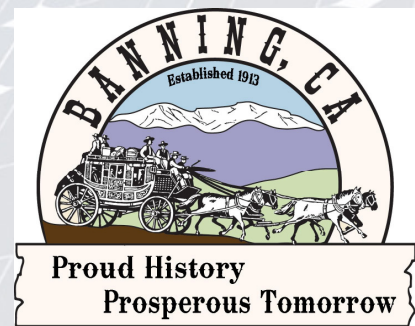


Energy Efficiency
Engineering

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Evaluation, Measurement and Verification (EM&V) Study

City of Banning Electric Utility



Prepared for:
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June 30, 2010

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1 Utility Overview

The City of Banning Electric Utility (Banning) offers a number of energy efficiency and renewable energy programs to its customers throughout the City of Banning. This report describes these Banning energy efficiency incentive programs and the Evaluation, Measurement, and Verification (EM&V) Plans to be implemented for said programs.

On September 29, 2005, the Governor of California signed Senate Bill 1037 (SB1037) into law. SB 1037 requires that Publicly Owned Utilities put energy efficiency and demand reduction as a top priority and produce an annual report stating expected energy savings, actual energy savings, and descriptions of the programs producing these savings.

One year later, on September 29, 2006, Assembly Bill 2021 (AB2021) was signed into law. This Bill reiterates and adds upon Senate Bill 1037. The additions AB2021 made to SB1037 include an expansion of annual report requirements. These requirements include:

- An independent evaluation measuring and verifying the energy and demand savings produced by the utility's energy efficiency programs
- A tri-annual report highlighting annual targets and potential savings of energy efficiency and demand reduction for ten years

The goals of this EM&V study fulfill this first requirement by providing unbiased, independent evaluations of Banning's programs. As a part of this study, Lincus will provide Banning with:

- Program feedback and recommendations for improvement.
- Evaluation of energy efficiency program success.
- Evaluation of program data caliber.
- Increased confidence levels of energy efficiency program results.

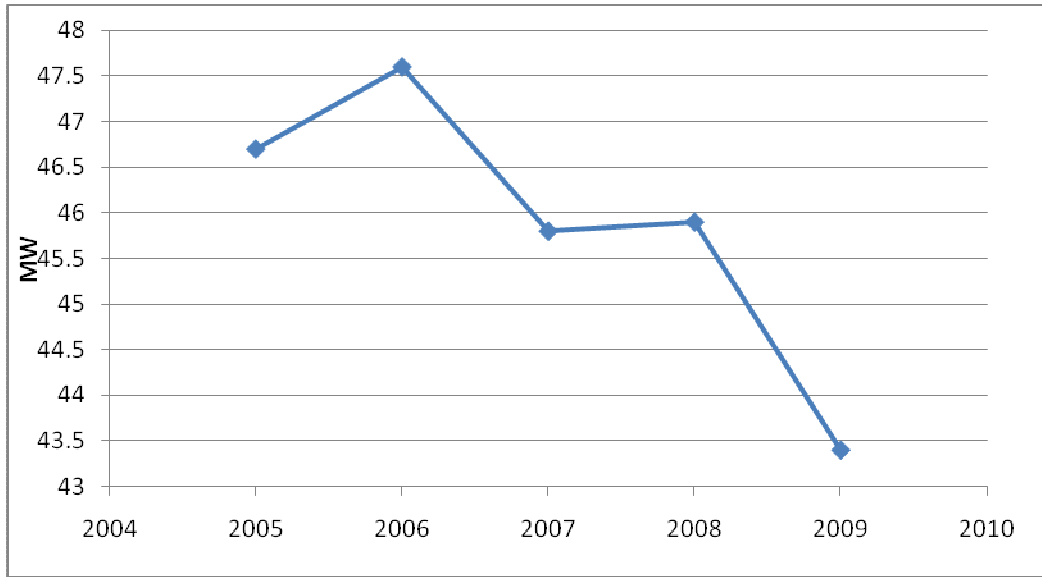
This EM&V study will consider the impacts of Banning's energy efficiency programs for FY2008/2009 (July 1, 2008 through June 30, 2009). This report is based upon information provided directly by Banning staff and its website.

1.1 General Utility Background Information

The City of Banning owns and operates the electric system serving more than 11,800 metered accounts in Banning, California. Banning is contracted with Southern California Public Power Authority ("SCPPA"), which provides a majority of Banning's 48 MW summer peak power requirements from coal, geothermal, nuclear, and hydro generating plants.

In the 2008-2009 fiscal year, the City of Banning Electric Utility served Banning, California with 43.4 MW and 144,757 MWh. Figure 1-1 below shows the actual yearly peak demand for Banning Electric Utility over the last five years.

Figure 1-1: Banning’s Actual 2005-2009 Peak Demand



Figures 1-2 and 1-3 below compare the baseline demand and energy forecast in AB2021 to the actual demand and energy over the last three years.

Figure 1-2: Banning’s AB2021 Submitted Baseline vs. Actual MW Demand

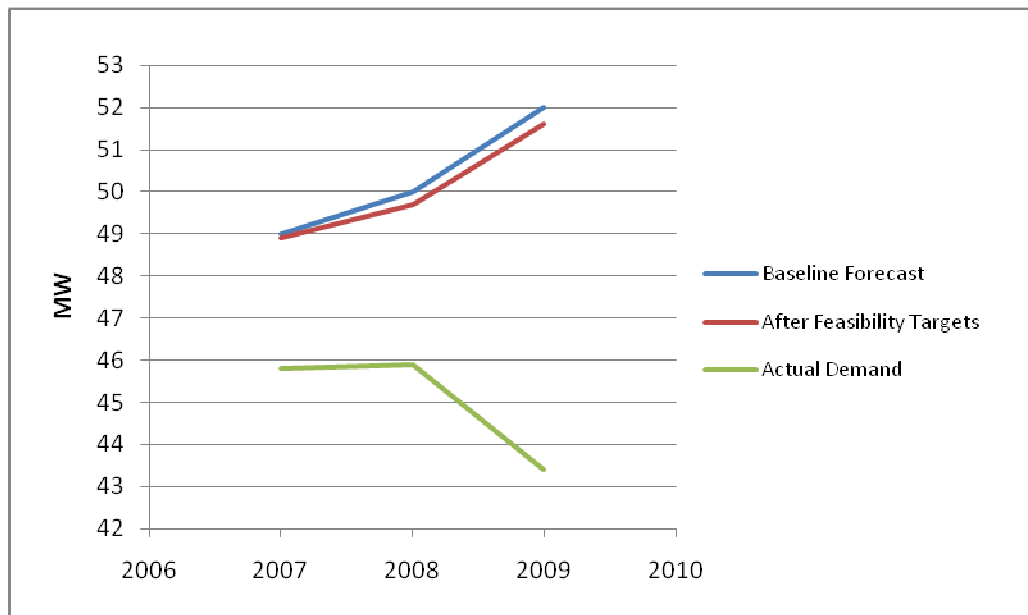
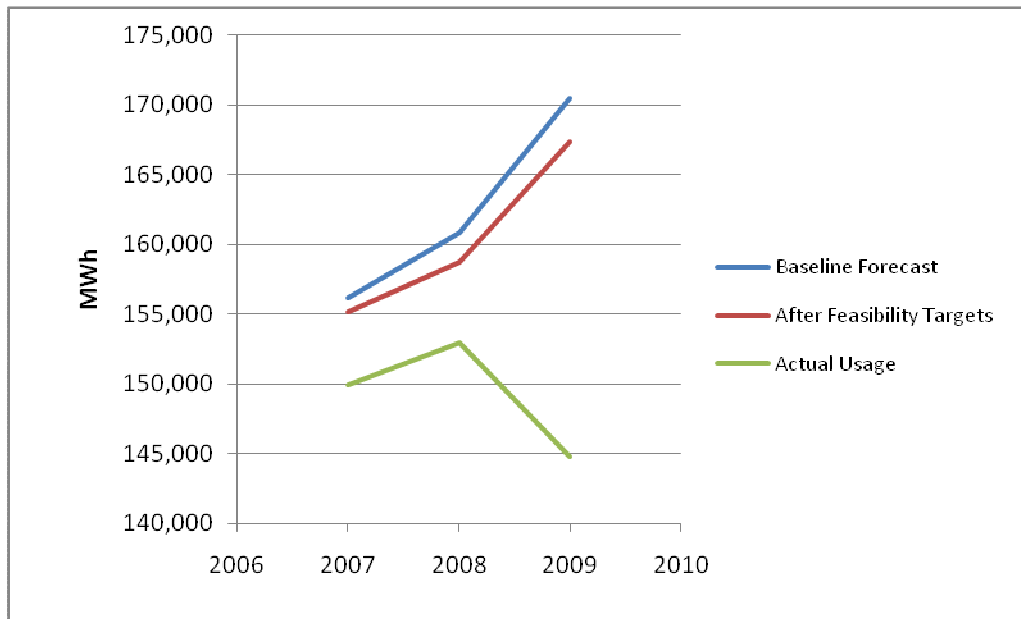


Figure 1-3: Banning's AB2021 Submitted Baseline vs. Actual MWh Usage



1.2 Key Customer Markets

Banning Electric Utility offers energy efficiency programs to residential and business customers alike. They also have a large offering to the low-income population.

2 Energy Efficiency Programs

In the 2008-2009 program year, Banning offered seven energy efficiency programs to residential and business customers. Through this program year, there was a total Utility Program Cost of \$397,924 which resulted in a net electrical savings of 3,787,963 kWh and 462.4 coincident peak kW. Below is a list of energy efficiency programs available to Banning customers, as described on Banning's website and by its staff.

3.1 2008-2009 Program Offerings



Shade Trees – The Shade Tree Program is an energy-saving program that provides incentives to customers that plant trees around their homes to protect against radiant heat gain and losses from the sun and black space. Banning gives residents up to \$50 per trees for up to five qualifying trees. There are 25 types of trees that qualify for the Program. These trees were selected because they are good shade trees that grow well in Banning.



Educational Audit – Banning technicians visit residential customer homes to help find simple, practical ways to reduce utility bills by increasing energy efficiency. Technicians perform a survey to show how simple upgrades such as using high-efficiency light bulbs (CFLs) and upgrading older, inefficient appliances can save energy and money. Technicians also provide free CFLs with advice regarding CFL disposal and recycling.

Refrigerator Recycling – Banning provides a billing credit up to \$90 to residential customers who recycle their second non-primary refrigerator. For some households, having a second refrigerator may be a necessity, but, for many families, a second refrigerator may be a preference costing far more than they realize to operate. Refrigerator must be full-sized, between 12 and 28 cubic feet.



Energy Star Refrigerator – This Program provides incentives for purchasing Energy Star qualified refrigerators, which use less energy than older units of comparable size. Residential and non-residential customers are given \$100 for units 14.0-23.9 cubic feet and \$200 for units 24.0-30.0 cubic feet.

Energy Star Products – Banning also provides incentives for purchasing other Energy Star qualifying equipment to both residential and non-residential customers. Ceiling Fans, Wall/Window AC units, Solar Light Tubes, Solar Attic Fans, Programmable Thermostats, Dishwashers, and Clothes Washers are all included in this Program. There is a \$500 cap

per calendar year per customer account. The customer must only send in a copy of the receipt and yellow Energy Guide tag.

AC Replacement – This Program offers rebates to both residential and non-residential customers who replace Central AC units and Heat Pumps with Energy Star qualified units. The incentive is tiered based the SEER rating of the units. Units with a SEER rating of 13-13.9 receive a rebate of \$50 per ton and the incentive increases every whole number up to \$500 per ton for units with a SEER rating of 18 or greater.



Energy Conservation/Weatherization – Banning offers incentives to customers for improving their building envelope. Measures such as attic and wall insulation, door replacement, window replacement, whole house fans (residential only) and Lighting (non-residential only) are included in this Program. All incentives are based off the square footage of product installed, except for the whole house fan, which is per fan. The customer cap is \$1,500 per calendar year for residential customers and \$15,000 for non-residential customers.

3 Summary of FY 2008-2009 Estimated Savings

Banning has an energy efficiency program tracking database that consists mostly of Excel files. An E3 calculator sheet was sent to Lincus containing the program energy and demand reduction and incentive totals from this energy efficiency program database. The Tables and Graphs below represent this data provided by Banning.

3.1 Residential Program Savings

Table 3-1 shows information provided from Banning’s energy efficiency program database of residential measures. This table provides the number of projects, estimated energy and peak demand reductions, net-to-gross ratios, and the incentives provided.

Table 3-1: Estimated Residential Energy and Demand Savings for FY 2008/2009

Program	# of Units	Gross Annual Reduction (kWh) ¹	Summer Peak Reduction (kW) ²	kWh % of Total	kW % of Total	NTG ³	Program Cost ⁴	Cost % of Total
Educational Audit Program	6,247	3,190,306	132.0	88.7%	38.1%	0.80	\$122,069	40%
Energy Conservation/ Weatherization	320	207,067	100.2	5.8%	29.0%	0.80	\$67,886	22%
AC Replacement	341	136,322	101.3	3.8%	29.3%	0.80	\$72,861	24%
Energy Star Refrigerators	115	34,996	5.9	1.0%	1.7%	0.80	\$25,367	8%
Refrigerator Recycling	7	13,622	2.1	0.4%	0.6%	0.80	\$2,197	1%
Shade Trees	25	10,474	1.5	0.3%	0.4%	0.80	\$5,020	2%
Energy Star Products	89	5,530	3.1	0.2%	0.9%	0.80	\$7,960	3%
Totals	7,144	3,598,317	346.1	100%	100%		\$303,360	100%

According to Banning’s E3 Final Report, the highest energy saving Program is the Educational Audit Program at 88.7%. This higher saving Program will be discussed more in Section 5 as it represents 80% of the total savings. The other Programs represent the remaining 20% and will not be considered for this EM&V Study. The AC Replacement Program savings numbers were disaggregated based off the number of units installed since the total savings provided included both Residential and Non-Residential Departments. It should also be noted that the CFLs <= 15W shown in the E3 Final Report are part of the Educational Audit Program.

¹ Energy reduction numbers taken from ‘EE Reporting Tool 2008 V1 FY 08-09 Actuals’

² Demand reduction numbers taken from ‘EE Reporting Tool 2008 V1 FY 08-09 Actuals’

³ NTG numbers taken from ‘EE Reporting Tool 2008 V1 FY 08-09 Actuals’ which references CPUC for ratios

⁴ Program Costs taken from ‘EE Reporting Tool 2008 V1 FY 08-09 Actuals’ as Total Utility Cost

The data shown in Table 3-1 is also presented in Figures 3-1 through 3-3. Figure 3-1 shows estimated energy reductions, Figure 3-2 shows estimated summer peak reduction, and Figure 3-3 shows the program costs.

Figure 3-1: Residential kWh Savings for FY 2008/2009

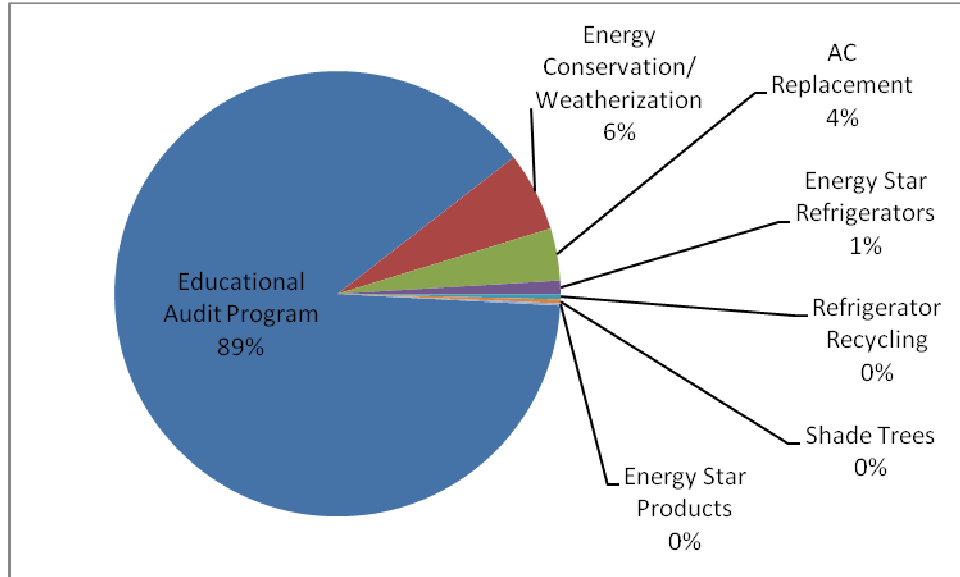


Figure 3-2: Residential Summer Peak kW Reduction for FY 2008/2009

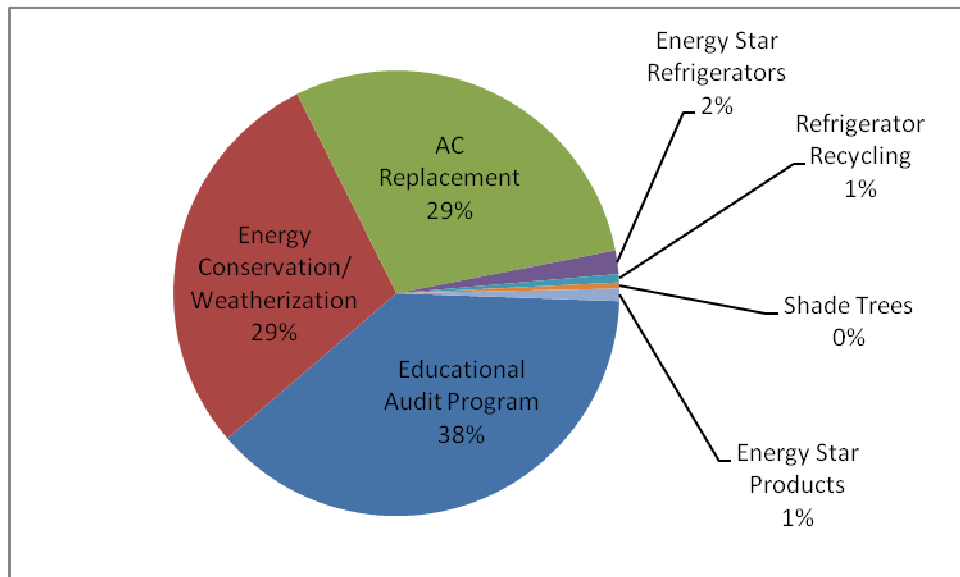
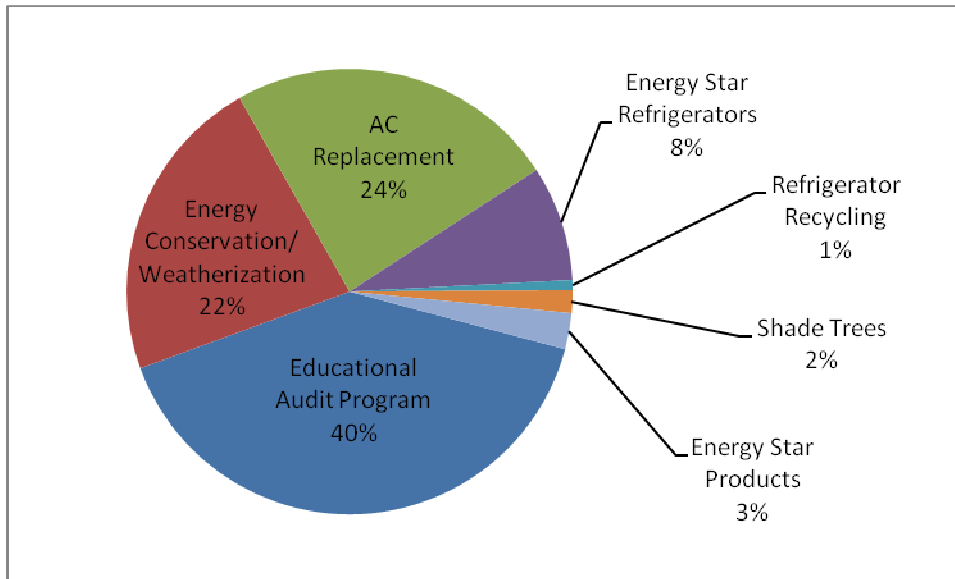


Figure 3-3: Residential Incentives Paid for FY 2008/2009



3.2 Non-Residential Program Savings

Table 3-2 shows information provided from Banning’s energy efficiency program database of non-residential measures. The non-residential measures provide much greater levels of energy savings due to the higher demand of use. This table provides the number of projects, estimated energy and peak demand reductions, net-to-gross ratios, and the incentives provided.

Table 3-2: Estimated Energy and Demand Impacts for FY 2008/2009 for the Non-Residential Sector

Program	# of Units	Annual Reduction (kWh) ⁵	Summer Peak Reduction (kW) ⁶	kWh % of Total	kW % of Total	NTG ⁷	Program Costs ⁸	Cost % of Total
AC Replacement	383	150,721	97.5	79.5%	83.8%	0.80	\$81,835	87%
Energy Conservation/Weatherization	60	38,825	18.8	20.5%	16.2%	0.80	\$12,729	13%
Totals	443	189,546	116.3	100%	100%		\$94,564	100%

According to Banning’s E3 Final Report, the largest energy saving Program is the AC Replacement Program at 79.5%. Energy Conservation/Weatherization is the next highest Program and represents 20.5% of the total savings. Both these Programs will be discussed more in Section 5. The AC Replacement Program savings numbers were disaggregated based off the number of

⁵ Energy reduction numbers taken from ‘EE Reporting Tool 2008 V1 FY 08-09 Actuals’

⁶ Demand reduction numbers taken from ‘EE Reporting Tool 2008 V1 FY 08-09 Actuals’

⁷ NTG numbers taken from ‘EE Reporting Tool 2008 V1 FY 08-09 Actuals’ which references CPUC for ratios

⁸ Program Costs taken from ‘EE Reporting Tool 2008 V1 FY 08-09 Actuals’ as Total Utility Cost

units installed since the total savings provided included both Residential and Non-Residential Departments.

The data shown in Table 3-2 is also presented in Figures 3-4 through 3-6. Figure 3-4 shows estimated energy reductions, Figure 3-5 shows estimated summer peak reduction, and Figure 3-6 shows the program costs.

Figure 3-4: Non-Residential kWh Savings for FY 2008/2009

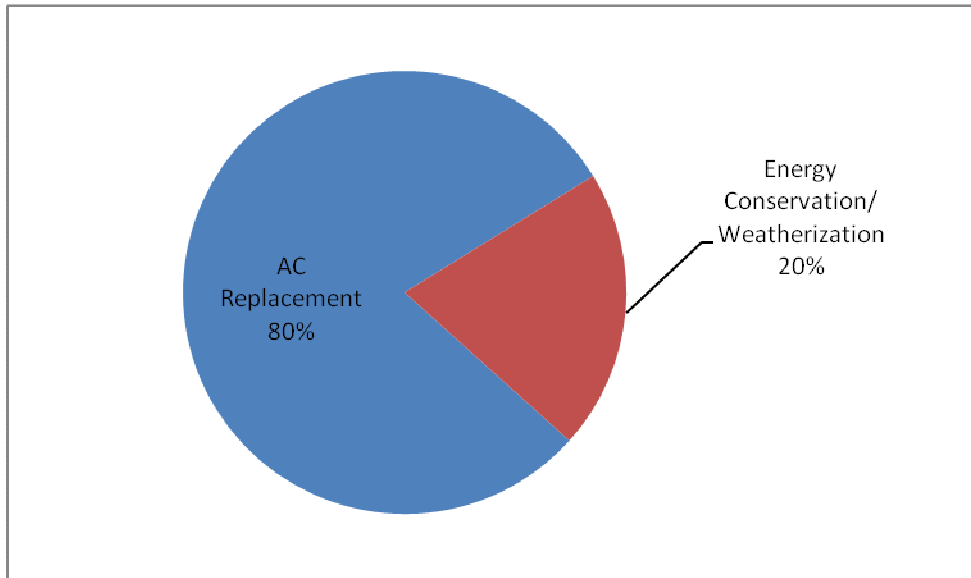


Figure 3-5: Non-Residential Summer Peak kW Reduction for FY 2008/2009

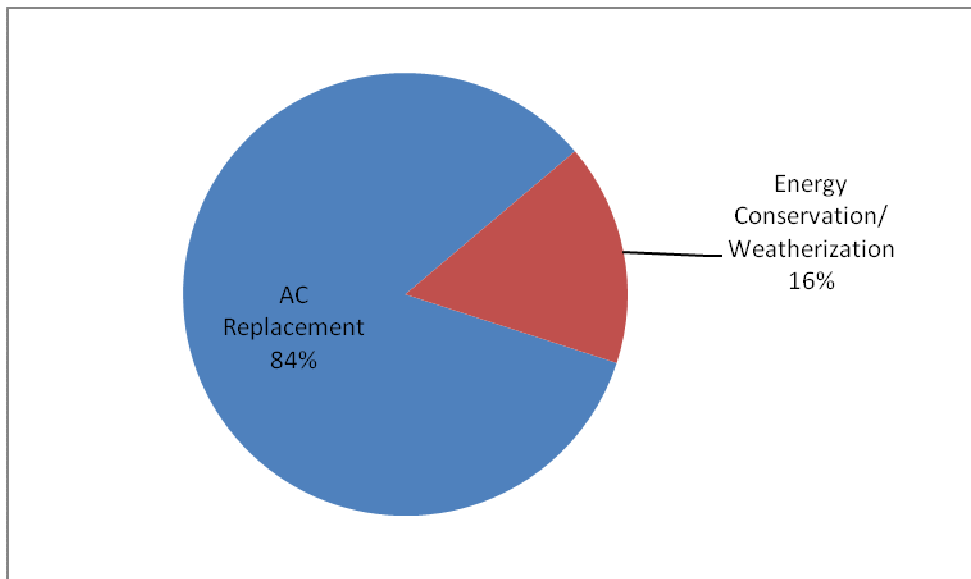
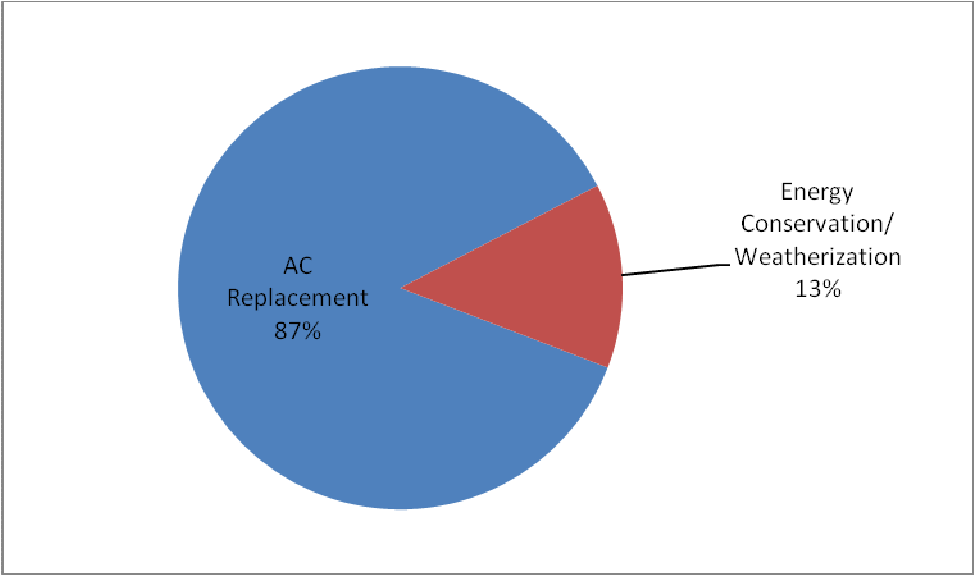


Figure 3-6: Non-Residential Incentives Paid for FY 2008/2009



4 Program Process Evaluation Plan

4.1 Background and Objectives

Based on Lincus' extensive program development, management, and evaluation experience, as well as the company's own internal EM&V process, Lincus has developed a standardized and streamlined EM&V process to assist Banning in maximizing program performance, while reducing EM&V costs. The tasks involved are:

- Define Program Goals and Review Tracking System
- Design Data Acquisition Plan
- Collect and Process Data
- Analyze Results
- Provide Results and Recommendations

Lincus proposes to begin the EM&V Study (Phase two) as soon as the EM&V Plan Development (Phase one) is completed. Upon authorization to proceed, phase two of the EM&V work (the scope of work in this plan) will be completed by June 30, 2010.

5 Program Impact Evaluation Plan

5.1 Impact Evaluation Methods

International Performance Measurement and Verification Protocol (IPMVP) is a great resource for considering the range of efficiency measures offered by Banning. Table 5-1, below, shows a list of IPMVP Measurement & Verification Options. The table provides a list of the different types of M&V options, how the savings are calculated for each option, and which M&V option may typically apply to the measures promoted. Lincus' approach to selecting M&V strategies will follow these guidelines.

Table 5-1: Overview of M&V Options

2007 IPMVP M&V Options	How Savings Are Calculated	Typical Applications
<p>Option A. Retrofit Isolation: Key Parameter Measurement Savings are determined by field measurement of the key performance parameter(s) which define the energy use of the efficiency measures' affected system(s). Parameters not selected for field measurement are estimated. Estimates can be based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of the estimated parameter is required.</p>	<p>Engineering models of baseline and reporting period energy from short-term or continuous measurements of key operating parameter(s); estimated values.</p>	<p>A lighting retrofit where power draw is the key performance parameter that is measured periodically. Estimate operating hours of the lights based on building schedules, occupant behavior, and/or prior studies.</p>
<p>Option B. Retrofit Isolation: All Parameter Measurement Savings are determined by field measurement of the energy use of the affected system. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period.</p>	<p>Short-term or continuous measurements of baseline and reporting-period energy, and/or engineering models using measurements of proxies of energy use.</p>	<p>Application of a variable-speed drive and controls to a motor to adjust pump flow. Measure electric power with a meter installed on the electrical supply to the motor, which reads the power every minute. In the baseline period this meter is in place for a week to verify constant loading. The meter is in place throughout the reporting period to track variations in power use.</p>
<p>Option C. Whole Facility Savings are determined by measuring energy use at the whole-facility or sub-facility level. Continuous measurements of the entire facility's energy use are taken throughout the reporting period.</p>	<p>Analysis of whole-facility baseline and reporting period (utility) meter data. Routine adjustments as required, using techniques such as simple comparison or regression analysis.</p>	<p>Multifaceted energy management program affecting many systems in a facility. Measure energy use with the gas and electric utility meters for a 12-month baseline period and throughout the reporting period.</p>
<p>Option D. Calibrated Simulation Savings are determined through simulation of the energy use of the facility. Simulation must demonstrate that it can adequately model actual energy performance measured in the facility.</p>	<p>Energy use simulation calibrated with hourly or monthly utility billing data.</p>	<p>Multi-faceted, new construction, energy management program affecting many systems in a facility - where no meter existed in the baseline period. Simulations are calibrated after installations of utility metering. Baseline energy use is compared to a simulation of reporting period energy use.</p>

5.1.1 M&V Program Options

Table 5-2 below, displays Banning’s initial M&V option selections by energy efficiency program. Most programs will use either Option A or B under the IPMVP protocols. Option A requires limited measurement and can be the quickest to verify energy savings. M&V Option B usually requires a seven day measurement period to generate trending data and usually takes longer to verify savings. Having all programs under Option A would be ideal for quick and easy, yet still precise. However, the savings for many measures depend on multiple variables that cannot be measured instantly, or even within a week. For these measures Option C and D will be required, a longer measurement period is needed to generate an accurate verification of savings for these Options. More description of the programs to undergo M&V will be done in Sections 5.2 and 5.3.

Table 5-2: Selection of M&V Program Options

Program	M&V Option	Duration of M&V	Measurements
Educational Audit Program	-	-	-
Audits	A	Varies	Varies
CFLs	A	Instant	Power and hours of operation
Residential AC Replacement	A	7 Days	Air temperature and HVAC consumption
Energy Star Refrigerators	A/C	Instant/Varies	Varies
Refrigerator Recycling	A/C	Instant/Varies	Varies
Residential Energy Conservation/Weatherization	-	-	-
Windows	C/D	Varies	Utility Bill analysis/modeling
Shade Trees	C/D	Varies	Utility Bill analysis/modeling
Energy Star Products	-	-	-
Ceiling Fans	A	Instant	Power and hours of operation
Solar Attic Fan	B	7 Days	Power, Flow, and Air temperature
Room AC	B	7 Days	Air temperature and HVAC consumption
Clothes Washer	A	Instant	Power for each mode and number of operations
Dishwasher	A	Instant	Power for each mode and number of operations not including hot water savings
Programmable T-Stat	B	7 Days	Air temperature and HVAC consumption
Non-Residential AC Replacement	A	7 Days	Air temperature and HVAC consumption
Non-Residential Energy Conservation/Weatherization	-	-	-
Windows	C/D	Varies	Utility Bill analysis/modeling
Attic Insulation	D	Varies	Utility Bills modeling
Lighting	A	Instant	Power and hours of operation

5.1.2 Program Sample Sizing

Based on the statistical formulas below, the overall sample sizes required to meet EM&V goals were calculated. Equation 5-1 represents the initial sample size to obtain 90% confidence level with 10% precision. Equation 5-2 is the “Finite Population Adjustment” to be used on populations less than 20 times greater than the initial sample size. Equation 5-2 also shows an example using the Residential AC Replacement population. In this case, the required sample size would be 341 units, since the final number should be rounded up to the nearest whole number.

Equation 5-1: Initial Sample Size Calculation

$$n_o = \frac{z^2 cv^2}{e^2} = \frac{(1.64)^2 (.3)^2}{(.1)^2} = 24.2$$

Equation 5-2: “Finite Population Adjustment” Sample Size Calculation

$$n = \frac{n_o N}{n_o + N} = \frac{(24.2)(341)}{(24.2 + 341)} = 22.6 = 23$$

where:

- n_o is the initial estimate of the required sample size.
- n is the finite population adjusted sample size required.
- N is the finite population of applications.
- cv is the coefficient of variance, defined as the standard deviation of the readings divided by the mean. Until the actual mean and standard deviation of the population can be estimated from actual samples, 0.5 is often accepted as an initial estimate. However, for more homogenous populations, 0.1 is commonly used.
- e is the desired level of precision. For example, e is 0.1 for 10% precision.
- z is the standard normal distribution value for the desired confidence level. For example, z is 1.96 for 95%, 1.64 for 90%, 1.28 for 80%, and 0.67 for 50% confidence.

Table 5-3 below shows the calculated program sample sizes required, using the equations described above. More description of the sample sizes of the programs to undergo M&V will be done in Sections 5.2 and 5.3.

Table 5-3: Banning Program Sample Sizing

Program	# of Units	Sample Size
Educational Audit Program	-	-
Audits	6,247	11
CFLs	22,000	11
Residential AC Replacement	341	23
Energy Star Refrigerators	115	10
Refrigerator Recycling	7	5
Residential Energy Conservation/Weatherization	-	-
Windows	320	23
Shade Trees	25	8
Energy Star Products	-	-
Ceiling Fans	2	2
Solar Attic Fan	2	2
Room AC	4	4
Clothes Washer	49	9
Dishwasher	27	5
Programmable T-Stat	4	3
Non-Residential AC Replacement	383	383
Non-Residential Energy Conservation/Weatherization	-	-
Windows	34	34
Attic Insulation	25	25
Lighting	1	1

5.2 Residential Program Impact Evaluation

Banning’s program database shows seven residential programs being tracked. Table 5-4 shows information provided from Banning’s energy efficiency program database of residential measures. It is a duplication of Table 3-1.

Table 5-4: Estimated Energy and Demand Impacts for FY 2008/2009 for the Residential Sector

Program	# of Units	Annual Reduction (kWh)	Summer Peak Reduction (kW)	kWh % of Total	kW % of Total	NTG	Program Costs
Educational Audit Program	6,247	3,190,306	132.0	88.7%	38.1%	0.80	\$122,069
Energy Conservation/Weatherization	320	207,067	100.2	5.8%	29.0%	0.80	\$67,886
AC Replacement	341	136,322	101.3	3.8%	29.3%	0.80	\$72,861
Energy Star Refrigerators	115	34,996	5.9	1.0%	1.7%	0.80	\$25,367
Refrigerator Recycling	7	13,622	2.1	0.4%	0.6%	0.80	\$2,197
Shade Trees	25	10,474	1.5	0.3%	0.4%	0.80	\$5,020
Energy Star Products	89	5,530	3.1	0.2%	0.9%	0.80	\$7,960
Totals	7,144	3,598,317	346.1	100%	100%		\$303,360

Banning has many residential energy efficiency programs, but due to time restraints, Lincus feels reviewing those programs that contribute to 80% of the total energy savings will be suitable for this EM&V study. However, for future EM&V studies, it is recommended that all programs be considered. Below are Lincus' recommendations of energy efficiency programs to receive impact evaluations.

1. Educational Audit (88.7%)

5.2.1 Educational Audit

As discussed in Section 2, Banning technicians perform surveys of customer homes and provide them with energy efficiency education and CFLs. Performing 6,247 surveys and providing 22,000 CFLs resulted in a gross energy savings of 3,190,306 kWh and demand reduction of 132.0 peak kW.

Lincus would like to have a confidence level of 90% with a confidence interval of +/- 10% while doing these impact evaluations. To meet a statistical confidence of 90% +/- 10%, Lincus will require a sample size of 11 Surveys and CFLs.

As seen in Table 5-3, the Educational Audit Program M&V would fall under IPMVP Option A for both the surveys and CFLs. However, since the savings for the surveys come from the 2005 KEMA Report and the CFLs are considered in DEER, Lincus will evaluate the 2005 KEMA report and use DEER savings numbers and verify the installation of the measures. A small phone survey will be conducted to verify the installation. Lincus feels this plan will minimize customer inconveniencing, while still providing adequate confidence in the savings numbers.

5.2.2 Residential Lower Priority Programs

The remaining six programs add up to the remaining 20% of the energy savings and are not recommended by Lincus to receive an impact evaluation at this time. In the future, these programs could be eligible for evaluation if they were to increase their energy savings and fall within 80% of the total energy savings.

5.3 Non-Residential Program Impact Evaluation Plan

Banning’s program database shows four non-residential programs being tracked. Table 5-5 shows information provided from Banning’s energy efficiency program database of non-residential measures. It is a duplication of Table 3-2.

Table 5-5: Estimated Energy and Demand Impacts for FY 2008/2009 for the Non-Residential Sector

Program	# of Units	Annual Reduction (kWh)	Summer Peak Reduction (kW)	kWh % of Total	kW % of Total	NTG	Program Costs
AC Replacement	383	150,721	97.5	79.5%	83.8%	0.80	\$81,835
Energy Conservation/Weatherization	60	38,825	18.8	20.5%	16.2%	0.80	\$12,729
Totals	443	189,546	116.3	100%	100%		\$94,564

Banning only had one commercial application during 2008-2009 FY. This application was for Banning Unified School District and breached across the non-residential energy efficiency programs shown in Table 5-5. Due to the time restraints stated previously, Lincus would normally recommend only the AC Replacement Program be considered in Phase Two of this Study, since it represents 80% of the total savings. However, it was brought to Lincus’ attention that the School District also implemented Lighting Measures that fall under the Energy Conservation/Weatherization Program, but were not input into the E3. Also, there was attic and wall insulation entered into the E3, but the E3 did not calculate the savings due to the savings per unit numbers not being available. For these reasons, Lincus recommends both the AC Replacement and Energy Conservation/Weatherization Programs be considered in the impact evaluation.

5.3.1 Non-Residential AC Replacement

As discussed in Section 2, Banning offers rebates to non-residential customers who replace Central AC units and Heat Pumps with Energy Star qualified units. The incentive is tiered based the SEER rating of the units. Units with a SEER rating of 13-13.9 receive a rebate of \$50 per ton and the incentive increases every whole number up to \$500 per ton for units with a SEER rating of 18 or greater. Banning approved 383 tons of cooling which resulted in a gross energy savings of 150,721 kWh and demand reduction of 97.5 kW.

Lincus would like to have a confidence level of 90% with a confidence interval of +/- 10% while doing these impact evaluations. To meet a statistical confidence of 90% +/- 10%, Lincus will require a sample size of 100% of the Measures.

As seen in Table 5-3, the Non-Residential AC Replacement Program M&V would fall under IPMVP Option A. However, since both of these measures are considered in DEER, Lincus will use DEER savings numbers and verify the installation of the measures. A small phone survey may be conducted to verify the installation. Lincus feels this plan will minimize customer inconveniencing, while still providing adequate confidence in the savings numbers.

5.3.2 Non-Residential Energy Conservation/Weatherization

As discussed in Section 2, Banning offers incentives to customers for improving their building envelope. Measures such as attic and wall insulation, door replacement, window replacement, and Lighting are included in this Program. Banning approved 6,003 square feet of glass for windows and doors which resulted in a gross energy savings of 38,825 kWh and demand reduction of 18.8 kW. The Lighting and Insulation Measures stated previously are not included in these savings numbers. The impact evaluation will include the savings.

Lincus would like to have a confidence level of 90% with a confidence interval of +/- 10% while doing these impact evaluations. To meet a statistical confidence of 90% +/- 10%, Lincus will require a sample size of 100% of the Measures.

As seen in Table 5-3, the Non-Residential Energy Conservation/Weatherization Program M&V could fall under any of the IPMVP Options depending on the Measure. Lighting would be Option A and Insulation and Windows would be Options C or D. Lincus will verify the Lighting savings by using equipment specification sheets and operating hours. Since the Insulation and Window Measures are considered in DEER, Lincus will use DEER savings numbers and verify the installation of the measures. A small phone survey may be conducted to verify the installation. Lincus feels this plan will minimize customer inconveniencing, while still providing adequate confidence in the savings numbers.

6 Program Process Evaluation Results

The Residential Process Evaluation includes the Educational Audit Program. The Non-Residential Process Evaluation includes the AC Replacement and Energy Conservation/Weatherization Programs.

The results of the Program Process Evaluation include the following areas:

1. Program application processing
2. Utility tracking system

6.1 Program Application Processing

While performing Phase One of this Study, it was discovered that all Measures were input into the EE Reporting Tool as Residential Measures. Doing so provides incorrect savings numbers as Residential and Non-Residential equipment, operating hours, and performance are all different. It is recommended that Banning input Non-Residential Measures as Non-Residential Measure into the EE Reporting Tool, as it will, more often than not, give more savings and provide a more accurate savings estimate.

6.2 Utility Tracking System

While obtaining information for Banning's Programs, it was discovered that all applications and information attached is located in different areas with different people. Banning has a tracking system that includes general information about the application, but doesn't contain all information that may be useful. Lincus recommends that Banning implement a tracking system that saves all information about the application and makes it easily accessible when needed. Appendix A describes a tracking system that meets and exceeds these recommendations. This tracking system is available to Banning from Lincus if they would like to use it. Lincus recommends this tracking system be applied to the Non-Residential Programs as well.

Implementing a new tracking system will:

- Bring down costs by providing all information in one location available to everyone and easy maintenance & revisions to the Programs, which ensures less down time
- Increase kWh savings by providing weekly updates to give Program Managers an idea when more customer outreach is necessary and allowing the ability to adapt and revamp new energy efficiency Programs faster and reach more participants in a short time

7 Program Impact Evaluation Results

The Program Impact Evaluation is a process of EM&V that determines the achieved energy savings of a Program. This savings is determined by comparing the energy use and demand after the Program has been implemented to what would have been used if the Program was not implemented.

7.1 Residential Program Impact Evaluation

As stated in Section 5, the Residential Impact Evaluation includes one Program: Educational Audit Program.

7.1.1 Educational Audit Program

During the audit process, the customers are asked about their current refrigerator age, air conditioner and its temperature settings, and ceiling fans. The technicians then provide the customers with information on how to save energy with all the above.

As stated in the KEMA Measure Qualification Methodology document used by Banning to obtain savings, “The California Investor Owned Utilities (IOU) actively participate in both residential and nonresidential energy education programs. Among the activities included in these programs are residential energy audits, community outreach through the IOU energy centers, and educational mailings. The IOU’s do not claim energy savings associated with their educational activities instead they limit reporting of energy savings associated with energy efficiency to their rebate programs. Though, a methodology for quantifying the energy savings associated with home audit programs has been developed as part of the 2002 Program Evaluation for the Statewide Home Energy Efficiency Survey Program. The associated savings are rolled up for all types of audits (in-home, mail, telephone and internet) as follows: 24,606,851 kWh, or 398 kWh per audit.”

Although it can be difficult to justify the savings from just informing customers of savings, the kWh savings per unit stated in the KEMA Measure Qualification Methodology document seems reasonable. Just setting back a thermostat while people aren’t home and installing the CFLs given to the customers could save the same amount of energy stated in the KEMA Report. It is Lincus’ recommendation that further analysis be done to justify the current savings of this Measure.

7.2 Non-Residential Program Impact Evaluation

As stated in Section 5, the Non-Residential Impact Evaluation includes two Programs: AC Replacement and Energy Conservation/Weatherization.

7.2.1 AC Replacement

For the AC Replacement Program, the applications were reviewed and it was determined that all the applications followed the Program guidelines. It was noticed that the Program guidelines base the incentives off of the SEER rating of the units, however incentives were given for units greater than 64,000 BTU/h, which only have EER ratings and not SEER. For those units, the lowest incentive (\$50 per ton) was given. It is recommended that Banning include an EER rating minimum for units greater than 64,000 BTU/h.

The online Air-Conditioning, Heating, and Refrigeration Institute (AHRI) directory was used to gather system efficiencies using the model numbers of the outdoor and indoor units. Using the efficiencies obtained, DEER 2008 were used to gather the kWh and peak kW savings per ton in Climate Zone 15 for primary and secondary school building types. A simple spreadsheet calculation was done to verify the savings. Table 7-1 shows Banning's claimed (ex-ante) savings and Lincus' verified (ex-post) savings for the AC Replacement Program's HVAC category.

Table 7-1: AC Replacement Program's savings

Claimed Gross kWh Savings	Claimed Gross Peak kW Savings	Verified Gross kWh Savings	Verified Gross Peak kW Savings
150,721	97.5	354,543	69.0

It is recommended that Banning require the installed HVAC units to be AHRI certified, not only to have confidence in the efficiencies and cooling capacities provided, but to make it easier to obtain the efficiencies and cooling capacities if they are not provided in the application.

7.2.2 Energy Conservation/Weatherization

This Program consisted of three Measure categories during the 2008-2009 FY: Lighting, Insulation, and Windows. All applications from the 2008-2009 FY were sent to Lincus for review.

For the Lighting category, as stated in Section 5, Banning did not enter Lighting savings for this Program during the 2008/2009 FY into their E3. The Lighting applications were still reviewed for this Study to provide more savings for Banning.

The lighting contractors sent their calculations with the applications and those calculations were reviewed. The contractors used the input power of the ballasts as the fixture wattages as they should have and the savings numbers are legitimate, except, Banning took to total kW savings as the Peak savings, which is inaccurate. A coincidence factor of about .93 should be used to determine the Peak demand savings. Also, HVAC interactive effect savings were not considered. Lighting fixtures generate heat when they are in operation. This generated heat increases the

temperature of the room, which increases the load the air-conditioners needs to cool. When a lighting retrofit is done, the wattage of the fixture decreases and the heat generated also decreases. This will result in savings from the air-conditioners since the heat load is less. Typically HVAC interactive effects increase the kWh savings by 17% and the kW savings by 20%. It is also recommended that Banning use this in their future analysis. It is theoretically free savings for the Utility. It is also recommended that Banning also include kWh savings into the E3, since there are kW savings. Table 7-2 shows Banning's claimed (ex-ante) savings and Lincus' verified (ex-post) savings for the Energy Conservation/Weatherization Program's Lighting category.

Table 7-2: Energy Conservation/Weatherization Program's Lighting Category savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
0	0	8,869	3.2

For the Insulation category, as stated in Section 5, Banning entered this Measure into their E3, however savings were not calculated because there wasn't a per unit savings number in the E3. DEER 2005 was used by Lincus to determine the savings of the Insulation in a primary school. Table 7-3 shows the savings numbers for a primary school in Climate Cone 15 per 1,000 square feet of insulation of different vintages.

Table 7-3: Primary School Attic/Ceiling Insulation savings

Primary School CZ 15 per 1000 sqft insulation			
After 1978		1978-1992	
kWh	kW	kWh	kW
21	0.093	10	0.040

Although the savings numbers aren't very large, they are savings nonetheless. Table 7-4 shows Banning's claimed (ex-ante) savings and Lincus' verified (ex-post) savings for the Energy Conservation/Weatherization Program's Insulation category.

Table 7-4: Energy Conservation/Weatherization Program's Insulation Category savings

Total R-30 Insulation sqft	Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
22,620	0	0	470	2.1

For the Window category, Banning entered this Measure into their E3, however savings were calculated for a Residential customer. DEER 2005 was used by Lincus to determine the savings of

the windows for a primary school. Table 7-5 shows the savings numbers for a primary school in Climate Cone 15 per 100 square feet of window of different vintages.

Table 7-5: Primary School Window Insulation savings

	DEER 2005 Primary School CZ 15 per 100 sqft			
	Before 1978		1978-1992	
	kWh	kW	kWh	kW
North 15%	258.775	0.167	182.111	0.120
North 20%	276.024	0.179	196.058	0.132
East 20%	964.637	0.424	698.197	0.321
East 30%	1030.93	0.453	751.192	0.351
South 20%	1192.16	0.672	856.683	0.511
South 30%	1273.33	0.716	920.405	0.555
West 20%	796.418	0.837	589.873	0.622
West 30%	851.247	0.897	634.886	0.670

Although the savings numbers aren't very large, they are savings nonetheless. Table 7-6 shows Banning's claimed (ex-ante) savings and Lincus' verified (ex-post) savings for the Energy Conservation/Weatherization Program's Insulation category.

Table 7-6: Energy Conservation/Weatherization Program's Window Category savings

Total Window sqft	Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
3,445	22,771	11.0	29,554	19.3

8 Program Realization Rates

A Realization Rate is a ratio that compares the previously calculated savings to the current verified savings. If a Realization Rate is greater than 100%, that means the previous savings were underestimated. If the Realization Rate is less than 100%, the previous savings have been overestimated. Using the verified kWh savings in Section 7, a Realization Rate can be calculated for each Program by dividing it by the claimed savings. Table 8-1 below shows the claimed and verified savings and the calculated kWh Realization Rate for each Program that underwent the M&V process.

Table 8-1: Program kWh Realization Rates

Program	Claimed Gross kWh Savings	Verified Gross kWh Savings	kWh Realization Rate
Educational Audit Program	3,190,306	3,190,306	100.0%
Non-Residential AC Replacement	150,721	354,543	235.2%
Energy Conservation/ Weatherization	22,771	38,893	170.8%
Lighting	0	8,869	∞
Insulation	0	470	∞
Windows	22,771	29,554	129.8%
Totals	3,363,798	3,583,742	106.5%

Table 8-2 below shows the claimed and verified savings and the calculated kW Realization Rate for each Program that underwent the M&V process.

Table 8-2: Program kW Realization Rates

Program	Claimed Gross Peak kW Savings	Verified Gross Peak kW Savings	kW Realization Rate
Educational Audit Program	132.0	132.0	100.0%
Non-Residential AC Replacement	97.5	69.0	70.8%
Energy Conservation/ Weatherization	11.0	24.6	223.6%
Lighting	0.0	3.2	∞
Insulation	0.0	2.1	∞
Windows	11.0	19.3	175.4%
Totals	240.5	225.7	93.8%

9 Conclusion and Recommendations

Overall, Banning's Programs are well run and provide Customers with much needed incentives for implementing energy efficiency into their lives. However, upon review, the energy savings and peak power reduction claimed by the Programs, as a whole, are slightly under and over-calculated, respectively, and some areas could use some changes to better the processing of applications and provide more accurate savings calculations.

The Educational Audit Program's kWh and kW savings stayed the same since the KEMA Report uses a very justifiable savings number. Further analysis is recommended though.

The Non-Residential AC Replacement Program's kWh and kW savings increased by 135.2% and 29.2%, respectively. These numbers changed due to Banning claiming them as Residential customers in the E3. School have different equipment and operating hours than Residential customers so, the energy savings increases. It is recommended that Banning add an incentive tier for AC units greater than 64,000 BTU/h cooling capacity.

The Energy Conservation/Weatherization Program's kWh and kW savings, as a whole, increased by 70.8% and 123.6%. This was due to the Lighting category not being entered into the E3, the Insulation category being entered but not calculating savings, and the Windows category being considered a Residential Measure. The Lighting category was good overall. The contractors who sent in the calculations didn't consider the coincidence factor or HVAC interactive effects. It is also recommended that kWh savings be considered. It is recommended that the Insulation category use DEER 2005 savings numbers as stated in Section 7. The Windows category also could use DEER 2005 savings numbers instead of Residential savings numbers from the E3.

A new Energy Efficiency Program Integration Platform could be used to store all applications, provide easy access to all application information when needed, and perform E3 calculations, such as TRC, PAC, and Levelized Costs, for reports and Program Management knowledge.

The Levelized Cost of Energy Savings is the price per unit the Utility pays to obtain savings. In this case, the Levelized Cost is how much the Utility is paying in incentives, direct install costs, and overhead costs per kWh saved through the Programs. Theoretically, this number should not be more than the Levelized Cost of Energy Production, or else the Utility is losing money. Table 9-1 shows the Levelized cost of Energy Savings by Program using the verified net kWh savings and Total Utility Cost based off the E3.

Table 9-1: Levelized Cost of Energy Savings by program

Program	Verified Gross kWh Savings	Claimed NTG	Program Cost	Levelized Cost (\$/kWh)
Educational Audit Program	3,190,306	80%	\$49,720.00	\$0.019
Non-Residential AC Replacement	354,543	80%	\$6,726.19	\$0.024
Energy Conservation/ Weatherization	38,893	80%	\$72,347.29	\$2.325
Lighting	8,869	80%	\$861.00	\$0.121
Insulation	470	80%	\$7,984.00	\$21.222
Windows	29,554	80%	\$63,502.29	\$2.686
Totals	3,583,742	80.0%	\$128,793.48	\$0.045

Figure 9-1 shows Levelized Cost of each Measure compared to the average of the four Programs verified, about \$0.045 per net kWh. This gives an idea of how much each Measure costs to incentivize relative to the savings Banning obtains. Because the levelized cost is so high, the Insulation Measure is not shown in Figure 9-1 due to the rest of the Measures being closer to the overall average and the lack of distinction between them.

Figure 9-1: Graph of the Levelized Cost of each Measure compared to the average

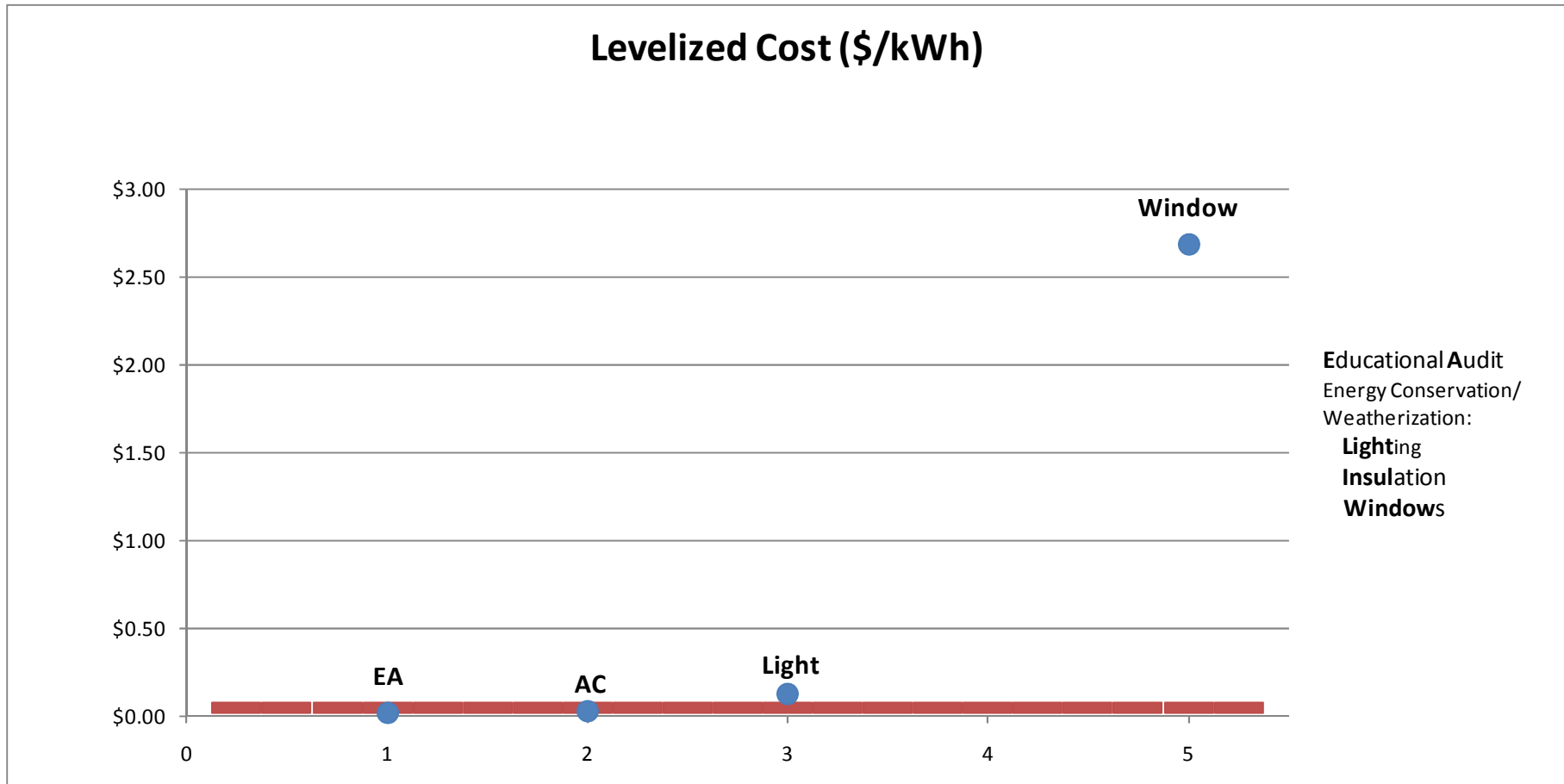
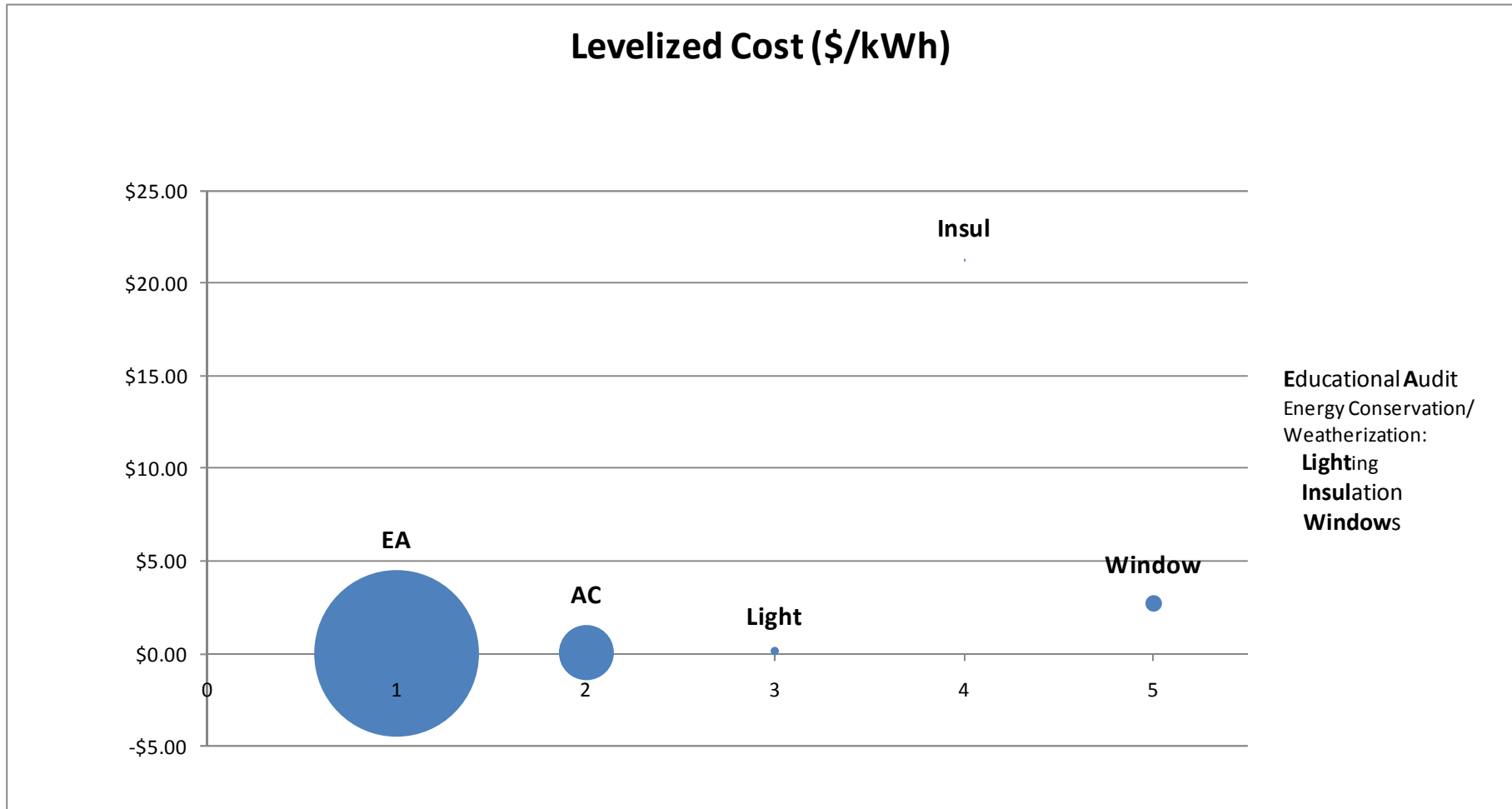


Figure 9-2 bubble graph that shows the same data from Figure 9-1, but also shows how much energy savings each Measure offers by the size of the bubble. As it can be seen, the Insulation Measure has a very high Levelized cost relative to the other Measure and offers very little energy savings. It would be in Banning's best interest to consider lowering the incentive for this Measure or removing it from the Energy Conservation/Weatherization Program completely. This is the Measure that are recommended Banning push to get more savings from.

Figure 9-2: Bubble graph of the Levelized Cost of each Measure based on verified kWh savings



Appendix A –Energy Efficiency Program Integration Platform

Lincus recommends a software program management software platform that can offer a robust functionality by combining many of the separate and independent excel worksheets, program data, application forms, accounting and billing notices as well as savings the data in one central location. The purpose of this energy efficiency program management platform is to promote, track, and evaluate energy efficiency installations made by your utility. This type of program management platform will allow Banning to configure & release new energy efficiency programs in a short span of time for different customer classes, keep track of program results and compare various programs or measures within a single business tool. In addition, this type of program management tool can provide detailed business critical reports for program administrators, customer service representatives, and inspection and EM&V consultants to review program performance. The benefits of this type of program management software include:

1. Simplifying Administrative Tasks

The tool should provide intuitive user interface for utility companies to execute their daily task with productivity.

- Should be easy to manage the task assignment / re-assignment and track status changes
- Should notify program managers on their pending tasks for prioritization
- Needs to validate most of the program check list, eliminating manual intervention
- Provide quick access to any energy efficiency programs information
- Easy to accommodate program changes to the existing programs without delays
- Be able to track, assess, and audit the program performance through dashboard and reports

2. Common Platform for Managing EE Programs

The tool provides a seamless view across programs and gets real-time information which will aid in both their strategic and tactical decisions:

- Bring down costs / complexity of hosting the application
- Easy maintenance & revisions to the Energy Program ensuring less down time
- Adapt and revamp new energy efficiency Programs faster and reach more participants in a short time

3. Data Integrity

The tool provides a robust solution which ensures accurate data entry into the application

- a. Needed field validation to avoid data entry errors
- b. Reports results are verifiable and repeatable in later years

4. Flexibility / Scalability

Lincus recommends that such tool is flexible and scalable and allows Banning to design more energy efficiency programs within a short time and reach to the market.

- a. Flexible to accommodate program changes
- b. Extensible application to handle new energy program requirements
- c. Needs to meet configurable requirements for future energy efficiency programs
- d. Be able to handle growth in Program users