EVALUATION, MEASUREMENT, AND VERIFICATION

CITY OF BERKELEY – CA YOUTH ENERGY SERVICES

PROGRAM NUMBER 1462-04

FINAL REPORT

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ABSTRACT

This report presents results of an Evaluation, Measurement, and Verification (EM&V) Study conducted on the Berkeley California Youth Energy Services Program. The program provides education and audit services to residential customers in Berkeley and Oakland, and low-cost hardware installation services. This evaluation covered program years 2004 and 2005. The report provides evaluations of the process and impact of the program and includes both participant and program representative views on the program and relevant market issues. Also included in the report is a discussion of the program gross and adjusted energy savings, estimates of the net-to-gross (NTG) ratio, and the resultant program net savings. Conclusions and recommendations on how to improve the effectiveness of the program in the future so as to improve its replicable nature are included in the report. Some of the tools used to conduct this study included savings estimates from the California DEER database, other secondary literature regarding savings estimates on various program measures, telephone surveys of participants and program representatives, and on-site inspections.

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1. INTRODUCTION

1.1 Background

The California Youth Energy Services (CYES) program is implemented by the non-profit Rising Sun Energy Center located in Berkeley, California. The goal of the program is to provide education and audit services to residential customers in Berkeley and Oakland, and low-cost or no-cost hardware installation services for select electricity and gas energy efficiency measures. Since 2000, CYES has trained and employed over 70 youth participants who have educated residents and installed energy and water conservation equipment in over 700 homes. CYES also holds a commitment to provide meaningful job skills and youth development programs that provide valuable services to residents. The intent of these measures has been to promote a greater interest in the services provided by the youth that is not based solely on people's interest in conserving energy. Instead, the measures expect to utilize the community's motivation in supporting programs that help their youth to further energy conservation.

1.2 Project Objectives

The overall Evaluation, Measurement, and Verification (EM&V) objectives of this project are to:

- Determine level of energy and peak demand savings achieved (direct installation component only).
- Measure cost-effectiveness (direct installation component only).
- Provide up-front market assessments and baseline analysis.
- Provide ongoing feedback and corrective and constructive guidance regarding the implementation of programs.
- Measure indicators of the program's effectiveness, including testing the assumptions that underline the program theory and approach.
- Assess the overall levels of performance and success of the program.
- Inform decisions regarding compensation and final payments.
- Help to assess whether there is a continuing need for the program.

1.3 Report Format

This report is organized in the following manner:

Section 2 provides an overview of the CYES Program, including a discussion of the program's objectives and installed unit descriptions.

Section 3 discusses evaluation methodology, including primary and secondary data collection activities.

Section 4 presents the process and impact evaluation results.

Section 5 discusses the attribution analysis and the energy and demand savings resulting from the CYES Program.

Section 6 presents conclusions and recommendations derived from the evaluation findings.

2. PROGRAM OVERVIEW

2.1 Program Description

The California Youth Energy Services (CYES) is a program of the non-profit Rising Sun Energy Center. It provides low-cost hardware installation services to targeted households as an incentive towards receiving education and audit services. In PY2004/PY2005, CYES trained youth (ages 16 to 21) to conduct home energy audits, disseminate energy efficiency and conservation information to households, and install basic energy efficiency hardware. The program targeted lower and moderate income households whose incomes exceed the eligibility thresholds for Low-Income Energy Efficiency (LIEE), Low-Income Home Energy Assistance (LIHEAP), and Department of Energy (DOE) Weatherization Services. The energy audits were used to identify opportunities for improvements in household energy efficiency. The energy audits were used to identify opportunities for improvements in household energy efficiency. The audit process also provided opportunities to discuss leave behind informational materials on local, statewide, and PG&E information on rebates or services. Direct install services include hot water, heating, and lighting measures.

2.1.1 Program Objectives

The program stipulated three objectives in order of importance:

- Primary Objective: To provide hard-to-reach households with energy education services, energy audits, basic energy efficiency measures, and hardware. This goal was addressed through:
    - Information Dissemination and Energy Education: CYES planned to conduct residential site visits at 2000 single-family, detached, duplex, triplex, and fourplex buildings. Representatives were responsible for helping occupants understand how their homes use energy in a way that was easy to understand. Moreover, unique energy-saving opportunities were identified through the use of media and promotional material provided by 3rd party sources, such as EBMUD[1] and PG&E. Overall, over 2,000 residential sites were visited.

    - Providing Energy Audits: The program had originally anticipated partnering with Lawrence Berkeley Lab in developing its *Home Energy Saver* audit survey (already developed as a website: www.homeenergysaver.lbl.gov) to provide households with customized energy usage analysis and energy-saving recommendations. Of the 2000 homes to receive information dissemination and education, approximately 500 households were to receive a comprehensive home energy audit survey that was to provide the household with customized energy usage analysis and energy-saving recommendations. Instead, over 1000 audits were completed and measures were installed at over 2000 households.

[1] East Bay Municipal Utility District

- Direct Low Cost Measure Installation: 2127 total households were provided with free materials and installation services. Measures included compact fluorescent lamps, water saving devices, and water heater temperature reduction. Water pipe insulation, clothesline installations, and programmable thermostats were installed at material cost.

- Secondary Objective: Training Youth on Energy Efficiency. This goal was accomplished through the employment of high school, community college, and trade school students to install measures and supervise installations. Participants received quality energy conservation education and technical training through PG&E and CYES while developing viable soft and hard job skills that to help them gain entry to careers in energy efficiency. Furthermore, the participants developed skills including: basic repair, home weatherization skills, teamwork, project planning, conflict mediation, and community organizing and outreach. CYES also made a significant effort to seek partners in related fields that could provide employment or internships to youth after the term of their contract with the CYES program.

- Tertiary Objective: Develop a Replicable Model. The purpose of this objective was to ensure that the CYES project may be easily expanded to other communities given that the program design and logic are successful. In order to accomplish this objective, Summit Blue collected data to validate the function of the program and metrics developed to refine the costs and likely success of expanding the program through a standardized template approach.

However, the primary goal of the project was to achieve a high penetration of energy-efficient equipment installations and to maximize the amount of cost-effective energy savings achieved for each "hard-to-reach" participant. As a result, the key measures of success are the number of installations achieved and the associated energy savings. Each of the program objectives and their corresponding tasks and results will be discussed in greater detail throughout the report.

2.2 Installed Unit Descriptions

Participant homes that requested materials installation received materials free of charge. All materials were installed on site by CYES auditors to ensure proper use. Materials installation consisted of the following:

- *Compact Fluorescent Lamps:* Homes requesting retrofits received up to six compact fluorescent lamps under the program.

- *Shower-heads:* Homes received up to two low-flow shower heads (2.5 gpm).

- *Faucet Aerators:* Homes received up to two low-flow kitchen or bathroom sink faucet aerators (1.5 gpm).

At-Cost Services

CYES also provided three extended services at materials cost for residents. They included:

- *Programmable Thermostats:* Youth auditors installed Energy Star programmable thermostats. Whereas CYES provided the thermostat and the labor costs, clients were only responsible for the cost of the thermostat.

- *Retractable Clotheslines:* Clients could request the installation of a retractable clothesline. CYES provided and installed the clothesline with no labor costs and the clients were only responsible for the measure costs.

- *Pipe Insulation:* Clients could also request that CYES auditors install insulation on hot water pipes. CYES provided and installed the pipe insulation on all exposed hot water lines and the first three feet of cold water inlet line with no labor costs. Clients only paid for the cost of insulation.

Removed Services:

CYES removed the following infiltration weatherization measures from the program after subsequent change order requests. Infiltration measures were removed to so that combustion appliance safety tests would not be required.

- *Door Weather Stripping*

- *Caulking*

It should be noted that throughout the duration of the contract, many change orders were made to the program resulting in the addition/removal of energy-efficient measures. Table 2-1 enumerates the unit installation goals for each relevant measure along with the revised installation goals after subsequent change order requests.

Table 2-1: Unit Installations

Measure/Activity Name	Change Order 1 (04/22/2004)	Change Order 2 (08/18/2004)	Proposed Installation Goals (03/18/2005)	Final Recorded Installations
Reduce DHW temp. by 10 degrees	300	300	300	78
Faucet aerators, gas hot water	1,280	1680	1,280	3225
Faucet aerators, electric hot water	320	420	320	14
Showerhead, gas hot water	1,280	850	1,280	1411
Showerhead, electric hot water	320	213	320	5
Pipe insulation, gas hot water	-	-	95	59
Pipe insulation, electric hot water	-	-	5	2
Retractable clothesline, gas dryer	320	320	520	558
Retractable clothesline, electric dryer	80	80	80	4
Compact fluorescent,15-watt (replacing 60-watt)	1600	2400	1600	2880
Compact fluorescent, 20-watt (replacing 75-watt)	0	1600	1600	2688
Compact fluorescent, 23-watt (replacing 100-watt)	-	-	2,400	2418
Fluorescent torchiere, 70-watt (replacing 300-watt)	156	200	156	144
Programmable thermostat (gas furnace only)	80	140	80	145
Total	**5,736**	**8,203**	**9,951**	**10,110**

3. EVALUATION METHODOLOGY

3.1 Program Process Evaluation Approach

The City of Berkeley CYES Program is one of a number of "partnership" programs that PG&E undertook in 2004 and 2005. Offered as part of a series of programs that are designed to leverage the unique capabilities of specific partnerships, it is useful to ask if this particular partnership was:

- Accountable – Did the program accomplish its objectives?
- Developed and Implemented Effectively – What methods could improve program implementation in the future?
- Replicable – Could this program be expanded efficiently and effectively in the future?

To understand these issues, the process discussion will cover the performance of the program relative to the following requisite performance metrics:

- Number of participants involved in the program.
- Number of measures installed through the program.
- Quality and quantity of information documented.
- Number and type of verification activities.

Finally, the evaluation assesses the extent to which a program or process is operating as intended and identifies opportunities for streamlining or otherwise improving operational efficiency. In keeping with this goal, Summit Blue first analyzed how the program currently functions along with the extent to which the program activities conform to statutory and regulatory requirements, program design, and customer expectations. Correspondingly, Summit Blue developed quantitative and qualitative assessments that provide complementary data on the strengths and weaknesses of the program components. The methods utilized in this process evaluation are comprised of surveys, documentation database analysis, and process and participation records, as well as in-depth interviews.

3.2 Program Impact Evaluation Approach

Participation data and the per-unit ex ante savings assumptions for each installed energy efficiency measure were compiled into an analytic database for the purposes of completing the program savings adjustments and analysis. Referenced savings values from DEER and other reputable sources were used to estimate the actual energy savings attributed to each energy efficiency measure. This methodology, along with the sources that were cited, is further discussed in Section 4.2.

Field data collected during this evaluation was then used to compute installation rates for each measure installed. This field data involved both visual inspection of measures at the site, and also telephone surveys to a random sample of participants who received field inspections to re-affirm site visit data. The evaluation installation rate data was then compared to the program tracking database and adjustments were made to account for discrepancies where it was statistically valid to do so. Together, the adjusted measure unit savings and adjustments to installation rates allowed Summit Blue to derive the gross savings attributable to each measure, and also to the program as a whole.

3.3 Primary Data Collection

Summit Blue utilized several survey and verification efforts to generate information regarding a number

of topics related to the program including: verification of the types and quantities of measures installed in the program, customer perceptions of and satisfaction with the program, and the estimated influence and attribution of energy savings to the program. These primary data collection efforts are discussed in greater detail below.

3.3.1 Program Participants

As previously stated, a total of 2127 participants received energy-efficient measure installations through the program. Throughout this process, CYES collected detailed information for each participant and entered this data into a participant tracking database. Data included the quantity and type of energy-efficient measures installed, the participant's contact information, the participant's measure usage frequency, and several process related questions.

Summit Blue also reviewed the implementation forms, paperwork, work orders, and procedures utilized by the City of Berkeley for implementation purposes to help develop data collection protocols that aided in the evaluation of a broad set of performance measures, including:

- Progress of the program in its primary, secondary, and tertiary objectives.
- Development and tracking of indicators that measure progress against barriers.
- Access and impact targeted market segment.
- Energy data.
- Measurements of customer satisfaction and effectiveness.

Each of these data collection components are discussed in greater detail below as well in subsequent sections of this report.

1. Progress of the Program in its Primary, Secondary, and Tertiary Objectives.

The program had multiple, prioritized objectives that were measured throughout its lifecycle The primary objective was to provide hard-to-teach households with energy education services, energy audits, and basic energy efficiency measures and hardware. These three components were reviewed in order to develop an appropriate dataset that included the following.

Component 1: Information Dissemination and Energy Education. CYES conducted educational site visits at 2065 single-family, detached dwellings, duplex, triplex, and fourplex buildings. CYES' ability to tailor services for individual households was based on four innovation principles:

- Identify unique energy-saving opportunities within the home.
- Pay attention to specific needs and lifestyles of the clients.
- Explain concepts in a way that is easy to understand.
- Help occupants understand how their homes use energy.

Data collected in review of this goal profiled how well these principles were being applied in the field.

Component 2: Provide Energy Audits. Of the 2065 homes receiving information dissemination and education, 1034 households received comprehensive home energy audit surveys. This provided the household with customized energy usage analysis and energy saving recommendations. Data collected in review of this goal profiled how recipients were selected, how the audits impacted recipient behavior and attitudes towards energy efficiency, and which market barriers were being impacted by this effort.

Component 3: Direct Low Cost Measure Installation. 2127 total households were provided with free

materials and installation services. The specific types of measure installed can be referenced in section 2.2. The data collected was provided by the CYES personnel, with assistance from Summit Blue in the data collection instruments and database design process.

The secondary objective was to provide youth employment and training on energy efficiency. To accomplish this objective, the program employed students in a broad range of residential energy issues, including measure installation. Data collected in review of this goal included various personnel and programmatic measures such as:

- Demographics of employed student base.
- Programmatic skills such as basic repair and home weatherization techniques.
- Personnel skills including teamwork, project planning, and conflict mediation skills.
- Support of broader community organizing and outreach goals.
- Post-program employment or internships.

The tertiary objective was to develop a requisite replicable model. The CYES project model was deemed to be easily expanded to other communities so long as the program design and logic were successful. To that end, Summit Blue collected and analyzed data to validate the function of the program metrics developed to refine the costs and likely success of expanding the program through a standardized template approach.

2. Development and tracking of indicator that measure progress against barriers.

The program was designed to address several barriers that are characteristic of moderate/low income, rental, and non-English speaking households. Numerous barriers exist for this hard-to-reach market, including:

- Consumer difficulty with market terminology for many of the terms associated with residential efficiency.
- Performance uncertainty about the potential future benefits and costs of measures.
- Information and search costs for identifying energy-efficient products or services, or learning about energy-efficient practices.

- Lack of interest by the targeted hard-to-reach population.
- Lack of internet access for many of the targeted low/moderate income households.

In recognizing these barriers, Summit Blue developed indicators that offered appropriate metrics designed to measure the effectiveness of the program in addressing these barriers.

3. Access and impact targeted market segment.

The program served residential customers in Oakland, Berkeley, Albany, Emeryville, Richmond, and El Cerrito. The target demographics and customers included:

- Renters at single and multi-family residences.
- Low-moderate income households.
- Non-English speaking households.
- The program referred low income/poverty level residents to the LIEE, LIHEAP, and DOE Weatherization services.

The data collected with respect to this performance measure verified that these target markets were being served and that the apportionment of services (audits, direct installation, etc.) was appropriate.

4. Energy data.

The data required to validate program energy savings is discussed in more detail in Section 4.2.4.

5. Measurements of customer satisfaction and effectiveness.

In order to ensure that participants received the highest quality of service through the program, employed representatives underwent mandatory training that addressed the following topics:

- Measure installations
- Energy conservation education
- Technical training through PG&E and CYES
- Project planning
- Conflict mediation
- Community organizing and outreach

CYES is unique in that it provided training and employment for an underprivileged population. The demographics of the 2004/2005 program were similar to the 2003 program in that the ethnic distribution of the representatives and program participants were correlated. This allowed the CYES representatives to more effectively communicate with the non-English speaking households. When collecting data pertaining to this performance measure through surveys and interviews, Summit Blue analyzed how the customers' satisfaction levels related to each of the aforementioned training topics and gauged their relative importance. Moreover, the data was used to determine what aspects of the program were desirable, and what aspects needed improvement in the future.

3.3.2 Program Representatives

Program managers and field representatives were also interviewed. The information gathered from them was integral in assessing the effectiveness of the program's processes and provided valuable insight into how the program could be improved in the future. More importantly, the representatives had valuable experience in working with the program on the implementation level and could quickly identify any discrepancies in assumptions and perceived operations.

3.4 Secondary Data Sources

Summit Blue compiled and reviewed the program performance and savings assumptions. This task entailed a summary review of current assumptions provided by the program implementer to verify their accuracy. Market assessment and baseline data was not developed specifically for this program, but was identified through secondary sources. This helped in assessing program penetration within its market and also contributed to outside spillover analysis (discussed in Section 4.2.4). The dataset included program implementation information to estimate impacts for two different program aspects:

- Direct measure installations' impacts including low-cost and at-cost installations.
- Energy education impacts.

Program documentation included various performance parameters that are included in this review. The measures included in the program and subjected to this analysis include those listed below:

- Reduction of domestic hot water temperature by 10 degrees
- Faucet aerators
- Low flow showerheads
- Pipe insulation
- Retractable clotheslines
- Programmable thermostats
- Compact fluorescent lamps
- Torchieres

Measure performance data, along with secondary source analysis, was collected and compiled in a Microsoft Excel spreadsheet.

The energy savings assumptions were based on two sources: the Low-Income Energy Efficiency (LIEE) Measure Cost-effectiveness Report, and when data was not available from this report, the 2002 technical potential study commissioned by the city and performed by Global Energy Partners (GEP). Data on the estimated useful life was also obtained from the GEP study where available. And the Database for Energy-efficient Measures (DEER) values was used to estimate incremental costs. It was assumed that 90% of the participant homes had natural gas heat and hot water and 10% had electric heat and hot water.

In order to gain an adequate perspective on the potential energy savings achieved by each measure, Summit Blue analyzed a large collection of qualified secondary sources and compared their estimates to the program assumptions in order to ascertain any discrepancies. The following sources were referenced due to their representative nature and credibility:

- The LIEE Preliminary Measure Cost-effectiveness Report
- The LIEE Measure Cost-effectiveness Report (June, 2 2003)
- The Database for Energy-efficient Resources (2004 – 2005)
- The Database for Energy-efficient Resources (2001)
- PG&E Work papers on CFLs and Faucet Aerators
- The GEP Technical Potential Study (2002)

Section 4.2.4 details the results collected from the aforementioned literature.

4. EVALUATION RESULTS

This section presents the evaluation results of the Berkeley CYES Program and discusses program accomplishments. Section 4.1 discusses the program process evaluation methodology and findings; Section 4.2 describes the program impact evaluation.

4.1 Program Process Evaluation

The program process evaluation for the City of Berkeley program discusses the results of the process evaluation relative to the following categories:

- Accountability – Did the program accomplish its objectives?
- Program Development and Improvement – What methods could improve program implementation and satisfaction in the future?
- Program Replication – Could this program be expanded efficiently and effectively in the future?

Finally, a process evaluation assesses the extent to which a program or process is operating as intended and identifies opportunities for streamlining or otherwise improving operational efficiency. In keeping with this goal, Summit Blue first analyzed how the program currently functions along with the extent to which the program activities conform to statutory and regulatory requirements, program design, and customer expectations. Correspondingly, Summit Blue developed quantitative and qualitative assessments that provide complementary data on the strengths and weaknesses of the program components. The methods utilized in this process evaluation are comprised of surveys, documentation database analysis, and process and participation records, as well as in-depth interviews.

4.1.1 Program Objectives Met

The originally filed Program Implementation Plan filed for this program provides the main program objectives (paraphrased for brevity in Table 4-1)[2]. In most cases, the program, as it was actually implemented, met or exceeded original goals. Some minor changes in measures were necessitated as the program was implemented: for example, the energy audits were conducted by hand without the web-based tool and these deviations are noted in the comments column below.

Table 4-1: Main Objectives

Original Objective	Actual Implementation	Comments
Primary Objective: To provide hard-to-reach households with energy education services, energy audits, and basic energy efficiency measures and hardware.	The program focused on renters, multi-family, low-moderate income, and non-English speaking households – servicing "hard-to-reach" households with a high degree of participant satisfaction. A survey of participants revealed an overall satisfaction with the program of 3.65 out of 4.	A discussion on the cultural distribution of program participants may help develop an accurate model of the program's impact on different ethnicities, and ability to roll-out to different communities.
Sub-Objective: Information Dissemination and Energy Education. CYES planned to conduct residential site visits at 2,000 households and provide energy conservation information dissemination. Trained youth auditors will give residents information on simple and expanded household energy conservation, both verbally and by handing out written material. They will help connect residents to appropriate programs for energy efficiency services and/or materials rebates. Information on the efficiency measures that were installed during the visit will also be presented.	Approximately 2127 households were visited.	Survey results show that householders recall receiving information on both energy and water conservations measures and programs. See section 4.1.3. Program implementation staff report that more readily customizable brochures would have helped, e.g., as they learn what (and which language) is working, they would like to be able to readily retool brochures without a cumbersome approval process. Word documents, instead of PDFs, could facilitate adaptation. Particular attention was paid to the water-energy relationship, which may be why the kitchen aerators were so popular.

[2] City of Berkeley and Youth Energy Services, Energy Efficiency Program Proposal, PY2004/PY2005, R. 01-08-028, Residential Dwelling Audits, Direct Install and Youth Training, September 2003.

Sub-Objective: Provide Energy Audits. Of the 2000 homes receiving information dissemination and education, 500 households were to receive a comprehensive energy audit.	Substantially more audits were conducted than were originally planned. In all over 1000 households were audited.	Originally intended to have a web component, this audit was actually conducted by hand in the field. Implementation staff report that cost for large appliances is a major barrier, and to a lesser extent, another barrier is apathy.
Sub-Objective: Direct Low Cost Measure Installation. This program was to provide several materials at no cost to 1000 of the 2000 total households. Free materials installation was to be conducted both as an energy conservation measure and as a strategy to gain market interest in the CYES audit services, i.e., a "foot in the door". Measures were to include compact fluorescent bulbs, water saving devices, water heater temperature reduction and water pipe insulations, programmable thermostats, clothesline installations, door weather-stripping, and caulking. Water saving materials (which account for substantial energy savings) such as showerheads and aerators were obtained at no cost to the program from local water agencies.	Over 2100 households were reached with a total of over 13,000 measures recorded. Of all the measures, substantially more aerators and 15 and 20 Watt CFLs were installed than was originally intended. Program change orders removed the infiltration measures.	CYES also provided three extended services at materials cost for residents (Programmable Thermostats, Retractable Clotheslines, Pipe Insulation). Programmable thermostats were only installed in the first year. Follow-on calls from customers to get additional and ongoing help with their programmable thermostats were logged by CYES. Other issues identified were whether customers were using the thermostats and the elderly, in particular, were reported to have difficulty with the small screens.[3]
Secondary Objective: Training Youth on Energy Efficiency. Youth Employment and Training. Employing high school, community college, and trade school students to install measures and to supervise installations provides program benefits above and beyond lower installation costs. Participants received quality energy conservation education and technical training through PG&E and CYES while developing viable soft and hard job skills that may help them gain entry to careers in energy efficiency.	Student participants in the program did indeed learn several soft and hard job skills, such as communication skills, confidence and technical training on energy efficiency, and even computer data entry.	This program could be improved by the creation of additional job pathways and skills. Given the concern that utilities have with the aging work force and the lack of "younger workers," this would seem to be a good fit to explore further. At least 2 students report changing their course of study at college as a result of this experience.
Third Objective: Develop a Replicable Model. The demonstration of the CYES project as feasible and cost-effective has given rise to the desire to expand this model to other communities. CYES has already developed a breadth of systems and information for starting a CYES project including: a "how-to" manual for developing a new program, a proprietary scheduling system that addresses specific needs and constraints of the program, and a DVD promotional video that outlines the program.	Programs like this are replicable, effective, and desirable. Community based social marketing experts know that environmental and sustainability oriented changes often happen at the neighborhood and even street level.[4]	The ease with which a program like this can be replicated depends on the supporting and available infrastructure from sponsoring agencies. Also, there is some concern that some areas can become over served with non-profit services. However given the uptake on this program, this program has not reached saturation.

4.1.2 Program Development and Improvement

Programs can generally be improved by removing barriers to customer participation, improving marketing, and improving the structural support provided to the program. Table 4-2 summarizes the issues identified in interviews with program staff.

[3] Interview with Program staff.

[4] Doug McKenzie-Mohr, William Smith, Fostering Sustainable Behavior, 1999.

Table 4-2: Program Improvements

Category	Reported Concern	Potential Solution	Comments
Customer Barriers	Residents sometimes hard to convince that program is really free.	Pre-sell by landlord or influential community member, e.g., church leader, business owner, setting up sign up tables in a larger local business following an e-mail blast by an employer or message by a church leader. Employees or members can then sign up for the service after hearing about the endorsement.	Logistically the engagement of these channels requires additional upfront legwork on the part of implementation staff and subsequent coordination on the back end. Engaged channels often want to know what has happened with their constituency which can add additional tracking and record-keeping. Not all faith-based initiatives are successful, and CYES did not have ready success with African American churches. However, sufficient interest in this outreach channel exists for some utilities to employ faith-based outreach specialists.
Customer Barriers	Language barriers existed making communication difficult at times.	Partnering with churches and other community organizations to reach those in the community that do not speak English.	Program managers did secure and receive pro bono interpretation services and did also hire Spanish speaking staff. However with support this hurdle could be a lever instead of a barrier. For example, PG&E staffers or community members could be paired with youth to visit specific language subgroups. The PG&E staffer could "pre-sell" the program, and the students could do the installations. The PG&E staffer could then be on hand while a team of several students worked in a specific neighborhood to explain the program if need be.
Customer Barriers	Case studies were desired to help explain the benefits of the audit.	Create living case studies by identifying leaders in communities and provide them with enhanced training and audits could serve to further get the word out. A graphic presentation to demonstrate the audit efficiency process could help show how the process works.	
Customer Barriers	Recipients of audits reported being concerned about how long a visit takes.	Create better scheduling options, perhaps by not using mass transit. Neighborhood targeting could help tighten response time/rate. Better preview by landlord could presell the visit. CYES could prepare a letter for the landlord or convince the landlord or facilities manager to come with students to gain entry.	Continue to work with staff to help them appreciate they are working against the clock of a customer's attention.

Customer Barriers	Lack of leisure time by program recipients.	Again continue to emphasize the time issue to students delivering the program, but consider eliminating the least popular measures to improve visit completion times.	Consider eliminating the least popular measures to improve visit completion times.
Program Barriers	Efficiency can be invisible, e.g., we don't know who in the community has signed up (without looking in a database.) As a result information dissemination within the community might not be as fluid as would be desired.	Some kind of signage or sticker could be placed in a window, or on a mailbox. CYES helped me save energy and water, FREE! – ask me how.	Signs or commitments like these can lose impact if they are over-used, as in the case of Prop 65. However in growing a young program, they can facilitate a means of ready neighborhood referral. This strategy has been used with other "invisible programs" like backyard composting as well.
Program l Issues	Concern for the safety of young people in strangers' households.	Continue and expand buddy system. Although Megan's law database information could be pulled prior to visit by young person.	Although a buddy system was utilized, Summit Blue understands that this concern has been addressed for the coming year, as CYES plans to pair an over 18 staffer with an under 18 staffer.
Structural Issues	Structure of program planning documentation could be improved.	The savings estimates on several measures were not fully cited and documented, and the unit savings potential was either understated or overstated on several measures when compared to industry accepted standard documents, such as the DEER database, PG&E working papers, or final LIEE. While several of the sources cited above were not available at the time the program was originally developed, it may have been possible to document and research the potential savings for some measures, such as CFL lamps,	The program would benefit from a more thorough review of industry literature and accepted standards in developing measure savings estimates. This research should be more thoroughly documented in program plans.
Structural Issues	Using the bus system to conduct outreach may not be time efficient.	The youth could have an energy-efficient vehicle, perhaps on loan from EBMUD or the City of Berkeley with a magnetic logo – "Free energy audits in your neighborhood today"	This would provide relatively free marketing and finding ways to better leverage initial program contacts. However the cost to insure young drivers may be prohibitive.

Structural Issues	PG&E marketing collateral could be better suited to the project, e.g., staffers reported some disconnect with variable numbers. The "wheel" which students used to look up heater usage and the leave behind each quoted a slightly different number. The leave behinds from PG&E also included appliances with very low energy consumption, so impact of the savings message was dampened.	PG&E should work more closely with "partnerships" to design program marketing collateral. Staffers report that usage on smaller appliances are not helpful to the energy efficiency discussion. They would eliminate smaller appliance numbers from the leave behind, e.g., television electrical usage information.	Graphic visual elements were desired to show the impact of the energy producing industry. However, it may be that this could create more of a negative image and reduce PG&E credibility.
Structural Issues	Ability to rehire and grow staff passion and skills	Create system of progressive responsibility	Would require the budget to hire second year staff at a higher rate. One staffer commented, "I'm working at Petco this year, CYES was so much better. I was helping people not charging people."

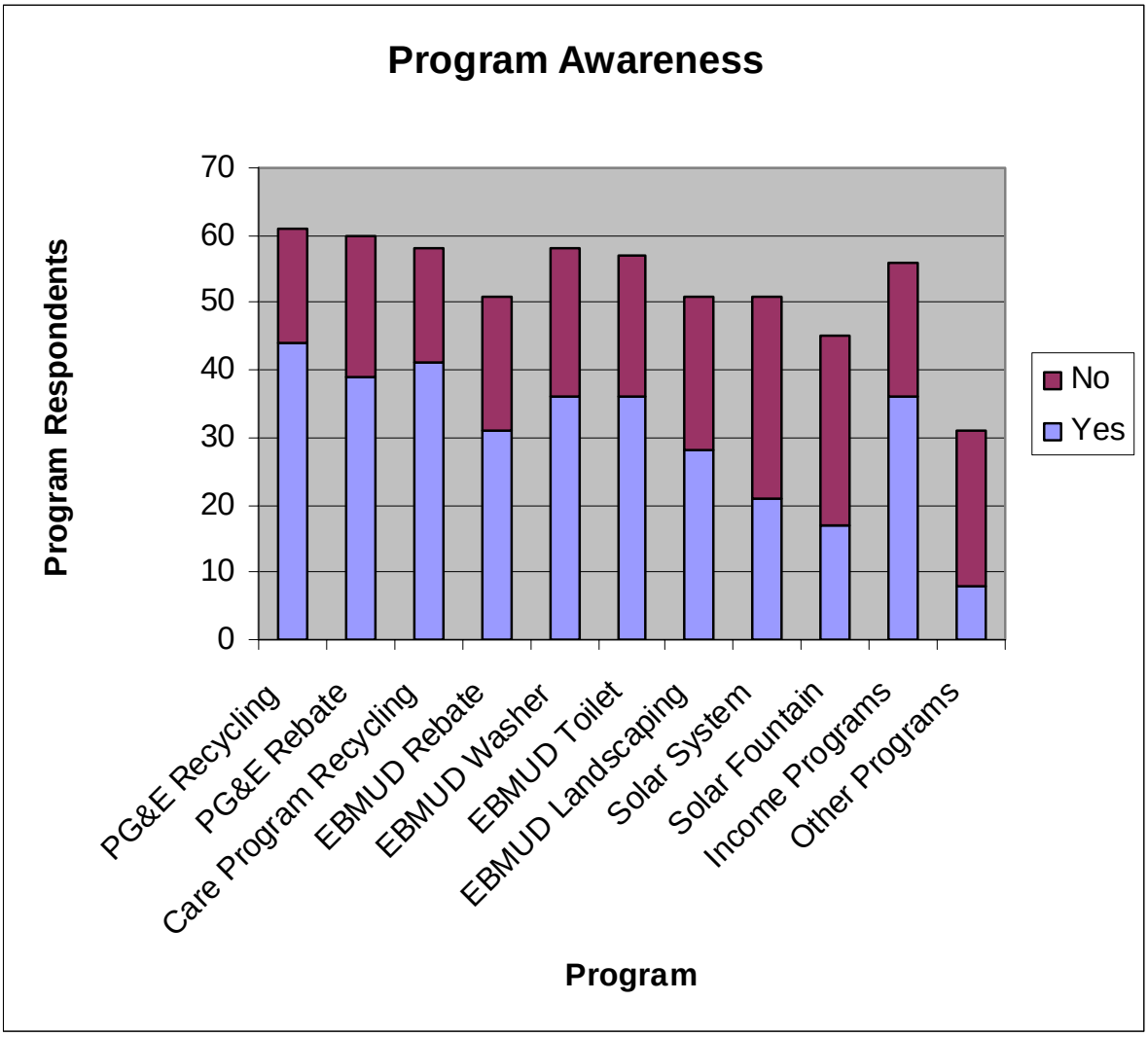
This program had a very high satisfaction rating from those participants surveyed (n=82). The average quality of the program was rated by participants as 3.65 where 1 was "poor" and 4 was "excellent". It is believed that the provision of free materials and services may have contributed substantially to this rating. However, it should be noted that the average expectation satisfaction rating was 1.46, where 0 was not met and 2 was surpassed. In our opinion, this shows that the training and role playing on active listening and customer service with youth staff were successful. Comments received from surveys indicated that over 90% of the survey respondents were very pleased with the level of knowledge and professionalism upheld by the youth representatives.

4.1.3 Effectiveness of Program Marketing Plan

It is clear that any program's success is dependent, in part, on the marketing efforts employed and their ability to penetrate the desired population front. Summit Blue was interested in determining the extent to which the customers were aware of similar energy efficiency programs and their impact on their lifestyles. More importantly, this information was used to later analyze the potential free-ridership and spillover attributed to these energy programs offered.

Figure 4-1 illustrates the compiled responses of program participants when asked about their familiarity and involvement in other programs. It should be noted that only a portion of the participants responded to the questions asked. The non-respondents were discounted, as it was impossible to determine whether or not they were involved or simply did not want to release the requested information.

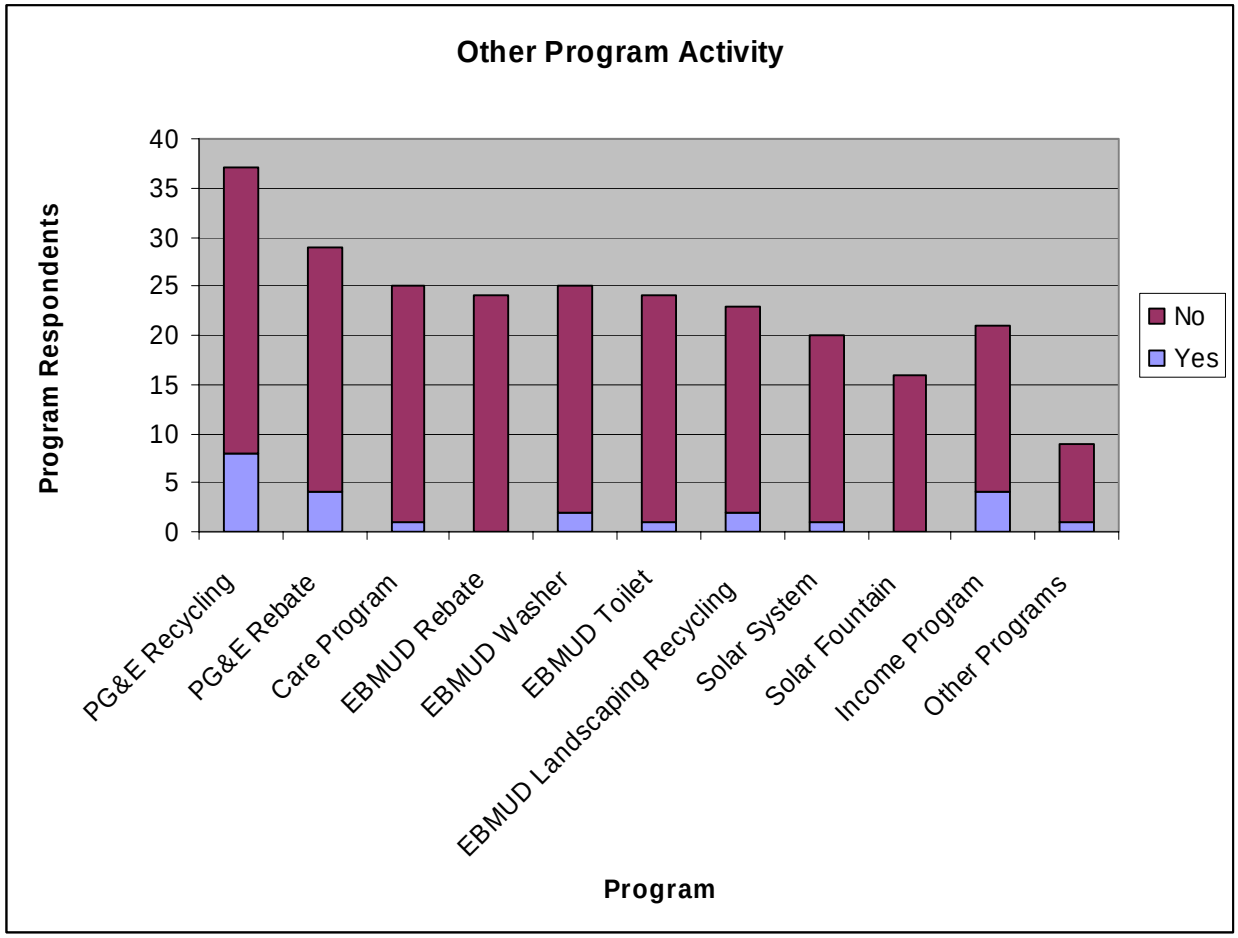
Figure 4-1: Program Awareness



A fair number of respondents were aware of other programs and even remembered receiving information about them. Customers most readily recognized programs offered by PG&E, followed closely by EBMUD. 68.6% of the respondents recognized the PG&E programs, while 60.4% of the respondents recognized programs offered by EBMUD. And on average, 58.2% of the respondents were familiar with other energy programs offered in, and near, the district. However, it should be noted that only a portion of the program participants surveyed participated in this exercise.

Summit Blue also analyzed the degree to which respondents acted on the information provided to them about other programs. Figure 4-2 depicts the survey results with respect to this question.

Figure 4-2: Other Program Activity



The PG&E programs, along with the Income Program, had the most activity (22.2% and 23.2% respectively). Overall, 9.5% of the program respondents actually remembered and acted on information given to them concerning other programs. The results imply that there may have been a substantial relationship between participation in the CYES Program and participation in other programs. Effective marketing through PG&E may prove useful in garnering more support in the future.

In addition, 65 program participants were asked to rate the quality of education personally received regarding other programs and rebates. The average response was a 3.25/4, where 1 was equivalent to "poor" and 4 was equivalent to "excellent." Clearly, this implies that the respondents were pleased with the marketing efforts and materials provided to them pertaining to other energy-efficiency programs.

With respect to the CYES Program, 71 respondents had an average response of 3.18/4 when asked to rate the quality of education they received about how to conserve energy. As such, these statistics point out that the CYES Program's marketing efforts are viable and competitive with other program outreach efforts.

4.2 Program Impact Evaluation

This section details and assesses program effectiveness in terms of end results. Moreover, the analysis also analyzes the net causal effects of the program beyond the immediate results in order to gain a complete understanding of the program's impact on its target market.

Participation data, per-unit ex ante savings assumptions, analytic databases, and secondary sources were all used in this evaluation to calculate realization rates for each measure. The realization rates were then applied to the quantity and measure count variables reported in the program tracking and verification system. Together, the realization rates and adjusted savings values allowed Summit Blue to derive the gross savings attributable to the program along with a qualitative analysis of the savings results.

4.2.1 Verification of Installations

Summit Blue actively partnered with CYES representatives in order to verify the measure installations reported in the program database. This was done through site visits and telephone surveys to confirm the accuracy of both the field auditor activities and field installations. Table 4-3 illustrates the expected and actual number of verifications for each measure conducted by CYES representatives and Summit Blue staff. A sample mean approach was used to estimate sample sizes for measures that contributed a substantial portion of projected program savings. For measures where the sample was equal to or greater than 10% of the population, the sample size was calculated to be:

$$(N * SD^2 * Z^2) / (N * E^2 * SD^2 * Z^2)$$

Where:

N = Population size
SD = Standard Deviation
Z = Value corresponding to the critical region for the normal curve at the selected confidence interval
E = Error

And for measures that had a small percentage of Btu impacts to total projected savings, the sample size was limited to roughly 10% of the sites. This methodology served to confirm the activities of the program in a way that was cost-effective and allowed the measures that contributed the largest percentage of program savings to receive the highest degree of field verification activity from both implementation and Summit Blue staff.

It should be noted that the number of actual site visits varied from the estimated projections due to a fair amount of “overlapping” measures (the number of different measure types that were installed at the same site). And although measure installations and sample sizes were adjusted throughout the program lifecycle, the EM&V samples remained consistent with the research plan methodology.

Table 4-3: Verification of Installations

Measure	Expected Installations	Recorded Installations	Target EM&V Sample Size	Number of Field Samples Verified by Implementation Staff	Number of Field Samples Verified by Summit Blue	Number of Implementation Staff Reports Verified by Summit Blue's Telephone Survey of the Customer
Reduce DHW temp. by 10 degrees	300	78	8	7	6	2
Faucet Aerators, gas hot water	1,280	3225	66	84	92	37
Faucet Aerators, electric hot water	320	14	1	0	0	0
Showerhead, gas hot water	1,280	1411	65	39	38	12
Showerhead, electric hot water	320	5	1	2	4	2
Pipe insulation, gas hot water	95	59	6	7	2	1
Pipe insulation, electric hot water	5	2	1	0	0	0
Retractable clothesline, gas dryer	520	558	60	39	44	14
Retractable clothesline, electric dryer	80	4	1	1	1	1
Compact fluorescent, 15-watt (replacing 60-watt)	1,600	2880	66	97	100	45
Compact fluorescent, 20-watt (replacing 75-watt)	1,600	2688	66	94	80	37
Compact fluorescent, 23-watt (replacing 100-watt)	2,400	2418	66	49	60	18
Fluorescent Torchiere, 70-watt (replacing 300-watt)	156	144	12	12	12	3
Programmable Thermostat (gas furnace only)	80	145	46	32	27	13

4.2.2 Adjustment to Recorded Installation Rates

In addition to the verification approach described in section 4.2.1, Summit Blue also utilized telephone interviews, personal interviews, and persistence surveying to determine the causal relationship between recorded installation and verified installation values. This process also allowed Summit Blue to accurately quantify the overall number of measures installed through the program and calculate the actual retention rates.

Table 4-4 illustrates the difference between the recorded number of installations at the sites receiving verification and the corresponding verified number of measure installations:

Table 4-4: Verified Installation Rates for Field Inspected and Telephone Verified Survey Sample

Measure	Sample Recorded Installations	Sample Verified Measures	Sample Verified Installation
Reduce DHW temp. by 10 degrees	13	12	92.3%
Faucet Aerators, gas hot water	139	113	81.3%
Faucet Aerators, electric hot water	4	4	100.0%
Showerhead, gas hot water	65	63	96.9%
Showerhead, electric hot water	6	6	100.0%
Pipe insulation, gas hot water	9	9	100.0%
Pipe insulation, electric hot water	0	0	-
Retractable clothesline, gas dryer	69	64	92.7%
Retractable clothesline, electric dryer	2	2	100.0%
Compact fluorescent, 15-watt	152	155	102.0%
Compact fluorescent, 20-watt	137	118	86.1%
Compact fluorescent, 23-watt	91	87	95.6%
Fluorescent torchiere, 70-watt	21	20	95.2%
Programmable thermostat	46	43	93.5%
Total	**754**	**657**	**92.3%**

This sample was comprised of 85 sites that were randomly chosen to undergo on-site verification through program representatives and Summit Blue. The “Sample Recorded Installations” column details how many installations of each measure were tracked in the program database. Consequently, the “Sample Verified Installations” column enumerates the actual number of measure installations recorded upon visiting each residential site.

Although there are sometimes large discrepancies between the recorded installations and verified installations, it should be noted that many program participants removed measures for various reasons prior to the verification exercises. In addition, the period of time that passed between installations and verification activities varied between three and 14 months which may have significantly affected the number of measures still in place during field activities. Summit Blue accounted for this aspect by asking on-site participants how many measures were removed in order to develop an estimate of how many measures were installed as opposed to how many measures were in place during the verification process. Upon inspection of the installation rates, it is clear that the program’s recorded installations correlated fairly well with the actual number of installations verified – 92.3% on average. This was considered to be within the error margin of the sample.

Most of the measures had installation rates greater than 90%. Although the faucet aerators and 20-watt CFLs had installation rates that were substantially lower, it should be noted that these two measures had fairly high removal rates, respectively. It is also probable that many people with these measures underestimated the actual number removed. It is likely that the faucet aerators were removed due to fouling or mineral deposits. The removal rate of the 20 Watt CFLs may be due to high lamp failure rates, though this was not confirmed in discussions with customers.

Summit Blue also conducted a detailed persistence study in order to update and true-up the installation rates and develop realization rates, where realization rate is defined as the number of verified measures installed net of measures removed. This was done through a telephone survey that was conducted in March 2006 and served the purpose of determining how many of the measures were still in place. In addition, the results acquired were compared to the original calculated installation rates in order to determine what the final realization rate was. Table 4-5 illustrates the findings of the persistence study. Faucet aerators on electric DHW systems were not addressed in this persistence study because of the small number of installations.

Table 4-5: Derivation of Final Installation Rates

Measure	Sample Recorded Installations	Sample Verified Installations	Persistence Exercise Verified Installations	Persistence Rate	Verified Measure Installation Rate	Final Realization Rate
Reduce DHW temp. by 10 degrees	2	2	2	100.0%	92.3%	92.3%
Faucet aerators, gas hot water	32	23	20	87.0%	81.3%	70.7%
Faucet aerators, electric hot water	NA	NA	NA	NA	NA	NA
Showerhead, gas hot water	12	10	10	100.0%	96.9%	96.9%
Showerhead, electric hot water	2	2	2	100.0%	100.0%	100.0%
Pipe insulation, gas hot water	1	1	1	100.0%	100.0%	100.0%
Retractable clothesline, gas dryer	14	11	10	90.9%	92.8%	84.3%
Retractable clothesline, elect. dryer	1	1	1	100.0%	100.0%	100.0%
Compact fluorescent, 15-watt	45	41	38	92.7%	102.0%	94.5%
Compact fluorescent, 20-watt	37	26	25	96.2%	86.1%	82.8%
Compact fluorescent, 23-watt	18	15	15	100.0%	95.6%	95.6%
Fluorescent torchiere, 70-watt	3	3	3	100.0%	95.2%	95.2%
Programmable thermostat	13	12	10	83.3%	93.5%	77.9%
Average				96.2%	95.1%	91.6%

Summit Blue would like to stress that the final realization rate is not reflective of the installation rates; rather, the realization rate is the estimated percentage of measures still in place at the present time. The total program recorded installations were then multiplied by the final realization rates in order to develop the number of verified installations in place for each measure, as shown in Table 4-6.

Table 4-6: Verified Measures Installations

Measure	Total Program Recorded Installations	Final Realization Rate	Verified Installations in Place
Reduce DHW temp. by 10 degrees	78	92.3%	72
Faucet Aerators, gas hot water	3,225	70.7%	2,280
Faucet Aerators, electric hot water	14	100.0%	14
Showerhead, gas hot water	1,411	96.9%	1,368
Showerhead, electric hot water	5	100.0%	5
Pipe insulation, gas hot water	59	100.0%	59
Retractable clothesline, electric dryer	2	100.0%	2
Retractable clothesline, gas dryer	558	84.3%	471
Retractable clothesline, electric dryer	4	100.0%	4
Compact fluorescent, 15-watt	2,880	94.5%	2,722
Compact fluorescent, 20-watt	2,688	82.81%	2,226
Compact fluorescent, 23-watt	2,418	95.6%	2,312
Fluorescent torchiere, 70-watt	144	95.2%	137
Programmable thermostat	145	77.9%	113

Once again, it should be noted that the "Verified Installations in Place" column pertains to the number of measures still in place at the time of verification - not the number of measures initially installed. Thus, even though some values are particularly lower than expected, the discrepancies may be accounted for due to the transition period between the installation and verification processes, as well as participant preferences. For example, detailed conversations with participants revealed that a disproportionately high percentage chose to remove both Programmable thermostats and faucet aerators from their residences due to:

1.) Expectation differences

2.) Operational characteristics

3.) Incompatibility with existing hardware

Of 85 people surveyed, only 38 responded and gave the thermostat an average rating of 4.02/5, where 5 was rated as very satisfied, and 1 was rated as very dissatisfied. When asked why the thermostat was not in use, many participants stated that they found it too complicated to use. These, and other, factors are responsible for the lower than expected verified installation rates and are discussed further in subsequent sections as researchable issues.

4.2.3 Original Measure Unit Savings Estimates

Initial program energy savings assumptions were based primarily on two sources: the Draft LIEE Measure Cost-effectiveness Report and, where data was not available from this report, the 2002 Technical Potential Study commissioned by the city and performed by Global Energy Partners. Data on the estimated useful life was also obtained from these sources where available and DEER database values were used to determine incremental costs. In some cases no reference source was available for program savings assumptions. Where this evaluation assigns savings values, reasonable assumptions were made and explicitly stated as such.

It was assumed that 90% of homes have natural gas heat and hot water and 10% have electric heat and hot water. This evaluation did not explicitly confirm this assumption but agrees with this assumption based on the distribution of measures installed and the high percentage of home in the area with natural gas service. Table 4-7 provides subsequent detailed descriptions of assumptions pertinent to each program measure.

Table 4-7: Original Saving Assumptions

Measure	Original Program Energy Savings Assumptions
Reduce DHW Temperature by 10°	The base case assumed natural gas water heaters were set at 125 degrees or greater. GEP estimated that a 10° reduction would save 7.8 therms annually. [5] Measure life was estimated by GEP to be three years
Door Weather-stripping	LIEE savings data were used for door weather-stripping. The measure life was assumed to be 15 years. [6] No coincident demand was assumed.
Caulking	LIEE savings data were used for caulking. The measure life was assumed to be 15 years[5] and no coincident demand was assumed.
Faucet Aerators	LIEE savings data was used for aerators. Electric hot water was assumed to coincide with peak demand 50% of the time (kW = kWh/ (8760*2)). Measure life was estimated by 12 years[7]
Low Flow Showerheads	LIEE savings data was used for showerheads. Savings for electric hot water were estimated to be 80% of the equivalent natural gas Btus. Electric hot water was assumed to coincide with peak demand 50% of the time (kW = kWh/(8760*2)). Measure life was estimated to be 13 years. [8]
Pipe Insulation	LIEE savings data was used for pipe insulation. Electric hot water was assumed to coincide with peak demand 50% of the time (kW = kWh/(8760*2)). Measure life was estimated to be 13 years. [7]
Retractable Clotheslines	GEP assumed a baseline electric dryer of 832 kWh/year and that clothes can dry outside 50% of the year yielding 416 kWh savings. This value was applied to natural gas dryers at an equivalent Btu rate. Electric clothes drying was assumed to coincide with peak demand 50% of the time (kW = kWh/(8760*2)). Measure life was estimated to be 5 years.
Programmable Thermostats	LIEE savings data were used for thermostats. Measure life was estimated to be 15 years. [7]
Compact Fluorescent Lamps	LIEE savings data were used for CFLs. GEP estimates were used for measure life and the ratio of energy savings to demand reduction (2,475:1).

[5] HES Model Estimate; Gas Technology Institute, Benefits and Implications of Residential Energy Efficiency Programs in Illinois, April 2001.

[6] Barakat & Chamberlin, Demand–Side Management Resource Assessment – Residential Sector, 1993.

[7] Neos Corporation, Integrated Resource Planning Pilot Study for the Heatland Consumers Power District, 1993.

[8] Gas Technology Institute (op. cit.).

Some assumptions regarding standard cost-effectiveness values are stated below:

- No DEER IMC data was available for retractable clotheslines. The IMC was assumed to be $38.67 based on $25 for materials and 1.5 hours of crew labor at $9.11/hr.

- No DEER IMC data was available for DHW temperature reduction. The IMC was assumed to be $4.56 based on 0.5 hour of labor at $9.11 /hr.

- DEER IMC data for basic low-flow showerheads ($20) is excessively high given the CYES delivery channel. The IMC was assumed to be $13.79 based on $9.23 for materials (per DEER) and 0.5 hour of crew labor at $9.11/hr.

- DEER IMC data for caulking ($142) was excessively high given the CYES delivery channel. The IMC was assumed to be $23.22 based on $5 for materials and two hours of crew labor at 9.11/hr.

- DEER IMC data for CFLs ($14) was high given the CYES delivery channel. The IMC was assumed to be $6.52 based on $4.20 for materials (DEER) and 10 minutes of labor at $9.11/hr.

4.2.4 Adjustments to Unit Savings Estimates

In order to gain an adequate perspective on the potential energy savings achieved by each measure, Summit Blue reviewed various qualified sources and compared their estimates to the program assumptions in order to identify and resolve any discrepancies, and to provide the best savings estimates currently available. The following sources were referenced due to their representative nature and credibility:

- The Low Income Energy Efficiency (LIEE) Preliminary Measure Cost-effectiveness Report

- The Final LIEE Measure Cost-effectiveness Report (June 2, 2003)

- The 2001 Database for Energy-efficient Resources (DEER)

- The DEER 2004 – 2005 Update

- PG&E Work Papers on CFLs and Faucet Aerators

- The Global Energy Partners (GEP) Technical Potential Study (2002)

After this review, the evaluation team made the decision to evaluate the program based on the original savings estimates and adjusted unit savings estimates where the original savings assumptions did not agree with the most current, and accurate, documented estimates.

Table 4-8 through Table 4-19 illustrate the comparison of the original program measure savings assumptions to these sources where available, and discusses the logic behind Summit Blue's decision to adjust savings estimates. The final unit savings values are in bold, and are used in subsequent quantitative analysis. Table 4-20 provides a summary of the original program savings estimates, and the final values used in this analysis.

For the 10ºF reduction in domestic hot water temperature, the GEP Technical Potential Study provided the only acceptable, and available, savings estimates. Consequently, Summit Blue made no changes to the original program savings assumptions of 7.8 therms per unit for this measure.

Table 4-8: Reduce DHW Temperature by 10 Degrees

Source	Gross Coincident Peak Demand Reduction Per Unit (kW)	Gross Annual Energy Savings Per Unit (kWh)	Gross Annual Energy Savings Per Unit (Therms)
Program Assumptions			**7.8**
GEP Technical Potential Report			7.8

After reviewing the assumptions stated in each referenced source, Summit Blue chose to default to the LIEE Final Report savings estimates for aerators installed on sites with gas DWH. However, the DEER 2004 – 2005 savings estimates were used to revise the energy savings attributed to the faucet aerators supplied by electric DWH systems because the LIEE Final Report did not contain any demand savings values. It was deemed inappropriate to commingle values from multiple sources where a single data source did not yield all savings estimates (kW, kWh, and Therms) required. The DEER 2004 – 2005 savings estimates also provided information on demand estimates for single family and multi-family installations. This information was later used to adjust the final savings estimates for each measure dependent upon the distribution of measures installed at single and multi-family residential housing by the program.

Table 4-9: Faucet Aerators (Electric & Gas)

Source	Gross Coincident Peak Demand Reduction Per Unit (kW) (multi-family – single family)	Gross Annual Energy Savings Per Unit (kWh) (multi-family – single family)	Gross Annual Energy Savings Per Unit (Therms) (multi-family – single family)
Program Assumptions	.011	48.4	1.4
GEP Technical Potential Report			19.4
DEER 2001	.013 - .015	58 - 70	3 – 4
DEER 2004 2005	**.0115 - .022**	**52.2 - 99.9**	5.1 - 5.6
LIEE Preliminary Report		41.2 - 48.4	.9 – 1.4
LIEE Final Report		26.5 - 43.4	**2.6 - 3.6**
PG&E Workpapers	.0012	7.88	2.27

After reviewing the assumptions stated in each referenced source, Summit Blue chose to default to the LIEE Final Report savings estimates for showerheads installed on sites with gas DWH. The DEER 2004 – 2005 savings estimates were used to revise the energy savings attributed to showerheads supplied by electric DHW systems because the LIEE Final Report did not contain demand savings estimates. As with aerators, it was deemed inappropriate to commingle values from multiple sources where a single data source did not yield all savings estimates (kW, kWh, and Therm) required. The DEER 2004 – 2005 savings estimates also provided information on demand estimates for single family and multi-family installations.

Table 4-10: Efficient Showerheads (Electric & Gas)

Source	Gross Coincident Peak Demand Reduction Per Unit (kW) (multi-family – single family)	Gross Annual Energy Savings Per Unit (kWh) (multi-family – single family)	Gross Annual Energy Savings Per Unit (Therms) (multi-family – single family)
Program Assumptions	.055	239.2	9.1
GEP Technical Potential Report			44.2
DEER 2001	.033 - .039	148 – 179	9 – 10
DEER 2004 2005	**.0153 - .0293**	**69.6 - 133.3**	7.5 - 6.7
LIEE Preliminary Report		203.3 - 239.2	6.1 - 9.1
LIEE Final Report		66.6 - 108.7	**7.2 - 8.2**
PG&E Workpapers	.0031	20.2	6.1

Summit Blue chose to default to the LIEE Final Report savings estimates for pipes installed on sites with gas DWH, and the DEER 2004 – 2005 savings estimates were used to revise the energy savings attributed to pipe installations supplied by electric DHW systems. The LIEE Final report did not contain any demand savings values. The DEER 2004 – 2005 savings estimates also provided information on demand estimates for single family and multi-family installations.

Table 4-11: Pipe Insulation (Electric & Gas)

Source	Gross Coincident Peak Demand Reduction Per Unit (kW) (multi-family – single family)	Gross Annual Energy Savings Per Unit (kWh) (multi-family – single family)	Gross Annual Energy Savings Per Unit (Therms) (multi-family – single family)
Program Assumptions	.031	135.6	2.7
GEP Technical Potential Report			12
DEER 2001	.017 - .02	76 – 92	5
DEER 2004 2005	**.0153 - .0293**	**69.6 - 133.3**	6.7 - 7.5
LIEE Preliminary Report		115.3 - 135.6	1.8 - 2.7
LIEE Final Report		35.4 - 58.1	**3.6 - 4.6**

The rationale used to determine the revised energy savings estimates for CFL and torchieres was analogous to the logic noted previously. Ultimately, the DEER 2004 – 2005 savings were used to provide unit savings for these measures for several reasons. The PG&E Workpapers on lighting, while useful, did not provide the most current information available for each measure. This was also true of the DEER 2001 and LIEE Preliminary Reports. Hence, it was concluded that the updated 2005 DEER savings values provided the most current data when compared to other sources. The unit savings estimates for 15W, 18W, and 23W CFLs and 70 W torchieres are provided in Table 4-12 through Table 4-15.

Table 4-12: CFL (15W)

Source	Gross Coincident Peak Demand Reduction Per Unit (kW)	Gross Annual Energy Savings Per Unit (kWh) (multi-family – single family)
Program Assumptions	.0276	68.49
GEP Technical Potential Report	.04	99
DEER 2001	.0136	45.4
DEER 2004 2005	**.00328**	**34.6**
LIEE Preliminary Report		86.8 - 97.3
LIEE Final Report		65.6 - 94.8
PG&E Workpapers	.0072	58

Table 4-13: CFL (20W)

Source	Gross Coincident Peak Demand Reduction Per Unit (kW) (multi-family – single family)	Gross Annual Energy Savings Per Unit (kWh) (multi-family – single family)
Program Assumptions	.0337	83.6
GEP Technical Potential Report	.04	99
DEER 2004 2005	**.00401**	**42.3**
LIEE Preliminary Report		86.8 - 97.3
LIEE Final Report		65.6 - 94.8
PG&E Workpapers	.	70

Table 4-14: CFL (23 W)

Source	Gross Coincident Peak Demand Reduction Per Unit (kW)	Gross Annual Energy Savings Per Unit (kWh) (multi-family – single family)
Program Assumptions	.035	86.8
GEP Technical Potential Report	.04	99
DEER 2004 2005	**.00561**	**59.2**
LIEE Preliminary Report		86.8 - 97.3
LIEE Final Report		65.6 - 94.8
PG&E Workpapers	.0082	66

Table 4-15: CFL (70 W Torchiere)

Source	Gross Coincident Peak Demand Reduction Per Unit (kW)	Gross Annual Energy Savings Per Unit (kWh) (multi-family – single family)
Program Assumptions	.1184	293.71
DEER 2004 2005	**.01863**	**191.4**
LIEE Preliminary Report		86.8 - 97.3
LIEE Final Report		65.6 - 94.8

Because of the uncertainty about savings attributable to retractable clotheslines, Summit Blue conducted a subsidiary analysis on the savings estimates attributed to this measure. Table 4-16 provides the original program estimates while Table 4-17 provides the savings estimates obtained through the secondary literature review of several reputable sources.

Table 4-16: Retractable Clotheslines Savings Estimates

Source	Gross Coincident Peak Demand Reduction Per Unit (kW)	Gross Annual Energy Savings Per Unit (kWh)	Gross Annual Energy Savings Per Unit (Therms)
Program Assumptions		**416**	**14.198**
GEP Technical Potential Report		416	

Table 4-17: Clothes Dryer Energy Usage / Cycle

Source	kWh	Therms
LBL[9]	1.533	0.059
EERE[10]	2.786	0.107
LBL[11]	2.1	0.081
Average for secondary sources	2.14	0.082

Table 4-18 provides several estimates of the energy savings occurring, per participant, from the use of a clothesline instead of a gas or electric dryer. These values were based on the average energy use per dryer cycle based on the average savings per cycle noted in Table 4-17, and the number of washer loads dried on a clothesline. The number of washer loads dried by clothesline was derived from participant survey

[9] Lawrence Berkeley National Laboratory. Energy & Environmental Division, Preliminary Engineering Analysis for Clothes Washers, October 1996, Peter J. Biermayer.

[10] U.S. Department of Energy, Energy Efficient and Renewable Energy Division (http://www.eere.energy.gove/buildings/appliance_standards/residential/pdfs/chapter_7.pdf)

[11] Lawrence Berkeley National Laboratory. Energy * Environment Division

data collected during this evaluation. It should be noted that there are three estimates. The first, marked "Full Sample," was based on all survey respondents and indicated an average of 191 washer loads per year with 99 of the loads (52%) dried by clotheslines. The second estimate, labeled "Refined Sample," estimated that 12.2 Therms or 318.2 kWh per year was saved, depending on the type of dryer avoided. This estimate was based on a refinement of the survey data that excluded all participants who indicated that they washed less than 4 loads of laundry per week. The third estimate depicts the potential savings if the program participants washed their clothes with the same frequency indicated in several studies, and dried these clothes on the clotheslines with the frequency noted by the full sample of survey participants. These numbers were then compared to the initial program estimates for accuracy. The original program estimates were deemed acceptable, though they represent the high range of acceptable values.

Table 4-18: Retractable Clothesline Annual Energy Savings

Fuel	Full Sample	Refined Sample	Market Study
Gas (Therms)	8.1	12.2	16.4
Electric (kWh)	210.7	318.2	426.6

For programmable thermostats, the current deemed values based on the GEP Technical Potential Study were considered viable based on comparison to the DEER 2001 savings estimates. However, it should be noted that savings could not be adjusted for a ratio between single and multi-family residences as this information was not provided.

Table 4-19: Programmable Thermostat

Source	Gross Annual Energy Savings Per Unit (Therms) (multi-family – single family)
Program Assumptions	**18.3**
GEP Technical Potential Report	18.9
DEER 2001	10 – 38

Table 4-20 provides a summary of the units savings presented in the original program planning documents and the revised values used in this evaluation.

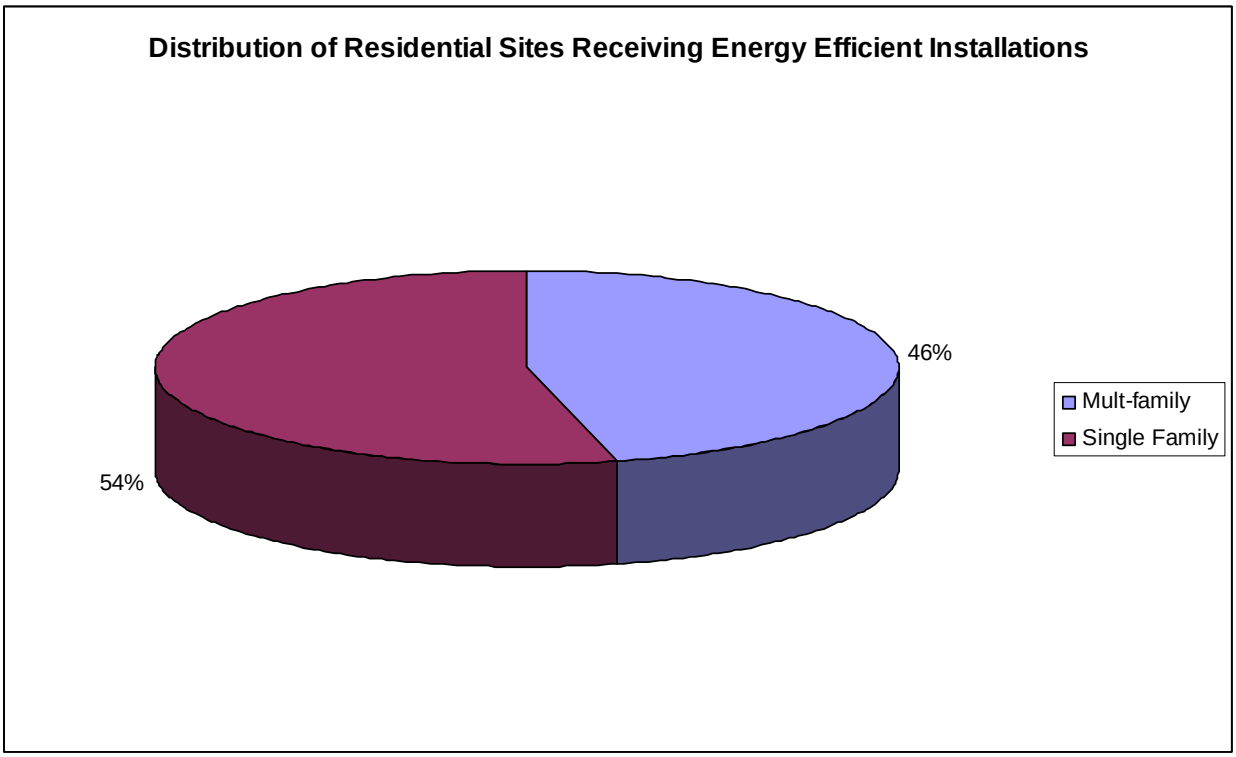
Table 4-20: Summary of Measure Unit Savings Adjustments

Measure	Savings Unit	Unit Savings Workbook Assumptions		Recommended Values		Net Difference	Percent Difference
		Single Family	Multi Family	Single Family	Multi Family		
Reduce DHW Temperature by 10 Degrees	Therms	7.80	7.80	7.80	7.80	0	0.00%
Faucet Aerators (Gas)	Therms	1.40	1.40	3.60	2.60	(1.2 to 2.2)	85 - 157%
Faucet Aerators (Electric)	kW	0.0110	0.0110	0.0220	0.0115	(.0005 to .011)	- 100%
	kWh	48.40	48.40	99.90	52.20	(3.8 to 51.5)	8 – 106%
Efficient Showerheads (Gas)	Therms	9.10	9.10	8.20	7.20	(-.9 to -1.9)	10 – 21%
Efficient Showerheads (Electric)	kW	0.0550	0.0550	0.0293	0.0153	(-.0257 to -.0397)	-47 to -72%
	kWh	239.20	239.20	133.30	69.60	(-105.9 to -169.9)	-44 to -71%
Pipe Insulation (Gas)	Therms	2.70	2.70	4.60	3.60	(.9 to 1.9)	33 - 70%
Pipe Insulation (Electric)	kW	0.0310	0.0310	0.0293	0.0153	(-.0017 to -.0157)	(-5 – 51%)
	kWh	135.60	135.60	133.30	69.60	(-2.3 to -66)	-2 to -49%
Retractable Clothesline (Gas)	Therms	14.20	14.20	14.20	14.20	0	0%
Retractable Clothesline (Electric)	kW	N/A	N/A	N/A	N/A	N/A	N/A
	kWh	416.00	416.00	416.00	416.00	0	0%
CFL (15 W)	kW	0.0276	0.0276	0.0033	0.0033	-0.02432	-88%
	kWh	68.49	68.49	34.60	34.60	-33.89	-49%
CFL (20 W)	kW	0.0337	0.0337	0.0040	0.0040	-0.02969	-88%
	kWh	83.60	83.60	42.30	42.30	-41.3	-49%
CFL (23 W)	kW	0.0350	0.0350	0.0056	0.0056	(-.02939)	-68%
	kWh	86.80	86.80	59.20	59.20	(-27.6)	-32%
CFL (70 W)	kW	0.1184	0.1184	0.0186	0.0186	-0.09977	84%
	kWh	293.71	293.71	191.40	191.40	-102.31	35%
Programmable Thermostat (Gas)	Therms	18.30	18.30	18.30	18.30	0	0%

4.2.5 Adjustment to Measure Savings for Type of Residence

The revised energy savings estimates for some energy-efficiency measures provided a distinction between the energy savings achieved in a single and a multi-family residence. In order to accurately determine gross program savings attributable to the program, the evaluation team conducted a study on the distribution of sites receiving energy efficiency measure installations from the program. Figure 4-3 details the percentage of households that were multi-family (apartment, duplex, fourplex, etc.) dwellings as well as the percentage of households that were single family residences.

Figure 4-3: Residential Distribution



As illustrated, 46% (979 residencies) of the impacted households were designated as multi-family and 54% (1148 residencies) of impacted households were designated as single family. This distribution served as a weight to standardize unit savings estimates where a distinction existed between measure savings for singe and multifamily residences. Table 4-21 provides the weighted average savings values used to develop adjusted gross savings estimates.

Table 4-21: Weighted Average Savings

Measure	Unit Energy Savings		
	Therms	kW	kWh
Reduce DHW temp. by 10 degrees	7.80		
Faucet Aerators, gas hot water	3.14		
Faucet Aerators, electric hot water		0.0172	77.9
Showerhead, gas hot water	7.74		
Showerhead, electric hot water		0.0229	104.0
Pipe insulation, gas hot water	4.14		
Pipe insulation, electric hot water		0.0229	104.0
Retractable clothesline, gas dryer	14.20		
Retractable clothesline, electric dryer			416.0
Compact fluorescent, 15-watt		0.0033	34.6
Compact fluorescent, 20-watt		0.0040	42.3
Compact fluorescent, 23-watt		0.0056	59.2
Fluorescent torchiere, 70-watt		0.0186	191.4
Programmable thermostat	18.30		

4.2.6 Gross Savings Estimate

The original program estimates for annual Therm, kWh, and kW savings were based on reputable sources and logical assumptions. However, the actual installation rates, energy savings assumptions, and residential distribution rates have changed significantly since the CYES Program's inception. Thus, it is Summit Blue's intent to adjust the assumed gross savings attributable to the program to accurately reflect the deviations noted in the verification field and engineering document review.

In order to calculate the gross savings attributable to each energy-efficient measure, Summit Blue has decided to utilize the following equation.

Measure Specific Energy Savings: (RI)(FRR)*(USE)*

Where:

RI = Recorded Installation Value
FRR = Final Realization Rate
USE = Unit energy savings

Table 4-22 provides the gross energy savings estimates attributable to each measure and the program. As shown in the table, the gross annual savings attributable to the program are 27,297 Therms and 354,915 kWh. Adjusted gross demand savings are estimated at 33.78 kW. These calculations take into account adjusted realization rates, installation records, resolved savings estimates, and housing type distribution.

Table 4-22: Program and Measure Gross Energy Savings

Measure	Recorded Installations	Final Realization Rate	Verified Unit Installations	Unit Savings Estimates			Adjusted Gross Annual Therm Savings	Adjusted Gross Demand Savings (kW)	Adjusted Gross Annual Energy Savings (kWh)
				Therms	kW	kWh			
Reduce DHW temp. by 10 degrees	78	92.3%	72	7.8			562	-	-
Faucet Aerators, gas hot water	3225	70.7%	2280	3.1			7,158	-	-
Faucet Aerators, electric hot water	14	100.0%	14		0.0172	78.0	-	0.24	1,091
Showerhead, gas hot water	1411	96.9%	1368	7.7			10,585	-	-
Showerhead, electric hot water	5	100.0%	5		0.0229	104.0	-	0.11	520
Pipe insulation, gas hot water	59	100.0%	59	4.1			244	-	-
Pipe insulation, electric hot water	2	100.0%	2		0.0229	104.0	-	0.05	208
Retractable clothesline, gas dryer	558	84.3%	471	14.2			6,681	-	-
Retractable clothesline, electric dryer	4	100.0%	4			416.0	-	-	1,664
Compact fluorescent, 15-watt	2880	94.5%	2722		0.0033	34.6	-	8.93	94,177
Compact fluorescent, 20-watt	2688	82.8%	2226		0.004	42.3	-	8.93	94,157
Compact fluorescent, 23-watt	2418	95.6%	2312		0.0056	59.2	-	12.97	136,847
Fluorescent torchiere, 70-watt	144	95.2%	137		0.0186	191.4	-	2.56	26,250
Programmable thermostat	145	77.9%	113	18.3			2,067	-	-
Total							27,297	33.78	354,915

5. ATTRIBUTION OF ENERGY SAVINGS

This section provides the relevant computations and analysis used to assess the viability of the assumed program net-to-gross (NTG) ratio of .80. The specific energy savings analysis focuses on the verified installations based on best available data during the Program development stage as a benchmark. The adjusted gross savings are presented as an ex-ante using the best current data for the purpose of designing and operating the next Program cycle. Discussed in more detail below, the attribution analysis uses methods to identify: 1) free-ridership – measures that would have been installed in absence of the CYES program and 2) spillover – savings from additional energy efficiency measures that were influenced by the CYES Program but not accounted for in the program records.

Free-ridership represents savings that would be achieved whether or not the program was implemented. These savings are subtracted from the program's installed gross savings. The purpose of this is to avoid attributing naturally occurring energy efficiency actions that would have occurred regardless of the program's existence. Conversely, savings that are due to the program, but not counted for in the program records (spillover) are added to the savings estimates. For example, the program may have influenced participants to invest in more energy-efficient window sealants which would reduce the amount of energy expended by the heater. However, these savings are not tracked in the program reporting documents.

As an initial summary of the findings in this section, the attribution analysis indicates a free-ridership weighted average estimated value of 26% and a spillover estimate of 6%, implying a NTG ratio of .78. This implies that that the assumed NTG value of .8 is acceptable. Table 5-1 presents the original program gross savings estimates, the gross savings recorded in the program workbook[12], the verified gross savings taking into account the verified installations and best available data at the program development stage, and the adjusted gross program savings based on updated savings information. Table 5-2 presents the original net projected savings, the recorded net savings, the verified net savings, and adjusted net savings accounting for the best available data during the Program evaluation period as well as the .80 default NTG ratio.

Table 5-1: Gross Savings Attributed to the Program

Gross Effects	Projected Gross Savings	Recorded Gross Savings	Verified Gross Savings[13]	Adjusted Gross Savings
Coincident Peak kW	244.3	272.2	248.6	33.8
Annual kWh	670,314	677,953	617,252.1	354,915
Annual Therms	22,628	28,699	25,116.9	27,297

Table 5-2: Net Savings Attributed to the Program

Net Effects	Projected Net Savings	Recorded Net Savings	Verified Net Savings[13]	Adjusted Net Savings
Coincident Peak kW	195.4	217.8	198.9	27.1
Annual kWh	536,251	542,363	493,801.7	284,341
Annual Therms	18,103	22,959	20,093.5	21,837

[12] December, 2005

[13] Based on unit savings estimates used in the original program plan

As is evident, the verified net savings (taking into account verified installations and the best available savings assumptions during the program development stage) correlate very closely to the projected and recorded net savings, indicating that the Program performed well compared to expectations.

It should be noted that accurately calculating precise free-ridership and spillover values is very difficult. Program participants are not guaranteed to answer hypothetical questions accurately. As a result, while difficult and subject to some judgments and assumptions, it is important that the attribution analyses be performed on energy efficiency programs such that reasonable information be provided to program representatives which will assist them in making good decision concerning the program in the future.

5.1 Net-to-Gross Analysis Approach and Results

The method for assessing the net energy savings attributable to the program is based on a net-to-gross (NTG) ratio. This ratio has two main components: 1) a net "free-ridership" factor, and 2) a market effects "spillover" factor.

The net factor subtracts from the gross savings the share of energy savings due to actions that participants would have taken anyway, i.e., actions that were not induced by the program. This process is intended to correct for energy efficiency measures that would have been installed even if the program were not in place. Due to the varying nature and installation rate of each program element, Summit Blue developed individual free-ridership factors for lighting and non-lighting measures. This approach is beneficial in that it allows program representatives to analyze the free-ridership effect for individual measures and adjust future planning for each measure accordingly.

The market factor is designed to capture program effects and impacts that go beyond the CYES Program. These market effects are referred to as "spillover" because they reflect impacts that extend beyond the bounds of program records.

The overall NTG ratio is meant to capture these two attributes of the program. When the NTG ratio is multiplied by the estimated gross program impacts, the result is an accurate estimate of program impacts that the program is directly responsible for. The equation utilized by Summit Blue to calculate the NTG ratio is:

$$NTG\ Ratio = (Net\ Factor)*(Market\ Factor)$$

The net factor is equivalent to the attributed fraction of savings or (1 – free-ridership rate).

The market factor is a combination of program spillover factors that may influence actions to be taken outside the program. This factor generally enhances or adds to the program's positive benefits. The market factor is defined to be (1 + spillover rate).

5.1.1 Free-Ridership Analysis

Summit Blue utilized a persistence survey to ask program participants a variety of questions addressing the program's impact on their decision to purchase and install high-efficiency equipment. The questions allowed Summit Blue to estimate the share of program-reported savings that are attributable to the program itself. A variety of questions were asked from different perspectives to elicit participant responses that indicated both direct and indirect program influence. Those participants whose responses suggest they may have installed high-efficiency measure without the program were considered partial free-riders. The analysis combines assessment of the individual respondents to yield a program-wide free-ridership estimate.

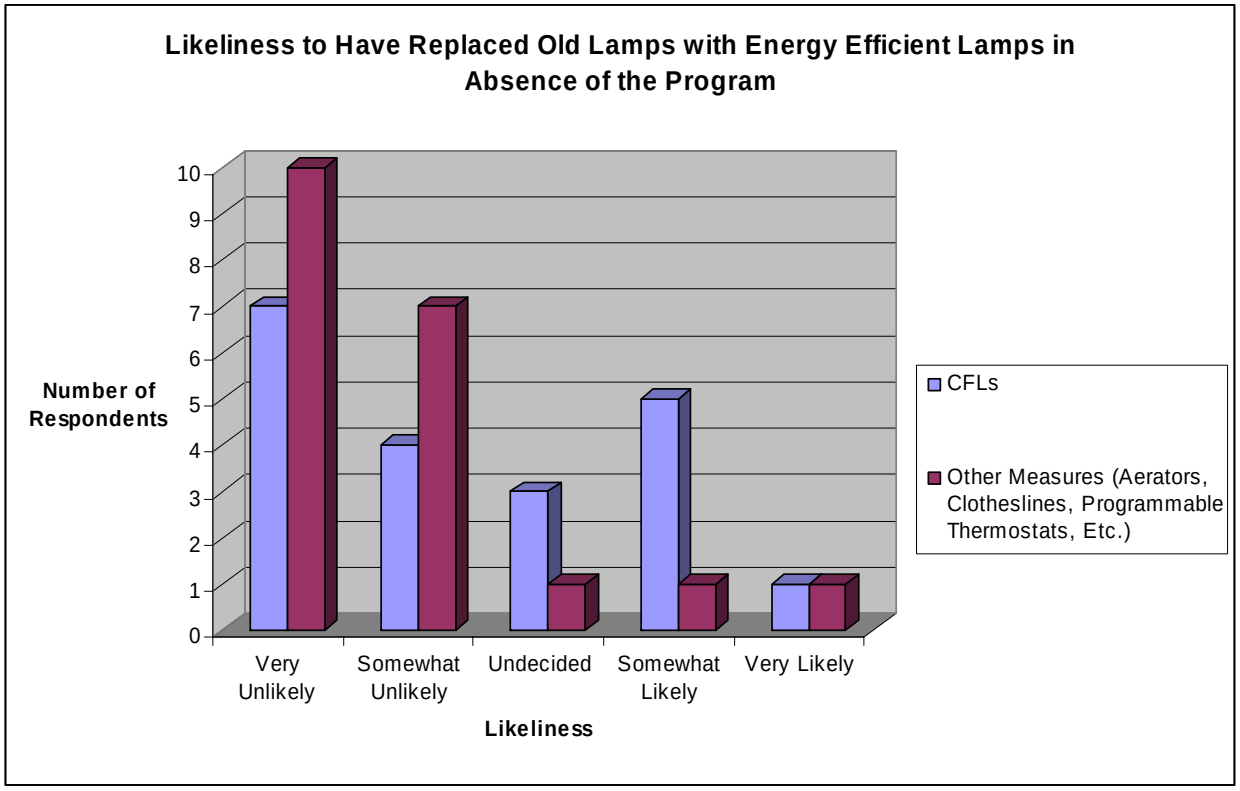
The primary free-ridership questions asked are outlined below:

1. *Were you planning to replace your [measure] prior to learning about the CYES program?*

2. *If the CYES program was not available, how likely is it that you would have replaced the [measure]) with a more energy-efficient measure?*

The responses to these questions were evaluated on a scale of 0-100%. If an individual respondent stated they would have taken energy-efficient actions in absence of the program, they received a score that was relatively higher than someone who stated they were uncertain as to whether or not they would have installed energy-efficient measures without the program. Figure 5-1 illustrates the results of this analysis.

Figure 5-1: Free-Ridership Analysis



Of the 20 people surveyed, the average free-ridership score was 32% for CFLs and 23% for the other energy-efficient measures. This evaluation uses the average response to the free-rider questions to estimate a program free-ridership value of 0.26.

The difference in lighting and non-lighting free-ridership values indicates that participants are more likely to install energy-efficient lights than the other non-conventional energy-efficient measures. This indicates that non-lighting energy-efficient measures might benefit from heightened marketing efforts because it is less likely that participants would have installed these measures without the influence of the program.

5.1.2 Spillover Analysis

As previously discussed, free-ridership reduces estimated program savings by accounting for savings that would have been achieved in absence of the program. Conversely, spillover increases estimated program savings by accounting for energy-saving activities that are a result of the program but are not captured in

program records. Spillover may range from additional activities taken at participant sites to widespread market effects that impact non-participants so long as the energy savings can be attributed to the influence of the program.

The following analysis is based on participant responses to questions regarding the percentage of residential equipment installation jobs at which they take additional measures not explicitly offered by the program. An example of the pertinent questions asked of the participants is illustrated below:

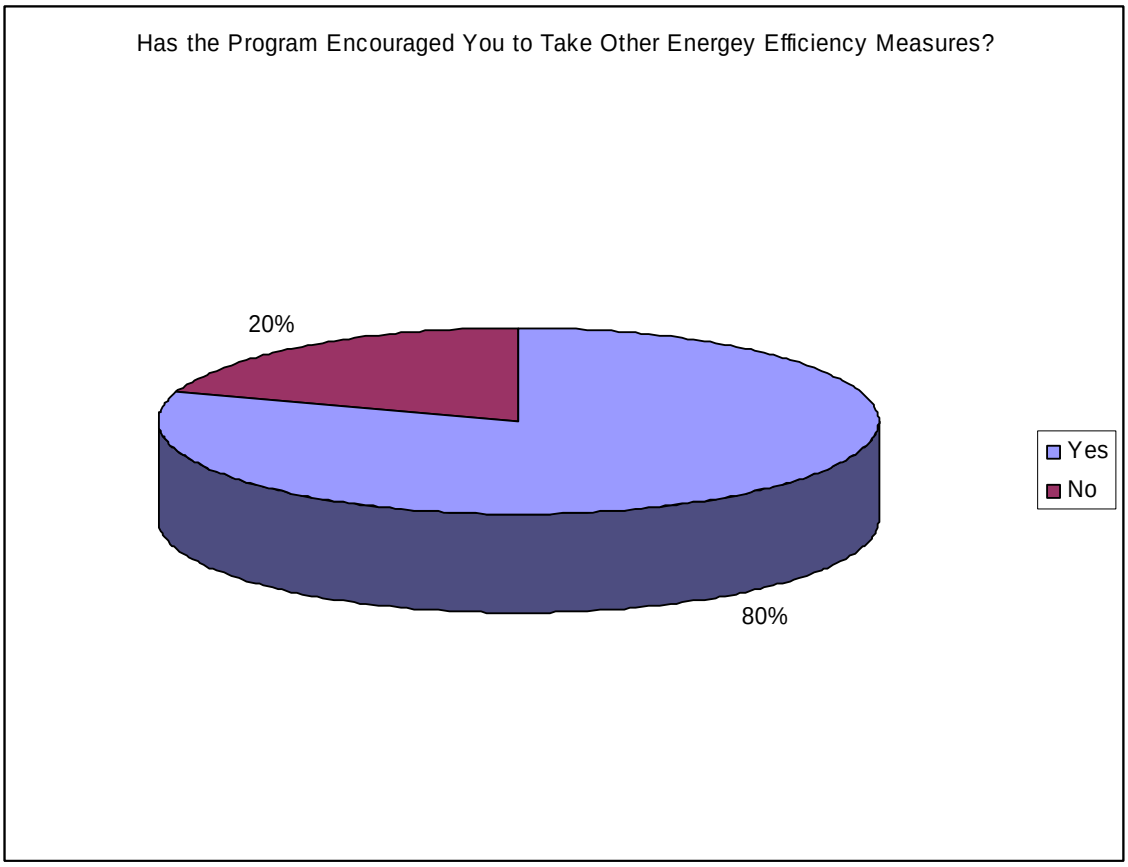
1. *Has your experience with the CYES program encouraged you to take other energy efficiency measures at your home?*

2. *Has the program encouraged you to install a higher efficiency [measure] than you would have otherwise?*

3. *Has the program encouraged you to install the [measure] sooner as opposed to waiting at least 6 months to a year?*

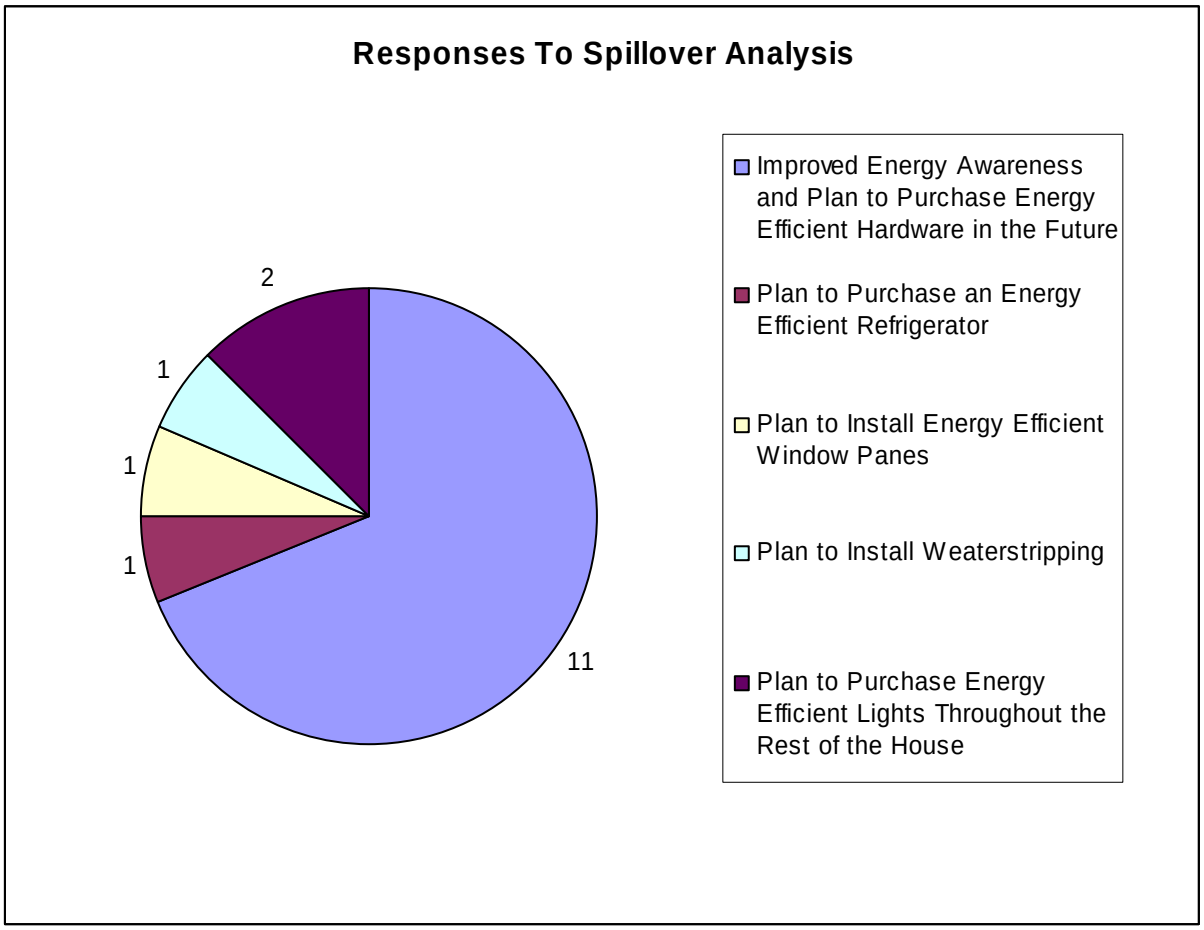
The responses to these questions were ranked on a scale of 0-100% depending on the probability that the program participant would or would not have taken extra energy-efficient actions as a result of the program. Figure 5-2 illustrates the results of this analysis.

Figure 5-2: Spillover Analysis Results



Out of the 20 respondents surveyed, 16 reported that the program encouraged them to take additional energy efficiency measures. This implies that the program has had a lasting effect on the Participants in terms of the knowledge imparted as well as the actions subsequently taken. Figure 5-3 further analyzes the extent to which the program influenced each respondent to partake in other energy-efficient measures.

Figure 5-3: Detailed Review of Responses to Spillover Analysis



The figure above illustrates the responses of participants when asked what other energy efficiency measures the program has influenced them to take. Eleven respondents stated that they were definitely more energy conscious and would act accordingly when making equipment purchases in the future. Others stated that they were in the process of purchasing a variety of energy-efficient equipment. Due to the qualitative nature of the responses gathered, it was difficult to assign numerical values to each participant's answer. In the end, a spillover rating was given dependent upon whether or not the measure was currently being purchased and how sincere/knowledgeable the respondent appeared to be with respect to the measure they planned to install. In addition, it was recognized that some participants would state that they were willing to partake in future energy efficiency measures in order to appear energy conscientious. Summit Blue took this aspect into account accordingly when determining the spillover ratio for the program.

Overall, the average spillover rating of 20 responding participants was 8% for CFLs and approximately 6% for the other measures. This evaluation uses the average response to the spillover questions to estimate a program spillover value of 0.06.

The spillover rating is fairly high indicating that participants have been influenced by the program, however it is unclear how much installation activity has actually occurred. The value of these spillover impacts pose immeasurable value as the potential continued energy savings that may result in the future

due to this program are very substantial.

5.1.3 Net-to-Gross Ratio and Net Savings

Based on the analytic approach discussed earlier, an estimation of net savings requires the multiplication of the gross savings value by the net-to-gross ratio. The net-to-gross factor was calculated as follows:

NTG = (Net Factor)(Market Factor)*

As stated earlier, the net factor is defined as (1 - free-ridership rate). Since the measures of this program have variable free-ridership rates, the Market factors vary as well.

The market factor is a combination of program spillover factors that may influence actions to be taken outside of the program. This factor enhances the program's measured impacts and is defined to be (1 + spillover rate). Again, each measure has a different spillover rate, and a corresponding different market factor.

The resulting net-to-gross ratio is calculated for each measure utilizing the following formula:

NTG = (1-Free-rider Rate)(1+ Spillover Rate)*

NTG = (1-0.26)(1+0.06) = 0.78*

5.1.4 Benefit Cost Analysis

The program workbook[14] was updated to provide a revised program benefit–cost analysis. This update involved 2 primary components;

1. The number of units installed by the program was revised to reflect the verified installation values for each measure. This analysis indicates that the revised program TRC is 0.6530, or roughly 93% of the original plan TRC of 0.6993. Similarly, the revised benefit / cost ratio as estimated by the participant test in 6.9549 compared to an original planned value of 7.4833, or about 93% of the original planned value.

2. The unit savings estimates were revised for several measures to reflect the values recommended on this evaluation. This analysis indicates that the proposed final program TRC is 0.4789, or roughly 68% of the original plan TRC of 0.6993. Similarly, the proposed benefit / cost ratio as estimated by the participant test in 5.2409 compared to an original planned value of 7.4833, or about 70% of the original planned value.

It should be noted that the budget figures, and avoided costs values used in the updated workbook were not revised. Table 5-3 provides the original projected, program reported, and revised total resource cost test estimates, while Table 5-4 provides the original projected, program reported, and revised participant test values.

[14] May 2006

Table 5-3: Total Resource Cost Test Estimates

Total Resource Cost Test	Projected	Recorded	Verified installations and original unit savings estimates	Verified installations and adjusted unit savings estimates
Lev Cost – Electric	$0.1256	$0.1295	$0.1464	$0.2532
Lev Cost - Gas	$3.0949	$3.1891	$2.5342	$2.3173
Costs	$367,755	$378,950	$368,822	$368,822
Benefits	$257,166	$267,034	$240,845	$176,624
Net Benefits	($110,589)	($111,917)	($127,977)	($192,198)
Ratio	0.6993	0.7047	0.6530	0.4789

Table 5-4: Participant Test Estimates

Projected Participant Costs and Benefits	Projected	Recorded	Verified installations and original unit savings estimates	Verified installations and adjusted unit savings estimates
PT Costs	$96,729	$112,237	$98,062	$98,062
PT Benefits	$723,852	$749,371	$682,009	$513,939
PT Net Benefits	$627,123	$637,134	$583,947	$415,877
PT Ratio	7.4833	6.6767	6.9549	5.2409

6. CONCLUSIONS AND RECOMMENDATIONS

This section presents Summit Blue's conclusions and recommendations derived from the evaluation, measurement, and verification of the CYES Program.

6.1 Conclusions

This section presents conclusions from program processes and impacts.

6.1.1 General Conclusions about the Program

The program was successful and met its goals. Summit Blue is confident that the CYES Program provided significant monetary, educational, and motivational benefits to residential participants. The Program is replicable to a large degree and will hopefully be successfully applied to different districts in the future. Most recommendations contained in this report are fine-tuning in nature for future implementation.

6.1.2 Conclusions about the Program Processes

Overall, the program recipients were very pleased with the services they received by local youth in their community. The program provides a replicable means by which to access the elusive "hard-to-reach" residential customer class with energy efficiency services, while at the same time providing job skills in energy efficiency to local area youth. Improved job pathways for youth participants could help the program meet the job training goals, through locating a partnership with job skills training and placement, perhaps even with PG&E. A large majority of participants interviewed found the Program to be both

enlightening and cost-effective, and almost everyone stated that they would like to see the Program extended to different districts.

6.1.3 Conclusions about the Program Impacts

- A review of program measure installation data provides several observations;
  - The program accurately recorded measures installations for the majority of measures, as shown in Table 6-1, with the exception of faucet aerators, 20W CFLs, and retractable clotheslines on gas dryers.
  - The number of measures installed on electric fueled DHW systems was much smaller than originally planned. It is likely that the number of electric fueled DHW systems was overestimated due to the high presence of gas service and high penetration rate of gas appliances in the program territory. This discrepancy is also true for clotheslines supporting gas or electric clothes dryers.
  - Conversely, the number of measures installed on gas appliances (DHW and clothes dryers) was much higher than originally estimated.
  - Field work conducted during the course of this evaluation confirmed that the measure installation rates reported by the program are accurate for all measures with the exception of faucet aerators. It is likely that faucet aerators that were left behind for customers to install were, in fact, not installed. It may also be that aerators that were installed ultimately fouled due to hard water and were removed.
  - Most of the measures installed through the program remain in place and operational however, with the notable exception of 20 Watt lamps. The evaluation team observed that a disproportionately high percentage of 20 Watt lamps that were installed by the program had been removed prior to the field verification visit.

Table 6-1: Planned, Recorded, and Verified Measures Installations

Measure	Unit Goals	Total Recorded Units (Actual + Commitments)	Verified Installations	Verified Installation Persistence
Reduce DHW temp. by 10 degrees	300	78	72	72
Faucet Aerators, gas hot water	1,680	3225	2622	2,280
Faucet Aerators, electric hot water	420	14	14	14
Showerhead, gas hot water	850	1411	1368	1,368
showerhead, electric hot water	213	5	5	5
Pipe insulation, gas hot water	95	59	59	59
Pipe insulation, electric hot water	5	2	2	2
Retractable clothesline, gas dryer	520	558	518	471
Retractable clothesline, electric dryer	80	4	4	4
Programmable Thermostat (gas furnace only)	140	145	136	113

Compact fluorescent, 15-watt	2,400	2880	2938	2,722
Compact fluorescent, 20-watt	1,600	2688	2315	2,226
Compact fluorescent, 23-watt	2,400	2418	2312	2,312
Fluorescent torchiere, 70 watt	200	144	137	137

- The original program design included assumptions in the unit-savings estimates for a variety of measures that have since been found to be inaccurate. After a thorough review of the available documentation and additional information from industry accepted reference sources, such as DEER, the unit savings estimates originally filed with, and approved, by PG&E were adjusted. Unit savings assumptions included both understated and overstated values. In general, gas measures tended to be understated, while savings estimates for CFL based lighting tended to be overstated. Because CFLs represented approximately 80 percent of planned program electricity savings, the gross and net savings verified through this evaluation are substantially lower than the planned or reported.

- Summit Blue also conducted research into the validity of the assumed program NTG ratio of 0.80 and believes that this value accurately reflects program attribution. Program participants were asked several additional questions regarding free-ridership and spillover effects and the responses were consistent with, and supportive of, the assumed program value.

- With respect to original Program savings assumptions and verified installation rates, the Program exceeded expectations for kW and Therm savings. Under the aforementioned scenario, the Program achieved 102% of kW savings, 92.1% of kWh savings, and 111% of Therm savings respectively. Thus, it is clear that the Program performed very well aside from the revised energy savings values.

6.2 Recommendations

This section provides insight into how the program may be improved in the future and how the program can be made substantially more replicable.

6.2.1 Program Design and Implementation

As stated in earlier sections, the CYES Program excelled in installing energy efficient measures and satisfying customer expectations through a variety of means. However, there were a variety of aspects that could be improved in the future in order to help the program realize a higher energy savings realization rate. The original measure savings assumptions, for example, could have undergone a more thorough examination in order to verify the validity of the claims. A simple check process with different qualified representatives might be sufficient in the future to catch any major problems in the original savings documents.

Moreover, much of the information was stored in workbooks that were updated regularly. However, these workbooks were fairly hard to utilize and understand, especially if one was new to the program. In the future, a more friendly user interface should be considered in order to reduce the probability of data input error and confusion. This would also enhance the replicable nature of the program in the future as well.

And although the idea of utilizing youth representatives to install energy efficient measures is novel and may cater to general interest of the impacted population, caution should be exercised when sending them into an unfamiliar environment. Perhaps a simple background check of potential program participants could be conducted before sending implementers out into the field. This would substantially reduce the liability potential of the program.

6.2.2 Researchable Issues

The CYES Program has a number of researchable issues that should be accounted for in the future. One issue is that the residents are sometimes hard to convince that the program is really free. This questionability can reduce the number of active participants, thereby reducing effectiveness. One solution might be to pre-sell the program by landlord or influential community member (Church leader, business owner, etc.). This will give the program reputable support as well as more publicity. Furthermore, it would allow organizations to reach those in the community that do not speak English – addressing a formidable barrier of the program. Of course, logistically, the degree to which this methodology is carried out may require additional upfront work on the part of implementation staff and subsequent coordination on the back end. However, analysis on the value of this approach would prove interesting.

Another issue to address would be program efficiency. Representatives were not aware of who signed up for the program without looking in the database. As a result, information dissemination within the community might not have been as fluid as desired. A potential solution to this issue might be to provide some kind of signage or sticker to be placed on the windows of the home. This would serve several purposes:

1.) Provide more efficient information dissemination

2.) Improve publicity

3.) Provide a public commitment by participating households

4.) Create potential idea or thought leaders in a neighborhood.

However, it should be noted that the overuse of signs can lose impact if they are overused[15]. The degree to which this methodology should be implemented would be of particular interest in the future – especially when trying to improve program awareness.

Finally, additional research should be conducted into the adaptability of energy efficient measures involved in the Program as well as the ease of use. As stated earlier, many participants found the Programmable thermostat hard to adjust to, and as a result, removed them. Perhaps an analysis on product usability could be included on measures with high removal rates in the next Program cycle.

6.2.3 Program Replication

The program was a success and, based on prior conjecture, deemed replicable. However, there are some factors that may further improve the program's replicable nature in the future should they be accounted for. For example, community based social marketing experts agree that environmental and sustainability oriented changes often happen at the neighborhood and even street level. Moreover, it should be noted that the ease to which a program like this can be replicated depends on the supporting and available infrastructure from sponsoring agencies. There is some concern that some areas can become over served with non-profit services. Although this program has not currently reached saturation, it is a component to consider when replicating the program in a different environment.

Another factor that may impact the replicable nature of the program is the duration of visits to local residences. Some participants reported that the process was somewhat long which could impact program

[15] As in Prop 65

participation in the future. Perhaps a better scheduling methodology could be developed to reduce the amount of time it takes to complete a visit (utilizing a vehicle owned by the program for transportation purposes instead of public transit, for example). In addition, neighborhood partnering could improve response time/rate and better preview by reputable community members could pre-sell visits.