross
19%	2%	83%

The NTG factor was applied to the unit savings to determine the net energy and demand savings. The net savings per project for the engineering analysis are shown in the tables below.

Table 312 Net Energy (kWh) Savings per Project, Engineering Analysis

Participant	2012	2013	Total
Retrofit	40,285	52,598	46,695
Direct Install	-	21,292	21,292
New Construction	-	8,120	8,120
Program Total	40,285	49,761	45,414

Table 313 Net Summer Demand (kW) Savings per Project, Engineering Analysis

Participant	2012	2013	Total
Retrofit	6.7	7.9	7.3
Direct Install	-	3.4	3.4
New Construction	-	2.1	2.1
Program Total	6.7	7.5	7.1

Table 314 Net Winter Demand (kW) Savings per Project, Engineering Analysis

Participant	2012	2013	Total
Retrofit	6.4	7.6	7.0
Direct Install	-	3.4	3.4
New Construction	-	1.3	1.3
Program Total	6.4	7.2	6.8

The net savings per participant for the engineering analysis are shown in the tables below.

Table 315 Net Energy (kWh) Savings per Participant, Engineering Analysis

Participant	2012	2013	Total
Retrofit	44,072	59,927	52,166
Direct Install	-	21,292	21,292
New Construction	-	8,120	8,120
Program Total	44,072	56,074	50,480

Table 316 Net Summer Demand (kW) Savings per Participant, Engineering Analysis

Participant	2012	2013	Total
Retrofit	7.3	9.0	8.1
Direct Install	-	3.4	3.4
New Construction	-	2.1	2.1
Program Total	7.3	8.4	7.9

Table 317 Net Winter Demand (kW) Savings per Participant, Engineering Analysis

Participant	2012	2013	Total
Retrofit	7.0	8.6	7.8
Direct Install	-	3.4	3.4
New Construction	-	1.3	1.3
Program Total	7.0	8.1	7.6

The billing analysis net savings is shown below.

Table 318 Retrofit Net Savings, Billing Analysis

	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Net Savings per Participant	18,978	3.13	3.01
Total Net Savings	5,067,199	837	803

The engineering analysis total net savings for each program are shown below.

Table 319 Total Net Energy (kWh) Savings, Engineering Analysis

Project Type	2012	2013	Total
Retrofit	5,156,462	7,311,135	12,467,596
Express Install	-	170,335	170,335
New Construction	-	32,482	32,482
Total	5,156,462	7,513,951	12,670,413

Table 320 Total Net Summer Demand (kW) Savings, Engineering Analysis

Project Type	2012	2013	Total
Retrofit	852	1,095	1,946
Express Install	-	27	26
New Construction	-	9	9
Total	852	1,130	1,982

Table 321 Total Net Winter Demand (kW) Savings, Engineering Analysis

Project Type	2012	2013	Total
Retrofit	817	1,050	1,867
Express Install	-	27	27
New Construction	-	5	5
Total	817	1,082	1,899

The total program savings for 2012-13 are shown below.

Table 322 Total Net Savings, 2012-13

Project Type	kWh	Summer kW	Winter kW
Retrofit	5,067,199	837	803
Express Install	170,335	27	27
New Construction	32,482	9	5
Total	5,270,016	873	835

13.5.3 Savings per Project Summary

AEG conducted engineering and billing analyses of the Commercial Incentive Program to assess gross energy and demand savings based on IPMVP Options A and C. AEG recommends utilizing a weighted average of the Retrofit, Express Install and New Construction energy and demand savings to determine Commercial Incentive Program savings for program tracking purposes as well as PSC filings. The Retrofit savings will be utilized from the 2012-2013 billing analysis savings. The billing analysis is a more accurate determinant of savings due to the comparison of energy usage pre- and post-measure installation versus the engineering analysis which utilizes an assumed baseline and doesn't account for interactive effects or changes in measure usage. The Express Install and New Construction savings will be utilized from the engineering analysis.

The tables below present the gross and net savings per project and per participant.

Table 323 Recommended Energy and Demand Savings per Project

Group	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Gross Savings per Project	22,540	3.7	3.6
Net Savings per Project	18,813	3.1	3.0

Table 324 Recommended Energy and Demand Savings per Participant

Group	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Gross Savings per Participant	22,515	3.7	3.6
Net Savings per Participant	18,792	3.1	3.0

13.5.4 Program Site Inspections and Installation Verification

AEG performed site inspections and installation verifications of 12 completed projects to perform quality assurance/quality control and verify application information. Due to participants' scheduling conflicts AEG was unable to conduct inspections in the Hazard area; however, most projects were concentrated in the Ashland and Pikeville areas. Proper installation verification was confirmed at all locations. The table below shows the number of completed site inspections in each area.

Table 325 Site Inspection Summary

Area	Count	%
Ashland	9	75%
Pikeville	3	25%
Hazard	0	0%
Total	12	100%

13.5.5 Program Cost-Effectiveness

Cost-effectiveness analysis compares the costs and benefits of efficient equipment with those of baseline (non-efficient) equipment. Cost-effectiveness analysis indicates whether the efficient technology(s) improve a customer's financial position, decreases overall energy costs to ratepayers, and/or raises society's well-being. A program is considered cost-effective if the TRC benefit-cost ratio is greater than 1.0.

AEG analyzed the cost-effectiveness of the Commercial Incentive Program utilizing four standard cost-effectiveness tests taken from the California Standard Practices Manual.¹⁰² Each test analyzes cost-effectiveness from a different perspective:

- **Participant Cost Test:** Compares customer costs and benefits of installing the measure. Will the participant benefit over the life of the measure?
- **Program Administrator Cost Test (Utility Cost Test):** Comparison of program administrator costs to supply-side resource benefits. Will utility costs to save energy be less than utility costs to deliver the same amount of energy?
- **Ratepayer Impact Measure:** Measures the impact of the DSM Program on utility rates if rates were to be adjusted to account for the program. Comparison of utility program costs and bill reductions associated with energy savings to supply-side resource benefits. Will customer rates increase?
- **Total Resource Cost Test:** Comparison of program administrator and customer costs to utility resource savings. Will the total costs of energy in the utility service territory decrease?

Results from the impact evaluation, utilizing IPMVP best practices, were utilized in the four cost-effectiveness tests taken from the California Standard Practices Manual. Kentucky Power specific inputs, including avoided costs, discounts rates, participation and incentives, were used to conduct the

¹⁰² The California Standard Practices Manual details guidelines and procedures for standardized cost-effectiveness evaluations.

cost-effectiveness analysis. Bencost, an updated version of a public domain model that AEG customized for Kentucky Power, was utilized to perform the cost-effectiveness modeling (see Appendix D). Bencost is an input-output model that calculates all four cost-effectiveness tests. All program costs and benefits are discounted to present-day dollar values in order to accurately compare future benefits with current costs.

The Commercial Incentive Program was found to be cost-effective for the 2012-2013 program years. Cost-effectiveness results are presented in the table below.

Table 326 Cost Effectiveness Results, 2012-2013

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.44	\$8,247,727	\$3,613,269	(\$4,634,458)
Utility Cost Test	1.81	\$1,996,626	\$3,613,269	\$1,616,643
Participant Test	5.99	\$1,204,292	\$7,214,353	\$6,010,061
Total Resource Cost Test	1.61	\$2,237,666	\$3,613,269	\$1,375,603

Evaluating the program on a prospective basis, the Commercial Incentive Program is also cost-effective and should be continued going forward. The prospective analysis utilizes projected 2014 program expenditures and participation as a proxy for future program years. The cost-effectiveness results can be used going forward assuming expenditures and participation are consistent for more forward-looking program years. The prospective cost-effectiveness results are presented in the table below.

Table 327 Cost Effectiveness Results, Prospective

Test	B/C Ratio	Total Costs	Total Benefits	Net Benefits
Ratepayer Impact Measure Test	0.47	\$6,154,614	\$2,914,528	(\$3,240,086)
Utility Cost Test	2.05	\$1,423,034	\$2,914,528	\$1,491,494
Participant Test	6.01	\$908,441	\$5,461,874	\$4,553,433
Total Resource Cost Test	1.82	\$1,601,181	\$2,914,528	\$1,313,347

13.6 Recommendations

AEG has recommendations on how to improve the program. These include:

Increase Program Marketing

AEG recommends that Kentucky Power and DNV GL work together to expand the marketing plan. The marketing plan should outline the audience targeted, the marketing materials and whether Kentucky Power or DNV GL is responsible for the promotion. Participating customers surveyed suggested increasing program publicity. DNV GL should continue to actively engage contractors to better inform them of the program requirements and discuss methods to streamline the participation process.

Review Incentive Levels

AEG recommends that Kentucky Power and DNV GL review customer incentives. Forty (40) percent of participating customers surveyed recommended that Kentucky Power increase equipment incentives. Kentucky Power and DNV GL should review the customer incentives to ensure that they encourage program participation and cover between 40 and 60 percent of the customer's incremental cost.

Streamline Participation Process

AEG recommends that DNV GL improve and streamline the participation process. On average, it took 50 days to process a Retrofit project incentive from the time the final application to the time the customer

payment was approved. Program participants have contacted the Kentucky Power Customer Service Representatives to inquire about the status of their rebate.

AEG recommends that DNV GL work with customers to reduce the number of cancelled projects. In 2012 and 2013, 143 projects were cancelled and 279 projects were rebated, 36 percent of which were cancelled at the request of the customer and/or contractor. DNV GL should continue to follow-up with the customers and/or contractors to determine if the project can be completed.

Express Install Program

AEG recommends that Kentucky Power consider hiring an implementation contractor that specializes in small commercial direct install programs if the number of Express Install projects does not increase in 2014. The small commercial market is typically an extremely hard market to reach, as demonstrated by the lack of program participation in 2013. Small commercial direct install programs are typically time-intensive programs in which representatives visit with small commercial customers to discuss and promote the program. A contractor who specializes in small commercial direct install programs could provide customers with dedicated resources to work through project challenges and could provide a significant increase to program participation.

Merge the Small Commercial High Efficiency Heat Pump/Central Air Conditioner Program

AEG recommends that Kentucky Power utilize DNV GL, the Commercial Incentive Program implementation contractor, to implement the Small Commercial High Efficiency Heat Pump/Central Air Conditioner Incentive Program. Some of the KPCO programs have implementation contractors that perform the day-to-day operations of the programs, but the small commercial HVAC program is run completely by KPCO staff. Therefore, KPCO staff is responsible for marketing and promotional activities, including visiting participating and potential HVAC dealers across the KPCO territory, processing rebate applications, program tracking and performing QA/QC inspections. Kentucky Power has not yet conducted an inspection to ensure qualifying systems are being installed.

The Commercial Incentive Program currently offers customer incentives for HVAC equipment. AEG recommends that Kentucky Power work with DNV GL to merge the Small Commercial High Efficiency Heat Pump/Central Air Conditioner Incentive Program with the Commercial Incentive Program. Kentucky Power and DNV GL should review the customer incentives to ensure that they encourage program participation, are consistent between the Small Commercial High Efficiency Heat Pump/Central Air Conditioner Incentive Program and the Commercial Incentive Program, and meet the Commercial Incentive Retrofit requirement that incentives are capped at 50 percent of the incremental equipment cost.



Kentucky Power Company
Appendix A.
Implementation
Contractor Interview
Guides

Process, Market and Impact Evaluations · July 2014

Prepared by:

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AEG interviewed DSM Program Implementation Contractors in Fall 2013. The interviews provided information on program implementation activities, program data and tracking mechanisms, the relationship with between Kentucky Power, and barriers to increased participation.

Residential Efficient Products Program (APT)

Program Development & Infrastructure

1. Describe APT's roles and responsibilities. Describe the relationship between KPCO and APT.
2. Were there any program changes in 2012/2013?

Manufacturer/Retailer MOUs

3. Were additional manufacturers/retailers approached to participate in the 2012/2013 program?
 - a. What are the general terms of the MOU agreements?
 - b. Did any manufacturers/retailers not meet the MOU criteria?
 - c. How many manufacturers/retailers are participating in the program?
 - d. Have any of the MOUs been modified?
4. What barriers exist that may discourage participation among large and small stores?
5. Is the entire KPCO service territory covered? How does APT try to control leakage?
6. What distinctions are made between branded and non-branded light bulbs?

Marketing

Retailer Events/Training

7. Field Representatives
 - a. How many field representatives work in the KPCO territory?
 - b. What type of training do the representatives receive?
8. Retailer Training
 - a. What type of training is provided to retailers?
 - b. How many training events were held in 2012/2013?
 - c. Who participated in the training events?

Incentive Processing and Tracking System

9. Describe the program tracking system.
10. Describe incentive processing activities.
11. Describe the payment process.

Areas for Improvement

12. Overall, how effective do you think the program has been in terms of achieving goals?
13. What do you see as the biggest barriers to program participation?
14. How could the program be improved?

Comments

Modified Energy Fitness Program (Honeywell)

Program Operations

1. Describe Honeywell's roles and responsibilities.
2. How long has Honeywell implemented the Modified Energy Fitness Program? Have there been any significant program changes in that time?
3. How frequently do you interact with Kentucky Power staff?

Marketing

4. How is the program marketed to customers?
5. What is the most effective marketing strategy?
6. Would you suggest any additional marketing strategies?

Program Participation

7. Describe the participation process.
 - a. How do customers enroll?
 - b. How is eligibility verified?
 - c. Does the customer have to submit any paperwork?
 - d. Do customers have any input regarding the measures/work completed?
8. How many Energy Auditors are working with the KPCO program?
 - a. Are these Honeywell employees or 3rd party auditors?
 - b. Are the auditors local to the Kentucky Power service territory?
9. Who completes the work identified by the Energy Auditor?
 - a. Are these Honeywell employees or 3rd party auditors?
 - b. How many contractors? How long have the contractors been involved with the program?
 - c. Are the contractors local to the Kentucky Power service territory?
 - d. Who purchases/stores the measures/equipment that will be installed?
 - e. Is there a pre-approved list of measures/costs? If yes, please provide.
10. Customer Service
 - a. Who operates the customer service line?
 - b. What are the hours of operation/staffing for the customer service line?

Tracking System

11. Describe the program tracking system.
 - a. What type of system is used for program tracking?
 - b. What data is collected?
 - c. Who has access to the tracking system? How is participant information/privacy protected?
12. Describe the invoicing process.
 - a. How often does Honeywell invoice KPCO?
 - b. Who reviews the invoice?
13. Quality Installation/Quality Assurance
 - a. What QA/QC procedures are in place?
 - b. Who conducts QA/QC?
 - c. What have the results been? Any concerns?

Program Satisfaction/Barriers

14. Have you received any customer feedback regarding the program?
15. Do you have an indication of the level of customer satisfaction?
16. What do you see as the biggest barriers to program participation? How could the program be improved?
17. Have you considered modifying the program to include/exclude measures?

Comments

Targeted Energy Efficiency Program

Program Development & Infrastructure

1. Please describe the roles and responsibilities of the agency.
2. How long has your agency been involved in the program?
3. Has the program undergone any changes? Please describe.
4. How often does your agency engage with Kentucky Power? What information is exchanged?

Program Operations

5. Please describe how a customer enrolls in the program.
6. How is eligibility determined?
7. How is the program funded? Is there a per participant spending cap?
8. Who performs the energy audits and measure installations? How are the measures procured?
9. How are the measure offerings determined?
10. How is participation data tracked over the course of the program?
11. Please describe any quality assurance/quality control activities.

Program Satisfaction/Barriers

12. Are there any aspects of the program that may discourage or prevent customers from participating?
13. Has there been any feedback from participants about the program? How would you describe the level of satisfaction?
14. How is the program marketed to prospective participants?

Areas for Improvement

15. Overall, how effective do you think the program has been in terms of achieving goals?
 16. How can the program be improved? Are there any measures that should be added or removed?
 17. Is the KPCO program similar to programs offered by other utilities?
 18. Do you have any additional comments?
-

Student Energy Education Program (NEED)

Program Development & Infrastructure

1. How long has NEED been involved in the KPCO Program?
2. Describe NEED's roles and responsibilities.
3. How are school districts selected to participate in the program?
4. Who recruits the schools (teachers/superintendents)?

Services

5. Describe the teacher trainings.
 - a. How often are trainings held?
 - b. Where are trainings held?
 - c. Approximately how many teachers attend?
6. How is the NEED curriculum developed?
 - a. What is included in the curriculum?
 - b. Is KPCO involved in curriculum development?

Tracking System

7. Is any data tracked for the program (e.g. teachers contacted, trainings held, etc.)? Describe the program tracking system.
 - a. What data is collected?
 - b. What type of system is used?
8. How often does NEED invoice KPCO and what is included in the invoice?

Areas for Improvement

9. Have you considered expanding the program to include more grade levels?
10. Overall, how effective do you think the program has been?
11. Has there been any feedback from teachers/students?
12. How could the program be improved?

Commercial Incentive Program (DNV KEMA)

Program Development & Infrastructure

1. Describe KEMA's roles and responsibilities.
 - a. Describe the relationship between KPCO and KEMA.
 - b. How many KEMA employees are assigned to the program and where are they located?
2. Were there any program changes in 2012/2013?

Marketing and Promotion

3. How is the program marketed to participants?
4. What marketing and outreach methods are most effective in reaching customers?
5. Who conducts customer outreach?

Participation Process

6. Describe the participation process.
 - a. How does the participant enroll the program?
 - b. How is participant eligibility verified?
 - c. Who completes the program application?
 - d. What is the primary reason an application is rejected?
 - e. Is the participant timeline ever extended?
7. Quality Installation/Quality Assurance
 - a. What QA/QC procedures are in place?
 - b. Who conducts QA/QC?
 - c. What have the results been? Any concerns?
8. Describe KEMA's involvement in coordinating measure installation.

Tracking System

9. Describe the program tracking system.
 - a. What type of system is used for program tracking?
 - b. What data is collected from participants?
 - c. Who has access to the tracking system?

Areas for Improvement

10. Overall, how effective do you think the program has been in terms of achieving goals?
11. What do you see as the biggest barriers to program participation?
12. How could the program be improved?

Comments



Kentucky Power Company
Appendix B. Contractor
Interview Guides
Process, Market and Impact Evaluations · July 2014

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AEG administered a 10 to 12 minute telephone survey to a sample of Kentucky Power HVAC Dealers, Residential Efficient Products stores, Student Education program teacher, and Commercial Incentive Program contractors. The surveys provided an assessment of customer satisfaction, identified potential areas for improvement and provided insight about customer attitudes toward energy efficiency and conservation issues. The surveys also provided insight on marketing and coordination efforts, and application processes.

Residential Efficient Products Program – Retailers

Kentucky Power is conducting an evaluation of its Residential Efficient Products Program. Your store has participated in the program by stocking and selling CFL's and I'd like to ask you a few questions about how things are going. All comments will remain confidential.

1. Prior to participating in the Kentucky Power program, did your store stock

	Yes	No
CFLs		
LEDs		

2. Does the Kentucky Power program have an influence on the types of light bulbs stocked?

- a) Yes
- b) No

3. In general, what types of lighting products sell best in your store?

- a) Incandescent
- b) CFLs
- c) LEDs

4. How well are _____ selling compared to incandescent bulbs?

	Sales are lower	Sales are about the same	Sales are higher
Standard CFLs			
Specialty CFLs			
LEDs			

5. How influential have the Kentucky Power incentives been in moving CFL stock?

- a) Very Influential
- b) Somewhat Influential
- c) Not Too Influential
- d) Not At All Influential
- e) Other (please specify)

6. In the absence of the Kentucky Power incentive, do you believe the store would have sold as many CFLs?

- a) Yes
- b) No

7. In the absence of the Kentucky Power incentive, do you believe the store would have sold the SAME TYPES of CFLs?

- a) Yes
- b) No

8. How influential do you think a Kentucky Power incentive would be in increasing LED sales?

- a) Very Influential
- b) Somewhat Influential
- c) Not Too Influential
- d) Not At All Influential
- e) Other (please specify)

Spillover

9. Have sales of other non-discounted efficient lighting products increased?

- a) Yes

- b) No
10. What types of products?
11. What influence do you think the Kentucky Power program had on these sales?
- a) Had no influence
 - b) Had some influence
 - c) Had a large influence
12. Do you think the Kentucky Power program is having an effect on consumer expectations regarding CFL prices?
- a) Yes
 - b) No
 - c) Other

Marketing and Education

13. Do you think the Kentucky Power promotional and education efforts are adequate?
- a) Yes (skip to Q15)
 - b) No (continue)
14. What would you change?
15. Did your store advertise or promote the Kentucky Power program (i.e. print ads, signage)?
- a) Yes (continue)
 - b) No (skip to Q17)
16. What type of advertising/promotion?
17. Would you recommend any changes to improve the promotion of efficient lighting?
18. Would you recommend any changes to improve consumer education about CFLs?
19. Would you recommend any changes to improve the program?

Thank you for taking the time to answer my questions.

Student Energy Education Program - Teachers

Kentucky Power is conducting an evaluation of its Student Energy Education Program. The program provides 7th grade classroom instruction materials to educate and inspire students to make smart energy choices to support a sustainable future. We would like to get your feedback and impressions of the program. The survey is for research purposes and all responses will remain confidential.

Program Participation

1. How did you first become aware of the Student Energy Education Program?
 - a) KPCO Staff
 - b) NEED Representative
 - c) School
 - d) Teacher
 - e) Other (please specify)
2. Why did you decide to participate in this program?
 - a) School required it
 - b) Important subject
 - c) Lesson plans were useful
 - d) Students benefit from receiving the CFLs
 - e) KPCO recommendation
 - f) Other (verbatim)
3. Were CFLs provided to distribute to the students?
 - a) Yes
 - b) No

Training

4. Have you attended any of the training events sponsored by NEED and Kentucky Power?
 - a) Yes
 - b) No
5. How many training events have you attended?
6. What was the biggest barrier to attending the training event?
 - a) Distance
 - b) Time
 - c) Interest
 - d) Other (specify)
7. How did you hear about the training event?
 - a) KPCO staff
 - b) NEED staff
 - c) School
 - d) Other teachers
 - e) Other

Free Ridership/Spillover

8. If your school had not participated in the program, how likely is it that you would have included energy efficiency as part of your curriculum?
 - a) Very likely

- b) Somewhat likely
- c) Not likely

9. Since distributing the CFL bulbs, have you included energy efficiency as part of your curriculum?

- a) Yes
- b) No

Satisfaction

10. Please rate your satisfaction with the following program components:

	Not Satisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
Training event locations					
Number of training events					
Educational resources					
CFLs provided					
KPCO Staff					
NEED Staff					
Program overall					

Comments (verbatim)

11. How could the program be improved?

- a) Make it available to more people
- b) More publicity
- c) Better training locations
- d) More training opportunities
- e) Additional lesson plans
- f) No suggestions
- g) Other (verbatim)

Thank you for taking the time to answer my questions!

Participating Manufactured Home Dealers

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's Mobile Home New Construction Program. I'd like to talk with you about your experience with the program and get some feedback. The survey should take about 5-10 minutes. All comments will remain confidential.

According to our records, you are currently a Kentucky Power participating Manufactured Home Dealer. Is that correct?

- a) Yes
- b) No (**THANK THEM AND END CALL**)

Program Awareness

1. How did you first learn about the program?
 - a) Kentucky Power employee
 - b) KentuckyPower.com
 - c) Customer
 - d) Advertisement
 - e) Word of Mouth (business associates)
 - f) Other (specify)
2. Why did you decide to become a participating Manufactured Home Dealer?
3. How long have you been a participating Manufactured Home Dealer?

Program Performance

4. How influential have the customer incentives been in moving projects forward?
 - a) Very influential
 - b) Somewhat influential
 - c) Not too influential
 - d) Not at all influential
5. Besides the incentive, what are the main factors driving customer participation?
 - a) Energy savings
 - b) Bill savings
 - c) Comfort
 - d) Environmental issues
 - e) Other (specify)
6. Do you usually complete and submit the customer rebate form on the customer's behalf?
 - a) Yes
 - b) No
7. Has the program influenced customers to install additional energy efficient equipment as a result of participating in the program?
8. If so, what additional efficiency measures did the customer opt to install?

Participation

9. What are your primary sources of information on energy efficiency equipment and services?
 - a) Online
 - b) Publications
 - c) Trade shows

- d) Kentucky Power
- e) HVAC Distributors
- f) Other (specify)

10. How important is it to you that your company is listed on the Kentucky Power website as a participating Manufactured Home Dealer?

- a) Very important
- b) Somewhat important
- c) Not too important
- d) Not at all important

11. What is your preferred medium of contact from Kentucky Power for program updates or information about program?

- a) Emails from Kentucky Power
- b) Insider newsletters
- c) Kentucky Power website
- d) Calls from Kentucky Power
- e) Other (specify)

Program Satisfaction

12. Please rate your satisfaction with the following program components on a five-point scale, where "1" means "Very Unsatisfied" and "5" means "Very Satisfied." How satisfied are you with the:

	5	4	3	2	1
Incentive offered					
Application requirements					
Incentive processing					
Customer service					
Interaction with Kentucky Power Staff					
Program overall					

Comments (verbatim)

13. What changes should be made to the program to make it more attractive to customers? To Manufactured Home Dealers?

Demographics

14. Approximately what percentage of your 2012/2013 business can be attributed to the Kentucky Power programs?

15. How long have you been in business?

16. How many employees do you have?

Thank you for taking the time to answer my questions.

Participating HVAC Dealers

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's Residential and Small Commercial HVAC Programs. I'd like to talk with you about your experience with the programs and get some feedback. The survey should take about 5-10 minutes. All comments will remain confidential.

According to our records, you are currently a Kentucky Power participating HVAC Dealer. Is that correct?

- c) Yes
- d) No (**THANK THEM AND END CALL**)

If they do not recall the program, "These programs provide incentives to residential and small business customers that purchase and install energy efficient HVAC equipment and/or receive diagnostic and tune-up service for their HVAC equipment."

Program Awareness

1. Which Kentucky Power program is your company involved with? **Mark all that apply**
 - a) Small Commercial High Efficiency Heat Pump/Air Conditioner Program
 - b) Small Commercial HVAC Diagnostic and Tune-Up Program
 - c) Residential High Efficiency Heat Pump Program
 - d) Residential HVAC Diagnostic and Tune-Up Program
 - e) Mobile Home High Efficiency Heat Pump Program
2. How did you first learn about the program(s)?
 - a) Kentucky Power employee
 - b) KentuckyPower.com
 - c) Customer
 - d) Advertisement
 - e) Email
 - f) Word of Mouth
 - g) Event/meeting/presentation
 - h) Other (specify)
3. Why did you decide to become a participating HVAC Dealer?
4. How long have you been a participating HVAC Dealer?

Program Performance

5. What type of equipment is serviced *most frequently* under the HVAC Diagnostic and Tune-Up Program?

	Small Commercial	Residential
Heat Pump		
Air Conditioner		

6. How efficient is the equipment *most frequently* installed under the Small Commercial Heat Pump/Air Conditioner Program?
 - a) Heat Pump (SEER/HSPF)
 - b) Air Conditioner (SEER)
7. How efficient is the equipment *most frequently* installed under the Residential Heat Pump Program?
 - a) Heat Pump (SEER/HSPF)

8. How influential have the customer incentives been in moving projects forward?
 - a) Very influential
 - b) Somewhat influential
 - c) Not too influential
 - d) Not at all influential
9. Besides the incentive, what are the main factors driving customer participation in the programs?
 - a) Energy savings
 - b) Bill savings
 - c) Comfort
 - d) Environmental issues
 - e) Other (specify)
10. Do you usually complete and submit the customer rebate form on the customer's behalf?
 - a) Yes
 - b) No
11. Has the program influenced customers to install additional energy efficient equipment as a result of participating in the program?
12. If so, what additional efficiency measures did the customer opt to install?

Participation

13. What are your primary sources of information on energy efficient HVAC equipment?
 - a) Online
 - b) Publications
 - c) Trade shows
 - d) Kentucky Power
 - e) HVAC Distributors
 - f) Other (specify)
14. Do you have access to energy efficient HVAC equipment through local HVAC Distributors? *Read Answers*
 - b) Yes, excellent access
 - c) Yes, decent access
 - d) Yes, minimal access
 - e) No
 - f) Explain
15. How important is it to you that your company is listed on the Kentucky Power website as a participating HVAC Dealer?
 - a) Very important
 - b) Somewhat important
 - c) Not too important
 - d) Not at all important
16. What is your preferred medium of contact from Kentucky Power for program updates or information about program?
 - a) Emails from Kentucky Power
 - b) Kentucky Power website
 - c) Calls from Kentucky Power
 - d) Visits from Kentucky Power staff
 - e) Other (specify)

Program Satisfaction

17. Please rate your satisfaction with the following program components on a five-point scale, where "1" means "Very Unsatisfied" and "5" means "Very Satisfied." How satisfied are you with the:

	5	4	3	2	1
Incentive offered					
Equipment included in the program					
Application requirements					
Incentive processing					
Customer service					
Interaction with Kentucky Power staff					
Program overall					

Comments (verbatim)

18. How important was the HVAC Dealer incentive in getting you to participate in the program?

- a. Very important
- b. Somewhat important
- c. Not too important
- d. Not at all important

19. What changes should be made to the program to make it more attractive to customers? To HVAC Dealers?

Demographic

20. Approximately what percentage of your 2012/2013 business can be attributed to the Kentucky Power programs?

21. How long have you been in business?

22. How many employees do you have?

Thank you for taking the time to answer my questions

Express Program Contractor

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's Commercial Incentive Program. I'd like to talk with you about your experience with the program and get some feedback. The survey should take about 5-10 minutes. All comments will remain confidential.

According to our records, you have installed energy efficient equipment through the Commercial Incentive Program. Is that correct?

- a) Yes
- b) No (**THANK THEM AND END CALL**)

Program Awareness

1. How did you first learn about the program?
 - a) Program Implementer (KEMA)
 - b) Kentucky Power employee
 - c) KentuckyPower.com
 - d) Email
 - e) Word of Mouth (business associates)
 - f) Other (specify)
2. How long have you been an Express Program contractor?
3. Do you promote the Express Program to customers?
 - a) Yes (please describe)
 - b) No
4. How frequently do you communicate with a KEMA representative (method of communication, topics, etc)?

Program Performance

5. What type of energy efficient equipment do customers most frequently install? **Read Answers**
 - a) Lighting
 - b) Refrigeration
 - c) Other (specify)
6. How influential have the customer incentives been in moving projects forward?
 - a) Very influential
 - b) Somewhat influential
 - c) Not too influential
 - d) Not at all influential
7. Besides the customer incentive, what are the main factors driving program participation for customers?
 - a) Energy savings
 - b) Bill savings
 - c) Comfort
 - d) Environmental issues
 - e) Other (specify)
8. Has participating in the program influenced customers to install additional energy efficient equipment?
9. If so, what additional efficiency measures did the customer opt to install?

Participation

10. What are your primary sources of information on energy efficiency equipment and services?
 - a) Online
 - b) Publications
 - c) Trade shows
 - d) Other (specify)

11. Do you have access to energy efficient lighting equipment through local distributors? **Read Answers**
 - a) Yes, Excellent Access
 - b) Yes, Decent Access
 - c) Yes, Minimal Access
 - d) No
 - e) Explain

12. Do you have access to energy efficient refrigeration equipment through local distributors? **Read Answers**
 - a) Yes, Excellent Access
 - b) Yes, Decent Access
 - c) Yes, Minimal Access
 - d) No
 - e) Explain

13. Please rate your satisfaction with the following program components on a five-point scale, where "1" means "Very Unsatisfied" and "5" means "Very Satisfied." How satisfied are you with the:

	5	4	3	2	1
Incentive offered					
Equipment included in the program					
KEMA representative					
Data collection requirements					
Incentive processing					
Program overall					

Comments (verbatim)

14. Are there any barriers to customer participation?
 - a) Yes (please describe)
 - b) No

15. What changes should be made to the program to make it more attractive to customers?

16. Do you have any additional program recommendations?

Dealer Demographics

17. Approximately what percentage of your 2012/2013 business can be attributed to the Kentucky Power programs?

18. How long have you been in business?

19. How many employees do you have?

Retrofit Program Contractor

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's Commercial Incentive Program. I'd like to talk with you about your experience with the programs and get some feedback. The survey should take about 5-10 minutes. All comments will remain confidential.

According to our records, you have installed energy efficient equipment through the Commercial Incentive Program. Is that correct?

- a) Yes
- b) No (**THANK THEM AND END CALL**)

Program Awareness

1. Which Kentucky Power program is your company involved with? **Mark all that apply**
 - a) Prescriptive Program
 - b) Custom Program
2. How did you first learn about the program(s)?
 - a) Program Implementer (KEMA)
 - b) Kentucky Power employee
 - c) KentuckyPower.com
 - d) Customer
 - e) Email
 - f) Word of Mouth (business associates)
 - g) Other (specify)
3. Do you promote the Commercial Incentive Program to customers?
 - a) Yes (please describe)
 - b) No

Program Performance

4. What type of energy efficient equipment do customers most frequently install? **Read Answers**
 - a) Lighting
 - b) Refrigeration
 - c) HVAC
 - d) Food Service
 - e) Other (specify)
5. How influential have the customer incentives been in moving projects forward?
 - a) Very influential
 - b) Somewhat influential
 - c) Not too influential
 - d) Not at all influential
6. Besides the customer incentive, what are the main factors driving program participation for customers?
 - a) Energy savings
 - b) Bill savings
 - c) Comfort
 - d) Environmental issues
 - e) Other (specify)

7. Do you usually complete the following customer rebate components? **Read Answers**

	Yes	Sometimes	No
Pre-Approval Application			
Pre-Approval Application Worksheets			
Pre-Approval Application Custom Engineering Calculations			
Final Application			
Final Application Worksheets			
Final Application Custom Engineering Calculations			

8. Do you usually submit the customer rebate?

- a) Yes
- b) No

9. Has participation in the program influenced customers to install additional energy efficient equipment?

10. If so, what additional efficiency measures did the customer opt to install?

Participation

11. What are your primary sources of information on energy efficiency equipment and services?

- a) Online
- b) Publications
- c) Trade shows
- d) Other (specify)

12. Do you have access to energy efficient equipment through local Distributors? **Read Answers**

	Yes, excellent access	Yes, decent access	Yes, minimal access	No
Lighting				
Refrigeration				
Motors				
HVAC equipment				
Food Service				

Explain

13. Please rate your satisfaction with the following program components on a five-point scale, where "1" means "Very Unsatisfied" and "5" means "Very Satisfied." How satisfied are you with the:

	5	4	3	2	1
Incentive offered					
Prescriptive equipment included in the program					
Application requirements					
KEMA representative					
Incentive processing					
Customer service					
Program overall					

Comments (verbatim)

14. Are there any barriers to customer participation?

- a) Yes (please describe)
- b) No

15. What changes should be made to the program to make it more attractive to customers?

16. Do you have any additional program recommendations?

Dealer Demographics

- 17. How long have you been in business?
- 18. How many employees do you have?



Kentucky Power Company

Appendix C. Participant Survey Guides

Process, Market and Impact Evaluations · July 2014

Prepared by:

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AEG administered a 10 to 12 minute telephone survey to a sample of program participants to assess program experience and awareness, customer satisfaction, barriers to participation, free ridership and areas for improvement. Kentucky Power provided data for program participants that received a rebate between January 1, 2012 and September 30, 2013. AEG calculated the sample size at a 90 percent confidence interval with an error margin of +/-10 percent. Participants were then randomly selected based on unique identifiers determined by Microsoft Excel's random number generator.

Community Outreach CFL Program

1. How did you hear about the outreach event?
2. Why did you choose to attend the event?
3. How many of the CFLs that you received today do you plan to immediately install in your home?
 0 1 2 3 4
4. In what rooms in your home do you plan to install the CFLs? (Check all that apply)
 Bedroom
 Bathroom
 Kitchen
 Living Room
Other (Please Specify) _____
5. Have you considered replacing all or some of the light bulbs in your home with CFLs?
 Yes No
6. How likely is it that you would have purchased and installed similar CFLs if Kentucky Power was NOT DISTRIBUTING them for FREE?
 Very Likely
 Somewhat Likely
 Neutral
 Somewhat Unlikely
 Very Unlikely
7. Approximately how many CFLs are currently installed in your home?
 0 1 – 2 3 - 5 6 - 10 More than 10
8. What has prevented you from using CFLs in the past? (Check all that apply)
 I thought it would cost too much money
 I was not sure how long I would remain in my home
 I was not convinced I would save more money
 I did not like the light quality of CFLs
 CFLs do not properly fit my lighting fixtures
 I was concerned about health impacts of CFLs
Other (please specify) _____
9. How many outreach events have you attended?
10. Have you participated in any Kentucky Power energy savings programs? (Check all that apply)
 Residential Efficient Products Program

- Residential High Efficiency Heat Pump Program
- Residential HVAC Diagnostic and Tune-Up Program
- Mobile Home High Efficiency Heat Pump Program
- Mobile Home New Construction Program
- Modified Energy Fitness Program
- Targeted Energy Efficiency Program

11. How influential was the Kentucky Power energy savings program(s) on your decision to attend the Community Outreach Event?

- Very Influential
- Somewhat Influential
- Neutral
- Slightly Influential
- Not Influential

12. Are you a customer of Kentucky Power?

- Yes No

13. Is your home a

- House Apartment Condominium
Townhouse Mobile Home
Other (specify) _____

Thank you for taking the time to answer my questions!

Student Education Program

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's Student Energy Education Program. I'd like to talk with you about your impression of the program and get some feedback. The survey should only take about 10 minutes and the information you provide will be kept confidential.

The Student Energy Education Program is a program for 7th grade students sponsored by Kentucky Power. According to our records, your child's school participated in this program.

Are you aware of this program?

- a) Yes
- b) No

Program Participation

Part of the program is to educate students on the benefits of energy efficiency and to distribute high efficiency compact fluorescent light bulbs.

1. Did your child bring home any educational materials from school?
 - a) Yes
 - b) No
2. How informative were the education materials provided to your child in educating your household on the benefits of energy efficiency?
 - a) Very informative
 - b) Somewhat informative
 - c) Not informative
3. Did your child bring home the four 23 Watt CFLs?
 - a) Yes
 - b) No
4. How many of the high efficiency light bulbs that you received are currently installed in your home?
 - a) 1
 - b) 2
 - c) 3
 - d) 4
 - e) None

Free Ridership/Spillover

5. How likely is it that you would have purchased and installed high efficiency light bulbs if you had not received them for free through the program?
 - a) Very likely
 - b) Somewhat likely
 - c) Not likely
6. Have you purchased and installed any *additional* energy efficient equipment as a result of participating in the program?
 - a) Yes
 - b) No (Skip to Q9)
7. What type of equipment have you purchased?
 - a) Upgraded to Energy Star Appliances
 - b) Replaced incandescent light bulbs with CFLs

- c) Replaced incandescent light bulbs with LEDs
 - d) Installed new efficient doors
 - e) Installed new efficient windows
 - f) Installed / upgraded insulation (walls, ceiling, attic)
 - g) Other (verbatim)
8. How important was the program in your decision to take these additional actions?
- a) Very Important
 - b) Somewhat Important
 - c) Not Important

Customer Satisfaction

9. How satisfied are you with the performance of the high efficiency light bulbs you received through the program?
- a) Very satisfied (skip to 11)
 - b) Satisfied (skip to 11)
 - c) Neutral (skip to 11)
 - d) Dissatisfied
 - e) Very dissatisfied
10. Why are you dissatisfied with the bulbs?
- a) Lighting quality
 - b) Health risk
 - c) Disposal
 - d) Other (specify)
11. How could the program be improved?
- a) Make it available to more households
 - b) More educational materials
 - c) More information on other Kentucky Power programs
 - d) No suggestions/good the way it is
 - e) Other (verbatim)

Demographic

12. Do you live in a _____ **Read List**
- a) Single family attached or detached building
 - b) Multifamily building with two or more units
 - c) Mobile home
 - d) Other (specify)
13. Do you own or rent your home?
- a) Own
 - b) Rent

Thank you for taking the time to answer my questions!

Modified Energy Fitness Program

Hello, I'm _____ with Applied Energy Group. We are conducting a survey on behalf of Kentucky Power as part of their continual effort to improve their energy efficiency programs. According to our records, your household received measures and/or rebates in the Modified Energy Fitness Program. The survey should only take about 10 minutes and the information you provide will be kept confidential.

Were you involved with the decision to participate in this program or is there someone else in your household who made that decision?

- a) Yes
- b) No (Ask to speak to that person, repeat intro)

If the customer does not recall the program: "The program provides free energy audits to customers to help identify areas to improve energy efficiency in your home."

Program Participation

2. How did you hear about the program? **Indicate first mention**
 - a) KPCO call
 - b) Bill Insert
 - c) Community event
 - d) KPCO website
 - e) Referral
 - f) Other (specify)
3. What was the primary reason you decided to participate? **Mark all that apply**
 - a) Wanted to save energy
 - b) Seemed like a good offer from Kentucky Power
 - c) Wanted to save money
 - d) Referral
 - e) Other (specify)
4. What energy efficiency measures were installed in your home? **Mark all that apply**
 - a) Hot water pipe insulation
 - b) Weatherstripping/caulking/doorsweep
 - c) Low-flow showerhead
 - d) Duct sealing
 - e) Water Heater Wrap
 - f) CFLs
 - g) Other (specify)
5. Were the measures you received installed by the auditor, yourself, or someone else?
 - a) Auditor
 - b) Self-install
 - c) Other (specify)

Satisfaction

6. How knowledgeable was the energy auditor about energy savings techniques?
 - a) Very knowledgeable
 - b) Somewhat knowledgeable
 - c) Not knowledgeable

7. Rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied were you with the:

	5	4	3	2	1
Scheduling the appointment					
Energy auditor					
Measures installed					
Educational materials					
Response times to requests for information					
Program overall					

Comments (verbatim)

Free Ridership

8. Prior to participating in the program, were you planning to purchase and install the measures installed through the program?
- Yes
 - No (skip to Q11)
9. What factors prevented you from purchasing and installing the measures before receiving the free energy audit? **Mark all that apply**
- Cost
 - Uncertain living arrangements
 - Awareness of savings potential
 - Awareness of measures
 - Availability of measures
 - Other (specify)
10. If you had not received the free energy audit, how likely is it that you would have purchased and installed the measures you received?
- Very likely
 - Somewhat likely
 - Not likely

Spillover

11. Have you recommended the program to any family, friends, or neighbors?
- Yes
 - No
12. Since participating in the program, has your household purchased additional energy efficient equipment?
- Yes
 - No (Skip to Q15)
13. What type of equipment have you purchased? **Mark all that apply**
- Upgraded to Energy Star Appliances
 - Replaced incandescent light bulbs with CFLs
 - Replaced incandescent light bulbs with LEDs
 - Installed new efficient doors
 - Installed new efficient windows
 - Other (verbatim)

14. How important was the program in your decision to take these additional actions?
- a) Very Important
 - b) Somewhat Important
 - c) Not Important

Barriers to Participation

15. Would you recommend this program to others?
- a) Yes
 - b) No
16. Why do you say that? **Mark all that apply**
- a) It saves electricity/we need to conserve it
 - b) It saves money
 - c) It's easy to do
 - d) It's a good program
 - e) The participation process is difficult
 - f) The program is costly
 - g) Other (please specify)
17. How could the program be improved?
- a) Make it available to more people
 - b) More publicity
 - c) Better communication
 - d) No suggestions
 - e) Other (verbatim)

Demographics

18. Do you live in a _____
- a) Single family attached or detached building
 - b) Multifamily building with two or more units
 - c) Mobile home
 - d) Other (specify)
19. Do you own or rent your home?
- a) Own
 - b) Rent

Thank you for taking the time to answer my questions!

Targeted Energy Efficiency Program

Hello, I'm _____ with Applied Energy Group. We are conducting a survey on behalf of Kentucky Power as part of their continual effort to improve their energy efficiency programs. According to our records, your household participated in the Targeted Energy Efficiency Program. The survey should only take about 10 minutes and the information you provide will be kept confidential.

Were you involved with the decision to participate in this program or is there someone else in your household who made that decision?

- a) Yes
- b) No (Ask to speak to that person, repeat intro)

If the customer does not recall the program: "The program provides weatherization and energy efficiency services to qualifying residential customers."

Program Participation

1. How did you hear about the program? **Indicate first mention**
 - a) Community Action Agency
 - b) Radio advertisement
 - c) Newspaper article
 - d) Bill insert
 - e) Community event
 - f) KPCO website
 - g) Referral
 - h) Other (specify)
2. What was the primary reason you decided to participate? **Mark all that apply**
 - a) Wanted to save energy
 - b) Seemed like a good offer from Kentucky Power
 - c) Wanted to save money
 - d) Referral from family/friend/neighbor
 - e) Other (specify)
3. Which Community Action Agency did you work with to participate in the program?
 - a) LKLP
 - b) Northeast
 - c) Big Sandy
 - d) Gateway
 - e) Middle Kentucky
 - f) Other (specify)
4. What energy efficiency measures were installed in your home? **Mark all that apply**
 - a) Energy audit
 - b) Air leakage test
 - c) Air leakage sealing
 - d) Attic insulation
 - e) Floor insulation
 - f) Side-wall insulation
 - g) Duct sealing/insulation
 - h) CFLs
 - i) Hot water heating insulation
 - j) Other (specify)

Satisfaction

5. How knowledgeable was the weatherization crew about energy savings techniques?
 - a) Very knowledgeable
 - b) Somewhat knowledgeable
 - c) Not knowledgeable

6. Rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied are you with the:

	5	4	3	2	1
Scheduling the appointment					
Energy auditor					
Measures installed					
Educational materials					
Community Action Agency					
Response times to requests for information					
Program overall					

Comments (verbatim)

Free Ridership

7. Prior to participating in the program, were you planning to purchase and install the measures installed through the program?
 - a) Yes
 - b) No (skip to Q10)

8. What factors prevented you from purchasing and installing the measures before participating in the program? **Mark all that apply**
 - a) Cost
 - b) Uncertain living arrangements
 - c) Awareness of savings potential
 - d) Awareness of measures
 - e) Availability of measures
 - f) Other (specify)

9. If you had not participated in the program, how likely is it that you would have purchased and installed the measures you described?
 - a) Very likely
 - b) Somewhat likely
 - c) Not likely

Spillover

10. Have you recommended the program to any family, friends, or neighbors?
 - a) Yes
 - b) No

11. Since participating in the program, has your household purchased additional energy efficient equipment?
 - a) Yes
 - b) No (Skip to Q14)

12. What type of equipment have you purchased? **Mark all that apply**
 - a) Upgraded to Energy Star Appliances

- b) Replaced incandescent light bulbs with CFLs
- c) Replaced incandescent light bulbs with LEDs
- d) Installed new efficient doors
- e) Installed new efficient windows
- f) Other (verbatim)

13. How important was the program in your decision to take these additional actions?

- a) Very Important
- b) Somewhat Important
- c) Not Important

Barriers to Participation

14. Would you recommend this program to others?

- c) Yes
- d) No

15. Why do you say that? **Mark all that apply**

- a) It saves electricity/we need to conserve it
- b) It saves money
- c) It's easy to do
- d) It's a good program
- e) The participation process is difficult
- f) The program is costly
- g) Other (please specify)

16. How could the program be improved?

- a) Make it available to more people
- b) More publicity
- c) Better communication
- d) No suggestions
- e) Other (verbatim)

Customer Demographics

17. Do you live in a _____

- a) Single family attached or detached building
- b) Multifamily building with two or more units
- c) Mobile home
- d) Other

18. Do you own or rent your home?

- a) Own
- b) Rent

Thank you for taking the time to answer my questions!

Mobile Home New Construction Program

Hello, I'm _____ with Applied Energy Group. We are conducting a survey on behalf of Kentucky Power as part of their continual effort to improve their energy efficiency programs. According to our records, your household participated in Kentucky Power's Mobile Home New Construction Program. The survey should only take about 10 minutes and the information you provide will be kept confidential.

Were you involved with the decision to participate in this program or is there someone else in your household who made that decision?

- a) Yes
- b) No (Ask to speak to that person, repeat intro)

If the customer does not recall the program: "The program provides rebates to customers who purchase a qualifying new mobile home."

Program Participation

1. How did you first become aware of the program? **Indicate first mention**
 - a) Participating Mobile Home Dealer
 - b) KentuckyPower.com
 - c) Kentucky Power Bill Insert
 - d) Radio/Television/Newspaper Ad
 - e) Word of Mouth (Friend / Neighbor)
 - f) Other (verbatim)
2. Why did you decide to participate in the program? **Mark all that apply**
 - a) Mobile Home Dealer recommended it
 - b) Wanted to save money
 - c) Seemed like a good offer from Kentucky Power
 - d) Wanted to save energy
 - e) Other (verbatim)
3. How important was the information you received from the Mobile Home Dealer in your decision to upgrade to an energy efficient heat pump?
 - a) Very important
 - b) Somewhat important
 - c) Not important

Satisfaction

4. How long did it take to receive the incentive after the mobile home was delivered?
 - a) 1 week
 - b) 2 weeks
 - c) 3 weeks
 - d) 1-2 months
 - e) 2-4 months
 - f) More than 4 months
 - g) Other (specify)

5. Rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied were you with the:

	5	4	3	2	1
a. Mobile home dealer					
b. Incentive processing time					
c. Incentive offered					
d. Interaction with Kentucky Program staff					
e. Response times to requests for information/assistance on forms					
f. Program overall					

Comments (verbatim)

Free Ridership

6. Prior to learning about this program, were you planning to purchase an energy efficient heat pump with your new mobile home?

- a) Yes
- b) No

7. How important was the Kentucky Power incentive in your decision to upgrade to the energy efficient heat pump?

- a) Very important
- b) Somewhat important
- c) Not important

8. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the upgrade to heat pump?

- a) Very likely
- b) Somewhat likely
- c) Not likely

Spillover

9. Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?

- a) Yes
- b) No (Skip to Q12)

10. What type of equipment have you purchased? **Mark all that apply**

- a) Upgraded to Energy Star Appliances
- b) Replaced incandescent light bulbs with CFLs
- c) Replaced incandescent light bulbs with LEDs
- d) Installed new efficient doors
- e) Installed new efficient windows
- f) Other (verbatim)

11. How important was the program in your decision to take these additional actions?

- a) Very Important
- b) Somewhat Important
- c) Not Important

Barriers to Participation

12. Would you recommend the mobile home dealer to someone else?

- a) Yes

- b) No
13. Why do you say that?
- a) Good job
 - b) Quality work
 - c) Professional/easy to work with
 - d) Helpful information
 - e) Efficient/quick installation
 - f) Finished on time
 - g) Good customer service overall
 - h) Unprofessional
 - i) Did not finish on schedule
 - j) Did not finish on budget
 - k) Other (verbatim)
14. Would you recommend the installation of a high efficient heat pump in a mobile home?
- a) Yes
 - b) No
15. Why do you say that?
16. Would you recommend this program to others?
- a) Yes
 - b) No
17. Why do you say that?
- a) It saves electricity/we need to conserve it
 - b) It saves money
 - c) It's easy to do
 - d) It's a good program
 - e) The participation process is difficult
 - f) The program is costly
 - g) Other (please specify)
18. How could the program be improved? **Mark all that apply**
- a) Make it available to more people
 - b) More publicity
 - c) Have more/better participating mobile home dealers
 - d) Faster processing of applications
 - e) Explain the program
 - f) Better communication
 - g) No suggestions
 - h) Other (verbatim)

Thank you for taking the time to answer my questions!

Residential High Efficiency Heat Pump Program

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's High Efficiency Heat Pump Program participants. I'd like to talk with you about your impression of the program and get some feedback. This is NOT a sales effort, but for research purposes only. The survey should only take 10 minutes. All comments will remain confidential.

According to our records, you received a rebate for a new heat pump through the High Efficiency Heat Pump Program. Were you involved with the decision to participate in this program or is there someone else in your household who made that decision?

- a) Yes
- b) No (Ask to speak to that person, repeat intro)

Program Participation

1. How many incentives did you receive for an efficient heat pump?
2. How did you first become aware of the program? **Indicate first mention**
 - a) Participating HVAC Dealer
 - b) Kentucky Power employee
 - c) KentuckyPower.com
 - d) Radio Advertisement
 - e) News Article
 - f) Email
 - g) Kentucky Power Bill Insert
 - h) Word of Mouth (Friend / Neighbor)
 - i) Community event/meeting/presentation
 - j) Other (verbatim)

Free Ridership

3. Prior to learning about this program, did you have specific plans to install a heat pump?
 - a) Yes
 - b) No
 - c) Don't know/refused
4. How important was the Kentucky Power incentive in your decision to buy the efficient heat pump?
 - a) Very important
 - b) Somewhat important
 - c) Not important
5. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the *exact same* equipment?
 - a) Very likely
 - b) Somewhat likely
 - c) Not likely

Spillover

6. Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment, such as lighting or HVAC appliances?
 - a) Yes
 - b) No (go to Q9)
7. What type of equipment have you purchased?

8. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the *additional* equipment?
- a) Very likely
 - b) Somewhat likely
 - c) Not likely

Program Awareness

9. Why did you decide to participate in the program? **Mark all that apply**
- a) Contractor recommended it
 - b) Needed a new cooling/heating system
 - c) Wanted to save money
 - d) Seemed like a good deal/offer from Kentucky Power
 - e) Wanted to save energy
 - f) Other (verbatim)
10. How important was the information you received from the HVAC Dealer in the decision to install this high efficiency equipment?
- a) Very Important
 - b) Somewhat Important
 - c) Not Important

Customer Satisfaction

11. About how long did it take to receive the incentive, from the time the equipment was installed until you received the rebate? **Read answers**
- a) Less than one month
 - b) 4 to 6 weeks
 - c) 6 to 8 weeks
 - d) More than 8 weeks
12. Please rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied are you with the:

	5	4	3	2	1
a) Contractor who performed the work					
b) Incentive processing time					
c) Incentive offered					
d) Interaction with Kentucky Program staff					
e) Response times to requests for information/assistance on forms					
f) Program overall					

Comments (verbatim)

13. Would you recommend this contractor to someone else?
- a) Yes
 - b) No
14. Why do you say that?
- a) Good job
 - b) Quality work
 - c) Professional/easy to work with
 - d) Helpful information
 - e) Efficient/quick installation
 - f) Finished on time

- g) Good customer service overall
 - h) Unprofessional
 - i) Did not finish on schedule
 - j) Did not finish on budget
 - k) Other (verbatim)
15. Based on your experience with the program, would you recommend this program to others?
- a) Yes
 - b) No
16. Why do you say that?
- a) It saves electricity/we need to conserve it
 - b) It saves money
 - c) It's easy to do
 - d) It's a good program
 - e) The participation process is difficult
 - f) The program is costly
 - g) Other (please specify)
17. How could the program be improved? **Mark all that apply**
- a) Make it available to more people
 - b) More publicity
 - c) Have more/better contractors on your list
 - d) Faster incentive processing
 - e) Explain the program/paperwork more
 - f) Better communication
 - g) No suggestions/good the way it is
 - h) Other (verbatim)

Demographics

18. Do you live in a _____
- a) Single family attached or detached building
 - b) Multifamily building with two or more units
 - c) Mobile home
 - d) Other
19. Do you own or rent your home?
- a) Own
 - b) Rent

Thank you for taking the time to answer my questions!

Mobile Home High Efficiency Heat Pump

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's Mobile Home High Efficiency Heat Pump Program participants. I'd like to talk with you about your impression of the program and get some feedback. This is NOT a sales effort, but for research purposes only. The survey should only take 10 minutes. All comments will remain confidential.

According to our records, you received a rebate for a new heat pump through the Mobile Home High Efficiency Heat Pump Program. Were you involved with the decision to participate in this program or is there someone else in your household who made that decision?

- a) Yes
- b) No (Ask to speak to that person, repeat intro)

Program Participation

1. How many incentives did you receive for an efficient heat pump?
2. How did you first become aware of the program? **Indicate first mention**
 - a) Participating HVAC Dealer
 - b) Kentucky Power employee
 - c) KentuckyPower.com
 - d) Radio Advertisement
 - e) News Article
 - f) Email
 - g) Kentucky Power Bill Insert
 - h) Word of Mouth (Friend / Neighbor)
 - i) Community event/meeting/presentation
 - j) Other (verbatim)

Free Ridership

3. Prior to learning about this program, did you have specific plans to install an efficient heat pump?
 - a) Yes
 - b) No
4. How important was the Kentucky Power incentive in your decision to buy the efficient heat pump?
 - a) Very important
 - b) Somewhat important
 - c) Not important
5. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the *exact same* equipment?
 - a) Very likely
 - b) Somewhat likely
 - c) Not likely

Spillover

6. Since receiving the Kentucky Power incentive, has your household purchased additional energy efficient equipment?
 - a) Yes
 - b) No
7. What type of equipment have you purchased?

8. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the *additional* equipment?
- a) Very likely
 - b) Somewhat likely
 - c) Not likely

Program Awareness

9. Why did you decide to participate in the program? **Mark all that apply**
- a) Contractor recommended it
 - b) Needed a new cooling/heating system
 - c) Wanted to save money
 - d) Seemed like a good deal/offer from Kentucky Power
 - e) Wanted to save energy
 - f) Other (verbatim)
10. How important was the information you received from the HVAC Dealer [or contractor] in the decision to install this high efficiency equipment?
- a) Yes
 - b) No
 - c) Other (verbatim)

Customer Satisfaction

11. How long did it take to receive the incentive after the equipment was installed? **Read answers**
- a) Less than one month
 - b) 4 to 6 weeks
 - c) 6 to 8 weeks
 - d) More than 8 weeks
 - e) Other (verbatim)
12. Please rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied are you with the:

	5	4	3	2	1
Contractor who performed the work					
Incentive processing time					
Incentive offered					
Interaction with Kentucky Program staff					
Response times to requests for information/assistance on forms					
Program overall					

Comments (verbatim)

13. Would you recommend this contractor to someone else?
- a) Yes
 - b) No
14. Why do you say that?
- a) Good job
 - b) Quality work
 - c) Professional/easy to work with
 - d) Helpful information
 - e) Efficient/quick installation
 - f) Finished on time

- g) Good customer service overall
 - h) Unprofessional
 - i) Did not finish on schedule
 - j) Did not finish on budget
 - k) Other (verbatim)
15. Would you recommend this program to others?
- a) Yes
 - b) No
16. Why do you say that?
- a) It saves electricity/we need to conserve it
 - b) It saves money
 - c) It's easy to do
 - d) It's a good program
 - e) The participation process is difficult
 - f) The program is costly
 - g) Other (please specify)
17. How could the program be improved? **Mark all that apply**
- a) Make it available to more people
 - b) More publicity/advertise it
 - c) Have more/better contractors on your list
 - d) Faster processing of applications
 - e) Explain the program/paperwork more
 - f) Better communication/easier to reach people at Kentucky Power
 - g) No suggestions/good the way it is
 - h) Other (verbatim)

Thank you for taking the time to answer my questions!

Residential HVAC Diagnostic and Tune-Up Program

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's HVAC Diagnostic and Tune-Up Program participants. I'd like to talk with you about your impression of the program and get some feedback. This is NOT a sales effort, but for research purposes only. The survey should only take 10 minutes. All comments will remain confidential.

According to our records, you received a rebate for diagnostic and tune-up service for your HVAC equipment through the HVAC Diagnostic and Tune-Up Program. Were you involved with the decision to participate in this program or is there someone else in your household who made that decision?

- a) Yes
- b) No (Ask to speak to that person, repeat intro)

Program Awareness

1. How many incentives did you receive for your heat pump diagnostic and tune-up service?
2. How did you first become aware of the program? **Indicate first mention**
 - a) Participating HVAC Dealer
 - b) Kentucky Power employee
 - c) KentuckyPower.com
 - d) Radio Advertisement
 - e) Email
 - f) News Article
 - g) Kentucky Power Bill Insert
 - h) Word of Mouth (Friend / Neighbor)
 - i) Community event/meeting/presentation
 - j) Other (verbatim)

Free Ridership

3. Prior to learning about this program, did you have specific plans to schedule a diagnostic and tune-up of your heat pump?
 - a) Yes
 - b) No
4. How important was the Kentucky Power incentive in your decision to have this diagnostic and tune-up service performed?
 - a) Very important
 - b) Somewhat important
 - c) Not important
5. If you had not received the Kentucky Power incentive, how likely is it you would have had this service performed on your equipment?
 - a) Very likely
 - b) Somewhat likely
 - c) Not likely

Spillover

6. Did you replace and/or receive a rebate for a new heat pump as a result of participating in the program?
 - a) Did not replace Heat Pump
 - b) Replaced Heat Pump WITH rebate

- c) Replaced Heat Pump WITHOUT rebate
- 7. Since receiving your diagnostic and tune-up service have you taken any additional energy efficiency actions?
 - a) Yes
 - b) No (skip to Q10)
- 8. What additional energy efficient actions have you taken?
- 9. If you have not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?
 - a) Very likely
 - b) Somewhat likely
 - c) Not likely

Program Awareness

- 10. Why did you decide to participate in this program? **Mark all that apply**
 - a) Contractor recommended it
 - b) Part of preventative maintenance agreement or service contract with HVAC dealer
 - c) Needed diagnostic and tune-up services for the cooling/heating system
 - d) Wanted to save money
 - e) Seemed like a good deal/offer from Kentucky Power
 - f) Wanted to save energy
 - g) Other (verbatim)
- 11. How important was the information you received from the HVAC Dealer [contractor] in the decision to have diagnostic and tune-up service?
 - a) Very important
 - b) Slightly important
 - c) Not important

Customer Satisfaction

- 12. About how long did it take to receive the incentive, from the time the diagnostic and tune-up service was performed until you received the rebate? **Read answers**
 - a) Less than one month
 - b) 4 to 6 weeks
 - c) 6 to 8 weeks
 - d) More than 8 weeks
- 13. Please rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied are you with the:

	5	4	3	2	1
Contractor who performed the work					
Incentive processing time					
Incentive offered					
Interaction with Kentucky Program staff					
Response times to requests for information/assistance on forms					
Program overall					

Comments (verbatim)

- 14. Would you recommend this contractor to someone else?
 - a. Yes

- b. No
15. Why do you say that?
- a) Good job
 - b) Quality work
 - c) Professional/easy to work with
 - d) Helpful information
 - e) Efficient/quick installation
 - f) Finished on time
 - g) Good customer service overall
 - h) Unprofessional
 - i) Did not finish on schedule
 - j) Did not finish on budget
 - k) Other (verbatim)
16. Would you recommend this program to others?
- a) Yes
 - b) No
17. Why do you say that?
- a) It saves electricity/we need to conserve it
 - b) It saves money
 - c) It's easy to do
 - d) It's a good program
 - e) The participation process is difficult
 - f) The program is costly
 - g) Other (please specify)
18. How could the program be improved? **Mark all that apply**
- a) Make it available to more people
 - b) More publicity/advertise it
 - c) Have more/better contractors on your list
 - d) Faster processing of applications
 - e) Explain the program/paperwork more
 - f) Better communication/easier to reach people at Kentucky Power
 - g) No suggestions/good the way it is
 - h) Other (verbatim)

Customer Demographics

19. Do you live in a _____
- a) Single family attached or detached building
 - b) Multifamily building with two or more units
 - c) Mobile home
 - d) Other
20. Do you own or rent your home?
- a) Own
 - b) Rent
 - c) Don't Know/Refused

Thank you for taking the time to answer my questions!

Small Commercial HVAC Diagnostic & Tune-Up Program

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's HVAC Diagnostic and Tune-Up Program participants. I'd like to talk with you about your impression of the program and get some feedback. This is for research purposes only. The survey should only take 10 minutes. All comments will remain confidential.

According to our records, you received a rebate for diagnostic or tune-up service for your HVAC equipment through the HVAC Diagnostic and Tune-Up Program. Were you involved with the decision to participate in this program?

- a) Yes
- b) No (ask to speak to that person, repeat intro)

Program Awareness

1. What kind of equipment did your business have the diagnostic and turn-up service performed on?
 - a) Central Air Conditioner
 - b) Heat Pump
 - c) Both
2. How did you first become aware of the program? **Indicate first mention**
 - a) Participating HVAC Dealer
 - b) Kentucky Power employee
 - c) KentuckyPower.com
 - d) Radio Advertisement
 - e) News Article
 - f) Email
 - g) Kentucky Power Bill Insert
 - h) Word of Mouth
 - i) Community event/meeting/presentation
 - j) Other (verbatim)
3. Why did you decide to participate in the program? **Mark all that apply**
 - a) Contractor recommended it
 - b) Needed diagnostic and tune-up services for the cooling/heating system
 - c) Wanted to save money
 - d) Seemed like a good offer from Kentucky Power
 - e) Wanted to save energy
 - f) Other (verbatim)
4. How important was the information you received from the HVAC Dealer [contractor] in the decision to have diagnostic and tune-up service?
 - a) Very Important
 - b) Slightly Important
 - c) Not Important

Free Ridership

5. How important was the Kentucky Power incentive in your decision to have this diagnostic and tune-up service performed on your heat pump?
 - a) Very important
 - b) Somewhat important
 - c) Not important

6. Prior to learning about this program, did you have specific plans to schedule a diagnostic and tune-up of your HVAC equipment?

	CAC	HP
Yes		
No		
Don't know/refused		

7. Was it necessary to change your plans to qualify for the program?
 a) Yes
 b) No
8. What changes were made?
9. If you had not received the Kentucky Power incentive, how likely is it you would have had this service performed on your equipment?
 a) Very likely
 b) Somewhat likely
 c) Not likely

Spillover

10. Did you replace and/or receive a rebate for a new heat pump or central air conditioner as a result of participating in the program?

	CAC	HP
Did not replace		
Replaced WITH rebate		
Replaced WITHOUT rebate		

11. Since receiving your diagnostic and tune-up service have you taken any additional energy efficient actions?
 a) Yes
 b) No (skip to Q14)
12. What additional energy efficient actions have you taken?
13. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?
 a) Very likely
 b) Somewhat likely
 c) Not likely

Customer Satisfaction

14. About how long did it take from the time the services were performed until you received the rebate? **Read answers**
 a) Less than one month
 b) 4 to 6 weeks
 c) 6 to 8 weeks
 d) More than 8 weeks

15. Please rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied are you with the:

	5	4	3	2	1
a) Contractor who performed the work					
b) Incentive processing time					
c) Incentive offered					
d) Interaction with Kentucky Program staff					
e) Response times to requests for information/assistance on forms					
f) Program overall					

Comments (verbatim)

16. Would you recommend the contractor to someone else?

- a) Yes
- b) No

17. Why do you say that? **Mark all that apply**

- a) Good job
- b) Quality work
- c) Professional/easy to work with
- d) Helpful information
- e) Efficient/quick installation
- f) Finished on time
- g) Good customer service overall
- h) Unprofessional
- i) Did not finish on schedule
- j) Did not finish on budget
- k) Other (verbatim)

18. Would you recommend this program to others?

- a) Yes
- b) No

19. Why do you say that? **Mark all that apply**

- a) It saves electricity/we need to conserve it
- b) It saves money
- c) It's easy to do
- d) It's a good program
- e) It's time consuming
- f) Difficult to participate in the program
- g) The equipment is costly to purchase
- h) Other (specify)

20. How could the program be improved? **Mark all that apply**

- a) Make it available to more people
- b) More publicity
- c) Have more contractors on your list
- d) Faster processing of applications
- e) Explain the program/paperwork more
- f) Better communication/easier to reach people at Kentucky Power
- g) No suggestions/good the way it is
- h) Other (verbatim)

Demographics

21. How would you classify your type of business?

- a) Big Box
- b) Restaurant
- c) Hotel
- d) Office
- e) Retail
- f) Other (verbatim)

22. Do you own or lease the place where you do business?

- a) Own
- b) Lease

Thank you for taking the time to answer my questions!

Small Commercial High Efficiency Heat Pump/Air Conditioner Program

Hello, I'm _____ with Applied Energy Group. We are conducting a survey of Kentucky Power's Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program participants. I'd like to talk with you about your impression of the program and get some feedback. This is for research purposes only. The survey should only take 10 minutes. All comments will remain confidential.

According to our records, you received a rebate for a new heat pump or air conditioner through the Small Commercial High Efficiency Heat Pump/Air Conditioner Incentive Program. Were you involved with the decision to participate in this program?

- a) Yes
- b) No (ask to speak to that person, repeat intro)

Program Participation

1. What kind of efficient equipment did you have installed in your business as part of this program?
 - a) Central air conditioner
 - b) Heat Pump
 - c) Both
2. How did you first become aware of the program? **Indicate first mention**
 - a) Participating HVAC Dealer
 - b) Kentucky Power employee
 - c) KentuckyPower.com
 - d) Radio Advertisement
 - e) News Article
 - f) Email
 - g) Kentucky Power Bill Insert
 - h) Word of Mouth (Friend / Neighbor)
 - i) Community event/meeting/presentation
 - j) Other (verbatim)
3. Why did you decide to participate in the program? **Mark all that apply**
 - a) HVAC Dealer recommended it
 - b) Needed a new cooling/heating system
 - c) Wanted to save money
 - d) Seemed like a offer from Kentucky Power
 - e) Wanted to save energy
 - f) Other (verbatim)
4. How important was the information you received from the HVAC Dealer in the decision to install the high efficiency equipment?
 - a) Very important
 - b) Somewhat important
 - c) Neutral
 - d) Not very important
 - e) Not at all important

Free Ridership

5. Prior to learning about this program, did you have specific plans to install a central air conditioner and/or heat pump?

	Heat Pump	Central Air Conditioner
Yes		
No		

6. Was it necessary to change those plans to qualify for the program?
 a) Yes
 b) No

7. If yes, what changes were made?

8. How important was the Kentucky Power incentive in your decision to buy the efficient central air conditioner and/or heat pump?

	Heat Pump	Central Air Conditioner
Very Important		
Somewhat Important		
Neutral		
Not Very Important		
Not At All Important		

9. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the *exact same type* of equipment?
 a) Very likely
 b) Somewhat likely
 c) Not likely
10. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the *exact same quantity* of equipment?
 a) Very likely
 b) Somewhat likely
 c) Not likely

Spillover

11. Since receiving the Kentucky Power incentive, has your business purchased additional energy efficient equipment?
 a) Yes
 b) No
12. What type of equipment have you purchased?
13. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the additional equipment?
 a) Very likely
 b) Somewhat likely
 c) Not likely

Customer Satisfaction

14. About how long was it from the time the equipment was installed until you received the rebate?

Read answers

- a) Less than one month
 b) 4 to 6 weeks

- c) 6 to 8 weeks
- d) More than 8 weeks
- e) Other (verbatim)

15. Please rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied are you with the:

	5	4	3	2	1
Contractor who performed the work					
Incentive processing time					
Incentive offered					
Interaction with Kentucky Program staff					
Response times to requests for information/assistance on forms					
Program overall					

Comments (verbatim)

16. Would you recommend the HVAC Dealer to someone else?

- a) Yes
- b) No

17. Why do you say that? **Mark all that apply**

- a) Quality work
- b) Professional
- c) Informative
- d) Quick Installation
- e) Finished on Time
- f) Good Customer Service
- g) Unprofessional
- h) Did Not Finish on Schedule
- i) Did not Finish on Budget
- j) Other (verbatim)

18. Would you recommend this program to others?

- a) Yes
- b) No

19. Why do you say that? **Mark all that apply**

- a) Saves electricity
- b) Saves money
- c) Easy to Participate
- d) A good program
- e) Time Consuming
- f) Difficult to Participate
- g) The Equipment is Costly
- h) Other (verbatim)

20. How could the program be improved? **Mark all that apply**

- a) Make it available to more people
- b) More publicity
- c) Better contractors
- d) Faster processing of applications
- e) Explain the program
- f) Better communication

g) Other (verbatim)

Demographics

21. How would you classify your type of business?

- a) Big Box
- b) Restaurant
- c) Hotel
- d) Office
- e) Retail
- f) Other (verbatim)

22. Do you own or lease the place where you do business?

- a) Own
- b) Lease

Thank you for taking the time to answer my questions!

Commercial Incentive Program – Express Install

Hello, I'm _____ with Applied Energy Group. We are conducting a survey on behalf of Kentucky Power as part of their continual effort to improve their energy efficiency programs. The survey should only take about 10 minutes and the information you provide will be kept confidential.

According to our records, your business received a rebate in Kentucky Power's Commercial Incentive Express Program. Were you involved with the decision to participate in this program?

- a) Yes
- b) No (ask to speak to that person, repeat intro)

Program Participation

19. How did you first become aware of the Commercial Incentive Program? **Indicate first mention**

- a) Lighting Contractor
- b) Kentucky Power
- c) Program Implementer (KEMA)
- d) KentuckyPower.com
- e) Bill Insert
- f) Program Flyer
- g) Word of Mouth (Business Associate)
- h) Other (please specify)

20. Why did you decide to participate in the program?

- a) Contractor recommended it
- b) Wanted to save money
- c) Seemed like a good offer from Kentucky Power
- d) Wanted to save energy
- e) Other (please specify)

21. Please check if you received a:

- a) Pre- inspection
- b) Post-inspection

Free Ridership

22. Had you been planning to install equipment with the EXACT SAME efficiency before you participated in the program?

- a) Yes
- b) No (go to Q6)

23. What factors had kept you from purchasing and installing the equipment?

- a) Cost concerns
- b) I wasn't sure how long I would remain at this location
- c) I wasn't sure what type of system/brand to install
- d) I was not convinced I would save more
- e) I did not have a contractor I felt I could trust
- f) Other (specify)

24. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the **exact same** equipment?

- c) Very likely
- d) Somewhat likely
- e) Neither likely nor unlikely

- f) Somewhat unlikely
- g) Not likely

Spillover

- 25. As a result of your participation in the program, have you taken any other steps to reduce your energy use?
 - a) Yes
 - b) No (skip to Q10)
- 26. What type of equipment has your business purchased?
- 27. What influence did the Kentucky Power program have on the decision?
 - a) Had no influence
 - b) Had some influence
 - c) Had a large influence

Customer Satisfaction

28. Rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied were you with the:

	5	4	3	2	1
Lighting Contractor					
Field Representative					
Incentives offered					
Rebate processing time					
Performance of the new equipment					
Response times to requests for information					
Program overall					

Comments (verbatim)

- 29. Based on your experience with the program, would you recommend this program to others?
 - a) Yes
 - b) No
- 30. Why do you say that? **Mark all that apply**
 - a) It saves electricity/we need to conserve it
 - b) It saves money
 - c) It's easy to do
 - d) It's a good program
 - e) The participation process is difficult
 - f) The program is costly
 - g) Other (please specify)
- 31. How could the program be improved?
 - a) Higher incentives
 - b) More publicity
 - c) Faster incentive processing
 - d) Better communication
 - e) Simplified application
 - f) No suggestions
 - g) Other (specify)

Demographics

32. How would you classify your type of business?

- a) Big Box
- b) Restaurant
- c) Hotel
- d) Office
- e) Retail
- f) Other (verbatim)

33. Do you own or lease the place where you do business?

- a) Own
- b) Lease

Thank you for taking the time to complete the survey!

Commercial Incentive Program – New Construction

Hello, I'm _____ with Applied Energy Group. We are conducting a survey on behalf of Kentucky Power as part of their continual effort to improve their energy efficiency programs. The survey should only take about 10 minutes and the information you provide will be kept confidential.

According to our records, your business received a rebate in Kentucky Power's Commercial New Construction Program. Were you involved with the decision to participate in this program?

- a) Yes
- b) No (ask to speak to that person, repeat intro)

Program Participation

1. How did you first become aware of the program?
 - a) Kentucky Power
 - b) Program Implementer (KEMA)
 - c) KentuckyPower.com
 - d) Word of Mouth (Business Associate)
 - e) Other (please specify)
2. Why did you decide to participate in the program?
 - a) Contractor recommended it
 - b) Wanted to save money
 - c) Seemed like a good offer from Kentucky Power
 - d) Wanted to save energy
 - e) Other (please specify)
3. Did you hire a contractor to install the equipment?
 - a) Yes
 - b) No
4. Who completed the reservation application?
 - a) Building manager
 - b) Contractor
 - c) Other (specify)
5. Who performed the calculations to determine ...
 - a) Actual Lighting Power Density
 - b) Building area
 - c) Operating hours per year
6. Who completed the final application and updated the worksheets and documentation?
 - a) Building manager
 - b) Contractor
 - c) Other (specify)
7. Did you meet with a Kentucky Power representative (KEMA) prior to submitting the reservation application?
 - a) Yes
 - b) No
8. Did the Kentucky Power representative (KEMA) complete the reservation application?
 - a) Yes
 - b) No

9. Did you receive an inspection?

	Yes	No
Pre-installation inspection		
Post-installation inspection		

Free Ridership

10. Had you been planning to install equipment with the EXACT SAME efficiency before you participated in the program?

- a) Yes
- b) No (go to Q13)

11. What factors kept you from purchasing and installing the equipment?

- a) Cost concerns
- b) I wasn't sure how long I would remain at this location
- c) I wasn't sure what type of system/brand to install
- d) I was not convinced I would save more
- e) I did not have a contractor I felt I could trust
- f) Other (specify)

12. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the *exact same* equipment?

- a) Very likely
- b) Somewhat likely
- c) Neither likely nor unlikely
- d) Somewhat unlikely
- e) Not likely

Spillover

13. As a result of your participation in the program, have you taken any other steps to reduce your energy use?

- a) Yes
- b) No (skip to Q16)

14. What type of equipment has your business purchased?

15. What influence did the Kentucky Power program have on the decision?

- a) Had no influence
- b) Had some influence
- c) Had a large influence

Customer Satisfaction

16. Rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied were you with the:

	5	4	3	2	1
Rebate application					
Participation process					
Incentives offered					
Rebate processing time					
Performance of the new equipment					
Response times to requests for information					
Program overall					

17. Based on your experience with the program, would you recommend this program to others?

- a) Yes
- b) No

18. Why do you say that?

- a) It saves electricity/we need to conserve it
- b) It saves money
- c) It's easy to do
- d) It's a good program
- e) The participation process is difficult
- f) The program is costly
- g) Other (please specify)

19. How could the program be improved?

- a) Higher incentives
- b) More publicity
- c) Faster incentive processing
- d) Better communication
- e) More design assistance
- f) No suggestions
- g) Other (specify)

Demographics

20. How would you classify your type of business?

- a) Big Box
- b) Restaurant
- c) Hotel
- d) Office
- e) Retail
- f) Other (verbatim)

21. Do you own or lease the place where you do business?

- a) Own
- b) Lease

Thank you for taking the time to answer my questions!

Commercial Incentive Program - Retrofit

Kentucky Power is conducting an evaluation of its Commercial Incentive Program. The program provides financial incentives to business customers who implement qualified energy-efficient improvements and technologies. We would like to get your feedback and impressions of the program. The survey is for research purposes and all responses will remain confidential.

1. How did you first become aware of the program?
 - a) Lighting Contractor
 - b) Kentucky Power
 - c) Radio Advertisement
 - d) Newspaper Advertisement
 - e) Program Implementer (KEMA)
 - f) KentuckyPower.com
 - g) Bill Insert
 - h) Program Flyer
 - i) Word of Mouth (Business Associate)
 - j) Other (please specify)
2. Why did you decide to participate in the program?
 - a) Contractor recommendation
 - b) Wanted to save money
 - c) Seemed like a good offer from Kentucky Power
 - d) Wanted to save energy
 - e) Other (please specify)

Program Participation

3. Did you submit a prescriptive or custom application?
 - a) Prescriptive (skip to Q5)
 - b) Custom
4. Who developed the detailed engineering calculations documenting annual energy and on-peak demand savings for the pre-application?
 - a) Kentucky Power representative (KEMA)
 - b) Contractor
 - c) Internal staff
 - d) Other (please specify)
5. What kind of efficient technology did you have installed?
 - a) Lighting
 - b) HVAC
 - c) Food Service and Refrigeration
 - d) Other (please specify)
6. Did you hire a contractor to install the equipment?
 - a) Yes
 - b) No
7. Did you meet with a Kentucky Power representative (KEMA) prior to submitting the pre-approval application?
 - a) Yes
 - b) No

8. Did the Kentucky Power representative (KEMA) complete the pre-approval application?
 - a) Yes
 - b) No
9. Please check if you received a:
 - a) Pre-approval inspection
 - b) Post-installation inspection

Customer Satisfaction

10. Please rate your satisfaction with the following program components on a five-point scale, where "5" means "Very Satisfied" and "1" means "Very Dissatisfied." How satisfied are you with the:

	5	4	3	2	1
Rebate Application					
Participation Process					
Incentive offered					
Rebate processing time					
Performance of the new equipment					
Field Representative					
Program overall					

Comments

11. Based on your experience with the program, would you recommend this program to others?
 - a) Yes
 - b) No
12. Why do you say that?
 - a) It saves electricity/we need to conserve it
 - b) It saves money
 - c) It's easy to do
 - d) It's a good program
 - e) The participation process is difficult
 - f) The program is costly
 - g) Other (please specify)
13. How could the program be improved?
 - a) Higher incentives
 - b) More publicity
 - c) Faster incentive processing
 - d) Better communication
 - e) Simplified application
 - f) No suggestions
 - g) Other (specify)

Free Ridership/Spillover

14. Had you been planning to install equipment with the EXACT SAME efficiency before you participated in the program?
 - a) Yes
 - b) No (go to Q16)
15. What factors had kept you from purchasing and installing the equipment?
 - a) Cost concerns
 - b) I wasn't sure how long I would remain at this location

- c) I wasn't sure what type of system/brand to install
 - d) I was not convinced I would save more
 - e) I did not have a contractor I felt I could trust
 - f) Other (specify)
16. If you had not received the Kentucky Power incentive, how likely is it you would have purchased the **exact same** equipment?
- a) Very likely
 - b) Somewhat likely
 - c) Neither likely nor unlikely
 - d) Somewhat unlikely
 - e) Not likely
17. As a result of your participation in the program, have you taken any other steps to reduce your energy use?
- a) Yes
 - b) No (end survey)
18. What type of equipment has your business purchased?
19. What influence did the Kentucky Power program have on the decision?
- d) Had no influence
 - e) Had some influence
 - f) Had a large influence

Thank you for taking the time to complete the survey!



Kentucky Power Company
Appendix D. Cost-
Effectiveness Inputs
Process, Market and Impact Evaluations · July 2014

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Table 1 Commercial Sector Programs Cost Effectiveness Inputs

Program	Measure	Measure Life	NTG Factor	Net per Unit			Gross per Unit	
				Net kWh	Net Non-Coincident Peak kW	Gross kWh	Gross Non-Coincident Peak kW	Gross Incremental Cost
HVAC Diagnostic	Com HVAC Diag HP	3	77%	666	0.04	866	0.06	\$100
	Com HVAC Diag CAC	3	77%	241	0.07	314	0.09	\$100
	Commercial Total	3	77%	551	0.05	717	0.07	\$100
Com HP/AC	HP ≤ 36 kBTU/h	15	45%	706	0.42	1,574	0.93	\$270
	HP 36 kBTU/h ≤ 65 kBTU/h	15	45%	1,144	0.68	2,550	1.51	\$479
	AC ≤ 36 kBTU/h	15	45%	96	0.20	214	0.45	\$300
	AC 36 kBTU/h ≤ 65 kBTU/h	15	45%	173	0.37	386	0.82	\$500
Commercial Incentive	Retrofit	15	83%	18,978	3.13	22,738	3.75	\$5,286
	New Construction	15	83%	21,292	2.14	25,510	2.56	\$11,218
	Direct Install	15	83%	5,010	3.35	6,002	4.02	\$3,711

Table 2 Residential Sector Programs Cost Effectiveness Inputs

Program	Measure	Measure Life	NTG Factor	Net per Unit			Gross per Unit	
				Net kWh	Net Non-Coincident Peak kW	Gross kWh	Gross Non-Coincident Peak kW	Gross Incremental Cost
Modified Energy Fitness	Door Sweep	5	95%	10	0.00	11	0.0031	\$0
	Weatherstrip (Per Lineal Foot)	15	95%	106	0.0029	112	0.0323	\$0
	Duct Sealing - Aluminum Tape (Per Foot)	20	95%	285	0.0306	301	0.1320	\$0
	Caulk (Per Lineal Foot)	15	95%	128	0.1252	135	0.0389	\$0
	Foam - 12oz Can	15	95%	144	0.0368	152	0.0438	\$0
	Hot Water Pipe Insulation - 3/4"	15	95%	140	0.0415	148	0.0169	\$0
	Water Heater Wrap	5	95%	186	0.0160	196	0.0224	\$0
	Hot Water Pipe Insulation - 1/2"	15	95%	162	0.0212	171	0.0195	\$0
	14w Cfl	5	95%	161	0.0185	169	0.0180	\$0
	23w Cfl	5	95%	86	0.0170	90	0.0096	\$0
	13w Cfl	5	95%	108	0.0091	113	0.0120	\$0
	16w R30 Cfl Floodlight	5	95%	158	0.0114	166	0.0176	\$0
	27w Cfl	5	95%	87	0.0167	92	0.0097	\$0
	Deluxe Neon Night Light	5	95%	0	0.0092	0	0.0000	\$0
	Low Flow Showerhead	10	95%	307	0.0000	324	0.0209	\$0
	Hot Water Heater Turndown	2	95%	84	0.0198	88	0.0101	\$0
Temperature Turndown	2	95%	-	0.0095	0	0.0000	\$0	
Residential Heat Pump	Replace HP	18	59%	775	0.13	1,311	0.23	\$700
	Replace Resistance Heat	18	55%	1,278	-0.04	2,334	-0.07	\$2,199
Residential HVAC Diagnostic	Heat Pump	3	46%	286	0.02	621	0.04	\$100
	Central Air Conditioner	3	46%	87	0.02	188	0.05	\$100
	Residential Total	3	46%	248	0.02	539	0.04	\$100
Mobile Home HP	Mobile Home Heat Pump	18	57%	1,668	-0.05	2,914	-0.09	\$2,898

Kentucky Power Company's 2012-2013 Demand Side Management Portfolio Evaluation | 2012-13

Program	Measure	Measure Life	NTG Factor	Net per Unit			Gross per Unit	
				Net kWh	Net Non-Coincident Peak kW	Gross kWh	Gross Non-Coincident Peak kW	Gross Incremental Cost
Mobile Home NC	Mobile Home New Construction	18	65%	1,306	0.45	2,012	0.70	\$3,231
Energy Education	23W CFL 4PK	5.2	67%	89	0.01	133	0.01	\$0
Community Outreach	Community Outreach	5.2	42%	64	0.01	151	0.02	\$0
Efficient Products	CFL	5.2	79%	35	0	44	0	\$2
	Specialty CFL	6.8	79%	35	0	44	0	\$5
	LED Bulbs	10	79%	32	0	40	0	\$15
Targeted Energy Efficiency	Lighting	5	85%	99	0.01	117	0.01	\$0
	Low Flow Showerhead	10	85%	169	0.01	200	0.01	\$0
	Water Heater Wrap	5	85%	135	0.01	159	0.02	\$0
	Pipe Insulation	25	85%	109	0.01	129	0.01	\$0
	Hot Water Temperature Setback	15	85%	73	0.01	86	0.01	\$0
	Programmable Thermostat	10	85%	346	0.00	408	0.00	\$0
	Floor Insulation	25	85%	234	0.05	276	0.06	\$0
	Sidewall Insulation	25	85%	317	0.01	375	0.02	\$0
	Attic Insulation	25	85%	302	0.06	357	0.07	\$0
	Duct Sealing	20	85%	557	0.52	657	0.61	\$0
	Air Sealing	15	85%	679	0.39	801	0.46	\$0
	Heat Pump	18	85%	9,698	0.47	11,449	0.55	\$0
	Gas-Lighting	5	85%	103	0.01	121	0.01	\$0
	Gas-Low Flow Showerhead	10	85%	169	0.01	200	0.01	\$0
	Gas-Water Heater Wrap	5	85%	141	0.01	167	0.02	\$0
Gas-Pipe Insulation	15	85%	113	0.01	133	0.02	\$0	