

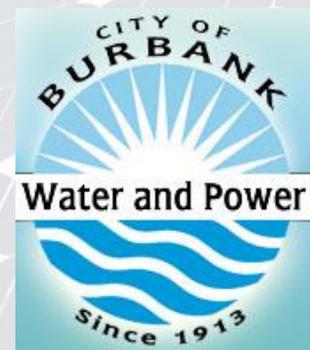


Energy Efficiency
Engineering

Carbon
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Solutions

Evaluation, Measurement and Verification (EM&V) Study

Burbank Water & Power



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1 Utility Overview

Burbank Water and Power (BWP) offers a number of energy efficiency and renewable energy programs to its customers throughout the City of Burbank. This report describes these BWP energy efficiency incentive programs and the Evaluation, Measurement, and Verification (EM&V) Study of 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 BWP's programs. As a part of this study, Lincus will provide BWP 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 BWP's energy efficiency programs for FY2008/2009 (July 1, 2008 through June 30, 2009). This report is based upon information provided directly by BWP staff and its website.

1.1 General Utility Background Information

Since 1913, Burbank Water and Power has been serving its residents and businesses with water and electricity. BWP currently provides for 45,000 households and 6,000 businesses throughout Burbank, California. Over these past 96 years of operation, many generation plants have been put into service and retired.

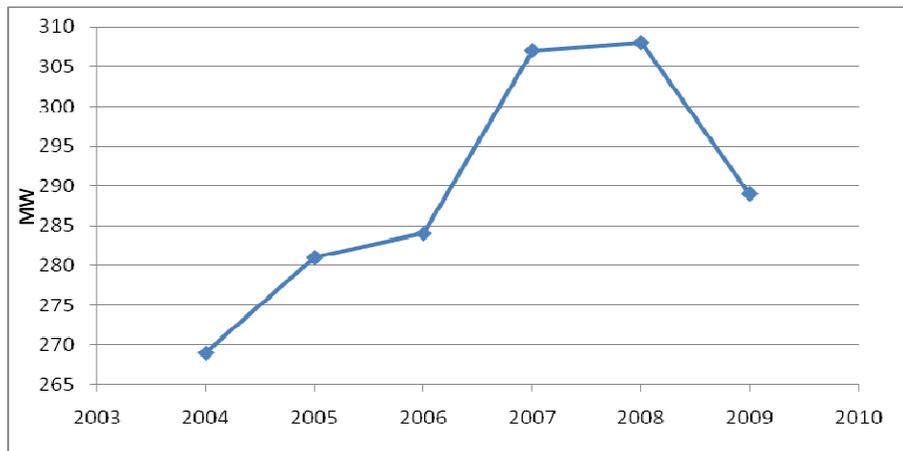
In 1941, BWP put its first steam unit into service, named Magnolia No.1 with a capacity of 10MW. A year later, Magnolia No.1's twin, Magnolia No. 2, began providing for its citizens and businesses as well. In 1948, another steam Magnolia unit joined the group, but this time it had twice the power as the others. Although three units were erected within seven years, it took five more years to bring a fourth Magnolia unit into service; this time, triple the power of the original plants. In 1959, BWP constructed the Olive Power Plant and began operation of its last steam unit for many years, named Olive No.1 at 42MW.

Over the next 40 years, BWP brought three gas units into service, totaling 70MW. BWP also shared plants with neighboring cities, totaling 341MW and retired the original three Magnolia units. In 2000, the 310MW Magnolia Power Plant was created by the Southern California Public Power Authority (SCPPA) to serve the cities of Burbank, Anaheim, Glendale, Pasadena, Cerritos and Colton. Burbank manages and operates the Magnolia Power Plant and receives 31% of the power produced.

In 2001, BWP began its first renewable energy plant installing a 300 kW Capstone micro turbine technology fueled by naturally occurring landfill gases. The plant later upgraded to 550 kW in 2005. Also, in 2005 BWP retired Magnolia No.4 and No.5, the last two original Magnolia units.

In the 2008-2009 fiscal year, Burbank Water and Power served Burbank, California with 289 MW and 1,184,000 MWh. Figure 1-1 below shows the actual yearly peak demand for Burbank Water and Power over the last six years. After discussion with BWP staff, the large increase between 2006 and 2007 is assumed to be because of increased temperature. Considering the demand went back down to a relatively normal level in 2009, this is not an unreasonable assumption.

Figure 1-1: BWP's Actual 2004-2009 Peak Demand



1.2 Key Customer Markets

Burbank Water and Power 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, BWP offered 13 energy efficiency programs to residential and business customers. Through this program year, there was a total incentive amount of \$2,404,414 which resulted in a net electrical savings of 8,677,488 kWh and 2,024 coincident peak kW. Below is a list of energy efficiency programs available to BWP customers, as described on BWP's website and by its staff.

2.1 FY 2008-2009 Program Offerings

Current Residential Customer Programs:



Residential Made in the Shade- Made in the Shade is an energy-saving program that provides trees to customers to protect their house from radiant heat gain and losses from the sun and black space. Through this program, BWP will give qualifying residents up to three shade trees for free. They also provide stakes, ties, and arbor guards, which are devices that protect tree trunks from weed trimmers and lawn mowers. Again, all of this is free. There are 35 types of trees offered through the Made in the Shade program. These trees were selected because they are good shade trees that grow well in Burbank.



Home Energy Analyzer - The Home Energy Analyzer is a free on-line audit service that provides valuable energy usage information and energy-saving recommendations. Customers just input their zip code and information about their residence and the software outputs average electric and gas costs and a breakdown of energy use of each component. Customers can even input their bills to compare to other residence.

Low Income Refrigerator exchange- BWP will replace qualifying customer's old primary refrigerators with a brand new money-saving Energy Star model and environmentally recycle the existing unit for free with this program. In order to qualify, customers must meet the income levels presented on the website, the primary refrigerator must be operational and at least 10 years old, and the refrigerator size must be between 14 and 25 cubic feet.



Refrigerator Round-up- Burbank Water and Power provides a \$100 billing credit to BWP customers who turn in their second non-primary refrigerator for environmental recycling. 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 10 and 26 cubic feet.



Mini refrigerators, such as wine coolers or dorm coolers, or commercial sized refrigerators will not be accepted. As a U.S. EPA's Responsible Appliance Disposal (RAD) partner, BWP is responsible for disposing of old, inefficient refrigerators using the best practices to help protect our environment. BWP is doing its part to reduce emissions of ozone-depleting substances (ODS) and greenhouse gases (GHGs).

AC Tune Up- BWP's Air Conditioning Tune Up program offers services to its customers that far exceed the standards of typical maintenance programs. BWP is working with Proctor Engineering Group, developer of the CheckMe! air-conditioning maintenance program. Customers can save up to \$110 on the cost of tuning up their AC unit and reduce their cooling bills up to 40%.



Home Rewards- Home Rewards is BWP's residential rebate program. Burbank residents must complete the Home Rewards application and send it to BWP's Conservation Group along with a copy of their receipt(s). The Home Rewards application lists the program eligibility requirements for each item included in the program. The majority of the items require the Energy Star label. The Home Rewards Program offers rebates on the following energy efficient items that meet our efficiency requirements:

- Clothes Washers
- Dishwashers
- Room Air Conditioners
- Refrigerators
- Low-E Windows
- Low-E Doors
- Whole House Fans
- Pool Pumps
- Solar Attic Fans
- Ceiling Fans (up to three per household)
- Central Air Conditioners
- Attic Insulation
- Wall Insulation



CFL Distribution - BWP provides two Compact Fluorescent Lights (CFLs) to participants of the Refrigerator Round-Up and Low Income Refrigerator Exchange Programs. CFLs use just one-fourth the energy used by traditional incandescent light bulbs and last for several years. In providing CFLs to consumers, BWP is working to ingrain the usage of these energy efficient products.

CFL Box Mailer - In July 2008, BWP sent every address in Burbank a small green box containing two energy-saving compact fluorescent light bulbs (CFLs) and two water-saving bathroom faucet aerators, along with information explaining why it is important to install these items. The

impact of the project was discovered through hiring of a market research company to conduct a survey. They discovered that 70% of the CFLs (51,600 light bulbs) and 28% of the faucet aerators (23,650) were installed.

LivingWise Educational Program - LivingWise is a residential savings and education program for Burbank Unified School District 6th grade students. LivingWise combines classroom learning, a home audit, and minor retrofits completed by students and parents. With their parents, students track the installation of the various energy-saving items, and submit a report to their science teacher.

Commercial Customer Programs:



Business Made in the Shade- Made in the Shade is an energy-saving program that provides trees to customers to protect their buildings from radiant heat gain and losses from the sun and black space. Through this program, BWP will give qualifying businesses up to 20 shade trees for free. They also provide stakes, ties, and arbor guards, which are devices that protect tree trunks from weed trimmers and lawn mowers. Again, all of this is provided for free. There are 35 types of trees offered through the Made in the Shade program. These trees were selected because they are good shade trees that grow well in Burbank.

Energy Solutions (business rebates) - BWP offers rebates to Burbank businesses under their Energy Solutions Program. Energy Solutions is an umbrella program offering financial assistance for energy-efficient projects. The incentives provided are based off the greater amount of \$0.05 per kWh saved over half the Expected Useful Life (EUL) or \$150 per kW reduced, but will not exceed 50% of the installed cost of the measure. Additionally, the annual customer rebate total may not exceed \$100,000. Rebates are awarded to customers who elect to perform an early retirement of their inefficient equipment and install new products that exceed Title 24 requirements. Below is a list of rebate examples eligible under this program.

- *Lighting retrofits* : BWP pays \$0.05 per kilowatt-hour saved over a one year period.
- *Heating, Ventilation, and Air Conditioning (HVAC) retrofits* : BWP provides a three-tier sliding scale for rebates based on the efficiency rating of the HVAC unit purchased. The higher the SEER or EER efficiency rating is over the baseline, the greater the rebate is.

- *Chiller retrofits* : BWP pays \$0.05 per kilowatt-hour saved over a one year period for customers who elect to perform an early retirement of their inefficient equipment and install a new unit that exceeds Title 24 requirements. When nonoperational equipment is being replaced, rebates will be determined based on energy-savings exceeding Title 24 requirements.
- *Motor replacements* : BWP provides incentives for premium efficiency motors as determined by the standards established by the U. S. Department of Energy's Federal Energy Management Program. Incentives are based on the HP of the motor.
- *Thermal Energy Storage* : Thermal Energy Storage (TES) is a method of shifting the demand of small commercial air conditioning systems from peak energy demand times to off-peak hours. TES systems make ice during off-peak hours and use the stored thermal energy during peak demand hours to provide cooling. The incentive is \$800 per kilowatt of demand saved.
- *Cool Roofing* : Cool Roofing is a roof coating that detours radiant heat from entering the building through the roof. BWP pays \$0.05 per kilowatt-hour saved over a one year period. In order to receive a rebate for this measure each of the following three conditions must be true:
 1. The space directly below the reroof area is air conditioned.
 2. reroof is NOT required to comply with Title 24 cool roof requirements. Customers are encouraged to refer to this document to determine if their roofing project must comply with Title 24.
 3. The cool roofing materials to be used will comply with the applicable Title 24 cool roof standards and tests.
- *PC network power management software*: This software allows system administrators to place computers into sleep mode and shut down any open files (after first saving them) when appropriate. An independent study determined average annual savings of 200 kWh per PC. BWP pays \$0.05 per kilowatt-hour saved over a one year period.
- *Miscellaneous Energy-Saving Retrofits* : The vast majority of business retrofit projects will fall into the categories listed above. For those energy-saving projects that do not fall neatly into one of the above categories, yet will meet the criteria of this program, BWP pays \$0.05 per kilowatt-hour saved over a one year period.



Business Bucks (Commercial Audit)- Business Bucks has two components. First, BWP will send a certified resource manager to eligible facilities interested in participating in the program. The resource manager will conduct a comprehensive energy and water survey,

looking at lighting, air conditioning, refrigeration, motors, water heating, water use and the building envelope. There is no cost to the business for this utility survey. A short report will be generated listing recommended efficiency retrofits. Each recommendation will include the cost to perform the retrofit, anticipated annual energy or water savings, and simple payback.

The second component of Business Bucks enables the customer to choose recommendations they would like to install and BWP's certified installers will conduct that work at the facility. BWP will pay up to \$2,000 for recommended retrofits selected. Any cost above the \$2,000 limit would be paid by the business.



AC Tune Up- BWP's Air Conditioning Tune Up program offers services to its customers that far exceed the standards of typical maintenance programs. BWP is working with Proctor Engineering Group, developer of the CheckMe! air-conditioning maintenance program. Customers can save up to \$110 on the cost of tuning up their AC unit and reduce their cooling bills up to 40%.

3 Summary of FY 2008-2009 Estimated Savings

BWP has an energy efficiency program tracking database that consists mostly of Excel files. A 2008/2009 Marketing Performance Stats sheet was sent to Lincus containing the program energy and demand reduction and incentive totals from this energy efficiency program database. Below are Tables and Graphs representing this data provided by the Marketing group of BWP.

3.1 Residential Program Savings

Table 3-1 shows information provided from BWP'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 Participants	Gross Annual Reduction (kWh) ¹	Gross Summer Peak Reduction (kW) ²	kWh % of Total	kW % of Total	NTG ³	Program Costs ⁴	Cost % of Total
CFL Mail Out	100,000	3,550,000	650.0	62.8%	55.7%	0.80	\$339,157	26%
Refrigerator Roundup	537	1,086,888	168.6	19.2%	14.5%	0.80	\$140,328	11%
Home Rewards	2,619	345,830	162.0	6.1%	13.9%	0.95	\$356,806	27%
Made in the Shade	539	225,914	31.2	4.0%	2.7%	0.80	\$55,419	4%
Home Energy Analyzer	467	185,866	0.0	3.3%	0.0%	0.80	\$18,522	1%
LivingWise Educational Program	1,168	108,202	41.0	1.9%	3.5%	0.80	\$50,555	4%
AC Tune Up	1,613	78,868	113.6	1.4%	9.7%	1.00	\$295,250	22%
Low Income Refrigerator Exchange	90	73,980	0.0	1.3%	0.0%	0.80	\$73,216	6%
Totals	107,033	5,655,548	1,166.4	100%	100%		\$1,329,253	100%

According to Burbank Water and Power's E3 Final Report, the largest energy saving Program is the CFL Box Mailer Program at 62.8%. . BWP's staff says that more CFLs may be sent out again, however it is not a reoccurring Program. Other high saving Programs are Refrigerator Roundup at 19.2%, Home Rewards at 6.1%, and Made in the Shade at 4.0%. These higher saving Programs will be discussed more in Section 5 as they represent 80% of the total savings, not including the CFL Box Mailer Program. The other Programs represent the remaining 20% and will not be considered for this EM&V Study. The AC Tune up Program savings numbers were disaggregated

¹ Energy reduction numbers taken from BWP Final Report E3 calculator

² Demand reduction numbers taken from BWP Final Report E3 calculator

³ NTG numbers taken from BWP Final Report E3 which references CPUC for ratios

⁴ Program Costs taken from FY 2008-2009 Marketing Performance Stats

based off the number of rebates since the total savings provided included both Residential and Non-Residential Departments. It should also be noted that the CFL Distribution Program shown in the E3 Final Report is part of the Refrigerator Round-Up and Low Income Refrigerator Exchange programs. The savings and costs numbers from the CFL Distribution Program have been rightfully distributed to the Refrigerator Round-Up and Low Income Refrigerator Exchange Programs.

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 incentives paid.

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

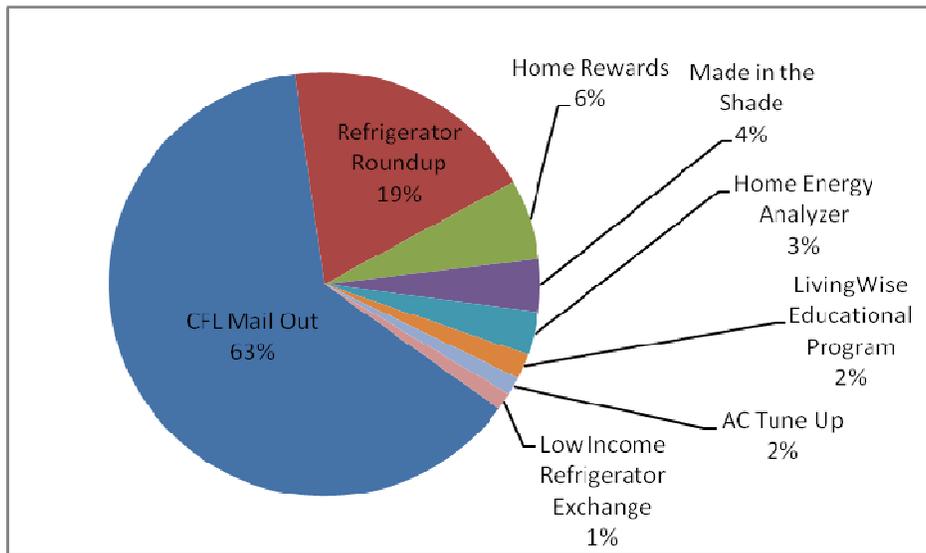


Figure 3-2: Residential Summer Peak kW Reduction for FY 2008/2009

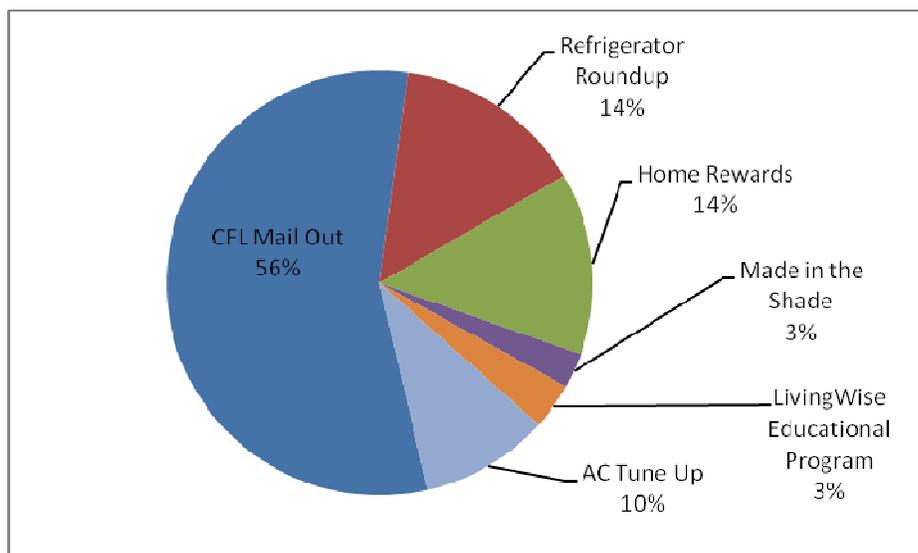
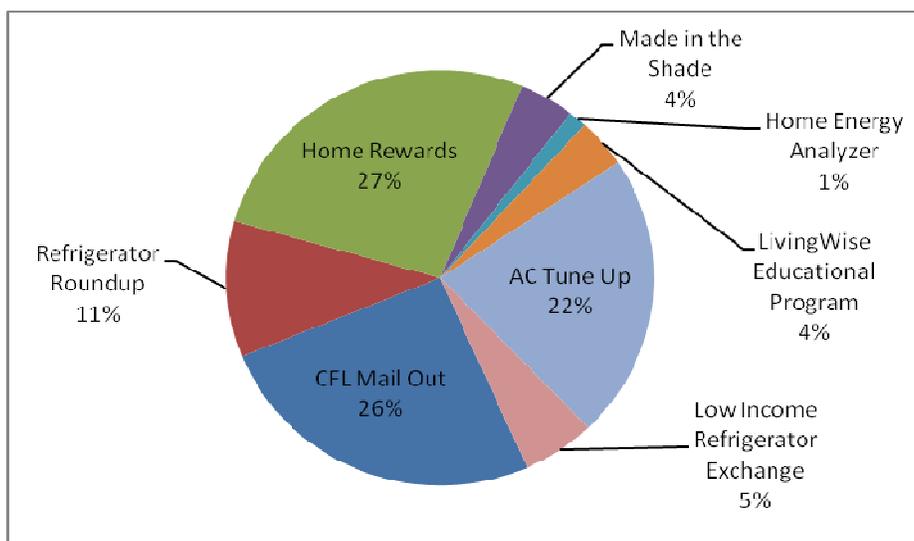


Figure 3-3: Residential Incentives Paid for FY 2008/2009



3.2 Non-Residential Program Savings

Table 3-2 shows information provided from BWP’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 Participants	Gross Annual Reduction (kWh) ⁵	Gross Summer Peak Reduction (kW) ⁶	kWh % of Total	kW % of Total	NTG ⁷	Program Costs ⁸	Cost % of Total
Energy Solutions	45	3,444,699	824.0	82.8%	77.2%	0.95	\$452,354	42%
Business Bucks	400	681,800	218.0	16.4%	20.4%	1.00	\$562,323	52%
AC Tune Up	317	15,587	22.4	0.4%	2.1%	1.00	\$58,350	5%
Made in the Shade	40	16,673	2.4	0.4%	0.2%	0.80	\$2,134	0%
Totals	802	4,158,759	1066.8	100%	100%		\$1,075,161	100%

According to Burbank Water and Power’s E3 Final Report, the largest energy saving Program is the Energy Solutions Program at 82.8%. This high saving Program will be discussed more in Section 5 as it represents 80% of the total savings. Business Bucks is the next highest Program and

⁵ Energy reduction numbers taken from BWP Final Report E3 calculator

⁶ Demand reduction numbers taken from BWP Final Report E3 calculator

⁷ NTG numbers taken from BWP Final Report E3 which references CPUC for ratios

⁸ Program Costs taken from FY 2008-2009 Marketing Performance Stats

represents 16.4% of the total savings. The last two Programs portray less than 1% of the total savings together. These three Programs represent the remaining 20% and will not be considered for this EM&V Study. The AC Tune up Program savings numbers were disaggregated based off the number of rebates 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 incentives paid.

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

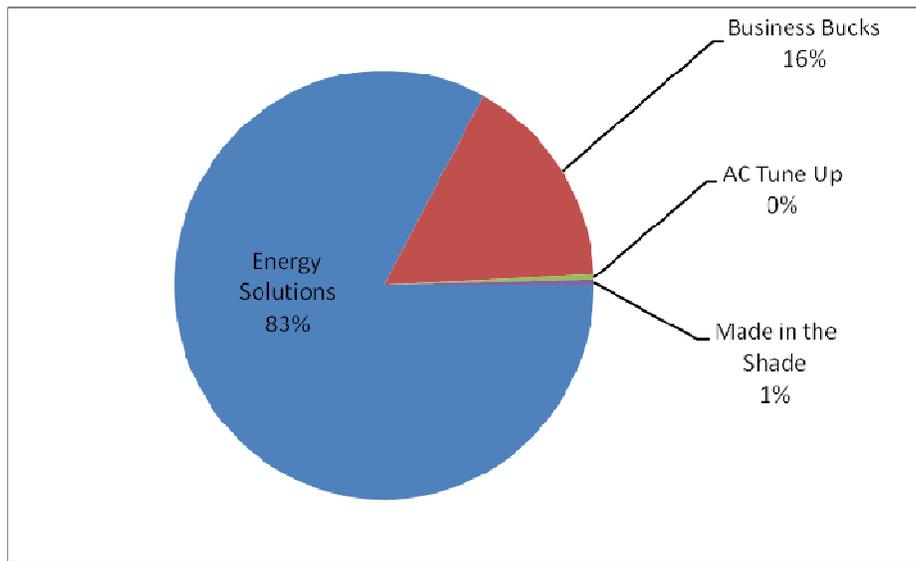


Figure 3-5: Non-Residential Summer Peak kW Reduction for FY 2008/2009

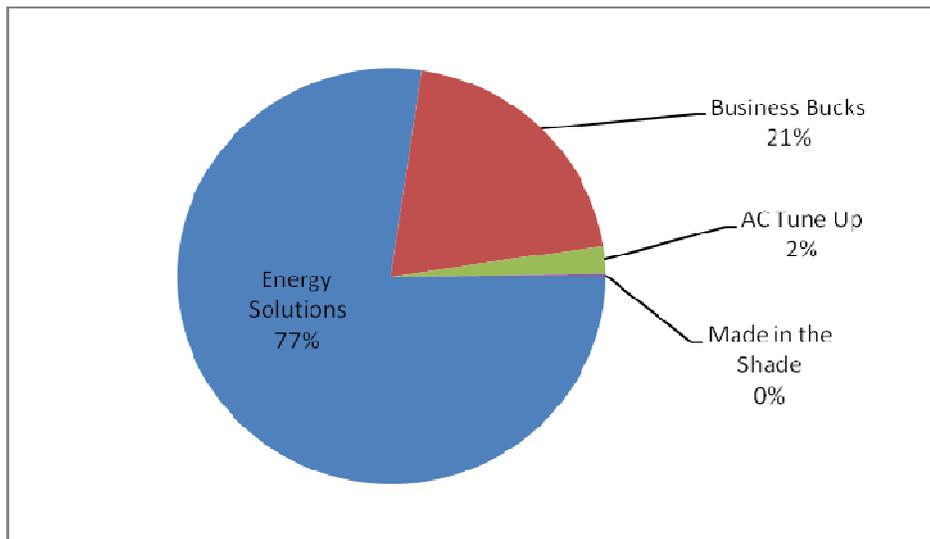
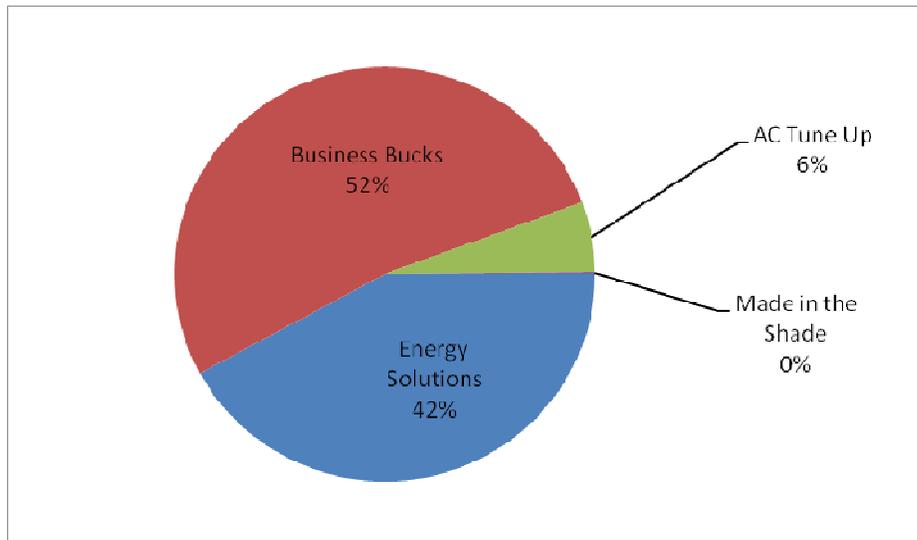


Figure 3-6: Non-Residential Incentives Paid for FY 2008/2009



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 BWP 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

4.2 Program Process Flow Diagrams

Figure 4-3 and Figure 4-4 illustrate the Residential Home Rewards and Non-Residential Energy Solutions program process flow. These process flowcharts begin at receiving the application to rejecting or paying the application.

Figure 4-1: Residential Home Rewards Program Rebate Process Flowchart

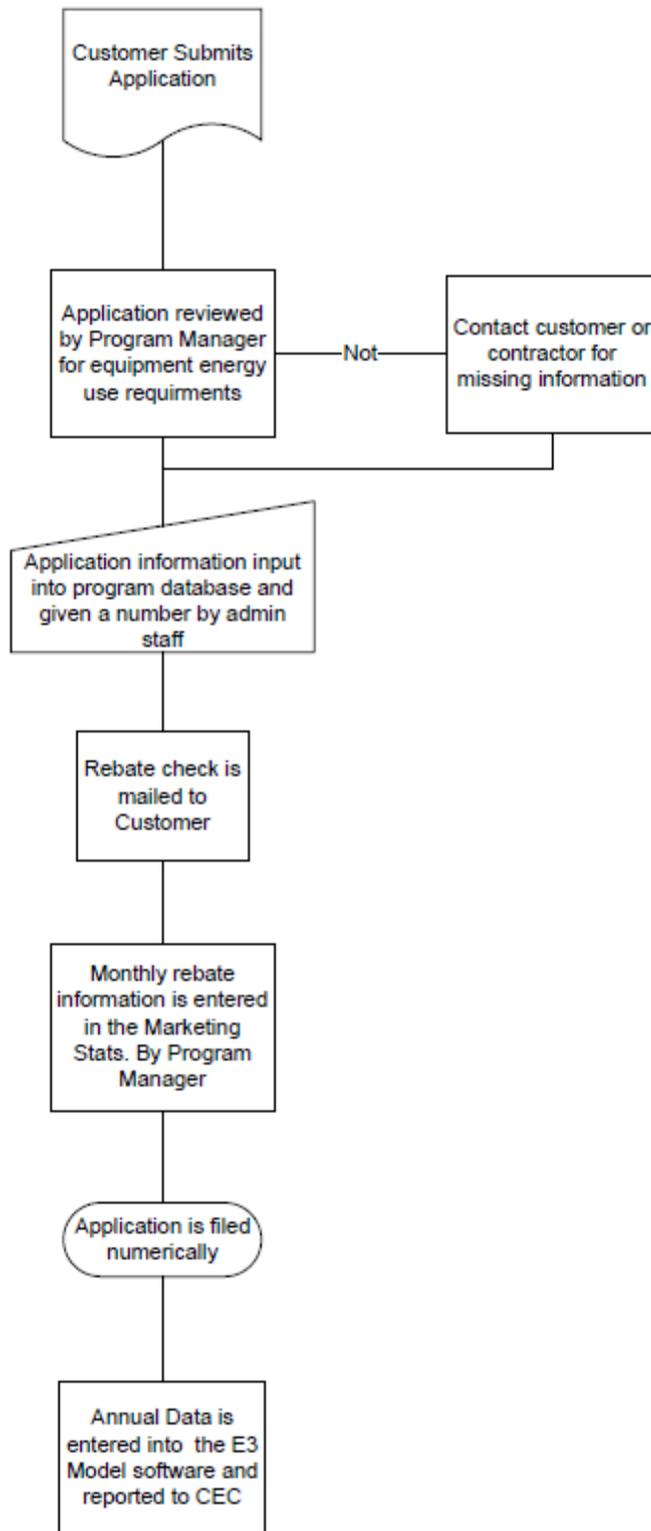
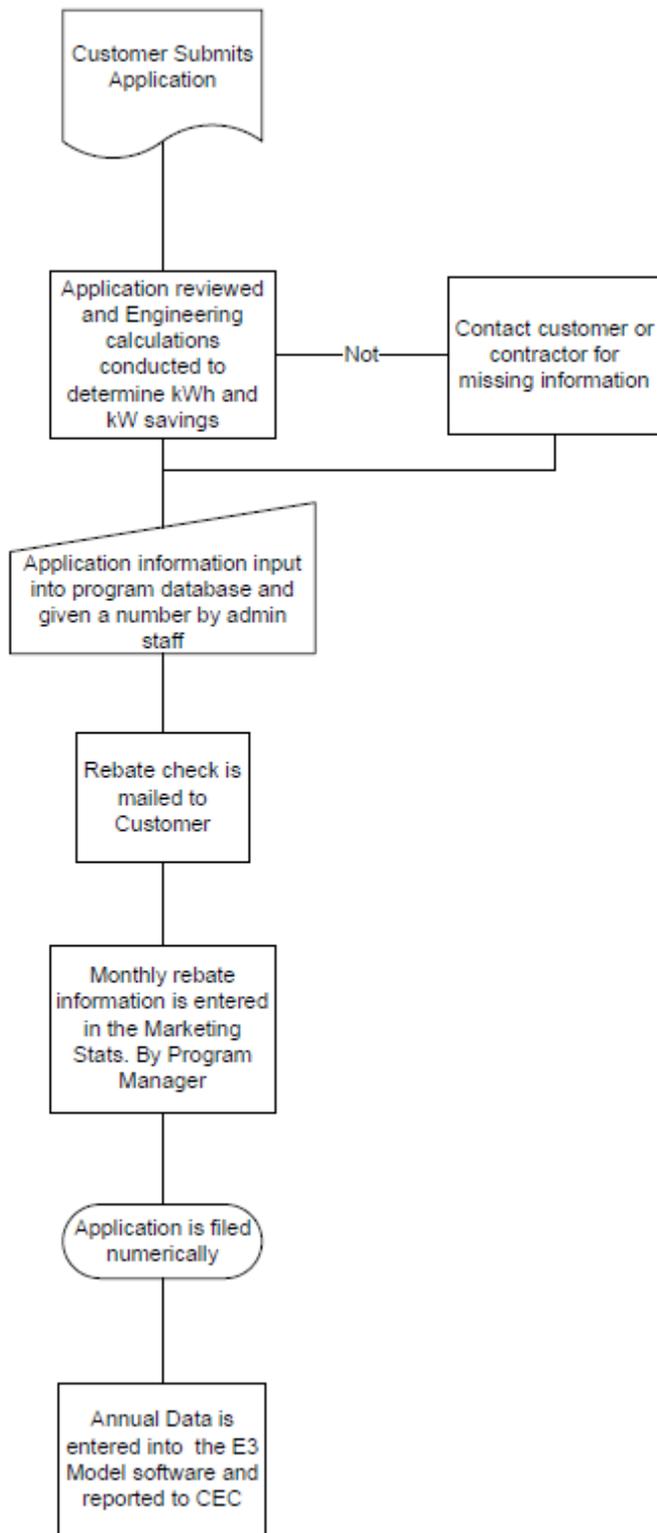


Figure 4-2: Non-Residential Energy Solutions Program Rebate Process Flowchart



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 BWP. 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 BWP’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
Residential Made in the Shade	C/D	Varies	Utility Bill analysis/modeling
Refrigerator Roundup	-	-	-
Refrigerator	A/C	Instant/Varies	Varies
CFLs	A	Instant	Power and hours of operation
Home Energy Analyzer	A/B/C/D	Varies	Depends on Measures
Low Income Refrigerator Exchange	-	-	-
Refrigerator	A/C	Instant/Varies	Varies
CFLs	A	Instant	Power and hours of operation
Residential AC Tune Up	B	Instant/7 Days	Air temperature and HVAC consumption
Home Rewards:	-	-	-
Ceiling Fans	A	Instant	Power and hours of operation
Central Air Conditioners	B	7 Days	Air temperature and HVAC consumption
Clothes Washers	A	Instant	Power for each mode and number of operations
Dish Washers	A	Instant	Power for each mode and number of operations not including hot water savings
Low-E Windows	B	7 Days	Air temperature and HVAC consumption
Pool Pumps	C/D	Varies	Utility Bill analysis/modeling
Refrigerators	B	7 Days	Power and hours of operation
Refrigerators	A	Instant	Power excluding interactive effects
Room Air Conditioners	B	7 Days	Air temperature and HVAC consumption
Solar Attic Fans	B	7 Days	Power, Flow, and Air temperature
Whole House Fans	C/D	Varies	Utility Bill analysis/modeling
Attic Insulation	D	Varies	Utility Bills modeling
Wall Insulation	D	Varies	Utility Bills modeling
LivingWise Educational Program	A	Instant	Varies on measures
Non-Residential Made in the Shade	C/D	Varies	Utility Bill analysis/modeling
Energy Solutions:	-	-	-
Lighting	A	Instant	Power and hours of operation
HVAC	B	7 Days	Air temperature and HVAC consumption
Other	A/B/C/D	Varies	Varies on Measures
Business Bucks	C/D	Varies	Utility Bill analysis/modeling
Non-Residential AC Tune Up	B	7 Days	Air temperature and HVAC consumption

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 Low Income Refrigerator Exchange population. In this case, the required sample size would be 10 participants, since the final number should be rounded up to the nearest whole number.

Equation 5-1: Initial Sample Size Calculation

$$n_o = \frac{z^2 cv^2}{e^2} = \frac{(1.64)^2 (.2)^2}{(.1)^2} = 10.76$$

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

$$n = \frac{n_o N}{n_o + N} = \frac{(10.76)(90)}{(10.76 + 90)} = 9.6 = 10$$

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 below.

Table 5-3: BWP Program Sample Sizing

Program	Applications (N)	Sample Size (n)
Residential Made in the Shade	539	25
Refrigerator Roundup	-	-
Refrigerator	537	11
CFLs	1074	3
Home Energy Analyzer	467	24
Low Income Refrigerator Exchange	-	-
Refrigerator	90	10
CFLs	180	3
Residential AC Tune Up	1,613	25
Home Rewards:	-	-
Ceiling Fans	35	3
Central Air Conditioners	146	21
Clothes Washers	543	7
Dish Washers	419	3
Low-E Windows	348	23
Pool Pumps	34	3
Refrigerators	601	11
Room Air Conditioners	190	22
Solar Attic Fans	237	11
Whole House Fans	7	5
Attic Insulation	51	17
Wall Insulation	8	7
LivingWise Educational Program	1,168	25
Non-Residential Made in the Shade	40	16
Energy Solutions:	-	-
Lighting	31	14
HVAC	8	7
Other	5	5
Business Bucks	400	3
Non-Residential AC Tune Up	317	23

5.2 Residential Program Impact Evaluation

BWP's program database shows eight residential programs being tracked. Table 5-4 shows information provided from BWP's energy efficiency program database of residential measures. It is a duplication of Table 3-1, except CFL Box Mailer was removed.

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

Program	# of Participants	Annual Reduction (kWh)	Summer Peak Reduction (kW)	kWh % of Total	kW % of Total	NTG	Program Costs
Refrigerator Roundup	537	1,086,888	168.6	51.6%	32.6%	0.80	\$140,328
Home Rewards	2,619	345,830	162.0	16.4%	31.4%	0.95	\$356,806
Made in the Shade	539	225,914	31.2	10.7%	6.0%	0.80	\$55,419
Home Energy Analyzer	467	185,866	0.0	8.8%	0.0%	0.80	\$18,522
LivingWise Educational Program	1,168	108,202	41.0	5.1%	7.9%	0.80	\$50,555
AC Tune Up	1,613	78,868	113.6	3.7%	22.0%	1.00	\$295,250
Low Income Refrigerator Exchange	90	73,980	0.0	3.5%	0.0%	0.80	\$73,216
Totals	7,033	2,105,548	516.4	100%	100%		\$990,096

BWP 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. Refrigerator Roundup (51.6%)
2. Home Rewards (16.4%)
3. Made in the Shade (10.7%)

CFL Box Mailer has the highest amount of energy savings out of all nine programs and would be on the list to receive an impact evaluation. However, this was discussed with BWP staff and Lincus was told that the CFL Box Mailer Program is not a reoccurring program. Therefore, it was removed from this list of programs to be evaluated at this time.

5.2.1 Refrigerator Roundup

As discussed in Section 2, Burbank Water and Power provides a \$100 billing credit to BWP customers who turn in their second non-primary refrigerator for environmental recycling. 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 to operate than they realize. Removing 537 refrigerators that are 10 years or older and providing two CFLs per participant resulted in a net energy savings of 1,086,888 kWh and demand reduction of 168.6 kW.

BWP processed and paid 537 applications for this program in the 2008/2009 fiscal year. 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 refrigerator and 3 CFL applications.

As seen in Table 5-2, the Residential Refrigerator Roundup Program M&V would fall under IPMVP Option A for both the refrigerators and CFLs. 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 will be conducted to verify the installation. Appendix B shows questions Lincus will ask customers in the phone surveys. Lincus feels this plan will minimize customer inconveniencing, while still providing adequate confidence in the savings numbers.

5.2.2 Home Rewards

As discussed in Section 2, Home Rewards is BWP's residential rebate program. Burbank residents complete the Home Rewards application and send it to BWP's Conservation Group along with a copy of the receipt(s). The application lists the program eligibility requirements for each item included in the program. The majority of the items simply require the Energy Star label. Providing incentives to residential customers purchasing energy efficient appliances resulted in a net energy savings of 345,830 kWh and demand reduction of 162.0 kW.

BWP processed and paid 2,619 total applications for this program in the 2008/2009 fiscal year. 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 3 ceiling fan, 21 central air conditioner, 7 clothes washer, 3 dish washer, 23 low-e window, 3 pool pump, 11 refrigerator, 22 room refrigerator, 11 solar attic fan, 5 whole house fan, 17 attic insulation, and 7 wall insulation (133 total) applications.

As seen in Table 5-2, the Residential Home Rewards Program M&V IPMVP Option could be any of the four Options, depending on the measure. However, since most of these deemed measures are included in DEER and Energy Star, Lincus will use DEER and Energy Star savings numbers and verify the installation and the operating hours of the measures either via on site or phone surveys. Appendix B shows questions Lincus will ask customers in the phone surveys. The only measure that isn't considered in DEER or Energy Star is solar attic fans. For this measure, Lincus will verify the installation visually, without customer disturbance, and obtain savings numbers from an energy model simulation. Lincus feels this plan will minimize customer inconveniencing, while still providing adequate confidence in the savings numbers.

5.2.3 Made in the Shade

As discussed in Section 2, Made in the Shade is an energy-saving program that provides trees to customers to protect their house from radiant heat gain and losses from the sun and black space. Through this program, BWP will give qualifying residents up to three shade trees. Providing customers with shade from the heating sun rays and cooling outer space resulted in a net energy savings of 225,914 kWh and demand reduction of 31.2 kW.

BWP processed and paid 539 participants for this program in the 2008/2009 fiscal year. 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 25 applications.

As seen in Table 5-2, the residential Made in the Shade Program M&V would fall under IPMVP Option D. This Option includes energy modeling the site using utility bills and knowledge of the placement of the shade trees. The location of the trees planted may be obtained either from the program documents or through visual inspection of the site.

5.2.4 Lower Priority Programs

The remaining four programs, not including CFL Box Mailer, 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

BWP’s program database shows four non-residential programs being tracked. Table 5-7 shows information provided from BWP’s energy efficiency program database of non-residential measures. It is a duplication of Table 3-2.

Table 5-7: Estimated Energy and Demand Impacts for FY 2008/2009 for the Non-Residential Sector

Program	# of Participants	Annual Reduction (kWh)	Summer Peak Reduction (kW)	kWh % of Total	kW % of Total	NTG	Program Costs
Energy Solutions	45	3,444,699	824.0	82.8%	77.2%	0.95	\$452,354
Business Bucks	400	681,800	218.0	16.4%	20.4%	1.00	\$562,323
AC Tune Up	317	15,587	22.4	0.4%	2.1%	1.00	\$58,350
Made in the Shade	6	16,673	2.4	0.4%	0.2%	0.80	\$2,134
Totals	768	4,158,759	1066.8	100%	100%		\$1,075,161

BWP has a few non-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 program to receive impact evaluations.

1. Energy Solutions (82.8%)

5.3.1 Energy Solutions

As discussed in Section 2, Energy Solutions is an umbrella program offering financial assistance for energy-efficient projects. The incentives provided are based off the greater amount of \$0.05 per

kWh saved over half the Expected Useful Life (EUL) or \$150 per kW reduced, but will not exceed 50% of the installed cost of the measure. Additionally, the annual customer rebate total may not exceed \$100,000. Rebates are awarded to customers who elect to perform an early retirement of their inefficient equipment and install new products that exceed Title 24 requirements. BWP approved 45 applications which resulted in a net energy savings of 3,444,699 kWh and demand reduction of 824.0 kW.

BWP processed and paid 31 Lighting, 8 HVAC, and 5 Other (45 total) applications for this program in the 2008/2009 fiscal year. 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 14 Lighting, all 7 HVAC, and all 5 other (26 total) applications.

As seen in Table 5-2, the Non-Residential Energy Solutions Program M&V could fall under any of the IPMVP Options depending on the measures. This Program has three main categories: Lighting, HVAC, and Other. Lighting would be an M&V Option A, which includes an instant measurement of the power for each fixture type and an assumption of the hours of operation. HVAC unit performance verification may be based on M&V Option A, which may include one week of monitoring of the power consumption of the air-conditioning unit. During said monitoring, data loggers will be left on site and verification will be done with the data collected. The Other category consists of 3 different measures and the M&V Options varies between A and C, depending on the measure. The M&V Options for the Other Category are shown in Table 5-8 below.

Table 5-8: M&V Options for Energy Solutions Other Category

Measure	M&V Option	Duration of M&V	Measurements
Energy Management System	C	Varies	Utility Bill Analysis
Variable Frequency Drive	A	Instant/7 Days	Power and operation hours
Milling Machine/System/VFD	A	Instant/7 Days	Power and operation hours

Since the Energy Management System (EMS) applications were sent in at the beginning of 2009, Lincus has chosen to perform a utility bill analysis, Option C, for the M&V process. This will consist of normalizing the utility bills to weather data and comparing the usage. The savings for the Variable Frequency Drive (VFD) will be verified using the variations recorded by the customer's controls system, if available. If Lincus cannot verify the load variability for the VFD, Lincus will use Option A to verify the savings with some data logging.. The measurement would be of the power and the duration of the measurement can vary between a day and a week, depending on the use of the VFD. The milling machine would fall under the exact same option as the one used for the VFD. As always, customer disturbance during these processes will be limited as much as possible.

5.3.2 Lower Priority Programs

The remaining three programs add up to the remaining 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.

6 Program Process Evaluation Results

The Residential Process Evaluation includes the Refrigerator Round-Up, Home Rewards, and Made in the Shade Programs. The Non-Residential Process Evaluation includes the Energy Solutions Program.

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 undergoing the customer phone surveys, it was discovered that about 64% of the customers that participated in the Refrigerator Round-Up Program replaced the recycled refrigerator with a new refrigerator. This ends up decreasing BWP's savings for this Program overall. It is recommended that Burbank perform surveys throughout the FY to verify the percentage of participants that replace the recycled refrigerators.

Although discrepancies were not found, it is recommended that Burbank verify that the trees given to participants of the Made in the Shade Program are installed in the spot designated by the Program Arborist, as stated on the Arborist Maps. It is also recommended that trees only be planted in the Western and Southern direction, relative to the house. This will be explained more in the Impact Evaluation Section.

Upon reviewing the applications for the Energy Solutions Program, Lincus has created a list of recommendations that could increase the quality of accepted applications. These recommendations will help BWP justify the savings customers obtain by performing retrofit projects.

In the beginning of the 2008-2009 FY, the Energy Solutions Program offered incentives to Non-Residential customers at a rate of \$0.05/kWh saved over half the EUL or \$150/kW reduced, whichever is greater, but not to exceed 50% of the measure cost. Beginning April 2009, BWP changed this incentive rate to the lesser of \$0.05/kWh saved over the first 12 months or 25% of the measure cost. Lincus feels this change was a good move for BWP. Most technologies lose efficiency over the EUL and to calculate the actual savings over the EUL is difficult. If BWP had not made this change prior to this EM&V study, Lincus would have made that recommendation.

Lincus also recommends that BWP perform a Total Resource Cost (TRC) calculation on every customized application. A TRC calculation compares the Societal Cost to the Societal Benefit. If the Societal Benefit is greater than the Societal Cost, it passes the test and justifies the payment of an incentive. Although a TRC calculation can get very complicated if all variables are rigorously considered, it can also be a simple, yet still acceptable, calculation if those same variables are reasonably considered. A TRC calculator can be compiled in a simple Excel spreadsheet using basic equation calculations. It is very important the TRC calculator use BWP's Avoided Cost factors in the calculations. Using another utility's discount rate, line loss factors, capacity reserve

factor, and demand and energy rates could provide false calculations. Performing this calculation on all applications will help BWP verify that the retrofit savings and incentives are justified.

In addition to the TRCs being calculated, it is recommended that Burbank require specification sheets of the new units (ballasts, lamps, air-conditioners, motors, etc.) be attached to the application when sent in by the customer or contractor for review. This will allow for smoother and more accurate processing of the application. It is also advised that air-conditioners require AHRI certification, 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 when the application is sent for review.

While trying to obtain access to a customer's site, in order to perform M&V, the customer would not allow Lincus to access the equipment needed to obtain required data. Upon further review of BWP's Terms and Conditions (T&C), there is only language that requires the customer to allow access to their site for a post-inspection. It is recommended that Burbank add language that requires customers to allow site access to BWP and their affiliates. Below is some language that could be used for this:

“Site Access Requirements: The Program(s) I select may require installations, audits, inspections, measurements of the performance of the solutions, and/or verification of installation of solutions. Therefore, I agree to provide reasonable access to the project site(s) for these purposes to BWP and/or its agents or assigns.”

Customized application calculations should use a baseline similar to what is stated in the SPC Procedure Manual. There are four baselines available to calculate from. The baseline that should be selected depends on two variables: the age of the units being replaced and the availability of Title-24 (T-24) and Industry Standards. The four baselines are as follows:

1. Current Title-24 Standards – This baseline is to be used at all times, unless current T-24 standards are not available for the specific retrofit or the retrofit qualifies for Early Retirement. Current Industry standards are used if current T-24 standards are not available for the specific retrofit.
2. Title-24 Standards for Early Retirement – Early Retirement is considered for units that are being retrofit prior to the end of their EUL. The SPC Procedures Manual currently only allows water-cooled chiller and motor savings to be calculated using this baseline. T-24 standards at the time the existing unit was installed would be used as the baseline in these cases.
3. Current Industry Standards – This baseline is used only if T-24 standards are not available for the specific retrofit. An example of this is air-compressors. There currently are not T-24 standards for these units, so Industry standards, at the time the existing was installed, could be used as the baseline.
4. Current Operating Conditions – If T-24 and Industry standards are not available, the current operating conditions can be used as the baseline for customized application calculations.

6.2 Utility Tracking System

While obtaining information for the Home Rewards Program, it was discovered that all applications and information attached are stored in the City's finance department with no other way to get them besides going through vaults, looking for a check number. BWP has a tracking system that includes general information about the application, but doesn't contain all information that may be useful. Lincus recommends BWP 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 BWP from Lincus if they would like to use it.

Lincus recommends this tracking system be applied to the Non-Residential Programs as well. This tracking system will have the capability to keep track of the new TRC calculations and other information recommended.

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 three Programs: Refrigerator Round-Up, Home Rewards, and Made in the shade.

7.1.1 Refrigerator Round-Up

The first step for this evaluation process was to verify the refrigerators were removed and recycled. Lincus obtained invoices from ARCA California Inc., Burbank's refrigerator recycling contractor, to Burbank for the 2008/2009 FY. ARCA also provided Lincus with Customer and Contractor signed documents giving Customer and refrigerator information and declaring the unit was operational and the unit was removed from the site. Verification of the refrigerators being removed was also done in the Customer phone surveys performed.

As per the sample size selected in Section 5.1, Customers were contacted until eleven successfully phone surveys were completed. Exact questions asked in the Customer phone surveys can be seen in Appendix B. All eleven Customers verified the old refrigerators were removed. However, seven of those eleven Customers said they replaced the old unit with a new unit. Since about 64% of the Customers replaced the old units with new units, the savings per unit was broken up into two groups: Remove and Recycle, Replace and Recycle. Table 7-1 shows Burbank's claimed kWh and peak kW per unit savings sourced from DEER 2005 for each Measure type in a Single Family home in all Climate Zones.

Table 7-1: Refrigerator Round-Up claimed savings per unit

DEER 2005 - Single Family All CZ			
Remove & Recycle		16-24W CFL	
kWh	kW	kWh	kW
1946	0.300	39	0.007

Table 7-2 shows the verified kWh and peak kW savings obtained from DEER 2008 for each Measure type in a Single Family home in Climate Zone 9. The 537 units removed were separated into the two groups using the ratio described above and then multiplied by the corresponding savings per unit numbers. The total refrigerator savings was verified as 402,219 kWh and 84.6

peak kW. As it can be seen, the refrigerator savings has gone down between DEER 2005 and DEER 2008. The CFL savings has increased due to the claimed savings being an average between a range of 16-24W CFLs and the verified being for 23W CFLs.

Table 7-2: Refrigerator Round-Up verified savings per unit

DEER 2008 - Single Family CZ 09							
Remove & Recycle		Replace & Recycle		Average per Refrigerator, Based on Survey		23W CFL	
kWh	kW	kWh	kW	kWh	kW	kWh	kW
1008	0.212	601	0.126	749	0.158	50	0.009

The Customers also received two 23-watt CFLs when their refrigerator was removed by ARCA. During the phone surveys, the Customers verified that the CFLs were installed and they replaced incandescent bulbs of various wattages throughout the house. The total CFL savings was verified as 54,211 kWh and 9.8 peak kW.

The total of the refrigerators and CFL savings gives the verified savings for the Program. Table 7-3 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Refrigerator Round-Up Program.

Table 7-3: Refrigerator Round-Up Program savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
1,086,888	168.6	456,430	94.4

7.1.2 Home Rewards

The Residential Home Rewards Program has twelve Measures: Attic Insulation, Ceiling Fans, Central A/Cs, Clothes Washers, Dishwashers, Low-e Windows, Pool Pumps, Refrigerators, Room A/Cs, Solar Attic Fans, Wall Insulation, and Whole House Fan. An Excel spreadsheet was sent to Lincus with every application paid during the 2008-2009 FY. This spreadsheet had customer information, such as name, address, and daytime phone number, Measure information, such as which Measure was implemented, make and model numbers, and other unit information, and rebate given. A processed application was also sent to Lincus to show what Burbank requires to process an application and how it is done. Using the spreadsheet sent by Burbank, the sample size was randomly selected based on the zip codes and time of the year as evenly as possible. The randomly selected customers were then contacted and asked the corresponding questions from the phone surveys in Appendix B. Once the sample size of successful phone surveys completed was met, DEER 2005, DEER 2008, and Energy Star were used to verify the savings.

The Attic Insulation Measure had a sample size of 17 customers and 17 successful phone surveys were completed. Ten of the 17 customers surveyed had attic insulation prior to installing the new insulation. Table 7-4 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references DEER, for a Single Family home in Climate Zone 09.

Table 7-4: Home Rewards Program’s Attic Insulation Measure claimed savings per unit

2006 KEMA Report - Single Family CZ 09	
R-0 to R-30 (per 1000 sqft)	
kWh	kW
542	0.264

DEER 2005 was used to obtain the savings for a Single Family home in Climate Zone 9 and a vintage before 1978. As it can be seen in Table 7-5, two savings numbers were needed to verify the savings with DEER. The first is for those customers that did not have attic insulation prior to new insulation (R-0 to R-30) and the second is for those customers that did have insulation prior to the new insulation (R-Vintage to R-30). All savings numbers in Table 7-5 are per 1,000 square feet of insulation. For this Measure, the kWh savings increased and the kW savings decreased compared to the 2006 KEMA Report.

Table 7-5: Home Rewards Program’s Attic Insulation Measure verified savings per unit

DEER 2005 - Single Family, CZ 09, Vintage before 1978			
R-0 to R-30 (per 1000 sqft)		R-Vintage to R-30 (per 1000 sqft)	
kWh	kW	kWh	kW
591	0.236	205	0.108

The total amount of insulation was obtained from the application spreadsheet given by Burbank to calculate the total Measure savings based off ten to seven insulation prior to no insulation prior ratio. Table 7-6 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Attic Insulation Measure. It is recommended that Burbank request existing condition information on their application and use the savings numbers from DEER 2005 to calculate future savings for this Measure.

Table 7-6: Home Rewards Program’s Attic Insulation Measure savings

Total sqft Attic Insulation	Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
69,119	27,642	13.5	25,123	11.1

The Ceiling Fan Measure had a sample size of 3 customers and 4 successful phone surveys were completed. Table 7-7 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references Energy Star.

Table 7-7: Home Rewards Program’s Ceiling Fan Measure claimed savings per unit

2006 KEMA Report (Energy Star)	
Average per Ceiling Fan	
kWh	kW
180	0.017

Energy Star’s Ceiling Fan Savings Calculator was used to calculate the savings for this Measure. The location used was Pacific to obtain the typical hours of operation and the percentage of hours per speed was kept the same. All verified savings numbers in Table 7-8 are per Ceiling Fan installed.

Table 7-8: Home Rewards Program’s Ceiling Fan Measure verified savings per unit

Energy Star	
Average per Ceiling Fan	
kWh	kW
179	0.023

Table 7-9 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Ceiling Fan Measure.

Table 7-9: Home Rewards Program’s Ceiling Fan Measure savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
6,300	0.6	6,255	0.8

The Central AC Measure had a sample size of 21 customers and 21 successful phone surveys were completed. Seven of the 21 customers surveyed used Room AC units prior to installing the new AC unit and the remaining 14 customers surveyed replaced an old unit with a new unit. Table 7-10 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references DEER, for SEER 14 above vintage at a Single Family home in Climate Zone 09. These savings numbers were used for all units regardless of the SEER value, i.e. SEER 16+ units would claim the savings of a SEER 14 unit.

Table 7-10: Home Rewards Program’s Central AC Measure claimed savings per unit

2006 KEMA Report (DEER) - Single Family, CZ 09, Above Vintage, SEER 14 (11.99 EER)	
per ton	
kWh	kW
256	0.344

As it can be seen in Table 7-11, DEER 2008 for a Single Family home in Climate Zone 9 and Energy Star were used to obtain the per unit savings by SEER rating. There were two categories needed to calculate the savings for this Measure. The first is for those customers that used Room ACs and the second is for those customers that replaced a Central AC unit. All savings numbers in Table 7-11 are per cooling ton.

Table 7-11: Home Rewards Program’s Central AC Measure verified savings per unit and SEER rating

	DEER 2008 - Single Family, CZ 09 & Energy Star		DEER 2008 - Single Family, CZ 09	
	Room AC to Central AC per ton		Central AC to Central AC per ton	
	kWh	kW	kWh	kW
SEER 14	278	0.420	126	0.189
SEER 15	261	0.342	146	0.191
SEER 16	420	0.521	121	0.150
SEER 17	315	0.389	151	0.187
SEER 18	254	0.330	162	0.211
SEER 19	264	0.329	179	0.224
SEER 20	237	0.344	171	0.248
SEER 21	294	0.429	221	0.323

It is recommended that Burbank use the savings corresponding to the SEER rating of the installed unit, since they are providing the customer with a larger incentive for the higher SEER rating. One might notice the savings is less for a 16 SEER. This is due to the EER of the 16 SEER units being less than the EERs of the 14 and 15 SEER units in DEER 2008. Table 7-12 shows the overall average per unit savings based on the number of units processed during the 2008-2009 FY.

Table 7-12: Home Rewards Program’s Central AC Measure verified average savings per unit based on 2008-2009 FY applications

DEER 2008 - Single Family, CZ 09 & Energy Star		DEER 2008 - Single Family, CZ 09	
Room AC to Central AC per ton		Central AC to Central AC per ton	
kWh	kW	kWh	kW
292	0.419	128	0.185

The total tonnage was obtained from the application spreadsheet given by Burbank to calculate the total Measure savings based off the seven customers with Room AC replacement and 14 customers with Central AC replacement ratio. Table 7-13 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Central AC Measure. It is recommended that Burbank request existing equipment information on their application and use the savings numbers from DEER 2008 and Energy Star to calculate future savings for this Measure.

Table 7-13: Home Rewards Program’s Central AC Measure savings

Total Tons	Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
550	140,160	188.3	100,590	144.7

The Clothes Washer Measure had a sample size of three customers and six successful phone surveys were completed. The savings for this Measure come from heating less hot water and drying less water out of the clothes. Of the six customers surveyed, one had an electric water heater and electric dryer, two had electric water heaters and gas dryers, one had a gas water heater and electric dryer, and two had gas water heaters and gas dryers. Table 7-14 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references Energy Star. The per unit savings below assume that all residences have gas water heaters. This is a conservative way to calculate savings.

Table 7-14: Home Rewards Program’s Clothes Washer Measure claimed savings per unit

2006 KEMA Report (Energy Star) - Vintage Baseline, Gas Water Heater	
per washer	
kWh	kW
32	0.014

As it can be seen in Table 7-15, DEER 2005 for all Residential and Climate Zones was used to obtain the savings. There were four categories needed to calculate the savings for this Measure: electric water heater/electric dryer, electric water heater/gas dryer, gas water heater/electric dryer, and gas water heater/gas dryer. All savings numbers in Table 7-15 are per clothes washer.

Table 7-15: Home Rewards Program’s Clothes Washer Measure verified savings per unit

DEER 2005 - All Residential, All CZ							
Electric Water Heater / Electric Dryer		Electric Water Heater / Gas Dryer		Gas Water Heater / Electric Dryer		Gas Water Heater / Gas Dryer	
kWh	kW	kWh	kW	kWh	kW	kWh	kW
590	0.246	424	0.177	168	0.070	0	0.000

The California Statewide Residential Appliance Saturation Study (RASS) done in June 2004 was referenced to obtain more accurate water heater/clothes dryer fuel type ratios. This study surveyed 3,187 residents about their water heater and 2,596 residents about their clothes dryers. The Study concludes that 94% of California residents have gas water heaters and the remaining 6% have electric water heaters. It also concludes that 74% of California residents that have clothes dryers have gas dryers and the remaining 26% have electric dryers. Multiplying the combinations out gives 69.7% of residents have gas water heaters and gas dryers, 24.0% have gas and electric, 4.7% have electric and gas, and 1.6% have electric and electric. These ratios and the savings numbers in Table 7-15 were used to calculate the savings.

The total number of clothes washers reviewed was obtained from the application spreadsheet given by Burbank to calculate the total Measure savings based off the category ratios stated above. Table 7-16 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Clothes Washer Measure. It is recommended that Burbank either use an average number from these savings in future calculations for this Measure or they include check boxes on the application to find out which combination of water heater and dryer the customer has and claim those savings accordingly.

Table 7-16: Home Rewards Program’s Clothes Washer Measure savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
17,376	7.6	37,855	15.8

The Dishwasher Measure had a sample size of 3 customers and 3 successful phone surveys were completed. Table 7-17 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references Energy Star. The per unit savings below assume that all residences have gas water heaters. This is a conservative way to calculate savings.

Table 7-17: Home Rewards Program’s Dishwasher Measure claimed savings per unit

2006 KEMA Report (Energy Star) - Vintage Baseline, Gas Water Heater	
per washer	
kWh	kW
41	0.013

DEER 2005 for all Residential and Climate Zones was used to obtain the savings in Table 7-18. The savings numbers are based off 160 loads per year, which is about three loads per week. Two of the three customers surveyed said they run their dishwasher 3 times a week and the third said

they run it once a week. DEER 2005 does not have different savings numbers for different water heaters like Energy Star does. All savings numbers in Table 7-18 are per Dishwasher installed.

Table 7-18: Home Rewards Program’s Dishwasher Measure verified savings per unit

DEER 2005 - All Residential, All CZ	
Energy Star Dishwasher, 160 loads/year	
kWh	kW
97	0.031

The overall savings were adjusted to match customer variation in loads per week. Table 7-19 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Dishwasher Measure. It is recommended that Burbank use the DEER 2005 savings numbers in the future as it provides more savings from a widely reliable source.

Table 7-19: Home Rewards Program’s Dishwasher Measure savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
17,179	5.4	31,611	10.02

The Low-e Windows Measure had a sample size of 23 customers and 23 successful phone surveys were completed. About 21% of the total square footage of glass reviewed was from multi-family housing. Table 7-20 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references DEER, for an Above Vintage Single Family home in Climate Zone 09. The per unit savings below assume that the retrofit windows are clear and not tinted. This assumption gives a more conservative savings number as the tinted option provides more savings.

Table 7-20: Home Rewards Program’s Low-e Windows Measure claimed savings per unit

2006 KEMA Report (DEER) - Single Family CZ 09 Above Vintage	
Clear Window (per 100 sqft)	
kWh	kW
226	0.17

As it can be seen in Table 7-21, DEER 2008 for a Single Family and Multi-Family homes in Climate Zone 9 and Vintage before 1978 was used to obtain the savings. A U-Factor and SHGC of 0.40 was selected since that is the minimum requirement for this Measure. There were two categories needed to calculate the savings for this Measure. The first is for those customers that replaced windows in a single family home and the second is for those customers that replaced windows in a multi-family home. All savings numbers in Table 7-21 are per 100 sqft of glass.

Table 7-21: Home Rewards Program’s Low-e Windows Measure verified savings per unit

DEER 2005 - Single Family, CZ 09, Vintage before 1978		DEER 2005 - Multi-Family, CZ 09, Vintage before 1978	
U-Factor & SHGC 0.40 per 100 sqft glass			
kWh	kW	kWh	kW
425	0.250	157	0.202

The total sqft of glass was obtained from the application spreadsheet given by Burbank to calculate the total Measure savings based off 79% of the glass was for single family homes and 21% was for multi-family homes. Table 7-22 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Low-e Windows Measure. It is recommended that Burbank use DEER 2005 savings values by building type and vintage to calculate future savings for this Measure. It is also recommended that a Single Family and Multi-Family selection be put on the application so savings can be easily determined.

Table 7-22: Home Rewards Program’s Low-e Windows Measure savings

Total sqft Glass	Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
45,584	47,189	35.5	167,949	109.4

The Pool Pump Measure had a sample size of 3 customers and 3 successful phone surveys were completed. Table 7-23 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references DEER, for an Above Vintage Single Family home in Climate Zone 09. The claimed savings is an average of Single Speed and Two Speed savings noted in the 2006 KEMA Report.

Table 7-23: Home Rewards Program’s Pool Pump Measure claimed savings per unit

2006 KEMA Report (DEER) - Single Family Above Vintage	
Average of Single Speed and Two Speed savings	
kWh	kW
1025	0.322

DEER 2005 for all Residential and Climate Zones was used to obtain the savings. The savings numbers are based off two categories: a single speed pump to a higher efficiency single speed pump retrofit and a single speed pump to a multi-speed pump retrofit. Two of the three customers surveyed said they retrofit a single speed pump with a higher efficiency single speed pump and the third said they retrofit a single speed pump with a multi-speed pump. All savings numbers in Table 7-24 are per Pool Pump installed. These savings numbers are the same as the 2006 KEMA Report.

Table 7-24: Home Rewards Program’s Pool Pump Measure verified savings per unit

DEER 2005 - All Residential, All CZ			
Single to Single Speed		Single to Multi- Speed	
kWh	kW	kWh	kW
650	0.104	1400	0.540

The overall savings were calculated using the retrofit ratio stated above. Table 7-25 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Pool Pump Measure. The change in savings comes from the ratio of Single Speed and Two Speed being different than Burbank’s originally assumed ratio.

Table 7-25: Home Rewards Program’s Pool Pump Measure savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
34,850	10.9	30,600	8.5

The Refrigerator Measure had a sample size of 11 customers and 11 successful phone surveys were completed. Table 7-26 shows Burbank’s claimed kWh and peak kW per unit savings sourced

from the 2006 KEMA Report, which references Energy Star. These savings number are a weighted average across various retrofit options.

Table 7-26: Home Rewards Program’s Refrigerator Measure claimed savings per unit

2006 KEMA Report (Energy Star) - Above Vintage	
Average per Refrigerator	
kWh	kW
316	0.054

DEER 2008 for Single Family homes in Climate Zone 9 was used to obtain the savings. There are four styles of refrigerator (bottom mount freezer, side mount freezer with through-the-door dispenser, side mount freezer without through-the-door dispenser, and top mount freezer) and three sizes (small, medium, and large) considered in DEER 2008. The savings numbers in Table 7-27 are based off an average of the savings numbers for each unit surveyed. All savings numbers in Table 7-27 are per Refrigerator installed.

Table 7-27: Home Rewards Program’s Refrigerator Measure verified savings per unit

DEER 2008 - Single Family, CZ 09	
Average per Refrigerator from those surveyed	
kWh	kW
178	0.037

Table 7-28 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Refrigerator Measure. It is recommended that Burbank use DEER 2008 to obtain the savings for each refrigerator reviewed by style and size.

Table 7-28: Home Rewards Program’s Refrigerator Measure savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
189,916	32.5	106,710	22.2

The Room AC Measure had a sample size of 22 customers and 27 successful phone surveys were completed. Eighteen of the 27 customers surveyed said they replaced an old Room AC. The other nine said they just added a new Room AC without replacing anything. The tonnage of the 27 units surveyed varied between 0.5 and 1.5 tons and the average was one ton. Table 7-29 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references Energy Star.

Table 7-29: Home Rewards Program’s Room AC Measure claimed savings per unit

2006 KEMA Report (Energy Star) - Above Vintage	
Average per ton	
kWh	kW
185	0.000

Energy Star’s Room AC Savings Calculator was used to calculate the savings for this Measure. The location used was Los Angeles to obtain the typical hours of cooling. All savings numbers in Table 7-30 are per Room AC unit (one ton average) installed.

Table 7-30: Home Rewards Program’s Room AC Measure verified savings per unit

Energy Star	
Room AC (1 ton average)	
kWh	kW
158	0.076

Table 7-31 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Room AC Measure. This verified savings number included the nine to 18 ratio of replacing nothing to replacing an old Room AC.

Table 7-31: Home Rewards Program’s Room AC Measure savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
35,129	0.0	20,029	9.6

The Solar Attic Fan Measure had a sample size of 11 customers and installation of the Measure was verified at 11 customer’s homes. As stated in the KEMA Measure Qualification Methodology

document used by Burbank to obtain savings, “There are no savings for solar attic fans in the DEER database or in PG&E workpapers.” In further discussions with Itron Consulting & Analysis Group (DEER consultant) about why DEER has not considered Solar Attic Fans as a Measure, Itron’s Engineer said “They are not a part of any California IOU rebate program, they do not displace any electricity, and their impact on energy reduction would likely be minimal and indirect.” This was confirmed by Lincus and further studies were searched for. A case study by Parker & Sherwin⁹, states that 460 kWh was saved by installing one solar attic fan on a house in Florida. Taking the climate and building envelope and HVAC efficiency standards differences into account, the 176 kWh savings per unit stated in the KEMA Measure Qualification Methodology document seems reasonable. It is Lincus’ recommendation that further analysis be done to justify the current savings of this Measure.

The Wall Insulation Measure had a sample size of 7 customers and 7 successful phone surveys were completed. All seven customers surveyed said there was not insulation previously and the vintage of all houses was before 1978. Table 7-32 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references DEER, for a Single Family home in Climate Zone 09.

Table 7-32: Home Rewards Program’s Wall Insulation Measure claimed savings per unit

2006 KEMA Report (DEER) - Single Family CZ 09	
R-0 to R-13 (per 1000 sqft)	
kWh	kW
287	0.154

DEER 2005 was used to obtain the savings for a Single Family home in Climate Zone 9 and a vintage before 1978. All savings numbers in Table 7-33 are per 1,000 square feet of insulation. These savings numbers are the same as stated above.

⁹ Parker, D. S., & Sherwin, J. R. (2000). Performance Assessment of Photovoltaic Attic Ventilation Fans. *Florida Solar Energy Center*, May 15-17.

Table 7-33: Home Rewards Program’s Wall Insulation Measure verified savings per unit

DEER 2005 - Single Family, CZ 09, Vintage before 1978	
R-0 to R-13 (per 1000 sqft)	
kWh	kW
287	0.154

The total amount of insulation was obtained from the application spreadsheet given by Burbank to calculate the total Measure savings based off DEER 2005. Table 7-34 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Wall Insulation Measure. The savings numbers are different in this table because the number of square feet of insulation is different between the Marketing Performance Stats file and the total from the Home Rewards application list sent to Lincus. The square footage from the application list was use as the verified since it had a breakdown of for each customer. An energy efficiency platform similar on the one in Appendix A can help eliminate this problem in the future.

Table 7-34: Home Rewards Program’s Wall Insulation Measure savings

Total sqft Wall Insulation	Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
10,103	2,296	1.2	2,897	1.6

The Whole House Fan Measure had a sample size of 5 customers and 3 successful phone surveys were completed. There were only eight applications for this Measure, and the other five customers respectfully chose not to participate in the survey. All three customers surveyed said there was no other form of night ventilation previously and the vintage of all houses was before 1978. Table 7-35 shows Burbank’s claimed kWh and peak kW per unit savings sourced from the 2006 KEMA Report, which references DEER, for a Single Family home in Climate Zone 09.

Table 7-35: Home Rewards Program’s Whole House Fan Measure claimed savings per unit

2006 KEMA Report (DEER) - Single Family CZ 09	
per 1000 sqft of home	
kWh	kW
15	0.003

DEER 2005 was used to obtain the savings for a Single Family home in Climate Zone 9 and a vintage before 1978. All savings numbers in Table 7-36 are per 1,000 square feet of home.

Table 7-36: Home Rewards Program’s Whole House Fan Measure verified savings per unit

DEER 2005 - Single Family, CZ 09, Vintage before 1978	
Whole House Fan per 1,000 sqft	
kWh	kW
17	0.002

The square footages of the eight homes that applied was obtained on a common knowledge website. Table 7-37 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Whole House Fan Measure.

Table 7-37: Home Rewards Program’s Whole House Fan Measure savings

Total Home sqft.	Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
13,541	210	0.0	231	0.02

7.1.3 Made in the Shade

Over the years, many studies have been done for shade trees; each having its own take on what kind of savings a tree can offer a house. Burbank originally used a SMUD (Sacramento Municipal Utility District) study for their savings numbers. Lincus obtained a study done for SMUD by Donovan and Butry¹⁰ which did a statistical analysis of shade trees in Sacramento. This study references a few other studies, including a study by Simpson and McPherson¹¹, and states trees in both the Western and Southern direction, relative to the house, “reduced summertime electricity use by 185 kWh,” trees in the Eastern direction don’t save any energy, because the shade from the tree is on the house during the morning hours when the cooling system isn’t in operation for residential customers and the sun’s rays are relatively weak, and trees in the Northern direction result in an increase of energy due to the tree blocking cooling effects of wind, blocking radiation heat transfer to space at night which cools the house, and other unknown methods. Although this

¹⁰ Donovan, G. H., & Butry, D. T. (2009). The Value of Shade: Estimating the effect of urban trees on summertime electricity use. *Energy and Buildings*, 662-668

¹¹ Simpson, J. R., & McPherson, E. G. (1996). Potential of Tree Shade of Reducing Residential Energy Use in California. *Journal of Arboriculture*, 10-18

study seems extensive in its descriptions and methodologies, in the statistical analysis, however, they had an R-Squared value of .656, which isn't very statistically impressive. It could also be unwise to use the savings numbers from Sacramento (Climate Zone 12) for Burbank (Climate Zone 9).

The Simpson and McPherson study uses a Shadow Pattern Simulator program that simulates two trees in the Western direction and one in the Eastern direction. It also runs the simulation for most of the Climate Zones in California. For Burbank (Climate Zone 9), the annual kWh savings is 403 and the peak kW savings is 0.49. Using the methodologies from the Donovan and Butry study, the savings from the Simpson and McPherson study turn into 201.5 kWh and .245 peak kW per tree planted in the Western or Southern direction, since the tree planted in the Eastern direction does not reduce energy consumption. It is more difficult to come up with the energy increase from trees planted in the Northern direction and they will be treated the same as trees planted in the Eastern direction.

In further discussions with Itron Consulting & Analysis Group (DEER consultant) about why DEER has not considered shade trees as a Measure, Irton's Engineer said "This measure is not included because DEER is focused on equipment/technology based measures. However, I think the savings from such programs are also very hard to verify/quantify, and I also believe that most California IOUs have discontinued their shade tree programs."

Table 7-38 gives the above stated savings numbers per tree in each direction and the percentage of trees planted in each direction. The percentage was based off the arborist maps given to each customer so the customer knows where to plant the tree when they receive it. The arborist used his best judgment at the time of the site survey in selecting the best tree locations to maximize the shade potential. The installation of the trees, based off the arborist maps, was verified by site visits to the sample size stated in Section 5.1.

Table 7-38: Made in the Shade savings per unit and percentage of trees in each direction

Study Findings kWh Saved per Tree			
201.5	201.5	0.0	0.0
Study Findings Peak kW Saved per Tree			
0.245	0.245	0.0	0.0
Percentage of Trees Planted			
West	South	East	North
57.7%	5.6%	26.7%	9.8%

There were 311, 30, 144, and 53 trees planted in the Western, Southern, Eastern, and Northern direction, respectively, using the above ratios. Table 7-39 shows Burbank's claimed (ex-ante) savings and Lincus' verified (ex-post) savings for the Residential Made in the Shade Program.

Table 7-39 Made in the Shade Program savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
225,914	31.2	68,712	83.5

7.2 Non-Residential Program Impact Evaluation

As stated in Section 5, the Non-Residential Impact Evaluation includes one Program: Energy Solutions.

7.2.1 Energy Solutions

This Program consisted of four Measure categories during the 2008-2009 FY: Lighting, HVAC, EMS, and VFD. All applications from the 2008-2009 FY were sent to Lincus for random selection and review.

For the Lighting category, all the applications were thoroughly reviewed and randomly selected based off the kWh savings and technology of the retrofit. Installation of the retrofit fixtures was verified with a site visit. There were some fixtures in a couple buildings that did not seem to be installed. In this case, those fixtures were not considered in the savings calculations. Not considering them in the verified savings while keeping them in the claimed savings results in the loss of savings necessary. While doing the site visit, the typical hours of operation of each fixture was obtained from the site staff.

The specification sheets of the fixtures were obtained online and the input wattages were used as the fixture wattages. This was one of the factors in the difference in savings numbers. A lot of the calculations done in the applications used the sum of the nominal wattage of the lamps as the wattage of the fixtures regardless of the ballast (Example: a 2-lamp fixture with F32T8 lamps is 64 Watts). This is an incorrect way of calculating savings of a fixture with a ballast. Ballasts have a Ballast Factor (BF) and Power Factor (PF) that change the input wattage of the fixture from the nominal wattage of the lamps. A typical 2-lamp fixture with F32T8 lamps and a normal-BF ballast, has an input wattage of about 58 Watts. Knowing this, the savings would be greater if the initial calculations used the nominal wattage of the lamps as the fixture wattage. A few applications had this problem, so the savings increased for these. It is recommended that lamp and ballast specifications sheets (pre and post) be required for processing applications. This will help verify the savings in the, also recommended, TRC calculations.

Another factor in the difference of savings numbers is 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 Burbank use this in their future analysis, along with the spec sheets and TRC calculations. Table 7-40 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Energy Solutions Program’s Lighting category.

Table 7-40: Energy Solutions Program’s Lighting Category savings

Claimed Gross kWh Savings	Claimed Gross peak kW Savings	Verified Gross kWh Savings	Verified Gross peak kW Savings
1,951,995	439.4	2,533,350	433.4

For the HVAC category, the applications were reviewed and it was determined that all the applications followed the Program guidelines except one. One of the applications used engineering calculation to calculate the incentive from the savings numbers as opposed to following the prescriptive (a set dollar amount per unit installed) incentive payment structure. Through consulting with Burbank, this happened due to a misinterpretation of the guidelines. It is Lincus’ recommendation to not include this application in the savings because the units installed do not qualify for the incentive, based off the guidelines for that FY. All other applications were selected for savings verification.

Since the HVAC category is a prescriptive Measure, it was decided to verify the savings using DEER savings based on the installed unit. Installation of the units was verified with a site visit. The model numbers of the units were compared to the model numbers on the applications and invoices. All model numbers seemed to match. 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 2005 and DEER 2008 were used to gather the kWh and peak kW savings per ton in Climate Zone 9 for the various building types noted in the site visit. A simple spreadsheet calculation was done to verify the savings. Table 7-41 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Energy Solutions Program’s HVAC category.

Table 7-41: Energy Solutions Program’s HVAC Category savings

Claimed Gross kWh Savings	Claimed Gross Peak kW Savings	Verified Gross kWh Savings	Verified Gross Peak kW Savings
40,578	22.1	35,604	20.1

It is recommended that Burbank 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.

For the EMS category, all applications were reviewed and it was discovered that one of the three applications made up more than 88% of the total kWh savings for this Measure. It was then determined that application would be verified and the GRR from that application would be applied to the other two applications. This application used an eQuest simulation model to determine the

savings. The savings for the two smaller applications came from a 10-15% of the total usage ratio. It is recommended that Burbank perform a bin weather data calculation to determine the savings of EMS Measure applications, unless energy simulation modeling, such as eQuest modeling, is available. A TRC calculation can also be integrated into this bin weather data calculator. It is also recommended that all EMS applications not be paid until all work has been completed and a commissioning of the equipment involved in the EMS has been done.

The eQuest model for the larger application was matched to the total billing of the previous year within 4%. There were four Measures implemented into the model: VFDs, Temperature Setback, Outside Air Economizers, and Warm up/Cool down. There was a fifth done in a spreadsheet calculation. All four Measures in the model were executed properly and make sense, except for the Warm up/Cool down Measure. This Measure seemed to overwrite the Temperature Setback Measure and became negative savings when the model simulation was run. This Measure was removed from the model simulation since it conflicted with another Measure. The only other problem with the model was each individual Measure was ran against the Baseline, so interactive effects were not taken into account. Lincus reran the model making the Measure run against each other to get a savings number that included interactive effects. The fifth Measure that was done in a spreadsheet calculation was done correctly and the savings were added to the model savings numbers. Table 7-42 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Energy Solutions Program’s VFD category.

Table 7-42: Energy Solutions Program’s EMS Category savings

Claimed Gross kWh Savings	Claimed Gross Peak kW Savings	Verified Gross kWh Savings	Verified Gross Peak kW Savings
816,643	230.0	611,307	164.3

For the VFD category, there were two applications during the 2008-2009 FY. One was for ventilation fans of milling machines and the other was for a cooling tower fan. The VFD on the ventilation fan was a project that included a new motor and a low building power factor increasing. However, these Measures ranged over different years and, in agreement with BWP, since savings numbers for each FY would not be properly distributed, it was determined that the GRR from the VFD on cooling tower would be applied to this application as well.

The cooling tower fans site would not allow Lincus to visit the site to perform data measurements, as stated in Section 6.1. As discussed and agreed upon with Burbank, a spreadsheet calculation would be done to calculate the savings for this application. TMY2 data and affinity laws were used to determine the savings. The number of hours the wet bulb temperature is within certain ranges was taken from TMY2 data and those hours were applied to kW consumption of the fan motors at the corresponding frequencies output by the VFD. Table 7-43 shows Burbank’s claimed (ex-ante) savings and Lincus’ verified (ex-post) savings for the Energy Solutions Program’s VFD category.

Table 7-43: Energy Solutions Program's VFD Category savings

Claimed Gross kWh Savings	Claimed Gross Peak kW Savings	Verified Gross kWh Savings	Verified Gross Peak kW Savings
200,585	48.8	167,764	0.0

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
Refrigerator Round-Up	1,086,888	571,175	52.6%
Home Rewards	345,830	571,564	165.3%
Attic Insulation	27,642	25,123	90.9%
Ceiling fan	6,300	6,255	99.3%
Central a/c	140,160	100,590	71.8%
Clothes Washers	17,376	37,855	217.9%
Dishwashers	17,179	31,611	184.0%
Low-E Windows/doors	47,189	167,949	355.9%
Pool pumps	34,850	30,600	87.8%
Refrigerators	189,916	106,710	56.2%
Room a/c	35,129	20,029	57.0%
Solar Fan	41,712	41,712	100.0%
Wall Insulation	2,296	2,897	126.2%
Whole House Fan	210	231	110.0%
Residential Made in the Shade	225,914	38,487	17.0%
Energy Solutions	3,009,801	3,348,024	111.2%
Lighting	1,951,995	2,533,350	129.8%
HVAC	40,578	35,604	87.7%
EMS	816,643	611,307	74.9%
VFD	200,585	167,764	83.6%
Totals	4,668,433	4,529,249	97.0%

It should be noted that the sum of the Home Rewards measures' claimed savings in Tables 8-1 and 8-2 is not equal to the total claimed savings from the E3. This is due to a mix up between files. Also, the sum of the Energy Solutions measures' claimed savings is not equal to the total claimed

savings from the E3. This is due to the E3 including RCM services savings, which was not considered in this M&V Study. 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
Refrigerator Round-Up	168.6	118.1	70.0%
Home Rewards	162.0	335.5	207.1%
Attic Insulation	13.5	11.1	82.6%
Ceiling fan	0.6	0.8	136.5%
Central a/c	188.3	144.7	76.8%
Clothes Washers	7.6	15.8	207.6%
Dishwashers	5.4	10.0	184.0%
Low-E Windows/doors	35.5	109.4	308.2%
Pool pumps	10.9	8.5	77.4%
Refrigerators	32.5	22.2	68.3%
Room a/c	0.0	9.6	∞
Solar Fan	1.9	1.9	100.0%
Wall Insulation	1.2	1.6	126.3%
Whole House Fan	0.0	0.0	48.8%
Residential Made in the Shade	31.2	46.8	150.0%
Energy Solutions	740.2	617.8	83.5%
Lighting	439.4	433.4	98.6%
HVAC	22.1	20.1	91.2%
EMS	230.0	164.3	71.4%
VFD	48.8	0.0	0.0%
Totals	1,102.0	1,118.1	101.5%

9 Conclusion and Recommendations

Overall, Burbank Water and Power'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 over-calculated and some areas could use some changes to better the processing of applications and provide more accurate savings calculations.

The Refrigerator Round-Up Program's kWh and kW savings decreased by 47.4% and 30.0%, respectively, overall. This decrease came from phone surveys discovering customers were replacing the recycled refrigerators with new refrigerators. Previously, the assumption was the customers did not replace the old unit with a new unit, and the savings was the full energy consumption of the old unit. Since customers are replacing the old units with new units, the savings, in this case, is the difference between the consumption of the old unit minus the consumption of the new unit, which is about 40% lower savings. Since about 64% of the Customers replaced the old units with new units, about 64% of the units recycled received the lower savings amount obtained from DEER 2008. The other 36% received the higher savings amount. It is recommended that Burbank either continue to use this ratio of 64% replacement going forward, or perform surveys throughout the FY to verify the percentage of replacements.

The Home Rewards Program's kWh and kW savings increased by 65.3% and 107.1%, respectively, overall. There are twelve Measures in this Program. Most of the Measures have a verified savings relatively close to the claimed savings. The minor difference between the savings is most likely due to the newest version on DEER (2008) that was used to verify the savings. A Measure that had a relatively large change in savings was Clothes Washers. That change was most likely due to the difference between the Energy Star website savings and the latest DEER savings. It is recommended that Burbank use the new verified per unit savings numbers, obtained from DEER 2005, DEER 2008, and Energy Star, in the future. It is also recommended that Burbank implement a new Energy Efficiency Program Integration Platform that can 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 Made in the Shade Program's kWh savings decreased by 83.0% and kW savings increased by 50.0% overall. This change in savings came from two studies done on shade trees. The first was a case study done for SMUD (Burbank's savings reference) which did a statistical analysis and the other was a study by two experienced shade tree studiers that did a computer simulation model. Based off the two studies, it was determined that Burbank should only claim savings off of trees planted in the Western and Southern direction, relative to the house. It is recommended that the arborist that consults with the customers only recommend the trees be planted in the Western and Southern directions and Burbank verify the installation of the shade trees after the trees have been delivered.

The Energy Solutions Program's kWh increased by 11.2% and kW savings decreased by 16.5% overall. There were four Measures for this Program during the 2008-2009 FY. The lighting Measure savings increased due to using spec sheets to obtain fixture input wattage, as opposed to

using the nominal wattage of the lamps, adding HVAC interactive savings, and verifying the hours of operation. The HVAC Measure decreased due to using the tons calculated by cooling capacity versus using the nominal tonnage and obtaining the savings based off building type from DEER 2005 and DEER 2008. The EMS Measure decreased due to a Measure of the eQuest model conflicting with another Measure and resulting in negative savings. The VFD Measure decreased due to TMY2 weather data calculation being less than the calculations from the application. It is recommended that Burbank perform TRC calculations, using BWP's Avoided Cost factors, for custom Measures to ensure the retrofit is worth the investment, DEER 2005 and DEER 2008 used for prescriptive Measure calculations, all savings calculations use Title-24 as the baseline, and a new Energy Efficiency Program Integration Platform be used that can 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)
Refrigerator Round-Up	571,175	80%	\$193,440.77	\$0.423
Home Rewards - Total	571,564	80%	\$417,345.77	\$0.913
Attic Insulation	25,123	80%	\$3,161.34	\$0.157
Ceiling fan	6,255	80%	\$860.34	\$0.172
Central a/c	100,590	80%	\$59,596.32	\$0.741
Clothes Washers	37,855	80%	\$73,751.40	\$2.435
Dishwashers	31,611	80%	\$33,445.15	\$1.323
Low-E Windows/doors	167,949	80%	\$77,093.57	\$0.574
Pool pumps	30,600	80%	\$2,272.60	\$0.093
Refrigerators	106,710	80%	\$100,465.31	\$1.177
Room a/c	20,029	80%	\$12,309.94	\$0.768
Solar Fan	41,712	80%	\$52,328.54	\$1.568
Wall Insulation	2,897	80%	\$1,411.95	\$0.609
Whole House Fan	231	80%	\$649.32	\$3.513
Residential Made in the Shade	38,487	80%	\$54,978.41	\$1.786
Energy Solutions - Total	3,348,024	95%	\$656,835.75	\$0.207
Lighting	2,533,350	95%	\$346,474.48	\$0.144
HVAC	35,604	95%	\$33,883.21	\$1.002
EMS	611,307	95%	\$212,167.85	\$0.365
VFD	167,764	95%	\$64,310.22	\$0.404
Totals	4,529,249	91.1%	\$1,322,600.70	\$0.321

Figure 9-1 shows Levelized Cost of each Measure compared to the average of the four Programs verified, about \$0.32 per net kWh. This gives an idea of how much each Measure costs to incentivize relative to the savings Burbank obtains. Because the levelized cost is so high, the Whole House Fans 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

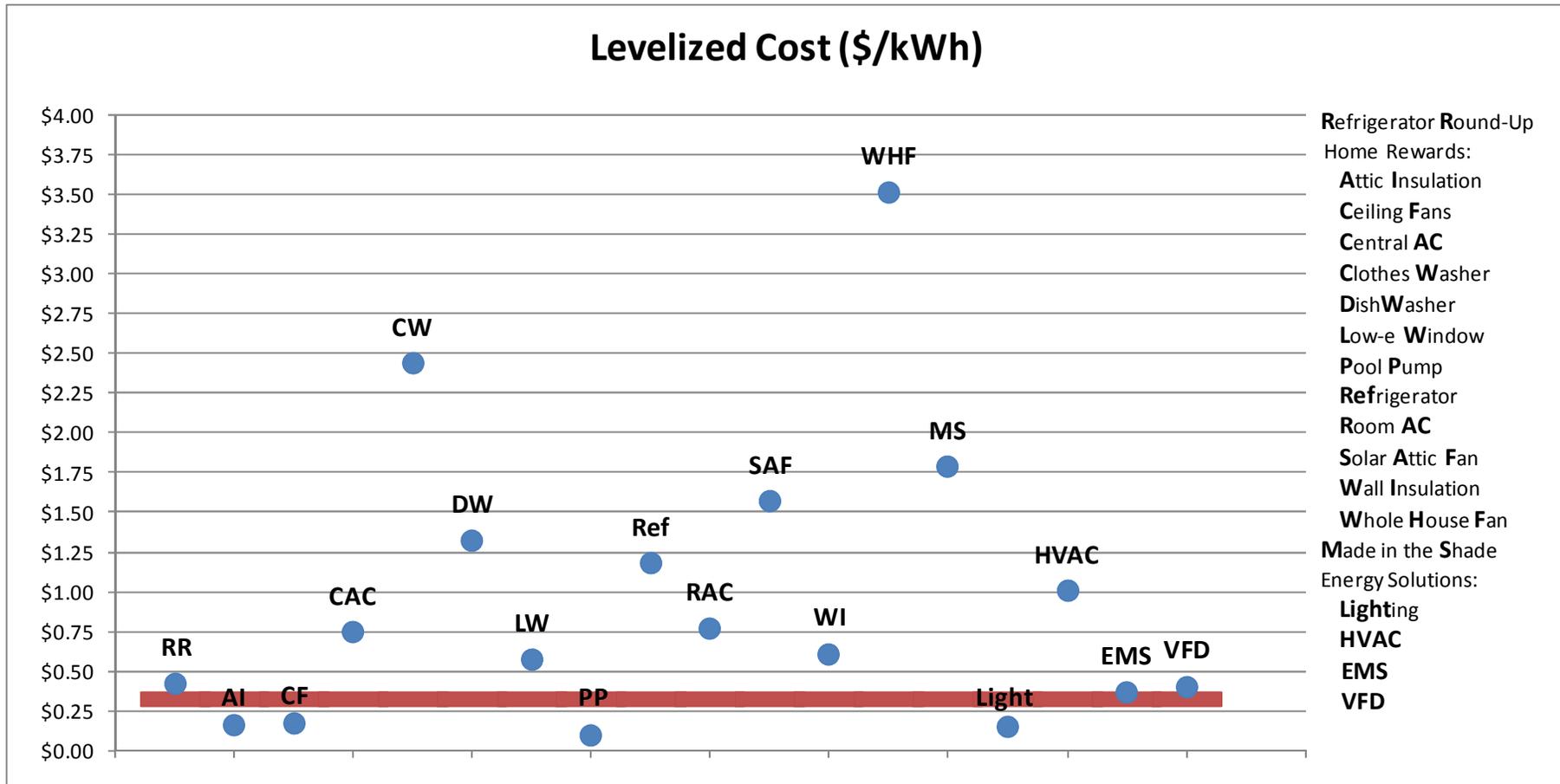
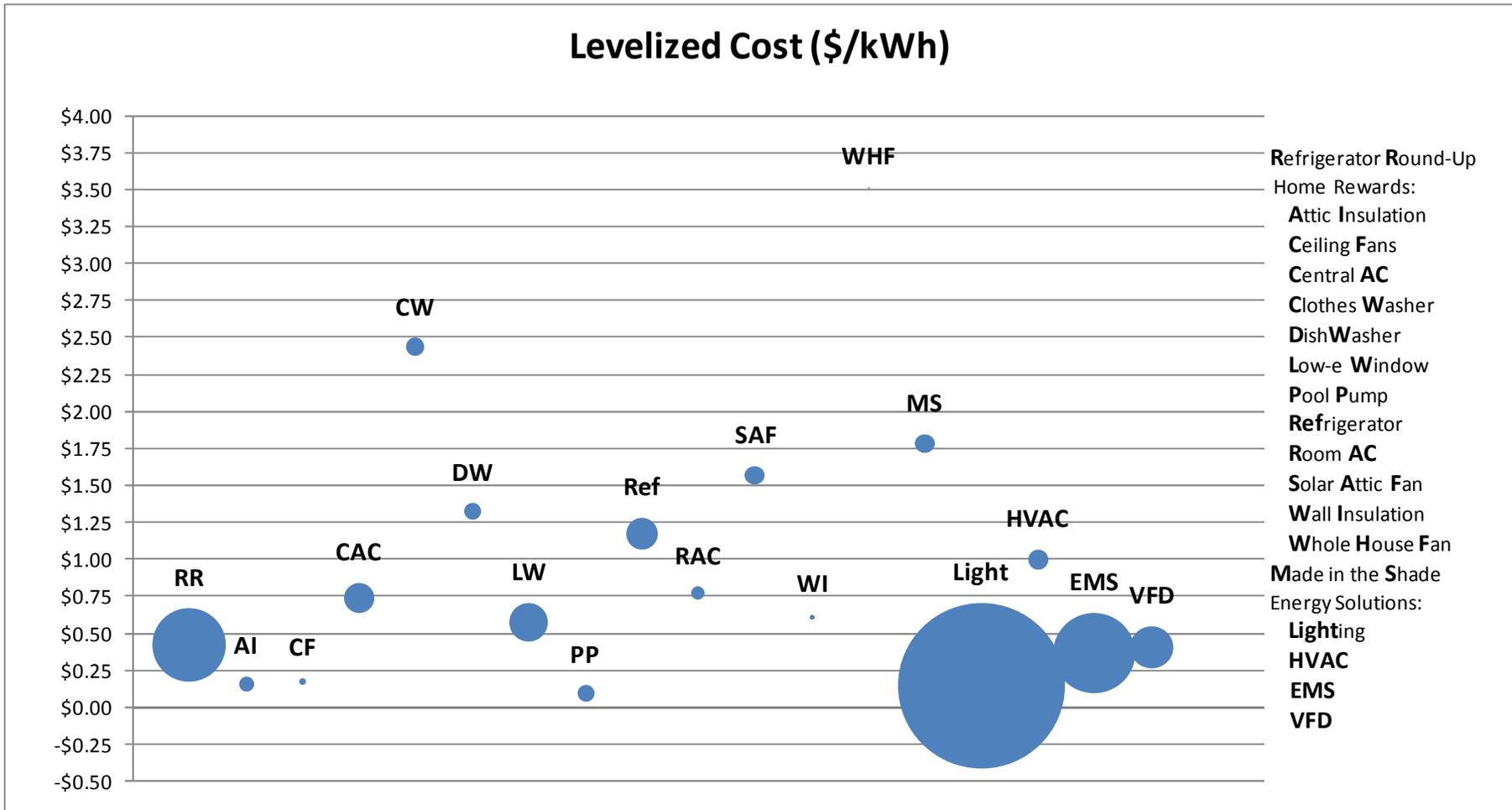


Figure 9-2 bubble graph that shows the same data from Figure 9-1, but also shows how much energy savings each Measure offers by the size of the bubble. As it can be seen, the Whole House Fan Measure has a very high Levelized cost relative to the other Measure and offers very little energy savings. It would be in Burbank's best interest to consider lowering the incentive for this Measure or removing it from the Home Rewards Program completely. Removing the Measure completely would not necessarily be missed by Customers, since only seven Customers applied for the rebate during the 2008-2009 FY.

The second highest Levelized Cost is the Home Rewards Clothes Washer. This is due to the RASS saying that most customers have gas water heaters and dryers. This lowers the electrical savings immensely. The only suggestion for lowering the Levelized Cost is to lower the incentive. The next highest Levelized Cost is the Made in the Shade Program. This Program could be difficult to vary to achieve a better Levelized Cost since Burbank can not lower the price they pay the arborist for consulting the customers and trees.

The fourth highest Levelized Cost is the Solar Attic Fan Measure. Upon review of other California Utilities, it was discovered that Burbank has one of the highest incentive amounts offered for Solar Attic Fans. To achieve a lower Levelized Cost, it is recommended that Burbank lower the incentive amount to between \$100 and \$125 to be competitive with neighboring Utilities. The Refrigerators from the Home Rewards Program offer more savings than the Solar Attic Fans but the Cost is still relatively high. A lowered incentive would bring the Levelized cost down and still be a good bonus for customers. The Energy Solutions Lighting and EMS Measures and Refrigerator Round-Up Program are the bigger programs and are all under the four Program average. These are the Measures that are recommended Burbank 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 BWP 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 BWP 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

Appendix B – Customer Surveys

I. Home Rewards Program

INTRO: Hello, my name is _____ and I'm calling on behalf of Burbank Water and Power. How are you tonight? We are performing a quick survey of your household's participation in BWP's Home Rewards Program. I assure you this is not a sales attempt. I am just gathering data to give back to BWP. According to our records, your household has purchased and received a rebate from BWP for [*PROGRAM MEASURE*]. Is this correct?

Did you participate in the decision to purchase this item or did someone else in the household do so?

If they did: (Continue below)

If someone else: May I speak with that person please? (Repeat INTRO and continue below)

May I ask for a couple minutes of your time to answer [*TWO TO SIX*] quick survey questions?

If yes: Thank you! (Continue with questions)

If no: Thank you for your time. (Call next person on list)

QUESTIONS BY MEASURE:

Attic Insulation:

1. Was there insulation in the attic previously?
 - a. Yes
 - b. No
2. What was the R-Value of the previous insulation?
3. If not sure, what is the vintage of the house?
4. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Ceiling Fans:

1. Was the fan installed?
 - a. Yes
 - b. No
2. Did the new fan replace an old fan?
 - a. Yes
 - b. No
3. About how many hours a day does it operate?

4. At what speed does the fan mostly operate?
 - a. Low
 - b. Medium
 - c. High
5. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Central Air Conditioners:

1. How old was the replaced unit?
2. Was the replaced unit the same size (tonnage) as the new unit?
 - a. Yes
 - b. No
3. If not, how big was the replaced unit?
4. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Clothes Washer:

1. Did the new unit replace an old unit?
 - a. Yes
 - b. No
2. Do you have a gas or electric water heater?
 - a. Gas
 - b. Electric
3. Do you have a gas or electric dryer?
 - a. Gas
 - b. Electric
4. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Dish Washer:

1. Did the new unit replace an old unit?
 - a. Yes
 - b. No
2. How many cycles a week is the unit ran?
3. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Low-E Windows:

1. Did these windows replace old windows?
 - a. Yes
 - b. No
2. If yes, were the old windows single paned or double paned?
 - a. Single
 - b. Double

3. If yes, did the old windows have tinting?
 - a. Yes
 - b. No
4. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Pool Pumps:

1. Did the new pump replace a single speed pump?
 - a. Yes
 - b. No
2. Is the new pump a two-speed or variable-speed pumps?
 - a. Two-Speed
 - b. Variable Speed
3. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Refrigerator:

1. Is the freezer on the new unit above, below, or to the side?
 - a. Above
 - b. Below
 - c. Side
2. If side, is there a through-the-door ice dispenser?
 - a. Yes
 - b. No
3. What size (cubic feet) was the old refrigerator?
4. If not sure, what is size of new unit?
5. Was old unit bigger or smaller?
 - a. Bigger
 - b. Smaller
6. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Room Air Conditioners:

1. Did the new unit replace an old unit?
 - a. Yes
 - b. No
2. How old was the replaced unit?
3. Was the replaced unit the same size (tonnage) as the new unit?
 - a. Yes
 - b. No
4. If not, how big was the replaced unit?
5. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Solar Attic Fan:

1. Did the solar attic fan replace an old attic fan?
 - a. Yes
 - b. No
2. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Wall Insulation:

1. Was there insulation in the wall previously?
 - a. Yes
 - b. No
2. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Whole House Fan:

1. Was there night ventilation or an economizer before?
 - a. Yes
 - b. No
2. Would you have made this purchase if BWP wasn't supplying a rebate?
 - a. Yes
 - b. No

Exodus: That concludes our survey. I would like to thank you for your time and I hope you continue to participate in Burbank Water and Power's Residential Energy Efficiency Programs.

II. Refrigerator Round-Up

INTRO: Hello, my name is _____ and I'm calling on behalf of Burbank Water and Power. How are you tonight? We are performing a quick survey of your household's participation in BWP's Refrigerator Round-Up Program. I assure you this is not a sales attempt. I am just gathering data to give back to BWP. According to our records, your household has recycled a second refrigerator. Is this correct?

Did you participate in the process of recycling the refrigerator or did someone else in the household do so?

If they did: (Continue below)

If someone else: May I speak with that person please? (Repeat INTRO and continue below)

May I ask for a couple minutes of your time to answer six quick survey questions?

If yes: Thank you! (Continue with questions)

If no: Thank you for your time. (Call next person on list)

QUESTIONS:

1. The old refrigerator was removed and you received your free CFLs?
 - a. Yes
 - b. No
2. Did a new unit replace the old unit?
 - a. Yes
 - b. No
3. Were the CFLs installed?
 - a. Yes
 - b. No
4. What kind of lamps did the CFLs replace?
5. Where were the CFLs installed?
6. Would you have considered recycling your secondary refrigerator if BWP wasn't providing you with an incentive?
 - a. Yes
 - b. No

Exodus: That concludes our survey. I would like to thank you for your time and I hope you continue to participate in Burbank Water and Power's Residential Energy Efficiency Programs in the future.

Appendix C – Customer Survey Results

I. Home Rewards Program

Attic Insulation:

	Yes	No
1. Was there insulation in the attic previously?	10	7
2. What was the R-Value of the previous insulation?	(3) R-11, (2) R-8, (1) R-10, (1) R-13, (3) unsure	
3. If not sure, what is the vintage of the house?	(2) 1955, (1) 1920s	
4. Would you have made this purchase if BWP wasn't supplying a rebate?	14	3

Ceiling Fans:

	Yes	No
1. Was the fan installed?	4	0
2. Did the new fan replace an old fan?	1	3
3. About how many hours a day does it operate?	Varies	
4. At what speed does the fan mostly operate?	(3) Medium, (1) Low	
5. Would you have made this purchase if BWP wasn't supplying a rebate?	2	2

Central Air Conditioners:

	Yes	No
1. How old was the replaced unit?	10-30 Years	
2. Was the replaced unit the same size (tonnage) as the new unit?	9	12
3. If not, how big was the replaced unit?	1-2 tons smaller	
4. Would you have made this purchase if BWP wasn't supplying a rebate?	18	4

Clothes Washers:

	Yes	No
1. Did the new unit replace an old unit?	5	1
2. Do you have a gas or electric water heater?	(3) Electric, (3) Gas	
3. Do you have a gas or electric dryer?	(4) Gas, (2) Electric	
4. Would you have made this purchase if BWP wasn't supplying a rebate?	4	2

Dishwashers:

	Yes	No
1. Did the new unit replace an old unit?	0	3
2. How many times a week is the unit ran?	(2) three, (1) one	
3. Would you have made this purchase if BWP wasn't supplying a rebate?	2	1

Low-e Windows:

	Yes	No
1. Did these windows replace old windows?	23	0
2. If yes, were the old windows single pane or double pane?	All Single	
3. If yes, did the old windows have tinting?	(21) No (2) Yes	
4. Would you have made this purchase if BWP wasn't supplying a rebate?	20	2

Pool Pumps:

	Yes	No
1. Did the new pump replace a single speed pump?	3	0
2. Is the new pump a single speed or multi-speed pumps?	(2) Single, (1) Multi	
3. Would you have made this purchase if BWP wasn't supplying a rebate?	3	0

Refrigerator:

	Yes	No
1. Is the freezer on the new unit above, below, or to the side?	(4) Side by Side, (5) Top. (2) Bottom	
2. If side, is there a through-the-door ice dispenser?	4	0
3. What size (cubic feet) was the old refrigerator?	Varies	
4. If not sure, what is size of new unit or model number?	Varies	
5. Was old unit bigger or smaller?	Varies	
6. Would you have made this purchase if BWP wasn't supplying a rebate?	6	5

Room Air Conditioners:

	Yes	No
1. Did the new unit replace an old unit?	18	9
2. How old was the replaced unit?	10-30 years	
3. Was the replaced unit the same size (tonnage) as the new unit?	(8) Smaller, (1) Larger, (9) Same	
4. If not, how big was the replaced unit?	.5-1.5 ton	
5. Would you have made this purchase if BWP wasn't supplying a rebate?	23	4

Solar Attic Fans:

	Yes	No
1. Did the solar attic fan replace an old attic fan?	3	14
2. Would you have made this purchase if BWP wasn't supplying a rebate?	10	7

Wall Insulation:

	Yes	No
1. Was there insulation in the wall previously?	0	7
2. What is the vintage of the house?	All before 1978	
3. Would you have made this purchase if BWP wasn't supplying a rebate?	7	0

Whole House Fans:

	Yes	No
1. Was there night ventilation or an economizer before?	1	2
2. What is the vintage of the house?	All before 1978	
3. Would you have made this purchase if BWP wasn't supplying a rebate?	2	1

II. Refrigerator Round-Up

	Yes	No
1. Refrigerator was recycled & received CFLS?	11	0
2. New unit replaced old?	7	4
3. Were CFLs installed?	10	1
4. What did CFL replace?	Incandescent	
5. Where were CFLs installed?	Throughout house	
6. Would you have considered recycling your secondary refrigerator if BWP wasn't providing you with an incentive to do so?	5	5