Final Report

2004-2005 GREEN SCHOOLS PROGRAMS EVALUATION

(PROGRAM 1430-04, 1435-04, 1426-04)

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Executive Summary

Program Overview

The Alliance to Save Energy (the Alliance, ASE) was awarded funding from the California Public Utilities Commission (CPUC) to implement the Green Schools Program (the Program) a local, energy efficiency program for schools in the Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas and Electric Company (SDG&E) service areas. Green Schools is an information-only program that provides energy conservation information to schools in a variety of formats, including energy education materials, which enable teachers to incorporate energy efficiency education into the normal curriculum; school- and community-based activities designed to increase participants' attitudes, awareness, and knowledge about energy efficiency; and recommendations to schools regarding behavioral and operations changes that will ultimately result in energy savings.

Market Characterization

To understand school districts' past and current involvement in energy efficiency programs, assess barriers to participating in such programs, and identify strategies for and interest in adopting new energy efficiency curricula, 74 telephone surveys were conducted with key district personnel throughout the three service territories. The following summarizes the key findings:

- ***Past and Current Participation***: More than 60% of those surveyed statewide have participated in a schools energy efficiency program within the past five years. Within the PG&E service territory, more than 50% have participated; within the southern California area, more than 70% have participated. The most common type of participation was in facility-retrofit programs, followed by new construction and curriculum based programs.
- ***Awareness of Green Schools***: The Green Schools Program from the Alliance to Save Energy was mentioned by 44% of the respondents as one of the curriculum programs in which they participated, followed by the NEEDS Program, Project Learning Tree, and Living Wise. The Green Schools Program has lower penetration within the PG&E service territory compared to the service territories of SCE and SDG&E.
- ***Non-Participation***: Only 22% of the schools who had not participated in an energy efficiency program within the past five years reported that they had been approached to participate. Of those who had been approached, 33% indicated that poor timing was the reason they did not participate. Others indicated that program recommendations were not economically viable or that the programs were not consistently available.
- ***Factors in Participation***: When asked to indicate the most important factors considered when deciding whether to participate in a curriculum-based program, the majority of responses center on alignment of materials with state standards (28%), teacher time/ease of use (17%), and cost/cost effectiveness of the programs (12%). Other common

responses included quality of the materials, educational benefit and relevancy to students, and the ability to integrate the materials into the existing curriculum.

- ***Interest in Participating***: The great majority of respondents stated they are either "Very" or "Somewhat" interested in the following three types of programs: project-based (91%), programs providing standard-based curricula (91%) and programs providing immediate savings through behavioral changes (96%).

Process Evaluation

In an effort to assess Program processes, and to provide an effective forum for collaboration, evaluation, and mid-stream feedback, Quantec, in conjunction with Shel Feldman Management Consulting, conducted a one-day stakeholder workshop in January 2005. The intent of the workshop was to examine the Program elements and goals in order to assess whether the Green Schools Program is successful at achieving its long-term goals and objectives of impacting student behavior at home and, ultimately, having a continued impact on their future energy related behavior. In light of the fact that an extensive process evaluation focusing on more short-term and intermediate effects was conducted during the 2002-2003 program year, this evaluation was able to focus on an examination of the Program's long-term effects. The following details the results of the initial workshop conducted early in the Program's implementation for the purpose of identifying the basic goals of the Program and assessing the ability of the current Program elements to result in more lasting behavioral changes for participants.

- ***Program Goal***: Affect long-term behavior by developing energy stewards and stewards of the environment.
- ***Program Theory***: Employ a strategy that uses materials/activities that can be integrated into the existing curriculum and across nearly all subjects. Effectively train teachers to change their perceptions and behaviors toward energy and the environment. Use hands-on activities that encourage student participation and active learning to engender lasting effects.
- ***Overcoming Barriers***: Encourage buy-in at multiple levels (superintendent, principal, and teacher) and make lessons meaningful to students to also encourage student buy-in. In addition, incentives and recognition of various forms help engage students and reinforce the relevance of energy efficiency. It is also critical to utilize Program activities that make energy "visible" and conceptually less abstract.
- ***Program Elements Supporting Program Goals and Address Barriers***: Several specific elements of the Program support the goal and help overcome the identified barriers.
    1. Offering teachers significant training prior to participating.
    2. Providing materials and lessons that are hands-on and age appropriate (e.g., school/home/business audits and Energy Patrols).
    3. Having local Program facilitators secure buy-in at different levels (principals, superintendents, facilities staff) and working closely with teachers and school facility staff.

4. Recognizing student achievements and developing meaningful lessons that help students make the connection between energy, energy efficiency, and the environment.

- ***Measuring Success***: Finally, to ensure continued Program viability, stakeholders emphasized the need for measuring successes. Various options for measurement were discussed including, improved tracking of Program activities and actions at participating schools, documenting Program achievements qualitatively using case studies and testimonial and tracking the number and impact of audits conducted outside the classroom.

In-Depth Family Interviews

To determine the long-term effect and reach of the Green Schools Program, in-depth interviews were conducted with the family of ten participating students. Specifically, these interviews were designed to gather data regarding the Program's impact on the students and to assess the reach of the Green Schools Program beyond the classroom, including whether the lessons have resulted in behavioral changes in the home by the students, parents, and/or siblings. While the limited sample prevent any statistically significant analysis, the anecdotal information serves as a case study and offers significant insight into how Program information is disseminated outside the classroom. The findings of this effort are highlighted below:

- The vast majority of students interviewed indicated that their general awareness and knowledge/understanding of energy and energy efficiency had improved since participating in the Program. All but one student responded that both awareness and knowledge/understanding had improved either highly or somewhat.
- The majority of the students (eight of the ten) stated that they had taken energy efficiency-related actions, typically in the form of behavioral changes, both at school and at home. Commonly cited actions taken at school included turning off lights, monitoring thermostat settings and going on "Energy Patrols." The most frequently referenced actions at home included turning off electronics when not in use, installing showerheads/aerators, and taking shorter showers, in addition to being more diligent about turning off lights and placing the thermostat at an energy-efficient setting.
- In addition to the students noting changes in their own behavior, all but one of the parents interviewed reported changes in their child's behavior since participating in the Green Schools Program. The observations of the parents validate both the student's statements and the Program's ability to transcend the classroom.
- Of the six siblings interviewed, five noted that their brother/sister had taught them something about energy or energy efficiency since they participated in the Program. Several of the siblings reported taking action around the home, and all six said they now felt that energy efficiency was either very (four) or somewhat important (two).
- While the students, their parents, and their siblings noted some specific behavioral changes, all families expressed an overall increase in their general awareness of energy issues in their homes as a result of the student's participation. One parent made the

comment, “Our overall knowledge [as a family] has improved a little; he’s raised our awareness and reinvigorated the family.”

- The change in awareness and behavior were not limited to energy issues, but often spilled over into a general increased cognizance of environmental issues in general. Many of the students and their families discussed recycling, landfill levels, and water/air pollution in the context of their experience in the Green Schools Program.
- It was the observation of the interviewers that the majority of the students were very enthusiastic about their experience in the Program. Several were able to effectively transfer that interest and enthusiasm to their parents, siblings, or both.

Savings Tracking Assessment

Based on the recommendations of the previous evaluation report, the 2004-’05 Program revised its processes for determining the energy impact of the Program. As part of this evaluation, the changes undertaken by the Program to improve their ability to track savings was assessed. The change in approach to estimating energy savings by ASE for the 2004-’05 Green Schools Program was thought to be a positive change. The Utility Manager (UM) model, based on utility bills, provides excellent documentation on baseline, predicted energy use, and adjustments to the energy use. The potential energy savings calculation becomes transparent and relatively easy to understand for all parties involved. Additionally, the database becomes a repository for much of the information that could be used in the future for a multivariable regression analysis, if chosen by ASE. While not discussed during the training held to discuss UM, a form has been drafted by ASE that would track what the actual behavioral changes occurring at the schools are and when they are taking place. If this information is obtained and maintained in a database, it would help any future regression analysis and may be able to be used with the current UM software to provide reasons why changes are seen in different months

In addition, it is important that the Alliance be cognizant of the fact that there are always fluctuations in utility bills from year to year that cannot easily be explained. UM provides a well documented model of possible savings based on actual utility bills, but it cannot account for all the differences between one year and the next. There is a likelihood that the utility bill may be higher in the test period than the baseline period for unknown reasons. As such, if there are reductions between the baseline and test years, the differences seen on the software reports should be indicated as estimated savings by ASE and their subcontractors.

Review of Program Results

As a result of the unexpectedly low energy savings estimated for several participating schools in the Southern California Edison service area, the Alliance to Save Energy asked Quantec to modify the existing workplan and review the Program savings analysis. Specifically, ASE requested that Quantec determine specific reasons why the estimated energy savings were relatively low at certain schools (if possible) and analyze energy efficiency actions taken and provide suggestions for improving the data collection. While much of the difference between the savings observed in the two service territories is likely due to the programmatic challenges faced

by local SCE project teams after the sudden death of a team leader, Quantec also looked for other rationales and offered suggestions for improvement when possible. Most suggestions center on improving the quantity and quality of data collection. Although it is difficult, regardless of the methodology employed, to prove a direct causal relationship between Program activity and the observed increases and decreases in energy consumption at participating schools (due the inherent fluctuation of school energy use and the size of the facilities), improved data on Program activities and changes at the school site will serve to minimize uncertainty regarding the Program's actual energy impact.

The following summarize our review of the Program results and highlights key points and recommendations.

- ***Utility Manager Inputs, Analyses, and Results***: Currently, the quantity and quality of SCE data available are inadequate to make UM adjustments . This is illustrated by the fact that only 13% of SCE schools received adjustments (compared to 52% of PG&E schools had their energy consumption levels adjusted to account for a physical or operational change). Although adjustments are not needed at all schools, the true percentage of schools implementing changes that require UM adjustments is certainly closer to 52% than 13%. Furthermore, while the exact impact of the data issues upon UM savings estimates is unclear, improving both the quantity and quality of data from SCE by establishing on-site points of contact at each participating school whenever possible will yield more accurate UM results. Although data collection processes are currently better in PG&E, similar efforts can further improve UM adjustments and results within the service territory. Differences in weather-calibration between service territories may also contribute to the observed disparity in savings. Conducting comparable analyses across utilities whenever possible may serve to lessen such differences.
- ***Recommendation for Improved School Reporting***: Although the Program has made significant strides to improve its data collection processes from participating schools, additional steps can be taken. First, future iterations of the Program should take steps to increase the percentage of schools submitting a monthly or quarterly report detailing the energy efficiency actions taken as part of their participation. By doing so, the Program can create a more viable and comprehensive dataset that documents total Program impact and allows for more substantial statistical analysis. Second, improvements should be made to the report that enhance its clarity, specificity, and focus. To avoid confusing and overwhelming respondents, the report should concentrate on only those changes created by the Program and the activities which generate the greatest energy impact and are easily quantifiable.

Market Characterization

Background

The evaluation of the Green Schools Program (the Program), implemented by the Alliance to Save Energy, involved a market characterization of the school segment that covered both northern and southern California. The market characterization report, which addresses school enrollment both in terms of numbers as well as ethnic and linguistic diversity, school funding, the need for renovation of existing schools and the construction of new schools, and school finance, is built upon a market characterization study prepared by Ridge & Associates under contract to the Pacific Gas & Electric Company. Quantec has augmented this market characterization study using information of specific interest to the Alliance gathered from 74 telephone interviews, which Quantec completed with key school district personnel, covering the service territories of *all four* Investor-Owned Utilities (IOUs).[1] The vast majority of those interviewed included district superintendents, assistant superintendents, directors of curriculum and instruction, and business managers since these are the district personnel and staff traditionally targeted by the Green Schools Program. The focus on these roles makes the interview results particularly relevant to the Green Schools Program. The survey results are interwoven throughout the market characterization study prepared by Ridge & Associates.

Using both publicly available information and the district survey results, the market characterization report addresses school management and decision-making, market barriers to investing in energy-efficient equipment and innovative curricula, the characteristics of elementary and secondary schools (K-12) in California, school finance, and the availability and potential of energy efficiency programs available to the target market. The contents of this report, however, narrow the results of the larger market characterization effort discussed above and provide only the results determined to be of the most significance to the Alliance to Save Energy and the Green School Program. The remainder of the market characterization may be accessed online in a separate report[2].

Available Programs

In California, there are estimated to be at least 25 energy efficiency programs targeted at schools administered by utilities, state agencies, and third-party implementers. Some of these programs have a facilities focus, others have a curriculum focus, and still others have a combined focus.

Facilities programs are designed to implement both hardware and behavioral changes to reduce energy use and demand at the school site. These programs use various strategies that include

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1 Samples were drawn from the PG&E, SCE, and SDG&E service territories. Districts within the Southern California Gas service territory were represented because of the significant overlap between the Southern California Edison and the SoCalGas service territories.

2 *California Schools Market Characterization*, Ridge & Associates, September 2005. http://www.calmac.org/publications/PGE_California_Schools_Market_Characterization.pdf

energy audits, rebates, financing, and training. The benefits from facilities programs are relatively short term and can be measured. There are three assumptions underlying the development of facility programs:

- Schools are under-represented among the participants in traditional non-residential audit and rebate programs.
- The under-representation of schools is a result of somewhat unique market barriers operating in the schools sector that are not fully addressed by the traditional non-residential audit and rebate programs.
- School energy programs can serve to overcome these market barriers, leading to an increase in participation in the various non-residential audit and rebate programs.

Curriculum programs are designed to introduce curriculum materials about energy use, conservation, and energy efficiency into K-12 classrooms. The intermediate and long-range benefits of increased knowledge, changes in attitudes, and changes in behavior resulting from these programs can also be measured, but measuring the effect of these benefits on future reductions in energy use is somewhat more difficult. There are two assumptions underlying the development and implementation of curriculum programs:

- Classroom science curricula in many schools ignore or under-emphasize energy use, conservation, and energy efficiency.
- Curricula materials that are focused on energy use, conservation, and energy efficiency and can be easily incorporated by teachers into their lesson plans will likely be used.

While this study could not verify that elementary and secondary schools are under-represented among the participants in utility-sponsored audit and rebate programs, the extent to which the barriers operating in the school market segment are unique is addressed. In addition, the study also addresses the extent of past participation in the various schools programs as an indication of the extent to which schools are likely to use classroom science curricula that emphasizes energy use, conservation, and energy efficiency.

Methodology

Primary data were collected from key district personnel throughout the service territories of PG&E, SCE, and SDG&E. Telephone surveys were used to collect these data using the questionnaire in Appendix A. The objectives of this survey were to:

- Assess past and current involvement of school districts in energy efficiency programs
- Assess barriers to participating in such programs
- Identify strategies for and interest in participating in energy efficiency retrofit programs
- Assess the extent to which energy is incorporated into the curriculum
- Identify strategies for and interest in adopting new energy efficiency curricula

The population frame consisted of 1,000 school districts located in the service territories of Pacific Gas & Electric (PG&E) Company, Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E). The plan called for completing interviews with 36 districts in the PG&E service territory and 36 in the combined service territories of SCE and SDG&E for an overall total of 72 interviews. At the state level, this sample size was expected to achieve estimates of various population parameters (e.g., past participation in energy efficiency programs, level of interest in future participation, etc.) at the 90% level of confidence and 10% level of precision. The precision at the utility service territory level would, of course, be lower.

Interviews were completed with approximately 100 individuals in 74 school districts statewide. The full disposition of the sample is provided in Table 1. In Table 2, we provide various survey completion rates:

- ***The pool efficiency rate*** is a measure of how efficient the sample frame was in reaching working numbers. That is, of all the numbers called, what percentage were working school district telephone numbers.
- ***The gross completion rate*** is the number of completions divided by the total number of call sheets.
- A more relevant number is ***the eligible completion rate***, which is the number of completions divided by the number of school districts reached that were eligible.

Ineligible districts were ones in which there was no answer, telephones were disconnected, the office was closed for the summer, the eligible respondent was on vacation, the telephone number was blocked, etc. The eligible completion rate of 21.3% was reasonably high for the schools sector. It should be noted, however, that 14.6 calls were required for each complete, an indication of the great effort required to achieve the eligible completion rate of 21.3%.

Table 1. Sample Disposition

Dispositions	Frequency (Districts)	Percentage of Districts Contacted
Complete	74	16.3%
Live/Active	58	12.8%
Max Attempts (5 Calls)	21	4.6%
No Answer	11	2.4%
Office Closed for Summer	12	2.6%
Refused	72	15.9%
Unavailable	35	7.7%
Vacation	57	12.6%
Voicemail	109	24.0%
Wrong/Invalid Number	5	1.1%
Total	*454*	*100%*

Table 2. Completion Rates

Types of Completion Rates	Rate
Pool Efficiency Rate	98.9%
Gross Completion Rate	16.3%
Eligible Completion Rate	21.3%

The number of completed surveys for each utility area is presented in Table 3. One should not interpret this table to mean that districts within the Southern California Gas Company (SCG) service territory are not represented. They are represented due to the fact that both SCE and SDG&E service areas include overlap with SCG. In addition, overlap exists between SCE and SDG&E in some of the districts called in the SDG&E sample.[3]

Table 3. Completed Surveys, by Utility Area

Utility	Frequency	Percentage
PG&E	40	54%
SCE	26	35%
SDG&E	8	11%
Total	*74*	*100%*

The respondents to the survey included district superintendents, curriculum specialists, facility managers, and personnel in the business office. Tab le 4 presents these results for California, PG&E, and the other three utilities. More than 50% of the survey respondents statewide were from the superintendent's office – usually the superintendent or assistant superintendent. The percentages for the PG&E area and the SCE/SCG/SDG&E area were nearly 70% and 50%, respectively. In other cases, the primary interviewee was a district curriculum specialist, facilities staff, or someone from the business office. In those cases where it was necessary to speak with more than one person in a district to complete the survey, we spoke with two or more people from this group[4]

Table 4. Respondent to Survey, by State, PG&E, and SCE/SCG/SDG&E

	CA		PG&E		SCE/SCG/SDG&E	
	N	%	N	%	N	%
Superintendent's Office	43	58%	27	68%	16	47%
Curriculum Specialist	11	15%	8	20%	3	9%
Facilities	12	15%	3	5%	9	26%
Business Office	8	12%	2	7%	6	18%
Total	*74*	*100%*	*40*	*100%*	*34*	*100%*

Note: For SCE, etc. only, there were 2 cases where the respondent was a superintendent/ principal

[3] Because the application of weights to reflect the slightly disproportionate sampling between PG&E and the other three IOUs made little difference in the statewide estimates, all reported *statewide* survey results are un-weighted.

[4] In these cases, the person recorded as the respondent was the one who answered the majority of the questions.

Past and Current Participation

One way to measure the combined effect of these barriers is to assess districts' past and current participation in energy efficiency programs. Respondents were asked a number of questions regarding the extent to which any of the schools in their district were currently participating in any energy efficiency programs and the types of programs they have participated in within the last five years. More than 60% of those surveyed statewide have participated in a schools energy efficiency program within the past five years. Within the PG&E service territory, more than 50% have participated, while, within the southern California area, more than 70% have participated. Conversely, nearly 40% statewide have not participated within the past five years. However, *current* participation rates are just the reverse, with slightly more than 40% of districts statewide indicating that some of their schools are *currently* participating in energy efficiency programs. Of those districts with schools currently participating, 56% indicate that all the schools within their district are participating, and another 32% statewide indicate that at least 50% of the schools in the district are participating.

When respondents from school districts that had participated in the previous five years (60% of the respondents) were asked about the type of program in which they had participated, 53% indicated that their schools participated in facility retrofit programs and 16% in new construction programs. Twelve percent have participated in curriculum-based programs. Table 5 presents greater detail.

Table 5. Participation in Last Five Years, by Program Type, by Geographic Area

	CA		PG&E		SCE/SCG/SDG&E	
	N	% Yes	N	% Yes	N	% Yes
Curriculum-Based Program	9	12%	4	10%	5	15%
Facilities Retrofit Program	39	53%	19	48%	20	59%
New Construction Program	12	16%	3	8%	9	26%
None	29	39%	19	48%	10	29%
Another Type of Program	2	3%	1	3%	1	3%

Note: Percentages add to more than 100% since multiple responses were allowed.

Those who indicated that they had participated in a curriculum-based program were asked to specify which one(s). Table 6 presents these results. When interpreting this table, remember that the absolute numbers are fairly small and are, therefore, only suggestive.[5]

[5] For example, 12% of the 74 respondents indicated that they had participated in a curriculum-based program within the last five years. Of these, 44% specified the Alliance to Save Energy Green Schools Program. Thus, 74 * 0.12 * 0.44 provides the number of districts (3.91 – four) that participated in the Program.

Table 6. Participation in Curriculum Programs within the Last Five Years, for California and the Four Major IOUs

	CA		PG&E		SCE/SCG/SDG&E	
	N	% Yes	N	% Yes	N	% Yes
Alliance to Save Energy Green Schools Program	4	44%	1	25%	3	60%
NEEDS Program (National Energy Education Development)	1	11%	1	25%	0	0%
Project Learning Tree	1	11%	1	25%	0	0%
PEAK Program	0	0%	0	0%	0	0%
Living Wise Program	1	11%	1	25%	0	0%
Some Other Curriculum-Based Program	2	22%	1	25%	1	20%

The Green Schools Program from the Alliance to Save Energy was mentioned by 44% of the respondents as one of the curriculum programs in which they participated, followed by the NEEDS Program, Project Learning Tree, and Living Wise. The Green Schools Program has lower penetration within the PG&E service territory compared to the service territories of SCE, SoCalGas, and SDG&E, while the NEEDS Program and Project Learning Tree have only penetrated the PG&E service territory.

We also asked respondents about the current use of energy efficiency and conservation in the curriculum aside from the energy efficiency programs already mentioned. Statewide, 31% indicated that energy efficiency and conservation is a part of the curriculum. Of those who report "Yes," 27% indicated that energy efficiency is included through limited discussion in the science curriculum, while 18% stated energy efficiency is informally included in science courses or integrated by interested science teachers. Other examples of energy efficiency in the curriculum cited less frequently include monitoring the school's solar project, interested teachers utilizing PG&E materials, and having specific units on energy efficiency in science.

Of those districts that include energy efficiency in their curriculum, 50% indicated that it has been part of their curriculum for two to three years. Another 32% indicated that it has been a part of their curriculum for more than five years. The percentages for PG&E and Southern California areas were similar.

When asked why energy efficiency was added to the curriculum, 18% of these respondents indicated that the reason was to make the students socially conscious. Others indicated that they were motivated by the energy crisis of the 1970s or that teachers, administrative staff, or members of the community had championed energy efficiency. Still others indicated that energy efficiency had always been a part of the area's/school's mentality. However, 14% of respondents could not remember or did not know why energy efficiency was added to the curricula.

Those who indicated that they had participated in a facility retrofit and/or new construction program were then asked which specific program their district had participated in and when. Table 7 presents these results. When interpreting this table, remember that the absolute numbers are fairly small and are, therefore, only suggestive.

Table 7. Participation in Facility Retrofit/New Construction Programs within the Last Five Years, for California and the Four Major IOUs

Facility Retrofit/New Construction Programs	CA		PG&E		SCE/SCG/SDG&E	
	N	% Yes	N	% Yes	N	% Yes
Utility-Run Express Efficiency	2	6%	1	7%	1	5%
Savings By Design	7	19%	4	27%	3	14%
SDG&E Energy Saver (SDG&E Respondents Only)	4	67%	0	0%	4	67%
Standard Performance Contract (SPC)	3	8%	1	7%	2	9%
CEC Efficiency Financing Program	4	3%	1	7%	0	0%
CEC Bright Schools Program	2	8%	0	0%	3	14%
CEC Solar Schools Program	5	11%	2	14%	2	10%
Office of Public School Construction Energy Allowance Grant Program	3	14%	2	13%	3	14%
State Energy Revenue Bond Program	1	6%	1	7%	1	5%
Rebuild America Program	3	0%	0	0%	0	0%
Any Other Rebate Program	7	17%	3	20%	3	14%
Any Other Audit Program	4	11%	0	0%	4	19%

All those who participated were asked whether, as a result of their experiences, they would participate in another energy efficiency program in the future. It is very encouraging that nearly 85% responded that they are either significantly or somewhat more likely to participate in another energy efficiency program (51% and 33%, respectively).

Non-Participants

The next question is what can be done to reduce the barriers for the 39% of the respondents who have not participated in an EE program within the last five years. First, all surveyed non-participants were asked whether they had ever been approached regarding participation in an energy efficiency program. Statewide, only 22% reported that they were approached. The percentages were slightly less in the Northern California area with only 17% indicating that they had been approached, and slightly higher in the Southern California area (33%). Of those who had been approached, 33% indicated poor timing was the reason they did not participate. Others indicated that program recommendations were not economically viable or that the programs were not consistently available.

When asked how they learned about these programs, the unanimous response given by respondents was outreach materials. Contrast this to those who had participated in a program within the last five years, who indicated that they were approached in person by a program manager. Also, later results will show that respondents indicated that they prefer to be contacted in person, and, specifically, that the superintendent be contacted. Other means of learning about programs included contact from a former superintendent and from architects designing new construction projects for their district.

Non-participants were also asked what key elements of a program would encourage them to participate. The most common response given was that the program must have a high

"educational value." Other key elements cited less frequently included timing, expert energy consulting, alignment with state standards, relevancy, and cost.

Curriculum Decisions

The district survey provided some guidance on how to navigate the decision-making process within the school sector. We discuss some of these insights below.

Who and How to Contact

We asked respondents to the district survey about the best ways for implementers of curriculum-based programs to contact school districts regarding their programs. Statewide, 43% of the respondents indicated that programs should first contact the superintendent – either by email (9%), standard mail (8%), telephone (3%), any of the preceding (12%), or by presenting the program in person (11%). Other suggested methods for contacting school districts included contacting the curriculum coordinators/committee (9%), approaching individual schools through either the principal, science teachers or by making a presentation at a staff meeting (8%, 3%, 1%, respectively), and contacting the district's business office (5%).

How New Curriculum Topics Are Added

When asked how new topics were added to the curriculum, responses varied widely. Fourteen percent statewide indicated that the superintendent presents ideas to the administrative group and school board. Another 12% indicated that proposals to add new curriculum were handled through the curriculum coordinator, while another 11% indicated that changes were driven primarily by state standards. These results vary significantly between Northern and Southern California, however. In the north, 14% indicate that interested teachers develop units with a specific focus, and 14% say that the principal presents ideas to teachers and then to the school board. In the south, 21% indicate that superintendents present ideas to school board, and another 14% indicate that changes are handed down through the superintendent. Twenty-one percent also suggest that changes go through the curriculum coordinator.

Timing. Timing, or when to approach a district about the adoption of new curriculum materials, is also important. When asked how often curricula are reviewed and changes made, 74% of the statewide respondents indicated that the curriculum is reviewed each year, with an additional 7% indicating that changes are made on an ongoing basis. When asked how long the review process takes, 54% of respondents indicated that curriculum changes take six months or less, with another 17% indicating that the process takes seven months to one year. Conversely, 10% of the respondents noted that curricula are reviewed and modified every five or more years. Thus, for some schools, the review of their curriculum and the implementation of changes require more than a year, making it difficult, if not impossible, to participate in curriculum-based programs that were funded *and* evaluated on an annual basis. However, because California utilities are now funded for three years (2006-2008) rather than one, the timing issue should be alleviated, thereby increasing the pool of schools that can profitably be approached.

Factors in Participation. We also asked the respondents to indicate the most important factors considered when deciding whether to participate in a curriculum-based program. The majority of responses center on alignment of materials with state standards (28%), teacher time/ease of use (17%), and cost/cost effectiveness of the programs (12%). Other common responses included quality of the materials, educational benefit and relevancy to students, and the ability to integrate the materials into the existing curriculum.

Program Preferences. In an effort to learn what types of curriculum-based program activities are most preferred, respondents were asked what elements they look for when considering participation in a particular program. Statewide, 19% prefer "hands-on activities," 17% prefer easy integration/implementation, and 10% prefer alignment with state standards. These results varied slightly between the north and south, in that the most common response for the north, 26%, was hands-on activities and in the south, 33% preferred easy integration/implementation.

Future Participation. Finally, with respect to future interest, we asked respondents to rate their district's interest in:

- Project-based programs that are designed for compatibility with state and federal curriculum requirements
- Programs that provide standards-based energy-efficiency curricula
- Programs that can provide immediate, measurable energy savings through behavioral changes

In all cases, the great majority of respondents are either "Very" or "Somewhat" interested in all three types of programs: project-based (91%), programs providing standard-based curricula (91%), and programs providing immediate savings through behavioral changes (96%).

When asked about their preferences for *facilities-based retrofit programs*, 61% indicated they were "Very" interested, while another 29% indicated they were "Somewhat" interested. These results suggest that programs designed to help schools make energy efficiency retrofits would find great interest.

In addition, the endorsement of key organizations can make a difference when deciding whether or not to participate. The most frequently mentioned organization was the state/county Department of Education, with 84% of responses. Next was the California Energy Commission (61%), and the California Public Utilities Commission (51%). Though not specifically asked about the importance of an endorsement from the Office of Public School Construction, several respondents noted that OPSC approval would make a difference when they were asked whether endorsements from any other agencies would be meaningful.

Conclusions

The following review some of the more pertinent findings of the market assessment efforts.

- ***Past and Current Participation***: More than 60% of those surveyed statewide have participated in a schools energy efficiency program within the past five years. Within the

PG&E service territory, more than 50% have participated, while, within the southern California area, more than 70% have participated. The most common type of program was in facility-retrofit programs, followed by new construction and curriculum based programs.

- ***Awareness of Green Schools***: The Green Schools Program from the Alliance to Save Energy was mentioned by 44% of the respondents as one of the curriculum programs in which they participated, followed by the NEEDS Program, Project Learning Tree, and Living Wise. The Green Schools Program has lower penetration within the PG&E service territory compared to the service territories of SCE and SDG&E.
- ***Non-Participation***: Only 22% of the schools who had not participated in an energy efficiency program within the past five years reported that they had been approached to participate. Of those who had been approached, 33% indicated that poor timing was the reason they did not participate. Others indicated that program recommendations were not economically viable or that the programs were not consistently available.
- ***Factors in Participation***: When asked to indicate the most important factors considered when deciding whether to participate in a curriculum-based program, the majority of responses center on alignment of materials with state standards (28%), teacher time/ease of use (17%), and cost/cost effectiveness of the programs (12%). Other common responses included quality of the materials, educational benefit and relevancy to students, and the ability to integrate the materials into the existing curriculum.
- ***Interest in Participating***: The great majority of respondents stated they are either very or somewhat interested in the following three types of programs: project-based (91%), those with standard-based curricula (91%), and those providing immediate savings through behavioral changes (96%).

Process Evaluation

In an effort to assess Program processes, as well as provide an effective forum for collaboration, evaluation, and mid-stream feedback, Quantec, in conjunction with Shel Feldman Management Consulting, conducted a one-day stakeholder workshop in January 2005. The intent of the workshop was to examine the Program elements and goals in order to assess whether the Green School Program is successful at achieving its long-term goals and objectives of impacting student behavior at home and, ultimately, having a continued impact on their future energy related behavior. In light of the fact that an extensive process evaluation focusing on more short-term and intermediate-term effects was conducted during the 2002-2003 program year, this evaluation was able to focus on an examination of the Green School Program's long-term effects. The original evaluation workplan included plans for a follow-up workshop later in the implementation cycle; however, since we were able to sufficiently complete our investigation during the first workshop, the decision was made to reallocate funds into other more critical areas of the evaluation, and thus the subsequent workshop was not held[6]. The following details the results of the initial workshop conducted early in the Program's implementation for the purpose of identifying the basic goals of the Program and assessing the ability of the current Program elements to result in more lasting behavioral changes for those exposed to the Program.

Workshop Design and Process

While most evaluations do not have the opportunity to go beyond an examination of more short-term and intermediate-term effects, given the extensive process evaluation completed during the previous program period, we were able to design an evaluation that took an important first step toward investigating the longer-term effects of the Program. This was accomplished by assessing whether the current Program design was sufficient to achieve the long-term goal of having a continued impact on students' behavior as it relates to energy and the environment. As such, the workshop was designed along the lines of a focus group and was conducted over a two-day period with the primary stakeholders of the Green Schools Program. The group included implementers, Program designers and those with a key interest in the success of the Program. Program participants included the ASE Program director, the ASE Program manager, the local Program facilitators, and the ASE Program liaison.

Guided by a workshop facilitator, the intent was to encourage participants to objectively assess the current Program theory and design elements in order to determine whether the Program was successful at achieving its long-term goals and had utilized the best strategies for doing so. Topics addressed included the purpose and goals of the Program, Program design, barriers to achieving Program goals and how to effectively measure Program success and impacts. The following discussion details the results of the workshop process and highlights the key aspects of the Program identified by workshop participants as the key contributing factors enabling the

[6] The proposed change to the evaluation workplan was submitted and approved by the CPUC in April 2006.

Program to affect students' behavior outside of the classroom as well as students' future energy related behaviors.

Findings

To determine the best practices for implementing the Green Schools Program, stakeholders were first asked to take a step back and assess the underlying purpose of the Program or Program theory, as well as the fundamental tenets upon which the Program operates. Ultimately, the workshop process underscored the key factors necessary to achieve the long-term Program goals and objectives. These factors and other findings from the two-day workshop are presented below.

Program Goals

The consensus among stakeholders was that the primary goal of the Green Schools Program was fostering a lasting sense of environmental stewardship within participating students that extends beyond both the classroom and the students' time in the Program. In addition to instilling stewardship, stakeholders also stated a Program goal that included reconnecting students with the environment and helping them understand that taking energy-efficient actions have a direct impact on the environment. Several stakeholders utilized terms such as "disempowerment," "unaware," and "removed" when describing the relationship most students have with the environment and energy prior to participating in Green Schools. To address this, stakeholders noted that an additional goal of the Program was to make students aware of interrelationship of worldwide environmental resources, and energy and their energy-related actions. One stakeholder captured this sentiment noting, "It is important that the Program show students that this is something real and something that they can impact."

Program Elements

With Program goals defined, discussion shifted to how various elements of the Program helped achieve the aforementioned goals. It was first noted that schools provided an effective forum for promoting environmental awareness and energy efficiency since environmental awareness can be promoted in conjunction with science, math, writing and other traditional curriculum subject areas. As a result, Program lessons were more apt to be viewed not as something "sold" to the student, but something "learned."

When asked for specific examples of Program elements that helped achieve Program goals, stakeholders offered numerous suggestions including teacher trainings, energy education, and student audits.

Teacher Trainings. The twelve-hour, two-day teacher trainings are intended to expose newly participating teachers to Program lesson plans and resources. Although custodians and administrators often assist in implementation, teachers are predominately the Program's primary spokespeople at participating schools. As such, it is critical that teachers are well versed in the Program materials and that they are able to effectively and enthusiastically convey the Program's

message to their students. To help teachers understand Program goals, teachers participate in what a stakeholder described as "paradigm shift" exercises during the training. These exercises are designed to expose the teachers to new perspectives regarding the environment and energy efficiency with the intention of helping teachers understand the value of their effort teaching the Program, as well as that of Green Schools overall. The trainings also provide teachers with an opportunity to use and familiarize themselves with the professional energy efficiency diagnostic tools later used as lesson aids and for measurement during student audits. According to stakeholders, October had been identified as the earliest opportunity to conduct training sessions each school year since teachers are understandably resistant to attending session in August during their summer vacation and tend to be too busy establishing their classrooms in September.

In addition to the trainings, participating teachers also were visited regularly by local Program facilitators. The local Program facilitators, which oversee and assist the implementation of the Green Schools Program at multiple schools within a given geographic area, help teachers develop their "5-Strand Plan" for executing the Program in their classroom and offer guidance when needed. Collectively, the teacher trainings and facilitator assistance ensures that teachers, the primary spokespeople for the Program, are adequately supported in their efforts to teach students about the environment, energy and their ability to impact both through the adoption of energy efficient behavioral changes.

Energy Education. While the entire Green Schools Program could be viewed as "energy education", the Program lessons are organized in a manner such that students are taught about energy – what it is, where it comes from, and how it is used – before they are taught how to conserve it using energy efficiency practices. By doing so, the Program helps students develop a basic understanding of energy that informs and reinforces the energy efficiency lessons that follow. In addition, by taking the time to focus on energy education, the Program is able to bridge relatively abstract concepts (what energy is and where it comes from) with more familiar concepts (how it is used). By helping students draw these connections, the hope is that students are better able to understand the motivation behind energy efficiency and more likely to make lasting changes in their behavior.

Stakeholders offered a number of varying examples of Program energy education lessons including looking at "energy pathways" (following energy from its source in the environment through to its eventual use by an end-user), mapping the "appliance explosion" (charting the historic increase in specific end-uses over time) and interviews with older persons (to understand how energy was used in the past).

Student Audits – SEAT (Student Energy Audit Training), Small Business Audits, Home Energy Audits, and School Energy Patrols. One of the primary methods employed by the Program to engage students, increase awareness and foster environmental stewardship is to offer a curriculum that includes "hands-on" elements. Perhaps the best example of such an element is the SEAT Program, designed to give participating students an opportunity to apply the information they learned through the Program. As one stakeholder noted, SEAT, as well as the several other types of audit programs, give students "the important opportunity to 'do'[actively help the school save energy].'" The training teaches students how to perform a basic energy efficiency audit, i.e., how to identify significant energy uses and suggest opportunities for efficiency. These audits are often performed by both individual students and groups of student

around the school and, in some cases, at local businesses. Students are also encouraged to apply auditing principles at home. By both training students how to conduct audits and encouraging them to applying their new knowledge outside of school, the Program moves towards its goal of increasing awareness and fostering environmental stewardship that extends beyond the classroom. In addition, the audits whether at school, a local business or at home, are likely to increase the awareness of others[7] and generate both immediate and long-term energy savings. One stakeholder also noted that the basic training and experience provided by the Program could create potential career opportunities for some participating students when they enter the work force.

While not all students are trained to conducted audits, a common practice at participating schools (particularly at elementary schools) is the formation of an Energy Patrol. Energy Patrols typically consist of a team of students conducting a more informal audit, usually walking through the school checking for lights left on, thermostats set inappropriately, etc. While the younger students are not as familiar with auditing practices, simply participating in an Energy Patrol trains students to be observant of how energy is being used and to spot possible inefficiencies. Stakeholders felt that, much like the more formal auditing lesson taught through SEAT, these skills could be readily applied outside the classroom.

Barriers

Several different types of barriers to achieving Program goals were identified during the workshop, including difficulties getting district or school administrators to "buy in" to the Program and make it a priority, as well as making the concept of energy efficiency tangible and creating incentive and reward structure, that interest and engage students.

School Participation. Stakeholders commonly used the term "buy-in" when discussing Program barriers. Whether at the district, school, or classroom level, stakeholders felt it was critical to find someone to champion the Program. While it would be ideal to have buy-in at all levels, stakeholders noted local Program implementers were increasingly targeting administrators, such as principals and superintendents, since their endorsement and enthusiasm in turn encouraged teacher buy-in. It was also mentioned that facilitating teamwork and communication between superintendents, principals, and teachers when possible yielded positive results.

Indeed, lack of buy-in at higher administrative levels was cited as a barrier to success since, without such support, program lessons can become lost among the myriad of other state and federal educational requirements. Stakeholders felt that, given the complexity of current curricula and testing practices, institutional support helps ensure the Program remains a priority for teachers. To help overcome this barrier and make integration of the Program as easy as possible, the Program curricula is standards-based and aligned with existing state curricula, therefore encouraging both administrative and teacher support.

Making Energy Efficiency Tangible. Several stakeholders said that because energy is a relatively abstract concept – "invisible" as one described it – it can be a difficult subject to teach

[7] See evidence gathered from In-depth Family Interviews presented in the following section.

effectively. Students' general lack of awareness at the outset of the Program of how and why a light comes on when they flip the switch was cited by stakeholders as a barrier to the Program's goal of fostering environmental stewardship. As a result, teachers are faced with the difficult task of helping students connect the abstract concept of lights turning on with energy's origin as a natural resource. Although the Program's lessons are designed to assist in forging such connection, the "invisibility" of energy, and in turn energy efficiency, makes teaching environmental stewardship more difficult for teachers.

Incentive Structures. In addition to teaching students to understand the connection between energy and the environment, teachers are also tasked with motivating students to take personal interest in saving energy at the school. Since, as one stakeholder pointed out, students essentially have very little personal stake in the outcome or financial gain generated by their efforts in the Program, it is critical that incentive structures are developed that reward students for their interest and hard work. In the previous sections, the issue of administrative and teacher buy-in was discussed. Here the issue is creating student buy-in; that is, making students care about the Program, saving energy at their school and, most importantly, about energy efficiency in general.

Given limited Program and school funds, stakeholders mentioned that the Program has found creative means of generating student incentives. One such example offered by stakeholders was inviting local newspapers and television stations to do stories about students' efforts. By collaborating with local media, the Program has successfully recognized participating students and providing an incentive that not only encourages students to take part, but also reinforces the importance of their efforts. Stakeholders agreed that recognition, as well as tangible rewards (which can take the form of ice cream parties when Program energy goals are met), are a critical and effective means of creating incentive structures and securing student interest.

Measuring Success

Stakeholders stressed that determining the energy impact of any behavior-only program is inherently difficult. This is particularly true for the Green Schools Program, which aims not only to generate immediate energy savings on site through behavioral changes, but also to create long-term environmental stewards. Given this complexity, stakeholders were asked how best to measure the Program's success at meeting its goals. Several tools were noted including monthly tracking, case studies/testimonials, and the frequency of business and home audits.

Monthly Tracking. First and foremost, stakeholders discussed the monthly tracking system developed to catalogue schools' energy efficiency efforts through implementation. Created as a result of a recommendation from the 2002-2003 Green Schools Program evaluation, the system represents the Program's efforts to quantify, to the extent that behavioral changes can be quantified, the impact of the Program. The monthly reports, which are completed either individually or collaboratively by teachers, custodians, and administrators at participating schools, were revised during the Program's most recent implementation cycle to improve the quality and usefulness of submitted data. Additional discussion and recommendations regarding the monthly tracking system is provided in the Savings Review section.

Case Studies and Testimonials. Since traditional methods of quantifying Program impact are difficult, stakeholders noted that qualitative methods are most appropriate. One such example is using case studies or profiles of a specific school's involvement in the Program. Detailing

Program lessons, energy efficiency steps taken and results generated, the case studies also provide an opportunity to present, as one stakeholder described it, the "human side" of the Program. Since one of the primary goals of the Program is to create long-term change in the energy behavior of students, testimonials by students regarding the lessons are an appropriate form of cataloguing Program impact. Though anecdotal, the case studies and testimonials are effective methodologies for capturing and assessing changes in student perception and behavior.

Tracking Audits. Although a process for tracking the number of home and business audits conducted (as well as the energy changes resulting from those audits) has not yet been formally developed, stakeholders noted that tracking the frequency of such audits in the future would be beneficial. Understanding the number of each type of visit aids the Program in understanding the reach, and therefore the impact, of the Program outside the classroom.

Conclusions

The following summarizes the most important findings of the workshop.

- ***Program Goal:*** Affect long term behavior by developing energy stewards and stewards of the environment.
- ***Program Theory:*** Employ a strategy that uses materials/activities that can be integrated into the existing curriculum and across nearly all subjects. Effectively train teachers to change their perceptions and behaviors towards energy and the environment. Use hands-on activities that encourage student participation and active learning to engender lasting effects.
- ***Overcoming Barriers:*** Encourage buy-in at multiple levels (superintendent, principal, and teacher) and make lessons meaningful to students to also encourage student buy-in. In addition, incentives and recognition of various forms help engage students and reinforce the relevance of energy efficiency. It is also critical to utilize Program activities that make energy "visible" and conceptually less abstract.
- ***Program Elements Supporting Program Goals and Address Barriers:*** Several specific elements of the Program support the goal obtainment and help overcome the identified barriers. First, offering teachers significant training prior to participating in the Program. Second, providing materials and lessons that are hands-on and age appropriate (e.g., school/home/business audits and Energy Patrols). Third, having local Program facilitators secure buy-in at different levels (principals, superintendents, facilities staff) and working closely with teachers and school facility staff. Fourth, recognizing student achievements and developing meaningful lessons that help students make the connection between energy, energy efficiency, and the environment.
- ***Measuring Success***: Finally, to ensure continued Program viability, stakeholders emphasized the need for measuring successes. Various options for measurement were discussed including, improved tracking of Program activities and actions at participating schools, documenting Program achievements qualitatively using case studies and testimonial and tracking the number and impact of audits conducted outside the classroom.

Lastly, other aspects of the evaluation are designed to further examine many of the Program elements and theories illuminated during the workshop process. Specifically, the Market Assessment section investigates the importance of Program design/implementation considerations from the perspective of school superintendents and other district administrators[8]. In addition, the In-depth Family Interview section explore the reach of the Program outside the classroom.

[8] Note that information regarding Program design/implementation considerations from the perspective of teachers and school facility staff is available in the 2002-2003 Green Schools Program evaluation.

In-Depth Family Interviews

The Quantec evaluation team performed in-depth interviews the week of May 23, 2005, with the families of ten students participating in the Green Schools Program. The interviews were designed to gather data regarding the Program's impact on the student and to assess the reach of the Green Schools Program beyond the classroom, including whether the lessons have resulted in behavioral changes in the home by the student, parents, and/or siblings.

Methodology

To determine what the students learned about energy and energy efficiency as part of the Program, they were asked about their awareness and knowledge of energy efficiency pre- and post-Program participation, whether they have made any behavioral changes as a result of lessons learned, and whether they have talked to their families about energy efficiency. Parents and siblings were also asked about any impacts they have experienced as a result of their child/sibling participating in the Program, as well as any changes they observed in the behavior of the participating student.

Sample Composition

Due to difficulties soliciting families to volunteer, only a small sample of Program participants were interviewed for this assessment; therefore, the following summary of interview responses should be viewed as a case study of the experiences of these ten students (and nine families), rather than as a representation of overall Program impact.

As noted, ten participating students were interviewed, along with at least one parent for nine of the students, and a minimum of one sibling for seven of the students[9]. The group of students represented five schools in the San Francisco Bay Area and a range of levels from 2nd through 8th grade.

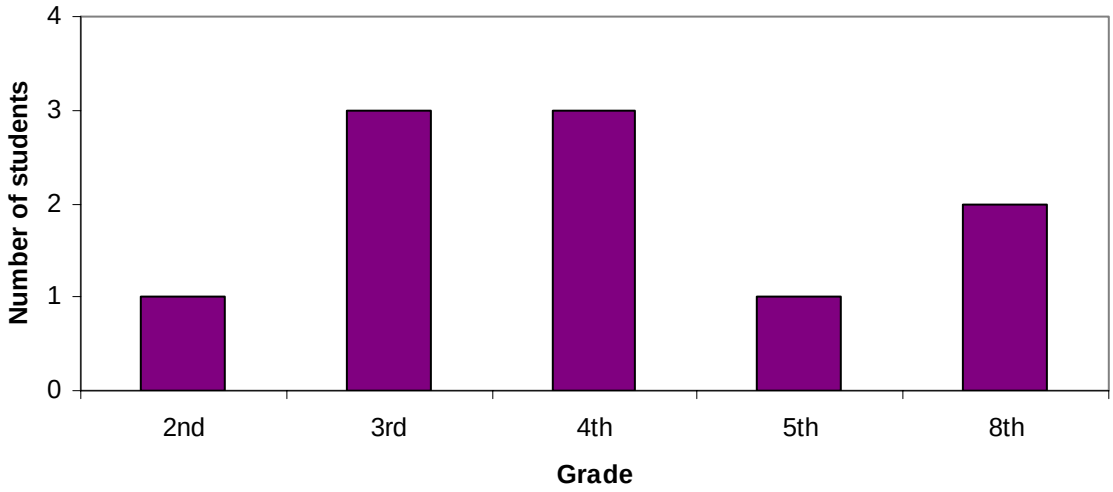
In addition, while the Green Schools Program covers a large geographic area spanning several utilities, the interviews were focused in the San Francisco Bay Area to limit the costs associated with the interviews. While only able to observe students from a portion of the Program's territory, the Bay Area was selected for the available mix of participating school types. As evident in Table 8, the five schools represented three different types of participating schools. In addition, Table 8 presents the student breakdown by school. The distribution of students by grade level is also provided in Figure 1.

[9] One student was interviewed without the presence of a parent since the parent of another participant without a parent attending, though a sibling was present (and therefore still classified as a family interview), was interviewed simultaneously with another participating student due to schedule complications. The sample also included two brothers who had participated at different grade levels.

Table 8. Student Interviews by School

School	School Type	City	No. Students Interviewed
Hacienda Elementary	First-Year Participant	San Jose	1
Manor School	Graduated Participant	Fairfax	2
Petaluma Junior High School	Second-Year Participant	Petaluma	2
Vallecito Elementary	First-Year Participant	San Rafael	4
Miller Creek	First-Year Participant	San Rafael	1

Figure 1. Grade Level of Students Interviewed



Results

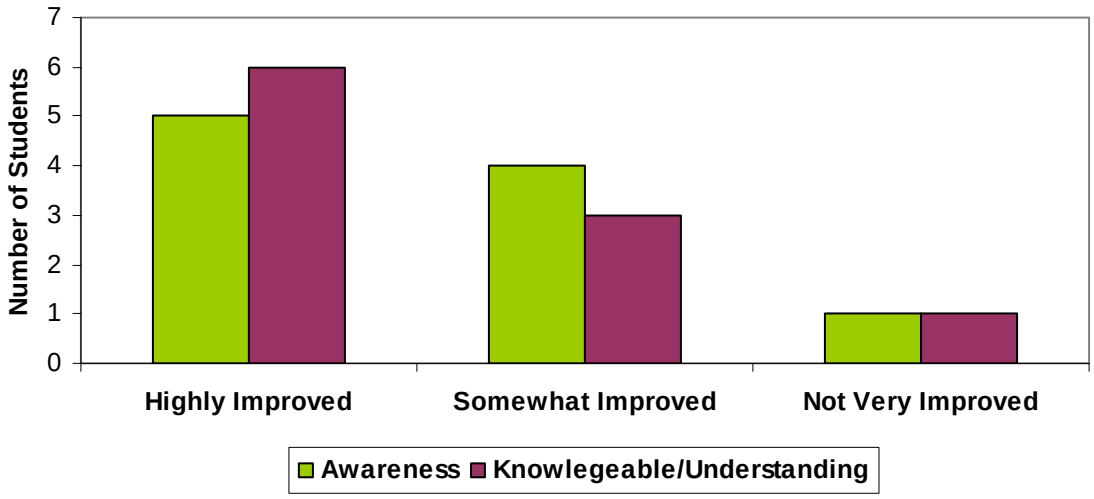
Student Experience

To assess the effectiveness of the Program, each student was asked to rate his or her *awareness* and *knowledge/understanding*[10] of energy and energy efficiency issues both before and after participating in the Green School Program. Of the ten participants, eight responded that they were "Somewhat Aware," and two said that they were "Not Very Aware" of energy efficiency before participating in the Program. With regard to their pre-participation knowledge/understanding of energy efficiency, the students rated themselves lower, with only three participants describing themselves as "Somewhat Knowledgeable," while four and three participants rated themselves as "Not Very" and "Not At All Knowledgeable," respectively.

[10] *Awareness* was described to interviewees as "having heard of energy efficiency." *Knowledge/understanding* was described as "knowing where energy comes from, and why it is important to pay attention to energy use."

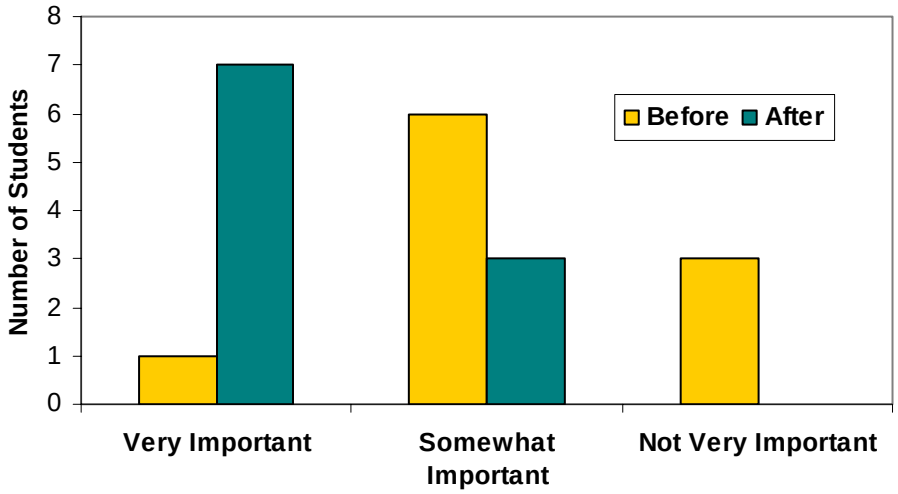
The students were then asked about changes in their awareness and knowledge/ understanding as a result of their participation in the Program. Most students felt that their level of both awareness and knowledge/understanding of energy and energy efficiency had either "Highly Improved" or "Somewhat Improved." Figure 2 displays the distribution of responses to questions regarding their perceived change in awareness and knowledge/understanding.

Figure 2. Awareness and Knowledge/Understanding of Energy Efficiency after Participation



In a similar vein, students were asked how important they felt it was to pay attention to energy efficiency before and after participating in the Green Schools Program. Of the ten students interviewed, all but one gave energy efficiency a higher importance rating after participating in the Green Schools Program. One student's rating of "Somewhat Important" remained the same. Figure 3 displays the students' perceived importance of paying attention to energy efficiency both before and after the Program.

Figure 3. Perceived Importance of Energy Efficiency before and after Program Participation



Each student was asked what he or she had learned, specifically, that changed how they thought about energy efficiency. Responses ranged dramatically from global environmental concerns such as the pollution created during energy generation, alternative energy sources, the small percentage of drinkable water on the planet, concerns regarding the volatility of nuclear power, and landfill overflow to household benefits such as reduced bills for their family through turning off lights, adjusting the thermostat, conserving water and simply, as one student phrases it, "not being wasteful." While some of the issues raised by the students, such as recycling and potable water resources are indirectly related to energy efficiency, students are learning about energy and the environment in a global context that increases general awareness of energy and environmental issues, as the Green Schools Program intends.

Student Action

A key aspect of this assessment was to gauge whether and how the Green Schools Program impacts the students' behavior outside of the classroom – at their school, at home, and possibly in their community. Each student was asked if they had applied any of the lessons from the Program outside of their classroom. Eight of the ten students stated that they had and offered a myriad of examples – though only for actions taken around their school and home.

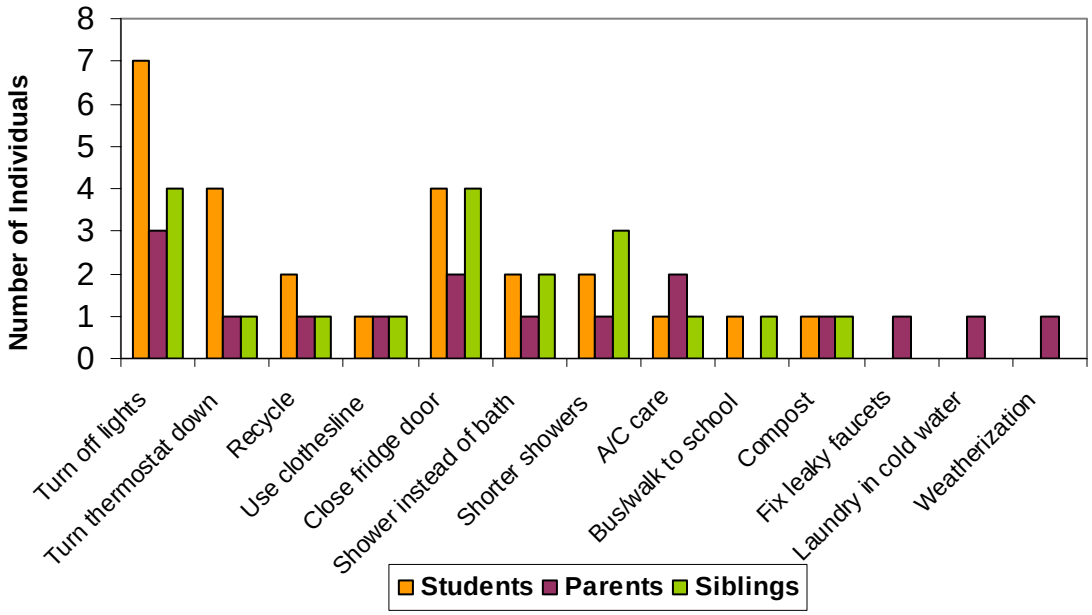
With regard to actions around their school, six students cited participating in "Energy Patrols" that went around the school checking that lights were off, thermostats were set appropriately, and ensured that all "vampire plugs" (power chords with transformers that extract energy even when the electronic source is not being used) were removed. One of the students offered details on their patrol saying that the classroom with the least number of energy violations each month was awarded the "Danny Flag," an achievement flag awarded by the flag's namesake – the school's popular janitor – who assisted with the patrols. The remaining two students who had taken action around their school talked about putting aerators on school sinks and making sure lights were off on sunny days. Two students from one school were able to share the lessons they had learned

with the rest of the school through plays, such as “Cinderella – Green Team Style” and “Mission Impossible” put on during all-school assemblies. The students said that the plays were fun and very popular with the other non-Green Team students in the school. One of the plays was even performed during a district school board meeting.

The majority of interviewed students, eight of the ten (though, interestingly, not the same eight), stated that they had taken energy related actions at home. Many of the actions taken at the school were also applied at home, with five students responding that they turn off lights and four others answering that they have adjusted the setting on their home thermostat. Students also mentioned checking for vampire plugs, making sure family members close the refrigerator door, turning off the television when no one is in the room, and taking water-related steps such as installing aerators, high-efficiency showerheads and taking shorter showers. In addition, all but one student said they had talked to a member of their family about how to improve the energy efficiency of their home.

In order to assess the types of behavioral changes resulting from participating in the Green Schools Program, each family member was read a list of energy efficiency habits and energy-saving behaviors that are commonly taught in the Program and asked whether they had implemented any of them at home. It was made explicit during the interviews that they should only indicate those behaviors that have changed as a result of the Program. Figure 4 displays the frequency with which various energy efficiency measures have been implemented in the students’ homes. The most common behavioral change by the students (seven of ten) was turning off lights when not in use. Siblings and parents also most commonly cited turning off lights – three and four, respectively. Other common behaviors for all family members included being more diligent about keeping the refrigerator door closed, turning the thermostat down in winter, and taking shorter showers.

Figure 4. Energy Efficiency Actions Taken at Home



Sibling and Parent Experience

As noted earlier, one of the objectives of the interview was to determine the influence that the student's participation in the Green School's Program had on the energy-related behaviors of the other members of the household. In addition, to gain additional perspective on the impact of the Program on the participating student, both siblings and parents were asked if they had noticed any changes in the student's behavior at home since taking part in the Program.

For nine of the ten participating students, at least one parent was interviewed. One parent was unable to attend, so the student was interviewed simultaneously with another student under the supervision of the other student's parent. Six of the ten students had siblings who attended the interview.[11]

Sibling Impacts and Observations. When the siblings were asked if the participating student had taught them some of the things they had learned, five of the six siblings interviewed said they had. No trends appeared in the lessons passed along, with each sibling citing a different lesson learned. Responses included being more conscious about closing the refrigerator door, turning off lights, not wasting water, taking shorter showers, and not littering.

Four of the five responsive siblings noted that they had observed a change in the behavior of their brother/sister at home with regard to their energy usage. Examples again included increased diligence in turning off lights when rooms are not in use and water consciousness. Perhaps one of the more telling remarks came from a sibling who was unable to provide a specific, but offered, "I don't know, but he talks about it all the time."

Lastly, the siblings were each asked how important they thought it was to pay attention to energy efficiency after their brother or sister's participation in the Program. Four of the responsive siblings thought that it was "Very Important" to pay attention to energy use at home, while two felt that it was "Somewhat Important."

Parent Impacts and Observations. Similar to the question posed to the participants' siblings, parents were also asked if their child had discussed his/her participation in the Program and household energy usage with them.

> "We didn't realize how easy it is to install low-flow shower heads; conserving water is important, we are on a well and it is possible to run it dry."
>
> "I think it's good to start kids young with these concepts. Adults are harder to change."
>
> "We are now seeking out other information, like making smoothies with a bicycle."

Parents were asked whether they had noticed a change in their child's awareness of energy issues and/or behavior. With the exception of one parent who noticed a change only in his child's awareness, all the parents indicated that they noticed a change in both the energy efficiency awareness and the behavior of their child as a result of the Green Schools Program.

[11] Of the six siblings interviewed, one was too young to give meaningful responses to some of the questions. When that sibling was unable to respond, the other five will be referred to as the "responsive siblings."

Parents were also asked about changes in their own knowledge/understanding of energy issues, as well as attitudes toward the importance of paying attention to energy. Of the eight parents interviewed (one of the student's parents could not attend and two of the interviewed students were brothers), four described themselves as "Very Knowledgeable" regarding energy and efficiency, two felt they were "Somewhat Knowledgeable," while the two others described themselves "Not Very Knowledgeable" before their child participated in the Program. Six of the eight parents felt that their knowledge/understanding had changed as a result of their child participating in the Program.

Parents were also asked if they had analyzed their energy bills prior to and after their child's participation in the Green Schools Program and, if so, had noticed any changes in the bills. Four of the eight parents had examined their energy bills prior to the Program, with one additional parent analyzing bills after the Program. One parent noted that their water bill had come down, and one had noticed lower electric and gas bills. However, most of the respondents indicated that it is difficult to determine what, if any, changes have occurred on their bills. In some cases, this was due to a lumping of utilities into one bill; in others it was due to a general rise in gas and electric prices in the last year.

Conclusions

Ten students and their families were interviewed and asked to share their Green Schools Program experiences with our evaluation team. The information obtained from this study is not representative of the population of students, parents, and siblings who have been involved in the Program; rather it is anecdotal of the experiences of these nine families (and ten students). The following highlight some of the interesting findings:

- The vast majority of students interviewed indicated that their general awareness and knowledge/understanding of energy and energy efficiency had improved since participating in the Program. All but one student responded that both awareness and knowledge/understanding had either "Highly Improved" or "Somewhat Improved."
- The majority of the students (eight of the ten) stated that they had taken energy efficiency-related actions, typically in the form of behavioral changes, both at school and at home. Commonly cited actions taken at school included turning off lights, monitoring thermostat settings and going on "Energy Patrols," while the most frequently referenced actions at home included turning off electronics when not in use, installing showerheads/aerators, and taking shorter showers, in addition to being more diligent about turning off lights and placing the thermostat at an energy-efficient setting.
- In addition to the students noting changes in their own behavior, all but one of the parents interviewed reported observing a change in their child's behavior since participating in the Green Schools Program. The observations of the parents validate the student's statements and the Program's ability to transcend the classroom.
- Of the six siblings interviewed, five noted that their brother/sister had taught them something about energy or energy efficiency since they participated in the Program. Several of the siblings reported taking action around the home, and all six said they now

felt that energy efficiency was either “Very Important” (four) or “Somewhat Important” (two).

- While the students, their parents, and their siblings noted some specific behavioral changes, all families expressed an overall increase in their general awareness of energy issues in their homes as a result of the student’s participation. One parent made the comment, “Our overall knowledge [as a family] has improved a little; he’s raised our awareness and reinvigorated the family.”
- The change in awareness and behavior were not limited to energy issues, but often spilled over into a general increased cognizance of environmental issues in general throughout the family. Many of the students and their families discussed recycling, landfill levels and water/air pollution in the context of their experience in the Green Schools Program.
- It was the observation of the interviewers that the majority of the students were very enthusiastic about their experience in the Program. Several were able to effectively transfer that interest and enthusiasm to their parents, siblings, or both.

Savings Tracking Assessment

Overview

The Alliance to Save Energy was funded to provide the Green Schools Green Communities (GSGC) Program in the PG&E and SCE service territories in 2002 and 2003. The Program underwent a process and impact evaluation at that time with the final report submitted July 9, 2004. The process component of the evaluation documented details of the Program, determined participant satisfaction with its core components, assessed the information flow within the Program, and reviewed the baseline and energy use tracking component. The impact component assessed the changes in attitudes, awareness, and knowledge due to the Program and no cost behavioral and operation changes at the schools. Recommendations were made to ASE based on the evaluation findings. Among the recommendations was the statement:

> The evaluation looked at the process used by the GSGC Program to calculate energy savings to determine if the savings coming out of that process were realistic. Based on this analysis, the evaluation team believes that there are difficulties within the process such that any estimated energy impacts should be provided only with a highly visible caveat indicating that, while the savings were created using a calibrated computer simulation, actual savings may be absent, less, or more than stated. The EZ Sim model, as it is used within this Program, should not be the basis for any monetary exchanges unless the Program puts more resources to the creation and maintenance of the models.[12]

ASE was re-funded to continue the Green Schools Program through 2005 and chose to use the recommendations from the previous evaluation to improve their Program. The Program also chose to include an optional task in the evaluation of the 2004-05 Program to track the changes made. While there may have been changes in response to other recommendations, the focus of this chapter documents the changes made within the energy savings component of the Program.

Savings Methodology

As evident by the Program's elements, there is a focus on energy savings within this information only program. In the Program Year 2002-03 program funding cycle, energy savings were based on calibrated EZ Sim files using billing data from the schools and nearby weather data. EZ Sim[13]

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[12] Final Evaluation Report for the Alliance to Save Energy Green Schools Green Communities 2002-2003 Schools Program. July 9, 2004. p. 4.33.

[13] From the marketing on the EZ Sim website: "EZ Sim is the next step in energy accounting. It uses actual utility bills to reveal the patterns of use in commercial buildings. EZ Sim is a quick spreadsheet tool that is equivalent to a sophisticated engineering analysis. It's designed for resource conservation managers and facility operators. You don't have to be an engineer to use it. EZ Sim uses actual energy bills and available information to reveal the patterns of energy use in a building. So, the cost to operate EZ Sim is almost nothing. EZ Sim lets you use utility bills to calibrate a simulation of a commercial building in an interactive graphic window. Once it matches

is an Excel-based bin-method computer simulation model that uses the average daily temperature along with building characteristics and operating conditions to determine energy use. The full analysis of the process of using EZ Sim within the Program is provided in the July 9, 2004, report and is not covered here.[14] Based on the recommendations regarding the process then in place for determining potential energy savings, ASE chose to review other available options for this component. The initial task for the evaluation team within the 2004-'05 Program was to work with ASE to develop solutions and implement the necessary steps to address these issues sufficiently to make mid-term corrections, as appropriate, for the current Program and to establish action items for future programs. However, the Program desired to have a baseline and energy savings process in place more quickly than would have been possible if they had waited for the evaluation team to work with them and provide different options. The evaluation team concurred with this and the decision was made by the Program to contract with Utility Management Services (UMS) for the energy baseline and savings services needed by the Program. The evaluation team members' task changed to one of documenting the chosen energy savings process and working with the program staff to assure that details of the UMS system were acknowledged by the staff and appropriately handled.

The Utility Management Services company provides database construction, electronic data interchange, data conversion and importing, and training for their clients. According to the UMS website (http://www.utilityaccounting.com/index.php), the software program used by UMS, Utility Manager (UM), provides tracking of "usage and expenses of not only electricity, but natural gas, water, sewer, garbage, and other utilities as well. It helps you compare the efficiency of your various facilities and pinpoint where action needs to be taken." ASE contracted with UMS in December 2004 to create and populate a database of electric utility monthly energy use and costs for up to 100 schools within the Program.[15] ASE, and all others who are provided a password, will access the database via a web-based interface called UM-Online. In addition to the database work, UMS was contracted to provide training in the use of UM-Online and help ASE set an energy baseline and possible energy adjustments within the database.

Energy Savings Component Details

After the contract was signed, UMS was provided the listing of school names and accounts to begin the database population. They worked with ASE to determine appropriate parameters to include and how to group information. A single formal training occurred over a two-day period in January 2005. This training included the direct Program staff (i.e., ASE and their sub-contractors) and a member of the evaluation team. It introduced the information kept within the database and different reporting capabilities of the software. There was much discussion around the set-up, inputs, and outcomes of the cost avoidance portion of the software. While no other formal trainings are planned, the UMS staff are available to all of the program staff (and sub-contractors) in the future via email or telephone on an as-needed basis.

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the building's utility bills, the simulation model can provide reliable estimates of potential conservation savings. So, you have assurance that the savings estimates are realistic." http://www.ezsim.com

[14] The report is available on www.calmac.org for interested readers.

[15] As there are currently less than 100 schools, the database, once populated, will encompass all schools within the program.

At the time of the training, there were 32 PG&E schools with historical data already in the database. UMS had the written consent and the ability to obtain data beginning January 2002 until the most current available (approximately November 2004) for these schools. The process of obtaining historical and on-going billing data was discussed for all three electric utilities with schools in the Program (PG&E, SCE, and SDG&E). It was acknowledged that it was more time-consuming to obtain the needed data from SCE. Participants in the training brainstormed how to help expedite the process, but determined no explicit outcome that was thought to have any higher likelihood of success than what was currently planned. The process to obtain historical PG&E data was proven timely, while how quickly data could be obtained from SDG&E was unknown. During the training, the process of how to obtain ongoing billing data was discussed, with some detail outlined for PG&E. The best approach to obtain ongoing billing data from SCE and SDG&E is an issue that is currently being addressed by ASE.

Once the data are entered, they undergo a quality assurance review by UMS in which anomalies are highlighted based on a set of parameters. Details about what occurs when anomalies are found had not been set at the time of the training.

The data are prorated according to the read dates so that when a month of energy use or cost is shown, it is a calendar month of data. As stated in the Utility Manager Pro Version 4.1 Users Guide:

- To provide the closest correlation between utility usage and cost and the month in which it was actually consumed, the software always uses a method known as prorate according to from and thru dates. The program calculates a daily average usage and cost for each invoice, and then assigns this average proportionally to the calendar month(s) spanned by the service period. This data accumulation method is preferred by most Utility Manager users for reports in general, and it provides the best results from an energy and utility management perspective. For example, assume you have a utility bill for $1500 for 3,000 therms of gas usage, and the billing period is from 9/15 through 10/14. Even though you receive the bill in October, only about half of the therms were consumed in October; the rest were consumed in September. With the Prorating method, The Utility Manager attributes consumption and cost proportionally according to the following example:

Usage
3000 therms ÷ 30 days = 100 therms average daily use
16 days X 100 therms = 1600 therms usage in September
14 days X 100 therms = 1400 therms usage in October
Cost
$1500 ÷ 30 days = $50 average daily cost
16 days X $50 = $800 cost for September
14 days X $50 = $700 cost for October

Historical data sets what period of time is considered the baseline period for each site. For the ASE program, the baseline represents the period of time prior to participation in the program when energy use was not potentially influenced by the program. UM has the ability to set a different baseline for each school in the program. However, it was decided during the training that the November 2003 to October 2004 would be considered the baseline period for the newly

participating schools (i.e., those beginning with the program after October 2004) while November 2002 to October 2003 would be the baseline period for schools in their second year of participation (i.e., those who joined the program after October 2003). November was considered the best starting date for the test period (i.e., that period where the ASE program may be influencing energy use) since schools are being recruited and trained during the first few months of the school year.

Savings within UM can be calculated by simply subtracting the billing cost of the test period from the baseline period (called the cost reduction method in UM) or through calculating the difference in energy use, the average cost per kWh, and then determining the cost savings (called the cost avoidance method in UM). ASE is using the cost avoidance method to provide possible energy and cost savings to schools.

Potential savings at each school are determined by the following algorithms:

$$Potential\ kWh\ Savings = Predicted\ Energy\ Use \pm Adjustments - Actual\ Energy\ Use \quad (1)$$

$$Cost / kWh_m = Monthly\ Energy\ Use_m / Monthly\ Cost\ on\ Bill_m \quad (2)$$

$$Cost\ Savings = \sum Potential\ Savings_m * Cost/kWh_m \quad (3)$$

As shown in equation 1, there are two methods of adjusting the data so that they are comparable to the state of the school during the test period. UM uses a single variable linear regression to determine if the utility bills are a function of weather. If a correlation is found between the weather and energy use (either cooling or heating), the predicted energy use is the baseline usage adjusted by weather data (the first element in equation 1). The second adjustment (a user adjustment) is specified as a series of monthly values for a specified period (shown as the second element in equation 1). Adjustments are made to usage and specified as either absolute values or percentages. The adjustment values can be either negative or positive.

The linear regression is based on heating degree days (HDD) and cooling degree days (CDD) as determined from the closest weather station. UM used three main factors to determine if the regression is statistically meaningful: 1) the R-squared between the change in energy usage and degree days be greater than 70%,[16] 2) the y-intercept is positive, and 3) the slope of the line is positive. If these three factors are met, the results of the regression are used to change the baseline usage to a predicted usage. There is another statistical step that is used to determine if the regression is used for every month. Called the 1% rule, the value of the independent variable in the regression must meet or exceed a statistical threshold. The independent variable (e.g., HDD or CDD) in a given test period must represent at least 1% of that variable in the entire base period or, as in the above tests, the regression results are rejected, but only for that period. For example, if the HDD total for the base year is 10,000 and the HDD in the test period for July is less than 100, the software will not apply the regression equation to predict July's usage value. Instead, the predicted value will be equal to the value for July of the base year.

[16] The balance points used for HDD or CDD are optimized.

The application of the degree days regression results can be set for each school as needed and overridden if desired, although there are no plans to override the regression model. If the regression is not in effect because it is not statistically meaningful, the predicted energy use equals the baseline energy use. While this portion of the predicted energy use was discussed during the training, UMS is actually performing the analysis and setting the toggle of whether or not to use the degree day regression for each site.

Where the user adjustments come from and how they are applied was given relatively careful attention during the training. It was stressed that those who are actually at the schools will best be able to provide the information about possible changes (such as additions of portables or lighting retrofits) that would affect energy use. The typical adjustments within UM are: 1) load adjustments, 2) retrofit/ energy conservation measures, 3) floor area changes, and 4) operating hour changes, although the program has the ability to have "other" changes. UM has a memo field to provide text about what the adjustment was based. If known with sufficient detail, UM can appropriately adjust the baseline energy use. If the percentage of energy use is used as a user adjustment, the percentage is multiplied by the current usage to obtain an absolute value that is then added or subtracted along with all the other user adjustments. During training, it was decided that the monthly reports from the sub-contractors would provide information to ASE about any changes that should be reflected in UM. All possible changes to UM would be forwarded on to UMS for implementation at each unique site.

Once all the data are included in the database, participants with the necessary login information can view the energy use and possible energy and cost savings between the base year and the test year(s) for their site. There was discussion around who can actually view the school specific reports. The decision was to keep each school able to see only their schools data. ASE and their sub-contractors have access to all schools within the program.

Conclusions

At the end of the training session, it was stressed by the evaluation team member that, during interactions with participants regarding the potential energy savings, Program staff needed to be cognizant of the fact that there are always fluctuations in utility bills from year to year that cannot easily be explained. UM provides a well documented model of possible savings based on actual utility bills, but it cannot account for all the differences between one year and the next. There is a likelihood that the utility bill may be higher in the test period than the baseline period for unknown reasons. As such, if there are reductions between the baseline and test years, the differences seen on the software reports should be indicated as estimated savings by ASE and their subcontractors.

The change in approach to estimating energy savings by ASE for the PY20004/05 Green Schools Program was thought to be a positive change. The UM model based on utility bills provides excellent documentation on baseline, predicted energy use, and adjustments to the energy use. The potential energy savings calculation becomes transparent and relatively easy to understand for all parties involved. Additionally, the database becomes a repository for much of the information that could be used in the future for a multivariable regression analysis, if chosen by ASE. While not discussed during the training, a form has been drafted by ASE that would track

what the actual behavioral changes occurring at the schools are and when they are taking place. If this information is obtained and kept in a database, it would help any future regression analysis and may be able to be used with the current UM software to provide reasons why changes are seen in different months

Review of Program Results

As a result of the unexpectedly low energy savings estimated for several schools participating in the Green Schools Program in the Southern California Edison service area, the Alliance to Save Energy asked Quantec to modify the existing workplan and review the Program savings analysis.[17] Specifically, ASE requested that Quantec determine specific reasons why the estimated energy savings were relatively low at certain schools, if possible, and 2) analyze energy efficiency actions taken and provide suggestions for improving the data collection.

Programmatic Challenges in SCE

Before proceeding with the analysis, it is important to note that the Southern California Edison Green Schools Program faced some programmatic challenges during the first and second years of implementation. The Alliance originally hired EEPIC, Inc., a local non-profit organization based in Southern California to implement local project leader duties. EEPIC was led by its president, George Barganier. Unfortunately, during the second year of the program, Mr. Barganier was diagnosed with a serious illness and passed away in May 2005.

While the Alliance made a transition to a new local project leader and the Program got back on track and met all deliverables, the consequence is that the PG&E Program is a more typical Green Schools Program during this implementation period than the SCE Program. Moving forward, the new SCE Program will be able to take lessons learned from the transition.

Methodology

As outlined above, the review consisted of three components. The intent and scope of each component are detailed below:

- ***Review Existing Utility Manager (UM)[18] Inputs, Analyses, and Results*:** To determine the integrity and range of data currently utilized by UM, Quantec reviewed program inputs. Assessments of data quality, as well as recommendations regarding the appropriate data for collection are provided. Specifically, analysis focused on assessing data availability and quality from inside the PG&E and SCE service territories. To better the impact of variance of data availability and quality on UM results, Quantec reviewed UM processes particularly in cases where results did not match expectations. In addition, recommendations regarding the appropriate contact for UM inputs at the school site or district are provided.

[17] Again, changes to the original workplan were submitted and approved by the CPUC in April 2006.

[18] The Utility Manager Online(TM) is an Internet based utility bill accounting and auditing tool that helps the commercial customer manager single or multiple sites, utility providers, and invoices in itemized detail. Utility Manager allows the customers to view information, run searches, and generate reports and graphs via the Web.

- ***Recommendations for Improved Data Collection:*** Although the original intention of this component was to conduct a detailed review of measures implemented at participating schools and correlate them with the observed UM savings, data limitations prevented such an analysis. Data was limited in two ways: first, not all participating schools had returned surveys to ASE listing their activities prior to the completion of the evaluation; and second, many of the surveys that had been submitted could not be analyzed (significant missing or incomplete data). As a result, the section offers recommendations for improving data collection for future use by ASE and evaluators. This step also helped support the previous component that addressed whether Program-induced changes have been documented adequately.

Results

Review of Existing Utility Manager (UM) Inputs, Analyses, and Results

The initial inputs for Utility Manager (UM) are raw energy billing data[19]. A comparison of billing data from the previous and current year is then made to determine changes in energy consumption. Adjustments to account for variation in weather between the two years are made when the UM model detects a significant relationship between energy consumption and outside temperature. In addition to weather-normalization, since both the physical structure of a school as well as their equipment and activity they house are often modified to meet the needs of their students and faculty, information regarding all such changes is used to augment the analysis. While some of the changes have a relatively small impact on energy consumption, some changes, such as remodeling additions and subtractions, have a substantial impact.

To make the necessary adjustments, detailed information regarding changes must be collected from knowledgeable school or district contacts and incorporated into the billing analysis. Quite simply, these changes affect the schools' energy consumption, and in turn, need to be accounted for in order to ensure an accurate comparison of utility billing data from year to year. UM allows users to make such adjustments to previous billing data to reflect changes.

As noted above, the purpose of reviewing UM inputs, analysis, and results was to identify relevant differences in the data or methodology between SCE and PG&E service territories that might account for the disparity in school exhibiting savings. While unable to pinpoint specific reasons for the savings variation, two general areas that may have each contributed to the variation were identified: data variation and weather calibrations. The following provides a discussion of – not an answer to - the issues related to each of the topics. However, whenever possible, specific recommendations for improving Program processes are offered.

It should be noted that the intent was not to evaluate UM itself; such an assessment was conducted previously by Equipoise Consulting in which the appropriateness and integrity of the analysis tool was verified.

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[19] Where appropriate both natural gas and electricity data are tracked for schools participating in PG&E's service territory while SCE participating schools focus exclusively on electricity.

Data Variations. Two types of data variations were observed – differences in the quantity of data collected and differences in the quality of data collected. Data quantity refers specifically to the number of schools providing data with which UM users can make the aforementioned adjustments for changes, while data quality refers to how knowledgeable about daily school changes the person of contact is, and how useful the provided data was for quantifying changes.

With regard to quantity, attempts to adjust for the various school changes were made for schools in both PG&E and SCE service territories. Table 9 provides an overview of the number and total magnitude of each type of adjustment made in both service territories. As apparent in the table, the amount of information gathered for PG&E schools greatly exceeds that collected for participating SCE schools. As presented in the table, 15 of the 29 schools in the PG&E territory (52%) had adjustments made for either building additions, computer additions, lighting retrofits, operating hour changes, or other school remodels (pool co-generation unit).

Conversely, adjustments in UM were made for only 4 of the 30 SCE schools (13%); all to account for structural additions or subtractions. With limited data, UM analysts were forced to operate under the assumption that there were no other types of energy-related changes, such as additional computers or modification of lighting or operating hours, that occurred at any SCE schools. This is highly unlikely. The relatively low quantity of information provided by SCE schools, and in turn the small number of adjustments able to be made in UM, likely contributed to the disparity of savings evident between the two territories.

Table 9. UM Adjustments by Utility

	SCE		PG&E	
	N	Magnitude	n	Magnitude
Square Feet	4	7,800 sqft	4	2,736 sqft
Computers	0	- - -	6	24,003 kwh/yr
Lighting	0	- - -	1	14,260 kwh/yr
Operating Hours	0	- - -	3	6,381 kwh/yr
Other	0	- - -	1	-74,070 kwh/yr
Total Adjustments		*4*		*15*

In addition to the sheer amount of data collected from participating schools in each territory, there is also the issue of data quality. When making adjustments, it is essential that the contact providing information for UM is not only aware that a change has taken place, but that he or she also has the ability to specify the type and magnitude of the change. During an interview a UM contact noted that district superintendents tended to be the primary point of contact for information regarding adjustments at SCE schools while principals, teachers, and/or custodians tended to provide such information within PG&E's service territory.

While a district superintendent may be aware of general changes in the size of schools within their district, it is unlikely that they will be able to provide estimates of the number of square feet added or subtracted as accurately as those working on-site. Furthermore, it is possible the superintendent would not be aware of other changes such as the addition of an after school program, the type of bulb being used to replace burnouts, or the specific numbers of computers added to the school's computer lab. Intuitively, it makes sense that principals and teachers will

be more knowledgeable about every day goings-on at their school than a superintendent managing an entire district. Accepting this assumption, part of the disparity between both the amount of adjustments made and energy savings levels observed in each territory could possibly be attributed to the differing contacts utilized in SCE and PG&E.

Regardless of whether the difference in UM savings is due to the difference in respondent types, it seems appropriate that attempts be made to gather data for adjustments directly from on-site contacts whenever possible. Not only does it appear that on-site contacts are more apt to provide information, but also that they are more likely to provide quality data. While superintendents might be utilized as default contacts for adjustments since they were the Program's initial point of contact when the district's participation was solicited, alternative on-site contacts are clearly better able to inform UM analysis and should be established at the onset of implementation for each participating school whenever possible.

To generally test the theory that more information, presumably through better school contacts, means more accurate UM results, Quantec tested for statistical significance between whether or not a school saved energy and whether or not adjustments were made for that school. Although the results failed to show a statistically significant relationship between adjustments and schools' energy savings, it is important to realize that not all schools need adjustments and regardless of whether adjustments are needed or not, there is a lot of variability inherent in energy consumption at schools.

Indeed, it is critical to recognize this inherent variability in consumption and understand that detecting changes in energy consumption attributable to behavioral changes using even a model as sophisticated as UM can be problematic. Independent of the quality or quantity of data provided by participating schools and the number of adjustments made, energy consumption at sites as large as schools fluctuates continuously as a result of numerous factors exogenous to the Program. For example, over time HVAC systems (Heating, Ventilating, and Air Conditioning) become less efficient. While this process is sometimes gradual, other times it is not. If a school with an older, deteriorating system runs its air conditioner a significant amount over the course of a year, it is entirely possible that the increased consumption due to the system's drop in efficiency from the previous year could obscure savings generated by the Program.

Given that schools are expected to save between 5% and 7% as a result of their participation in Green Schools, it is reasonable to expect that in some cases other factors completely unrelated to the Program and difficult to capture even using UM adjustments can either overemphasis or hide the actual energy impact of the Program. This point is underscored by the range of changes in energy consumption observed at participating schools. For example, participating schools exhibited a range of consumption changes from a decrease of 21.1% to an increase of 29.5% . Clearly, the Program's behavioral changes are not responsible for the entirety of either change and other factors are impacting energy use.

While attempting to control for such factors to the greatest extent possible through adjustments, even known changes in equipment at schools can be difficult to account for. For example, at M.P. Brown Elementary, the entire school retrofitted its T12 fixtures with magnetic ballasts to T8 fixtures with electronic ballasts during the school's participation in the Program. However, due to insufficient information adjustments were not made. According to UM the school

decreased its consumption the following year by 6.8%. Whether or not the Green Schools Program was the impetus for the retrofit, the example highlights that even known changes in equipment are difficult to adjust for and have the potential to both inflate or obscure the true impact of the Program. However, more information may make it possible for the savings from similar efficiency improvements, which were made as a result of the school's participation, to be attributed to Green Schools.

Weather Calibrations

As mentioned previously, UM can also be used for weatherization calibration. In order for UM to make this correction, the model of the school's energy consumption must demonstrate a relationship between energy consumption and weather by yielding an R-squared value of greater than 0.7.[20] The number of weather calibrations made by the utilities is presented in Table 10.

Table 10. Weatherization Calibration

Utility	Total Schools	School Exhibiting R-Squared Value > 70%	Percent Calibrated for Weather
SCE	30	19	63%
PG&E	29	8	28%

As a result of geographic differences, UM approaches weather-calibration in SCE and PG&E service territories differently. In SCE, UM utilizes cooling degree days (CDD) and PG&E uses heating degree days (HDD). Cooling degree days are associated with the amount of time that an air conditioner would be utilized to return the temperature to a given point where neither air conditioning nor heating is required. Conversely, heating degree days are associated with the amount of time spent heating to achieve the same result. However, the differing methodologies in each service territory makes comparisons difficult and may contribute to the apparent disparity in savings.

For example, if a school in PG&E territory heats with natural gas and cools with electricity then calibrating electricity consumption based on HDD may not be appropriate since a decrease in temperature has no impact on electrical use. In such a case using separate CDD calibrations for electricity and HDD calibrations for natural gas would be most appropriate. In addition, though north of SCE, PG&E's service territory covers California's Central Valley and other areas traditionally exhibiting significant cooling loads. If a school was participating in this area, it would again make more sense to calibrate-based on CDD rather than HDD when assessing electrical consumption.

While possible, such examples are not responsible for any of the observed differences in savings. It seems appropriate that decisions regarding whether to calibrate using HDD or CDD be made based on the individual school's fuel types for heating and cooling, as well as it's geographic

[20] The R-squared statistic demonstrates the predictive ability of a model (i.e., if a relationship exists between school energy consumption and weather a model of the two inputs will have a higher r-squared value). R-squared values range from 0 to 1.0.

location rather than simply the utility service territory. Although certainly much of the large difference in the number of weather calibrations undertaken between service territories is due to SCE's warmer weather, it is also possible that calibrating electricity consumption using HDD in PG&E's service territory underscored the relationship between electricity consumption and weather, thereby limiting UM's ability to calibrate. Generally, the difference in calibration methodology limits the ability to make an apples-to-apples comparison when assessing the observed changes in electricity consumption between service territories.

Recommendations for Improved Data Collection

As noted at the outset of the section, Quantec initially planned to conduct a regression analysis exploring the impact of various energy-efficient actions taken at schools upon observed UM savings. The intention was to pinpoint actions generating savings and assess whether the frequency of those actions differed between service territories. However, when collecting, organizing and aggregating data to conduct the analysis, it became clear that such an analysis would be difficult for two reasons. First, as a result of recommendations offered by the previous evaluation, the Program requires that participating schools submit the monthly reports, and many schools fail to return the tracking reports. This was especially true for schools in SCE that started later in the implementation cycle. Second, a large percentage of the reports that had been submitted were either left blank or contained unclear responses that were difficult to interpret or quantify.

As a result of this, the focus of this effort shifted to recommendations for improving data collection that might permit such analysis as part of future evaluations. These recommendations are intended to support the Program's ongoing attempts to refine the monthly report, improve Program tracking, and quantify Program impacts[21]. All recommendations are related to improving either the clarity, specificity, or focus of the monthly report.

Clarity. When attempting to attribute the energy savings associated with any type of efficiency activity to the Green Schools Program, it is critical to document that the Program served as the impetus for the activity. Simply, those filling out the monthly reports need to be clear that they should only report changes that have resulted from participation and not earlier, ongoing energy efficient practices. Although the upper-right hand corner of the table on the first page of the report clearly reads "Actions resulting from Green Schools Efforts," the questions that follow need to reinforce this sentiment. For example, in the questions pertaining to lighting, the respondent is asked if and in how many classrooms they turn off lights. It is important to phrase the question such that it gets at the Program's true impact. The question should ask if lights were turned off *earlier* (e.g., when the teacher leaves the room for the day instead of by a custodian later in the evening) or if the lights were turned off *more* often (e.g., during recesses or lunch) as a result of participation. By using words like *earlier* and *more* the respondent is more likely to consider the impact of the Program upon their lighting habits and not simply check that they

[21] To avoid any confusion it is important to note the Program revised its original monthly report during the course of the 2004-2005 Program and that all recommendations provided in this section related to revised report, not the original.

indeed turn off their lights. While such changes are subtle, they can help ensure accurate data regarding the influence of the Program.

The vast majority of respondents failed to answer several, if not most, of the report's questions. Although one option for all questions is "No changes have taken place," missing responses leave those analyzing the reports to wonder whether the school has not instituted the change or whether they simply did not complete the survey in its entirety. Again, though subtle, such ambiguities add uncertainty to the analysis. To help avoid this, the report header should state that either a lack of a response indicates the action was not taken (and remove the "No changes have taken place" response option) or emphasize that all questions need to be answered.

Specificity. One of the primary problems encountered when working with data from the monthly reports was ambiguity. Using the example from above, while important to know that lights are being turned off earlier or more often, it is equally important to quantify how much earlier or more often such a change is occurring. For example, the current report asks if the school "Keep[s] thermostat set at a constant temperature (68 degrees in winter and 78 degrees in summer)." Such a question is critical to assessing Program impact considering the percentage of energy use constituted by HVAC systems. However, the key is knowing not that the thermostat is set at a constant temperature but knowing how the current temperature setting varies from the previous setting prior to participating in the Program. Significant savings are likely to result if the school changed its standard setting from 72 to 68 degrees during the winter as a result of the Program. It is critical that the report asks respondent to specify such changes. In order to ensure greater data for analysis and aid respondents in providing such details, rather than offering a fill-in "Frequency" box, the survey should specify the response units. By telling respondents you want them to answer with the number of classrooms, the amount of square feet, or the degree difference, the reports will both generate more consistent and reliable data. In addition, rather than scaring off respondents, such structure actually encourages response by decreasing uncertainty.

Focus. As noted previously in the report, teachers, administrators, and custodians are all busy in their respective roles at a school and limiting the amount of time needed to complete the report is critical. The Program successfully shortened and condensed the monthly report during implementation. As a result of the changes, the revised report is generating a higher response rate than its predecessor.

If additional structure and specificity is to be added to the revised report it is critical that it is balanced with common sense. Rather than asking respondents to be specific on all questions, the report should focus specificity on those that generate the greatest savings and lend themselves to quantification. The previous example of tracking changes in thermostat settings is an appropriate example. Knowing the pre and post settings and the square feet of conditioned space makes calculating the energy impact of the change relatively straightforward. For another example, the current survey asks about "Use of natural light, curtains or blinds," at the schools. Although turning off lights and utilizing natural lighting instead can decrease energy consumption, it is very difficult to quantify. In the previous example regarding thermostats, asking for additional specificity makes sense, while in the latter example it does not. Using the magnitude of energy impact and ease of quantification as guides, specificity should be added carefully and only where

most appropriate. Adding specificity wisely will increase the usability of the data and prevent respondents from being overwhelming by too many questions.

Conclusions

While much of the above discussion is entirely unsatisfying for those seeking an answer to the difference in observed savings between PG&E and SCE territories, it elucidates the difficulty of tracking energy savings attributable to behavioral changes at a facility as large as a school. Although the Program is undoubtedly generating energy savings of some magnitude, it is difficult, regardless of the methodology employed, to prove a direct causal relationship between Program activity and the observed increases and decreases in energy consumption at participating schools. However, additional and improved data from schools regarding both changes in their physical structure and their implementation of Program elements will serve to minimize uncertainty regarding the Program's actual energy impact.

The following summarizes the above section and highlights key points and recommendations.

- ***Utility Manager Inputs, Analyses, and Results:*** Currently, the quantity and quality of data available to make UM adjustments is inadequate in SCE. This is illustrated by the fact that only 13% of SCE schools received adjustments, while 52% of PG&E schools had their energy consumption levels adjusted to account for a physical or operational change. Although adjustments are not needed at all schools, the true percentage of schools implementing changes that require UM adjustments is certainly closer to 52% than 13%. Furthermore, while the exact impact of the data issues upon UM savings estimates is unclear, improving both the quantity and quality of data from SCE by establishing on-site points of contact at each participating school whenever possible will yield more accurate UM results. Although data collection processes are currently better in PG&E, similar efforts can further improve UM adjustments and results within the service territory. Differences in weather-calibration between service territories may also contribute to the observed disparity in savings. Conducting comparable analyses across utilities whenever possible may serve to lessen such differences.
- ***Recommendation for Improved School Reporting:*** Although the Program has made significant strides to improve its data collection processes from participating schools, additional steps can be taken. First, future iterations of the Program should take steps to increase the percentage of schools submitting a monthly or quarterly report detailing the energy efficiency actions taken as part of their participation. By doing so, the Program can create a more viable and comprehensive dataset that documents total Program impact and allows for more substantial statistical analysis. Second, improvements should be made to the report that enhance its clarity, specificity and focus. To avoid confusing and overwhelming respondents, the report should concentrate on only those changes created by the Program and the activities which generate the greatest energy impact and are easily quantifiable.

Guidance on Revised Protocols

This section provides information to the Alliance about the latest California energy-efficiency evaluation protocols and the relationship between the protocols and the Alliance's Green Schools Program for 2006-08. The objective of this document is to provide guidance and suggestions that the Alliance can use to design and implement this, and potentially other, Programs to satisfy the requirements of the new protocols.

Overview of 2006-'08 Program in Southern California Edison Service Area

As outlined in the Alliance's November 2005 proposal to Southern California Edison (SCE), the Green Schools Program (the Program) teaches about energy efficiency achieved through behavioral changes, operational changes, and product retrofits. Teams of teachers, custodians, administrators, and students work together to develop and implement a program plan tailored to their school. A local project leader contacts the school monthly to assist and encourage school teams with planning and implementation. The Program also determines each school's baseline energy use and tracks monthly energy consumption; provides professional development to teachers; trains students to conduct audits of their schools, homes and local small businesses; and convenes school teams three times during the year to celebrate successes and learn from their experiences.

The objectives of the 2006-'08 Program in the SCE area include:

1. ***Provide an action-based approach for integrating energy curricula into schools*:** Provide standards-based, hands-on approach that supports teachers in customizing the Program to their unique classroom needs. Specifically, the Alliance will:
   - Train and support teams of teachers, custodians, and administrators at 25 schools per year to educate students and the school community about energy efficiency and actively involve school teams to save energy in schools and homes. The Alliance supports each school for two years.
   - Provide energy audit training to students at 5 high schools (approximately 100 students) per year.
2. ***Achieve energy savings*:** Produce energy savings in schools and homes through the following actions:
   - School-based behavior and operations changes estimated to save between 5 and 10 percent of electric consumption and a somewhat lower percentage of gas consumption.
   - Light bulb exchange in which students discuss the benefits of compact fluorescent lightbulbs (CFLs) with their parents after learning the life-cycle cost and environmental benefits of CFLs. Students will bring a working incandescent light bulb from home and receive a CFL replacement to take home. The total exchanges are estimated to be 12,000 units. The first will take place in Spring 2006 as a new

activity with schools participating in the 2004-2005 Program and two more exchanges will follow.

3. ***Work synergistically with SCE and other organizations engaged in energy efficiency and conservation initiatives in the SCE region*:** The Alliance will examine opportunities for greater coordination between water utilities and SCE as a way to increase the impact of the "efficiency message," and possibly providing cost-sharing opportunities.
4. ***Cultivate community energy-efficiency advocates to deliver energy-efficiency messages to the community***: Specific activities will be determined in conjunction with SCE and might include energy audits for small businesses conducted by high school students (producing leads for SCE's commercial retrofit program); community forums; or other community efficiency education activities involving moderate-income students.

Among the activities that will be conducted to implement the Program are the following:

- Conduct professional development workshops with school teams
- Train students to do energy-efficiency outreach
- Convene California Green Schools Advisory Council to review and evaluate different components of the program to ensure that the components are educationally sound and relevant
- Conduct Student Energy Auditor Trainings (SEAT)
- Provide monthly energy usage information to participating schools
- Conduct mid-year assessment meetings with school teams
- Facilitate the light bulb exchange

2005 California Energy-Efficiency Evaluation Protocols[22]

Overview

The current document (referred to hereafter as the Protocols) presenting the protocols for evaluating California energy-efficiency programs provides three primary evaluation protocols: impact, process, and market effects. The document also includes three other protocols—measurement and verification (M&V), sampling and uncertainty, and reporting—that are to be used in conjunction with these three types of protocols[23]. The purpose of each of the six protocols is described below:

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[22] The information provided here is based on *The 2005 California Energy Efficiency Evaluation Protocols, Second Draft*, December 7, 2005. The protocols were prepared for the California Public Utilities Commission by The TecMarket Works Team. At the time we prepared this document, the draft protocols were still being reviewed by the Administrative Law Judge for approval and adoption.

[23] There are two additional protocols for Codes and Standards programs and the Emerging Technology Program though both are outside the scope of this discussion.

- ***Impact Evaluation Protocol***: This protocol prescribes the minimum allowable methods to meet a specified level of rigor for measuring and documenting program or impacts. Impact evaluations estimate net changes in energy use and/or behavioral impacts expected to produce changes in energy use and demand. Impact evaluations address program direct impacts on participants, including participant spillover, but do not address influences on the operations of markets or on non-participants; these effects are addressed by the Market Effects Evaluation Protocol.
- ***Process Evaluation Protocol***: The process evaluation protocol supports program administrator's efforts to conduct process evaluations that document program operations and provide the basis for improving the operations or cost-effectiveness of programs.
- ***Market Effects Evaluation Protocol***: This protocol guides evaluations of the influence that programs have on markets and how energy use is affected.
- ***Measurement and Verification Protocol (M&V)***: The M&V protocol prescribes how field measurements and data collection will be conducted to support impact evaluations, updates to ex-ante measure savings estimates, and process evaluations.
- ***Sampling and Uncertainty Protocol***: This protocol prescribes the approaches for selecting samples, designing research, and conducting analysis in ways that identify, mitigate, and minimize bias in impact evaluations, M&V efforts, market effects studies, and process evaluation sampling efforts.
- ***Reporting Protocols***: The reporting protocols prescribe how evaluation reports are to be delivered and the information to be presented in those reports. They also provide a description of the information program administrators will need to have readily available to support the evaluation efforts.

According to the Protocols, evaluation planning begins with a high-level assessment of the need to evaluate a program or program component. The Joint Staff (California Energy and Public Utilities Commissions' staff) perform this assessment and consider, among other factors, the importance of the savings to the program portfolio and the uncertainty in the original savings estimates. The Joint Staff decide whether each program must comply with the Protocols or will only be required to comply with the CPUC's program reporting requirements.

If the decision is to apply the Protocols, a determination is made about whether the program is expected to generate *direct* energy or demand savings, where the link between the program activity and the savings is clear, straightforward, and relatively fast; or *indirect* energy savings, where there is a more tenuous link between the program activities and any eventual savings. If the program is defined as one that produces *direct* savings, then the next question is whether it will be guided by the Impact Evaluation Protocol or the Verification Protocol. The Verification Protocol is applied to programs whose savings are relatively small *and* certain. Since the Green Schools Program is expected to provide some direct savings through the light bulb exchange, which of these two protocols may be required must be determined.

Information and education programs are examples of programs that provide primarily indirect impacts. These programs depend upon inducing some form of behavior change (such as purchase behavior or participation in a more direct efficiency program). If a program provides *indirect*

savings, such as Green Schools, then its evaluation must be guided by the Indirect Impact Protocol that explicitly addresses the links between program-induced behavioral changes and eventual energy and demand impacts.

Reporting Protocol Requirements

The Reporting Protocol establishes the types of information that programs should document and make readily available for evaluation purposes. Generic program information requirements and those specific to training/education programs, like the Alliance's Program, are summarized below as extracted from the Protocols.

Program Information. The required information as listed in the Protocols includes:

1. Full program descriptions, including operational or procedures manuals, activities descriptions, and description of implementation territories
2. Detailed descriptions of tracking system and tracking system operations, including data dictionaries
3. Program management and staff names, titles, work locations, phone numbers, fax numbers, e-mail addresses
4. Program theories and associated logic models
5. Market operations theories describing the operations of the markets in which the program operates, and if developed, a description of how the program is to change the operations of the market, if available
6. A description of the size of the targeted market, including a description of the baseline conditions at the measure/behavior level and a discussion of how the program is expected to change baseline measure/behavior conditions, if available
7. A description of the pre-program technical potential at the measure/behavior level and a projection of the remaining technical potential at the end of the program cycle, if available
8. When the program relies on key market actors, trade allies, and other stakeholders to help the program reach energy saving or outreach goals, the administrator should provide a listing and description of these individuals/organizations with information that the evaluation contractors can use to contact the individuals/organizations

Program Data for Information, Education, and Advertising Focused Programs. For programs like this one, the specified list of required Program data includes:

1. Name of program(s) or program component(s)
2. Target population description, size, source of identifying information and lists of population members used in outreach activities; the size and operational characteristics of the market in which the program operates including the number of covered technologies operating in the market and their expected normal failure, change-out or replacement rates

3. Contact information where individual participants are identified to include:
    - First and last name of key contacts for each location (if known)
    - Address of individual contacts
    - Phone number of individual contacts
    - Fax number of individuals (if collected)
    - E-mail of individuals (if collected)
4. Marketing materials by numbers, types, and distribution
5. Education plan or media plan as is appropriate
6. Execution records for training held; information venues used; program participation agreements, commitments or other similar agreements; post-buy analysis; and other documentation of actual output
7. Records for dates, number, location, target audience, and attendance of events held, web-site hits, call-in numbers and rates, reach, frequency, Gross Rating Points, impressions, click through rate, composition, coverage, earned media, value of public service announcements, and other tracking and monitoring information as the program maintains, appropriate to the effort, and for each wave, campaign, and targeted effort; include definitions and calculation methods for monitoring statistics used
8. End-user information that is available to the program
9. Names and copies of previous evaluations and market research efforts used by the program to plan and structure program offerings and implementation efforts

Given the nature of this Program, items number 4 and 7 would probably not be very relevant.

Applicability of the Protocols to the Program

Table 11 summarizes the activities the Protocols require for impact evaluations. Process evaluation activities and requirements are discussed later.

Since the Program is primarily an information and education program, it is anticipated to produce indirect energy savings. However, as noted earlier it would be expected to provide some direct energy savings as well through the CFL exchange component. Based on our understanding of the Program and the Protocols, we assume that the Indirect Impact Protocol is the primary approach that will be required to evaluate the educational components of the Program . We anticipate that the Verification Protocol would be required to assess the effects of the light bulb exchange.

The requirements of these two impact evaluation protocols and their implications for the conduct of this Program are discussed below, followed by a discussion of the Process Evaluation Protocol.

Table 11. Impact Evaluation Activities

1	The Joint Staff identifies which programs will receive an impact evaluation, the type, and the rigor level.
2	The Joint Staff determines any special evaluation needs.
3	Program theory and logic models (PT/LM), if available, must be reviewed/assessed to identify impacts and evaluation elements required. Research design and sampling plan are developed. Evaluation Plan is developed and submitted to the CPUC.
4	Impact evaluation team is staffed to provide the skills required.
5	Develop and obtain CPUC concurrence on definitions of participants, non-participants, and comparison groups.
6	Meet requirements of the Sampling and Uncertainty Protocol.
7	All impact evaluations must be planned, conducted, analyzed, and reported to minimize potential bias. For regression-based consumption analysis: • Address the influence of weather when weather sensitive measures have been included. • For the Enhanced rigor level, assess, plan, measure, and incorporate background and change variables correlated with gross and net energy and/or demand savings. • Select comparison groups and justify selection; discuss potential bias and how comparison group minimizes potential bias. • Capture utility peak period in demand analysis. Address how building demand will reliably provide demand savings estimates. Report demand savings by Climate Zone. Engineering based methods must incorporate: • The influence of weather when weather sensitive measures have been included. • Meet all the requirements in the M&V Protocol including issues of baseline determination. • For the Enhanced rigor level of demand impact analysis use spot or continuous metering/measurement pre and post-retrofit for the peak hour. Demand savings must be reported by Climate Zone. Indirect impact analysis must incorporate: • Description of expected impacts and how they will be measured. • Discussion of identification and measurement of baseline • Extent of exposure/treatment and its measurement. • Comparison groups carefully selected with justification of the selection criteria and discussion of potential bias and how the comparison group minimizes potential bias. • Assessing, planning for, and analyzing to control for self-selection bias.
8	Regression analysis of consumption data must address: outliers, missing data, weather adjustment, selection bias, background variables, data screens, autocorrelation, truncation, error in measuring variables, model specification and omitted variable error, heteroscedasticity, collinearity, and influential data points in accordance with the Sampling and Uncertainty Protocol.
9	Engineering analysis and M&V based methods are required to address: sources of uncertainty in parameters, construction of baseline, guarding against measurement error, site selection and non-response bias, engineering model bias, modeler bias, deemed parameter bias, meter bias, sensor placement bias, and non-random selection of equipment or circuits to monitor in accordance with the Sampling and Uncertainty Protocol.
10	Prepare draft evaluation report meeting all requirements in the Reporting Protocol and incorporate the program's performance metrics.
11	Develop final evaluation report in accordance with guidance provided by the Joint Staff. Submit final evaluation report to the CPUC-ED.
12	Once accepted by the CPUC-ED, develop abstracts and post report on CALMAC web site following the CALMAC posting instructions.

Requirements and Implications of the Indirect Impact Protocol

Requirements. The requirements of the Indirect Impact Evaluation Protocol are summarized in Table 12. We assume that this Protocol will apply to the education components of the Program. Three levels of rigor are defined and the level required will be determined by the Joint Staff.

Table 12. Indirect Impact Evaluation Protocol Requirements

Rigor Level	Indirect Impact Evaluation Method Options
I	An evaluation to estimate the program's net changes on the behavior of the participants is required.
II	A two-stage analysis is required. The first stage is the same as in rigor level I. The second is to link the behaviors identified to estimates of energy and demand savings based upon prior studies.
III	A three-stage analysis is required that will produce energy and demand savings. In addition to the two-stage analysis, the third stage is to conduct field observation/testing to *verify* the occurrence of the level of net behavioral changes.

Which rigor level is required depends on the potential behavioral impact paths through which the Program acts. The Protocols define four paths. Paths C and D appear to be the most relevant to this Program.[24] Path C is defined as "those program-induced behavioral changes that can be observed or measured but are not tied to equipment replacement or the addition of equipment." Path D represents

> . . . behavioral changes that are too small, long-term or intermittent to be cost-efficiently verified through observation, field-testing, or surveying with enough reliability to measure any energy and demand impacts….Path D examples include . . . school programs that educate children on changing their energy use behavior when they are adults.

Path D usually requires rigor level I; Path C is likely to require either rigor level II or III. Given these criteria, it seems most likely that rigor level II will be required, though it is possible that rigor level III will be required.

Implications. Meeting these requirements in evaluating this Program will depend on the rigor level required by the Joint Staff. To conduct a rigor level I evaluation, the key requirement is to demonstrate that the program has carried out specific activities that are designed to produce behavioral change and that changes have occurred as a result. This is likely to require reviewing documentation of Program activities conducted, obtaining records of the specific changes made at each participating school, and additional steps such as interviews with participants and the Program implementers. Since the Protocol requires an estimate of net behavioral changes, an effort would be required to determine how the participants would have behaved without the Program or an assessment of the behavior of a non-participant control group.

[24] Paths A and B involve equipment installation, whereas Paths C and D involve only behavioral changes.

To implement a rigor level II evaluation, the additional step of linking the demonstrated behavioral change to energy savings is required. The Protocols indicate that this could be done through reliance on prior studies. However, the Program estimates energy savings for participating schools using the software product Utility Manager, which establishes baseline and tracking information through bill analysis, major load adjustments, and demand reduction information derived from the corresponding cost-effectiveness calculator and portfolio workbook. This method should be more reliable and preferred than using prior studies. A key element to include with this analysis are methods demonstrating the causal relationship between the Program, behavior changes, and energy savings.[25] In addition, analysis of non-participating schools would help establish the net savings effects of the Program.

If rigor level III is required, then an additional step is necessary to verify in the field that the behavioral changes have occurred. For this Program, examples of rigor level III evaluation activities might include review of school policy and planning documents along with interviews of participants, and testing subsequent school participants' knowledge and reported actions. School site visits to verify Program-induced changes could also be an important component of rigor level III evaluation. Since rigor level III requires verification of *net* behavioral changes, again an analysis of the behavior of non-participants would likely be required.

Requirements and Implications of the Verification Protocol[26]

Requirements. Since direct energy savings will be generated by the Program through the light bulb exchange, the verification protocol will also likely be applied to the evaluation. As noted previously, the Program estimates that participating students will bring 12,000 working incandescent bulbs to school to exchange for CFLs, which would then be installed at home.

According to the Protocols:

> "The objectives of measure installation verification are to confirm that: (1) the measures were actually installed, (2) the installation meets reasonable quality standards, and (3) the measures are operating correctly and have the potential to generate the predicted savings. Installation verification shall be conducted at all sites claiming energy or peak demand impacts where M&V is conducted."

Implications. To follow this Protocol, it will be necessary for the Program to track who exchanged bulbs, when the exchange took place, the wattage of the incandescent bulb, and the total number exchanged in addition to participant contact information. Ideally, a representative and statistically significant sample of participating households would be selected for on-site verification. However, given the Program's larger focus on education, this may be impractical for this Program.

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[25] The Protocols provide suggestions for the types of approaches that would be suitable.

[26] We note that the December 7, 2005, draft of the Protocols does not specifically define a Verification Protocol although it refers to it on page 9. We assume for discussion here that this term is used to mean "measure installation verification" as discussed in the chapter "Measurement and Verification Protocol."

One option might be for the Program to establish a process through which students would report back on where CFLs were installed, as well as other related information such as hours of operation, failure rates, etc. This approach could be supplemented with telephone surveys designed to verify the information for a sample of households. Alternatively, the information could be collected solely through telephone surveys. We emphasize that these options reflect our judgment at this point and might not be acceptable under the finalized Protocols.

Requirements and Implications of the Process Evaluation Protocol

Requirements. The Protocols state:

> "Process evaluation is not a required evaluation activity in California. It is however critical to the successful implementation of cost-effective and cost-efficient energy efficiency programs. . . A process evaluation is defined as: a systematic assessment of an energy efficiency program, product or service, or a component of an energy efficiency program, product or service, for the purposes of (1) documenting program operations at the time of the examination, and (2) identifying and recommending improvements that can be made to the program to increase the program's efficiency or effectiveness in acquiring energy resources while maintaining high levels of participant satisfaction."

Process evaluations are to be planned, budgeted, designed, implemented, and reported under the direction of the portfolio administrators. The administrators are responsible for the process evaluations for their statewide programs, administrator-specific programs implemented within their services areas, programs conducted by third-parties under contract to the administrators, and programs or services that are procured via a bidding or other contractual processes. For this Program, therefore, it appears that SCE will have responsibility for the process evaluation.

It is anticipated that most programs will have at least one in-depth comprehensive process evaluation within the 2006-'08 funding cycle, but a program may be subject to more or less study depending on issue, timing, and importance.

Topics likely to be covered in the process evaluation include:

- Program Design
  - Program design and design characteristics, and the program design process
  - The program mission, vision, and goal setting and the goal-setting process
  - Assessment or development of program and market operations theories and supportive logic models, theory assumptions, and key theory relationships - especially their causal relationships
  - Use of new practices or best practices
  - Program Administration
  - The program oversight and improvement process
  - Program staffing allocation and requirements
  - Management and staff skill and training needs
  - Program information and information support systems

    - Reporting and the relationship between effective tracking and management, including both operational and financial management

- Program Implementation and Delivery
    - Description and assessment of the program implementation and delivery process
    - Quality control methods and operational issues
    - Program management and management's operational practices
    - Program delivery systems, components and implementation practices
    - Program targeting, marketing, and outreach efforts
    - Program goal attainment and goal-associated implementation processes and results
    - Program timing and timelines and time sensitive accomplishments
    - Quality control procedures and processes
- Market Response
    - Customer interaction and satisfaction (both overall satisfaction and satisfaction with key program components and including satisfaction with key customer-product-provider relationships and support services)
    - Customer or participant's energy-efficiency or load-reduction needs and the ability of the program to deliver on those needs
    - Market allies' interaction and satisfaction
    - Low participation rates or associated energy savings
    - Market allies' needs and the ability of the program to meet those needs
    - Reasons for overly high free-riders, or too low a level of market effects, free drivers or spillover
    - Intended or unanticipated market effects

Probable process evaluation data collection and assessment efforts, as outlined in the Protocols, include:

1. Interviews and surveys with administrators, designers, managers, and implementation staff (including contractors, sub-contractors and field staff)
2. Interviews and surveys with trade allies, contractors, suppliers, manufacturers and other market actors and stakeholders
3. Interviews and surveys with participants and non-participants
4. Interviews and surveys with technology users
5. Interviews and surveys with key policy makers and public goods charge stakeholders
6. Observations of operations and field efforts, including field tests and investigative efforts
7. Unannounced participation in the program to test operations and operational practices, processes, and interactions
8. Operational observations and field-testing, including process related measurement and verification efforts

9. Workflow, production, and productivity measurements.
10. Reviews, assessments and testing of records, databases, program-related materials, and tools used
11. Collection and analysis of relevant data or databases from third-party sources (equipment vendors, trade allies and stakeholders, market data suppliers)
12. Focus groups with participants, non-participants, trade allies, and other key market actors associated with the program or the market in which the program operates

Implications. Based on the Protocols, this Program would be expected to have at least one process evaluation during the next three years. It would be prudent to conduct this evaluation early to identify any implementation issues that might affect the outcomes.

Placing an emphasis on how the energy-efficiency training and audit training were conducted would provide useful information that might increase the effectiveness in later years. Early observations of how the tracking of behavioral changes was working would be useful to ensure that quality data were available. Likewise, an early review of the processes used for the light bulb exchange could determine whether the CFLs themselves, as well as the data collection process, were working effectively.

Some of the Program implications of the Process Evaluation Protocol are similar to those associated with the other evaluation activities. In particular, it will be important to establish accurate and timely tracking protocols to ensure that information is available on the participants. It will probably be important to identify non-participants for the process evaluation and it would be efficient and effective to use the same non-participants for both the process and impact evaluations.

Appendix A: Survey Instrument

State of California Schools Market Assessment
District Contact Survey

Interviewer: _____ Date: _____

Time Start: _____

Introduction

NORTHERN CALIFORNIA ONLY: Hello, my name is _____. I'm calling on behalf of Pacific Gas and Electric Company and the Alliance to Save Energy. Could I please speak with (insert contact if available from database) or with the person who is responsible for decisions regarding the adoption of curriculum/ participation in energy efficiency programs?

[IF ASKED, explain that PG&E has two schools programs that are designed to reduce the barriers schools face in adopting energy efficiency measures, to aid schools in addressing energy efficiency needs and improving the overall energy efficiency of schools within participating school districts, and to educate students and their parents on energy efficiency and electric and gas safety AND that the Alliance to Save Energy is a coalition of business, government, environmental, and consumer leaders who promote energy efficiency worldwide to achieve a healthier economy, a cleaner environment and greater energy security. They are coordinating efforts to assess the needs and interests of school districts in participating in school energy efficiency programs.]

[Reintroduce yourself, if necessary, and continue.]

The Alliance to Save Energy is gathering information regarding past or current experience with school-based energy efficiency programs, as well as to better their understanding of the barriers to participation in such programs, in an effort to improve its existing schools program, the Green Schools Program. Do you have about 10-15 minutes to answer a few questions? If available, proceed. If not, make arrangements for callback. [SKIP TO INTERVIEW]

SOUTHERN CALIFORNIA ONLY: Hello, my name is _____. I'm calling on behalf of the Alliance to Save Energy. Could I please speak with (insert contact if available from database) or with the person who is responsible for decisions regarding the adoption of curriculum/participation in energy efficiency programs?

[IF ASKED, explain that the Alliance to Save Energy is a coalition of business, government, environmental, and consumer leaders who promote energy efficiency worldwide to achieve a healthier economy, a cleaner environment and greater energy security. They are coordinating efforts to assess the needs and interests of schools in participating in school energy efficiency programs.]

[Reintroduce yourself, if necessary, and continue.]

The Alliance to Save Energy is gathering information regarding past or current experience with school-based energy efficiency programs, as well as hoping to better its understanding of the barriers to participation in such programs, in an effort to improve their Green Schools Program. Do you have about 15-20 minutes to answer a few questions? If available, proceed. If not, make arrangements for callback.

If appropriate contact is unavailable, make arrangements for callback. Thank and terminate.

Call back arrangement:

Date	**Time**
_____	_____

Participant Identification

SAY: We appreciate your willingness to provide feedback and want to assure you that your answers will be kept strictly confidential and will not be directly attributable to you.

1. Is there anyone at the school district that may be better able to provide information regarding experience with energy efficiency programs or the current or past utilization of energy efficiency curriculum?

   - ❑ Yes Name: _____ Phone: _____ [THANK AND TERMINATE.]
   - ❑ No .....[Proceed with survey.]
   - ❑ Don't know.....[Proceed with survey].

2. Before we start, what is your position within the school district?

   _____

Current Experience with Energy Efficiency Programs

3. Are any of the schools in your district currently participating in any energy efficiency programs?

   - ❑ Yes 1
   - ❑ No.....2 [Skip to Q5]
   - ❑ Don't know/Don't remember .....-8 [Skip to Q5]
   - ❑ Refused .....-9 [Skip to Q5]

4. Approximately, how many schools in your district are currently participating? _____ [USE CDS code to determine the number of schools in the district. Use this info to compute percent of schools in district who participate in a program]

5. In the last five years (including the current year), what type(s) of energy efficiency program(s) has (have) the district participated in? [Check all that apply]

- ❑ A) Curriculum-Based Program 1
- ❑ B) Facility Retrofit Program 2
- ❑ C) New Construction 3
- ❑ D) None.....4 [SKIP TO Q10]
- ❑ E) Other (Specify):.....5
- ❑ F) Don't know/Don't remember .....-8
- ❑ G) Refused .....-9

6. Curriculum-based Programs (matrix) [ANSWER IF Q5=1 OR DK OR REF] Please indicate whether you have participated in any of the curriculum-based programs listed below and, if so, when the district participated in the program. [MONTH AND YEAR ARE PREFERRED, BUT IF NOT KNOWN, CALENDAR YEAR IS OKAY.]:

Curriculum-based PROGRAM	YES (1)	NO (2)	DON'T KNOW (-8)	REFUSED (-9)	In which years did the district participate in this program?
A. Alliance to Save Energy Green Schools Program					
B. PG&E's Energenius					
C. NEEDS Program (National Energy Education Development)					
D. Project Learning Tree					
E. PEAK Program					
F. Living Wise Program					
G. Other program that provides curriculum on energy efficiency					
G1. Program name_____		G2. Program Implementer_____			

7. Retrofit/New Construction Programs (matrix) [ANSWER IF Q5=2 OR 3 OR DK OR REF] Please indicate whether you have participated in any of the retrofit/new construction programs listed below and, if so, when the district participated in the program. [MONTH AND YEAR ARE PREFERRED, BUT IF NOT KNOWN, CALENDAR YEAR IS OKAY.]:

RETROFIT/NC PROGRAM	YES (1)	NO (2)	DON'T KNOW (-8)	REFUSED (-9)	In which years did the district participate in this program?
A. Utility run Express Efficiency					
B. Savings By Design					
C.SDG&E Energy Saver					
D. Standard Performance Contract (SPC)					
E. PG&E's School Resources Program					
F. CEC Efficiency Financing					
G. CEC Bright Schools Program					
H. CEC Solar Schools Program					
I. Office of Public School Construction Energy Allowance Grant Program					
J. State Energy Revenue Bond Program					
K. Rebuild America Program					
L. Any local utility run *rebate* program					
L1. Program name_____		L2. Program Implementer_____			
M. Any other utility *audit* program					
M1. Program name_____		M2. Program Implementer_____			

8. How did you learn about the energy efficiency programs that you participated in? [Check all that apply]

- ❑ A) Outreach Materials – mailing, flyer, etc. 1
- ❑ B) Visit from Program Manager 2
- ❑ C) Co-worker or Colleague.....3
- ❑ D) Presentation at conference/meeting 4
- ❑ E) Other (Specify): 5
- ❑ F) Don't know/don't remember .....-8
- ❑ G) Refused .....-9

9. As a result of your experience(s), how likely are you to participate in another energy efficiency program in the future? Would you say . . .

- ❑ Significantly more likely.....1
- ❑ Somewhat more likely 2
- ❑ Somewhat less likely.....3
- ❑ Significantly less likely.....4
- ❑ Don't Know/Don't Remember .....-8
- ❑ Refused .....-9
- ❑ [SKIP TO Q15]

Non-Participation in Past Programs

10. Have you ever been approached to participate in an energy-efficiency program?

- ❑ Yes 1
- ❑ No .....2 [SKIP TO Q15]
- ❑ Don't know/Don't remember .....-8 [SKIP TO Q15]
- ❑ Refused .....-9 [SKIP TO Q15]
- ❑

11. What kind of program was it? [Basic Description(s)]

_____

12. What prevented your district from participating in the program(s)?

_____

13. How had you been approached about the energy efficiency program? [Check all that apply]

- ❑ A) Outreach Materials – mailing, flyer, etc. 1
- ❑ B) Visit from Program Manager 2
- ❑ C) Co-worker or Colleague.....3
- ❑ D) Presentation at conference/meeting 4
- ❑ E) Other (Specify):_____.....5
- ❑ F) Don't know/don't remember .....-8
- ❑ G) Refused .....-9

14. What are the key elements of any energy education materials that must be present before your district would consider using them? _____

Energy Efficiency In Current Curriculum

15. Outside of any of the programs we have discussed, is information about energy efficiency currently included in any of the curriculum being used in your district?

- ❑ Yes 1
- ❑ No.....2 [Skip to Q19]
- ❑ Don't Know .....-8 [Skip to Q19]
- ❑ Refused .....-9 [Skip to Q19]

16. Please (briefly) describe how energy efficiency is integrated into the current curricula.

_____

17. How long has energy efficiency been part of the curricula?

- ❑ 1 year.....1
- ❑ 2-3 years.....2
- ❑ 4-5 years.....3
- ❑ More than 5 years ago.....4
- ❑ Don't Know .....-8
- ❑ Refused .....-9

18. Why was energy efficiency first added to the curricula?

_____

Adoption of New Curriculum

19. What is the best way for implementers of standards-based energy efficiency programs to contact school districts regarding their programs?

_____

20. Please briefly describe the process of how new topics, such as energy efficiency, are added to curricula.

_____

21. How often are curricula reviewed and changes made?

- ❑ Every year 1
- ❑ Every 2-3 years 2
- ❑ Every 4-5 years 3
- ❑ More than 5 years.....4
- ❑ Don't Know/don't remember.....-8
- ❑ Refused .....-9

22. How long does this process usually take?

_____

23. When making decisions about new curriculum materials, what are the most important factors that you take into consideration?

_____

24. Does the structure/type of Program activities offered by a program affect your willingness to participate in a Program?

- ❑ Yes 1
- ❑ No (Go to Q26) 2
- ❑ Don't Know (Go to Q26).....-8
- ❑ Refused (Go to Q26).....-9

25. Please specify what types of Program activities/offerings are most preferred when deciding to adopt/implement a Program?

_____

26. How would you rate your district's interest in project-based programs that are designed for compatibility with state and federal curriculum requirements?

- ❑ Very Interested.....1
- ❑ Somewhat Interested.....2
- ❑ Somewhat Uninterested.....3
- ❑ Not at all Interested.....4
- ❑ Don't Know .....-8
- ❑ Refused .....-9

27. How would you rate your district's interest in programs that provide standards-based energy-efficiency curricula?

- ❑ Very Interested.....1
- ❑ Somewhat Interested.....2
- ❑ Somewhat Uninterested.....3
- ❑ Not at all Interested.....4
- ❑ Don't Know .....-8
- ❑ Refused .....-9

28. How would you rate your district's interest in programs that can provide immediate, measurable energy savings through behavioral changes?

- ❑ Very Interested.....1
- ❑ Somewhat Interested.....2
- ❑ Somewhat Uninterested.....3
- ❑ Not at all Interested.....4
- ❑ Don't Know .....-8
- ❑ Refused…….-9

29. Please rank the three aforementioned Program attributes in terms of their importance when deciding whether to participate in an energy-efficiency program:

- ❑ Project-Oriented.....____
- ❑ Standards-Based Curricula.....____
- ❑ Immediate, Measurable Savings.....____
- ❑ Another Attribute (Specify: _____).....____

30. How would you rate your district's interest in facilities-based/retrofit programs (e.g., programs that give rebates for installing energy efficiency equipment)?

- ❑ Very Interested.....1
- ❑ Somewhat Interested.....2
- ❑ Somewhat Uninterested.....3
- ❑ Not at all Interested.....4
- ❑ Don't Know/Don't remember.....-8
- ❑ Refused.....-9

31. Does the endorsement by any of the following organizations increase the chances of participation in curriculum-based or facilities-based energy efficiency programs? [READ] [CHECK ALL THAT APPLY]

- ❑ A) State/County Department of Education.....1
- ❑ B) California Energy Commission.....2
- ❑ C) California Public Utilities Commission.....3
- ❑ D) Natural Resources Defense Council.....4
- ❑ E) Another Organization (Specify:_____) 5
- ❑ F) Don't Know/Don't remember.....-8
- ❑ G) Refused.....-9

32. Approximately what percent of the classrooms in your district are re-locatable classrooms?

_____ Percent
_____ Don't Know

33. Is this percent expected to increase or decrease and by how much?

1 ___ Increase: By ____ Percent: In ____ Years
2. ___ Decrease: By ____ Percent: In ____ Years
3. ___ No Change
8. ___ Don't Know

34. Do you have any other comments regarding the issues we've discussed?

_____

THANK AND TERMINATE