Southern California Edison Evaluation of 2000-2001 School Programs

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1. EXECUTIVE SUMMARY

1.1 Introduction

The Southern California Edison Company's (SCE) decision to implement and evaluate the Green Schools, Living Wise®, and PEAK Programs for the 2000-2001 academic year was in response to Ordering Paragraph 33 issued as part of Decision (D.) 00-07-017 on July 11, 2000. This ordering Paragraph states:

> PG&E and Edison shall continue their school-based education programs for PY 2001 and SDG&E and SoCalGas shall conduct pilot tests of these school-based programs in their service territories for PY 2001. The utilities shall monitor the effectiveness of the program and changes in awareness and behaviors attributable to the program and report the results in the Quarterly Reports and in an evaluation report to be submitted to the Energy Division by December 1, 2001. The utilities shall explore the feasibility of a future statewide school-based education strategy using PG&E's and SCE's programs as models.

The elements of SCE's response[1] to Ordering Paragraph 33 that form the framework for this evaluation are presented below:

> SCE is implementing three pilot school programs through third-party initiatives during PY2000 and continuing through PY2001 – Living Wise®, Green Schools, and Peak.
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> The Living Wise® Program (LWP) is implemented by the National Energy Foundation and targets 6,000 sixth grade students. The Program features a blend of classroom learning activities and hands-on audit information and energy-efficiency installation projects that students complete in their homes with parental assistance.
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> The Green Schools Program (GSP) is implemented by the Alliance to Save Energy and currently includes three school districts (grades K-12) and one regional Occupational Program supporting 19 high schools within 7 school districts. The purpose of the Green Schools Program is two-fold: to reduce energy costs in schools, and to educate students and their families about energy and the link between efficiency, the environment,

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SCE's response continued:

> SCE and PG&E will continue to monitor and evaluate their school-based programs. The current efforts will be enhanced to monitor the effectiveness of the programs and the changes in awareness and behaviors attributable to the programs as required in Ordering Paragraph 33. SCE and PG&E's revised evaluation plan will be developed by the first quarter of 2001, and the final evaluation report will be submitted to the Energy Division by September 1, 2001. Results of the evaluation studies and monitoring will be shared with the other utilities as analyses are conducted and completed.

Finally, the issue of a statewide school-based program was addressed:

> PG&E, SCE, SDG&E and SoCalGas will confer jointly to determine whether a statewide school-based program would be effective, which would be the best program model to implement, or whether to offer more than one kind of option.

Ordering Paragraph 33 states that the objectives of these evaluations are to monitor:

1. the effectiveness of these three pilot programs, and
2. changes in awareness and behaviors attributable to these programs.

Because all three of these programs are pilot programs, there is a greater emphasis on *process* evaluation with the main objective of improving the programs and the methods for estimating impacts than on the impacts themselves. Once the programs are further developed and the program designs stabilize, greater emphasis will be placed on *impact* evaluation.

We hasten to add that even in the ultimate impact evaluation one should not place too great an emphasis on kWh and kW impacts since these impacts represent only a portion of the total impact. The other portion is comprised of educational outcomes that include knowledge gains and attitudinal changes with respect to energy efficiency and conservation. For these types of educational programs, those applying benefit-cost tests, such as the Total Resource Cost Test, must find a method for valuing not only the kWh and kW impacts but also educational impacts. To ignore such educational impacts would do a disservice to these educational programs.

The remaining task of exploring the possibility of a statewide school-based program will be addressed in a separate report to be submitted jointly to the CPUC by SCE, PG&E, SDG&E and SoCalGas by December 31, 2001.

1.2 Evaluation Objectives

In response to Ordering Paragraph 33, we established three evaluation objectives covering the GSP, LWP, and the PEAK. These are:

1. to develop a baseline market characterization for the schools sector,
2. to monitor the effectiveness of the GSP, LWP, and PEAK programs, and
3. to monitor changes in awareness and behaviors attributable to these programs.

1.3 Methods

The methods used to evaluate the Green Schools, Living Wise, and PEAK Programs include both quantitative and qualitative techniques and draw on existing program data as well as data collected by the evaluation team. Table 1-1 presents a summary of these data for each program.

Table 1-1. Data Sources, by Program

Data Source	Green Schools Program	Living Wise Program	PEAK Program
Program tracking database	X	X	X
Surveys of teachers		X	
Surveys of households		X	
Surveys of workshop participants			X
Student pre-tests and post-tests		X	
Student post-test (STEM training)	X		
In-Depth interviews with program staff	X	X	X
In-Depth interviews with school administrators or facility managers	X		
In-Depth interviews with teachers	X	X	X
kWh consumption estimates	X	X	X
California State Department of Education	X	X	X
Literature review	X	X	X
Survey of workshop participants	X		

1.4 Results

1.4.1 Market Characterization

There are a variety of conclusions that can be made regarding the schools market segment.

- There is a drastic need for additional classrooms owing to increased enrollments and reduced class sizes. Failure to take advantage of energy efficient options when new facilities are built/added would represent a significant missed opportunity.
- Because of reduced school funding over the last 20 years, there is a drastic need for major repairs and renovation of existing buildings. This is the case despite the passage of Proposition 1A. Failure to take advantage of energy efficient options when renovations are made represents a significant missed opportunity.
- The market barriers facing schools include information-search costs, performance uncertainty, organizational practices, and high first costs. Organizational practices and high first cost may be the greatest barriers.

1.4.2 Green Schools Program (GSP)

Below are the key findings regarding the GSP.

1.4.2.1 Participation

- Three high schools, three middle schools, four elementary schools, and one regional occupational center participated in the GSP in the 2000-2001 academic year.
- A total of 992 students were exposed to the GSP.

1.4.2.2 Impacts

- School administrators, teachers, facility managers, and custodians received GSP training. In general, they reported the training and support to be very good.
- Sixty high school students were trained as energy auditors with 51 students passing the final examination.
- School administrators, teachers, facility managers, and custodians felt that their own behavior as well as their students' behavior with respect to conservation had changed during the year.
- The preliminary savings estimates are 428,073 kWh and 14,527 therms. This translates into a total electric bill reduction of $51,369 and a total gas bill reduction of $8,716.
- The GSP achieved some success in broadening efficiency education to students' families and the larger community.

1.4.2.3 Future Activities

- In the 2001-2002 school year, the GSP will continue in those schools that participated in the 2000-2001 school year and expand to an additional 10 schools.
- Savings estimates for those schools participating in the 2000-2001 school year will be finalized.

1.4.2.4 Evaluation Recommendations

- A pre-test and post-test should be implemented in the fall 2001.

1.4.3 Living Wise Program (LWP)

Below are the key findings regarding the LWP.

1.4.3.1 Participation

- Thirty-four schools participated in the LWP in the 2000-2001 academic year.
- LWP materials were used by 134 teachers.
- LWP reached 5,908 students.

1.4.3.2 Impacts

- Students exposed to the LWP experienced statistically significant increases in knowledge
- An estimated 17,894,642 kWh were saved.
- An estimated 2,069,069 therms were saved.
- An estimated 492,343,032 gallons of water were saved.

1.4.3.3 Future Activities

- In fall 2001, the LWP will be implemented in additional yet-to-be-named schools.

1.4.3.4 Evaluation Recommendations

- Use a longer version of the teacher survey, which allows for the collection of more information by which to judge the effectiveness of the LWP.

1.4.4 PEAK Program (PEAK)

Thus far, two phases of PEAK have been completed with a third phase planned for the 2001-2002 school year. The results are presented for the first two phases and the planned activities for the third phase are described.

1.4.4.1 Phase 1

- Approximately 50 students at one private school in Corona del Mar participated in the development of PEAK during the 1999-2000 school year.

1.4.4.2 Phase 2

- 12 teachers received in-service training in the Program

- 140 students participated in a summer PEAK orientation workshop
- One private school in Corona del Mar and one public school in the Santa Monica School District participated in the 2000-2001 academic year.
- 90 students participated at the one private school
- 140 students participated at the public school
- While no official estimates of kWh savings were made, a preferred technique for estimating savings has been identified for use in the 2001-2002 academic year

1.4.4.3 Phase 3

- The plans for Phase 3 include:
  - teaching students about kWh and kW reductions both at their schools and in their homes,
  - a greater effort to pursue kWh and kW reductions savings at the schools and in students' home through the use of formal energy audits, and
  - expanding PEAK to a wider audience.

1.4.4.4 Evaluation Recommendations

- Pre and post-test should be used to measure changes in both attitudes and knowledge. These tests are being developed for use in the 2001-2002 school year.
- Use engineering algorithms as a way of estimating kWh savings and kW demand reductions rather than relying on an analysis of energy bills.

1.4.5 Overall Conclusions

- All three organizations have been actively involved in implementing their respective programs and will continue to do so through the fall 2001.
- All three programs have evolved considerably over the last 12 to 18 months in response to changing district and student needs and have been well received by students, teachers, and administrators.
- While some have been more successful than others in measuring energy impacts, others have made great strides in developing sound approaches to estimating such impacts.
- Participants have occasionally incorporated or are considering incorporating certain features from other programs that complement their programs. This kind of cross-fertilization is a key to their continuing improvement and demonstrates flexibility on the part of the program designers and openness to new ideas.
- Because all three of these programs are pilot programs, there is a greater emphasis on process evaluation, with the main objective of improving the programs and the methods for estimating impacts, than on impact evaluation itself. Once the programs are further developed and program designs stabilize, greater emphasis

will be placed on impact evaluation. Thus, it is premature to judge how effective the programs are in achieving their educational and energy saving objectives.

- However, when conducting the impact evaluations of these programs, one should take into account, in addition to the stated educational and energy saving objectives, at least three additional attributes:
    - the policy objectives of SCE and California (short-term energy savings versus long-term behavioral changes leading to sustained energy savings over the long run)
    - the measurement of *all* the benefits including energy savings, knowledge gains and attitudinal changes
    - the degree to which programs can be customized by teachers
- The various techniques, either used or planned to be used, for estimating savings for these three programs produce estimates of *gross* savings only. There is no established net-to-gross ratio (NTGR) by which to convert these *gross* savings to *net* savings. If impact evaluations of any of these programs are conducted in the future, the issue of the NTGR must be addressed at that time.

2. INTRODUCTION

The Southern California Edison Company's (SCE) decision to implement and evaluate the Green Schools Program (GSP), the Living Wise® Program (GSP) and the PEAK Program for the 2000-2001 academic year was in response to Ordering Paragraph 33 issued as part of Decision (D.) 00-07-017 on July 11, 2000. This ordering Paragraph states:

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The elements of SCE's response[2] to Ordering Paragraph 33 that form the framework for this evaluation are presented below:

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> PG&E, SCE, SDG&E and SoCalGas will confer jointly to determine whether a statewide school-based program would be effective, which would be the best program model to implement, or whether to offer more than one kind of option.

Thus, the objectives of this evaluation are to:

1. monitor the effectiveness of these three pilot programs, and
2. monitor changes in awareness and behaviors attributable to these programs.

Because all three of these programs are pilot programs, there is a greater emphasis on process evaluation with the main objective of improving the programs and the methods for estimating impacts than on impact evaluation itself. Once the programs are further developed and program designs stabilize, greater emphasis will be placed on impact evaluation.

We hasten to add that even in the ultimate impact evaluation one should not place too great an emphasis on kWh and kW impacts since these impacts represent only a portion of the total impact. The other portion is comprised of educational outcomes that include knowledge gains and attitudinal changes with respect to energy efficiency and conservation. For these types of educational programs, those applying such benefit-cost tests, such as the Total Resource Cost Test, must find a method for valuing not only the kWh and kW impacts but also educational impacts. To ignore such educational impacts would do a disservice to educational programs.

The remaining task of exploring the possibility of a statewide schools-based program will be addressed in a separate report to be submitted jointly to the CPUC by SCE, PG&E, SDG&E and SoCalGas by December 31, 2001.

For each of these three programs, we first outline the evaluation methodology, data sources, data collection plan, and sampling plan. The next section describes in greater detail the Green Schools Program (GSP), the Living Wise® Program (LWP), and the PEAK Program.

3. PROGRAM DESCRIPTIONS

Program descriptions of the three programs being evaluated are presented in this section. The Green Schools Program is presented first, followed by the Living Wise Program and the PEAK Program.

3.1 The Green Schools Program

The purpose of the Green Schools Program (GSP) is two-fold:

1. to reduce energy costs in schools, and
2. to educate students and their families about energy and the link between efficiency, the environment, and finances.

It is a comprehensive and long-term approach to school efficiency, bringing together the facilities, instructional and administrative staff in a cooperative effort to improve education, using energy as a tool. Energy savings are achieved from behavior and operations as well as encouraging retrofits. Students are integrally involved in the efficiency activities, from energy patrols to in-depth school audits. Classroom activities include instruction, energy saving activities, and involvement of others from the school and broader community. The GSP instructional materials are correlated to the California Department of Education standards, making them easier for teachers to use to strengthen student academic learning. Students learn about ways they can help the environment, a compelling issue for many young people, and will involve their families in their energy lessons.

3.1.1 Essential Program Elements

There are three essential elements to the GSP:

1. The program is comprehensive and long-term, including retrofits, behavior, and operations, and instruction. It focuses on energy but also can include recycling, water efficiency, and low-toxic landscape and cleaning materials.

2. A percentage (usually half) of the dollar savings due to the no-cost behavior and operation energy savings are returned to the individual schools that achieved the savings, with the remainder going to the general district facilities budget. The savings are used to purchase books, computers, fund field trips and other educational activities, as determined by the principal with input from school teams.

3. The program is implemented at the school level by teams of teachers, custodians, administrators, and students, and includes three strands: instruction, efficiency action, and involvement of the larger community.

The GSP also conducts an award program, called the Earth Apple Awards. The purposes of the Earth Apple Awards are:

1. To recognize publicly student, teacher, and school efforts to save energy and the environment, and

2. To give teachers a way to assess ongoing student progress.

Awards can come in the form of trophies, equipment, books, special tours and other prizes.

3.1.2 Program Participants

The GSP is being implemented in three school districts and in one regional occupational program. Table 3-1 presents these participants.

Table 3-1. Participants in the Green Schools Program

School District	Schools/Centers
Hacienda la Puente USD	Workman High School
Hacienda la Puente USD	Wing Lane Elementary
Hacienda la Puente USD	Del Valle Elementary School
Hacienda la Puente USD	Sierra Vista Middle School
Bassett USD	Bassett High School
Bassett USD	Edgewood Academy
Bassett USD	Torch Middle School
Charter Oak USD	Cedargrove Elementary
Charter Oak USD	Charter Oak High School
Charter Oak USD	Royal Oak Middle School
East San Gabriel Valley Regional Occupational Program (ROP)	ESGV ROP

The GSP also uses the Savings Through Energy Management (STEM) Program offered by Wilson Educational Services, Inc. STEM is a three-to-five-day program for a group of students in grades 7-12 and their teacher. The school's custodian and an administrator are welcome to participate as well. The STEM instructor teaches participants to recognize real energy problems in the school, to identify appropriate and cost-effective solutions to the problems, to gather all data, to calculate the savings in fuel and dollar units and to present the information effectively. This program enhances important skills in science, math, and language. It includes a rigorous final exam (all word problems) and a written report that the STEM team presents and explains to the School Board. The STEM program was offered in three high schools and the regional occupational program.

The following GSP tasks provide the framework for this evaluation:

1. Work with school leadership, including the state as well as local-level administrators and teachers, to tailor the program to local needs, procedures, and priorities.
2. Align the GSP instructional materials to the California Department of Education standards.
3. Conduct a two-to-three-day training workshop for teams of instructional and facilities staff from each school.
4. Train students in each district to become certified student energy auditors.
5. Provide instructional and program implementation tools to each school district.
6. Broaden the efficiency education to students' families and the larger community.
7. Provide stipends and on-going program support to local project leaders in each district.
8. Develop a baseline of energy use for each school and assist schools in tracking savings.
9. Conduct a summer training workshop for returning and new school staff.

3.2 Living Wise® Program

The Living Wise® Program is delivered through 6th grade classes and features a blend of classroom learning activities and hands-on audit and energy installation projects which students complete in their homes with parental assistance.

3.2.1 Essential Program Elements

The key components are:

1. Interactive school-to-home program for 6th grade students
2. Teacher-designed classroom activities that reinforce student work on critical State Standards in core subject areas
3. Hands-on projects that use conservation kits to directly install efficiency technologies in the home, thus reinforcing education results
4. Involvement of parents and shaping family habits and awareness of the benefits of energy efficiency
5. Collection of residential audit information
6. Cross advertising that features other SCE energy efficiency programs
7. Community outreach

Each conservation kit contains the following materials:

1. A high efficiency showerhead
2. A night light
3. Water temperature check card
4. Flow rate test bag
5. Dirty furnace/AC filter alarm
6. Compact fluorescent lamp
7. Water efficient kitchen aerator
8. Air temperature energy monitor rule
9. Toilet leak detector tablets

Also included in the resource kit is a CD-ROM game that was developed as a means to introduce energy and water conservation to children and their parents.

There are 14 classroom lessons:

1. Understanding our natural resources
2. Responsible resource action
3. The energized world
4. Be electricity wise
5. Be natural gas wise
6. Be renewable energy wise
7. Energy action technologies
8. Home comfort wise
9. Water is essential for life
10. Be water wise
11. Water wise lawns and landscapes
12. Water in the community
13. Clean air wise

14. Be waste management wise

The amount of time recommended to cover these 14 lessons is a minimum of 7.5 hours. These materials are available upon request.

The goals of the Program are to:

1. reduce resource consumption in 6,000 SCE households over five years by:
   - 16,800,000 kWh
   - 369,000 therms
   - 140,580,000 gallons of water and wastewater,
2. effectively educate two generations of residential customers in 6,000 households, demonstrating the importance, ease, and benefits of energy efficiency,
3. install 6,000 compact fluorescent lamps (CFLs), high efficiency nightlights, filter tone alarms, high efficiency showerheads and other home efficiency devices,
4. conduct 6,000 basic home resource use audits, and
5. deliver information on other energy efficiency programs offering products or services to 6,000 households.

3.3 PEAK Program

The PEAK Program is a component of the Regional Energy Efficiency Initiative (REEI), which was conceived in the early 1990s by the California Energy Coalition as a means of establishing a partnership between cities and their serving utilities. REEI is a three-year demonstration project. The basis of the partnership was to encourage cities to actively embrace energy efficiency programs by creating energy efficiency master plans while in turn encouraging utilities to work with the cities to target their energy efficiency programs in a manner that is consistent with these city plans.

In May 1999, consistent with the parameters of the REEI and after years of discussion, the Cities of Santa Monica and Irvine, Southern California Edison and the California Energy Coalition agreed to embark on a 2-1/2 year demonstration program called the “2-Cities Project.” The 2-Cities Project has been organized to demonstrate the ability of cities, with guidance from Edison and the Coalition, to define, manage, and implement energy efficiency strategies for residential and small commercial underserved end users within their jurisdictions.

The PEAK Program was initially used in the late 1970s in a Laguna Beach school. In July 1999, after reviewing the 1979 videotape of students participating in PEAK, the Executive Committee of the REEI strongly endorsed updating this Program and introducing it into primary schools in Irvine and Santa Monica. Subsequently, using the original software and curriculum materials as a baseline, new curriculum and software were developed to meet the demands of the much more technologically sophisticated student of today. In Phase 1, the Program update was tested at Harbor Day School, a private school in Corona del Mar, during the 1999-2000 school year. In Phase 2, based on the Harbor Day experience, both the curriculum and software were updated and improved. In Phase 2, PEAK was also introduced to classes in the John Adams Middle School in the Santa Monica School District as a way of conducting a much broader beta test. Discussions regarding the PEAK Program have begun in the Irvine School District regarding the 2001-2002 school year.

3.3.1 Essential Program Elements

More specifically, the PEAK Program offers active units of study in energy, electricity, conservation and technology uses for upper elementary and middle school students. Sponsored by the California Energy Coalition, this project involves students in investigating and reducing energy use at home and at school. It consists of a mix of practical activities, and energy labs. The lessons and labs address the following elements:

1. Energy log
2. Static electricity includes four labs:
    - Static electricity
    - Building an electroscope
    - How is static electricity created
    - Static strokes
3. Room dimensions: finding the area
4. Home energy survey
5. Watts a light?
6. Changing electricity to light
7. Wattage worksheets
8. Energy contract (to be sent home)
9. Build an electric motor
10. Energy cost survey

Project materials also include a compact disk that assists students in creating computer models of their homes. This highly interactive home simulation program uses data collected by students. Fifty to 70 percent of the lessons use computers and involve students in tracking energy use over time. The objective is to teach the various ways that energy can be conserved and encourage students to implement energy saving measures and practices.

Central to the PEAK is the contract between the students and their families. The contract specifies that students share the savings equally with their families. A letter to the parents and a contract form are included in the PEAK materials.

The goals of the Program are to:

1. reduce energy consumption in the homes of participating students by 10 to 15 percent.
2. instill an ethic of energy efficiency into students and their families

3. demonstrate a practical application of math, science, and technology that benefits the whole society, and
4. beta test an operational software and curriculum program in Irvine and Santa Monica schools by fall 2000.

The key student learning objectives are that:

1. Students will apply energy concepts in the real world
2. Students will use basic math and science concepts to gather and analyze data
3. Students will apply strategies and change electrical use
4. Students will be in charge of creating important changes in electrical use at home and at school.
5. Students, using the software, will:
   - Create virtual models of their homes
   - Enter and calculate past electrical use in their homes
   - Simulate the project total electrical use
   - Improve management of the use of major and minor appliances
   - Compute the savings earned
   - Apply this model of energy conservation and dollar savings in their homes

The lessons and exercises address 30 California Science Standards and 36 Math Standards listed in Resources. A complete set of Program materials is available upon request.

The evaluation of the PEAK Program will focus on all three Phases.

3.4 Evaluation Objectives

In response to Ordering Paragraph 33, we have established these evaluation objectives covering the GSP, LWP, and the PEAK:

1. to develop a baseline market characterization for the schools sector,
2. to monitor the effectiveness of the GSP, LWP, and PEAK programs, and
3. to monitor changes in awareness and behaviors attributable to these programs.

The first objective, to develop a baseline market characterization of the schools sector, was adopted in order to provide a context for three programs being implemented by SCE.

4. METHODS

This section provides an overview of the methods that were used in evaluating the GSP, LWP and PEAK. It begins with the methods for characterizing the schools market segment, followed by separate methods sections for each of the three programs.

4.1 Market Characterization

The first objective, to develop a baseline market characterization of the schools sector, was adopted in order to provide a context for three programs being implemented by SCE. The market characterization involved a review of the literature and existing data that address the following issues:

1. Number of schools in California
2. Sources of school funding
3. School management practices and the emergence of site-based management
4. How decisions are made regarding capital investments
5. Who is involved in making these decisions
6. The purchasing process in schools and how it varies by school
7. Who has ultimate decision-making authority regarding capital investments
8. The criteria for making capital investments
9. The barriers to investing in energy efficient equipment
10. Descriptions of districts, schools and their demographic characteristics
11. The existing efficiency programs for schools and in which ones they have participated

There are several important points to mention regarding the relevance of this market characterization. First, while all three programs attempt to change attitudes and transmit knowledge regarding conservation and energy efficiency, they also focus on energy savings. However, they differ in terms of whether their primary focus is on savings at the school site or in the homes of the students. Thus, some of the issues discuss in the market characterization, are more relevant to some of the programs than to others. For example, the discussion of decisions regarding capital investments, the purchasing process, and the criteria for making capital investments are more relevant to the GSP since, while focusing primarily on energy saving behavior, does promote the installation of energy savings hardware that are identified through energy audits conducted by students with the support of Rebuild America. To a lesser extent, the GSP encourages energy savings in the homes of students. On the other hand, during the 2000-2001 school year, the PEAK Program focused primarily on achieving savings in the homes of students and is only beginning to explore ways to achieve savings at the school sites. Finally, the LWP continues to focus exclusively on achieving savings in the homes of students.

The discussion of some of the other issues is relevant to all three programs. For example, the number of schools and students and their forecasted growth can tell us something about the challenge of providing an energy education to all elementary and secondary students in California. Understanding school management practices can also help all three programs better understand how to approach and work with new school districts.

Finally, this market characterization will become even more relevant as utility-sponsored programs throughout the State evolve to address energy savings *and* educational goals both at the school sites and in students' homes.

Because this market characterization is focused on schools, some readers may be interested in studies that attempt to characterize the residential market. Such studies, and many others describing the residential market, can be found and, in many cases, downloaded from the California Measurement Advisory Committee (CALMAC) website: http://www.calmac.org/search.asp. If any study is not available for download, it can be obtained from the California Energy Commission. For example, this web site contains such recent studies as:

1. *Statewide Residential Customer Needs Assessment Study*
2. *Phase I Baseline Assessment for The Statewide Residential Lighting and Appliance Program: Final Report: Volume I*
3. *Statewide Residential Lighting and Appliances Saturation Study*
4. *Compilation of Existing Baseline Data on Programs and Market Segments*
5. *California Residential Efficiency Market Share Tracking: First-Year Interim Report*
6. *Residential HVAC Market Transformation: Market Characterization and Baseline Study*

There are two existing general sources of data that were used to characterize the schools market segment:

1. data provided by the California Department of Education (CDE), and
2. literature regarding the implementation of energy efficiency programs in schools.

Each is briefly described below.

4.1.1 California Department of Education

The CDE contains information that was used to describe the context within which the GSP and the LWP are implemented. The CDE maintains demographic and financial information on each school district.

4.1.2 Literature

Various sources of literature were explored including the University of California on-line library, the California High Performance Schools Program, the Rand Corporation library, conference proceedings such as those published by the American Council for an Energy Efficient Economy (ACEEE) and International Energy Program Evaluation Conference, and the Internet.

Literature was reviewed and integrated with the results of data from the California State Department of Education. The goal was to provide a comprehensive and internally consistent picture of the schools market segment that provides the context within which this evaluation was conducted.

4.2 Evaluation Methods: Green Schools Program

This section covers, for the GSP, the data collection plan, sample design, and analysis approach.

4.2.1 Data Collection

Existing data, contained in the GSP Database, were used to describe patterns of participation, dates of participation, the number of participating schools within each district, the number of classes within each school, and the number of students within each class. In addition, results of STEM training were obtained from Wilson Educational Services, which offered the STEM training. The results of the detailed energy audits and savings resulting from any behavioral and hardware changes were also collected. Data were also collected from those attending the mid-year and end-of-year workshops for GSP participants. Finally, information was collected from the SCE Program staff, key decisionmakers at each school, and key program staff. Each is described below.

4.2.1.1 Mid-Year Assessment

During the middle of the school year, a workshop was held, the purpose of which was to review the activities conducted during the fall semester and discuss lessons learned and any resulting modifications of the GSP. Plans for the spring semester were also discussed.

As a part of this workshop, a mid-year assessment was conducted that attempted to obtain feedback from participants regarding the implementation of the GSP and any changes that might have resulted. During the workshop, a brief survey was completed by participants. Data from the completed surveys were entered into Excel spreadsheets for analysis.

All participants in the mid-year workshop were asked to complete the mid-year assessment.

4.2.1.2 End-of-Year Assessment

During June 2001, a final workshop was conducted. Participants shared lessons learned and discussed the fall 2000 activities. As a part of this workshop, participants completed a short questionnaire, asking them to evaluate the GSP in terms of key personnel, communications, the support provided by the GSP, and future support needed from the GSP.

All participants in the end-of-year workshop were asked to complete the end-of-year assessment.

4.2.1.3 Achieved Energy Savings Survey

We prepared a summary of the reports, prepared by Wilson Educational Services that describe all the activities at each school, including the results of the initial audit, the monitoring and verification of installations, and estimation of savings.

Estimated savings from behavioral changes at all participating schools were assessed using reports prepared by the GSP.

4.2.1.4 In-Depth Interviews with Program Staff/Key Decisionmakers

In-depth interviews were conducted by R&A with SCE Program staff and key decisionmakers at a sample of participating schools. Interviewees were asked to comment on the GSP, its successes and failures. They were also asked to provide any ideas on how to improve the GSP.

Twelve in-depth interviews were conducted with SCE Program staff and key decision makers at each participating school.

4.2.1.5 Student Surveys

After the STEM training, all students were tested to measure what was learned.

4.2.1.6 Data Collection Summary

Table 4-1 presents the summary of the basic evaluation questions and the planned sources of data.

Table 4-1. Evaluation Question by Source of Data for the GSP

Evaluation Question	Program Database	Mid-Year Assessment	End-of-Year Assessment	STEM Post-tests	In-Depth Interviews	EZ Sim Analysis of kWh
How many teachers and students is the Program reaching?	X					
Which students are being reached by the GSP?	X					
Is the GSP well received by administrators, teachers, custodians, and students?		X	X		X	
How effective is the STEM program?				X	X	
How effective are the workshops?		X	X		X	
What are the kWh savings and kW demand reductions at the school site resulting from the GSP?						X
How can the GSP be improved?		X	X		X	

4.2.1.7 Achieved Sample

For the in-depth interviews and the STEM post-tests, we present the sample dispositions in Table 4-2.

Table 4-2. Achieved Samples

Data Source	Attempted	Achieved	Response Rate
STEM Post-tests	62	60	96.8%
In-depth Interviews	19	12	63.2%

The in-depth interviews were completed with four SCE/GSP staff members, four principals or assistant principals, two facility managers/custodians, and two teachers.

4.2.2 Analysis Approach

This evaluation addressed both process and impact. The analysis approach for each is presented below.

4.2.2.1 Process Evaluation

All data contained in the GSP database were reviewed as well as completed surveys of and in-depth interviews with teachers. In addition, information gathered through the teacher evaluations and the workshop surveys was used to identify any program design and implementation problems. After these problems are identified, necessary changes in the design and implementation of the GSP can be made.

4.2.2.2 Impact Evaluation

The evaluation of the impact of the GSP on the participants was conducted through an analysis of both self-report data provided by teachers, student surveys, and the results of conservation behaviors at participating schools.

4.2.2.2.1 Mid-Year and End-of-Year Assessments

Analysis of completed surveys was done to determine the extent to which the GSP was meeting the needs of participants and how the behavior of teachers, their colleagues and their students had changed with respect to energy efficiency and energy conservation.

4.2.2.2.2 Student Tests

After the STEM training, students were tested with a score of 60 percent or above considered passing.

4.3.2.2.3 Estimation of Energy Use Baseline and Energy Savings

The energy baseline and the energy savings were calculated using EZ Sim, which:

1. diagnoses energy patterns and consumption,
2. calibrates savings estimates to agree with actual energy usage,
3. estimates energy end-uses within the facility,
4. verifies vendor claims for energy products and services, and
5. generates performance targets to compare against actual energy bills.

EZ Sim is a spreadsheet tool designed for resource conservation managers and facility operators. EZ Sim uses actual energy bills and available information to reveal the patterns of energy use in a building.

EZ Sim also uses utility bills to calibrate a simulation of a commercial building in an interactive graphic window. Once it matches the building's utility bills, the simulation model can provide estimates of potential conservation savings. With EZ Sim, the calibration process reveals how energy is used within the facility to help diagnose why there is excessive consumption or poorly functioning building components. EZ Sim can also be used to predict what future utility bills should be and can help set performance targets to determine if installation is on track. All estimates of usage and savings are weather normalized using weather data provided by the National Oceanic and Atmospheric Administration (NOAA).

4.3 Evaluation Methods: The Living Wise® Program (LWP)

This section covers, for the LWP, the data collection plan, sample design, and analysis approach.

4.3.1 Data Collection

Existing data, contained in the LWP Database, was used to describe patterns of participation, dates of participation, the number of participating schools, and the number of teachers and students within each school.

Additional data was collected from both students and teachers who used LWP curriculum materials. Each data collection effort is described below.

4.3.1.1 Review of Savings Calculation

The LWP staff provided R&A with electronic files containing information on all returned showerheads and the results of flow-rate tests. The LWP staff also provided R&A with electronic files containing data from Household Report Cards, which are used to collect information from students on which elements (e.g., showerheads, night lights, etc.) they installed in their home.

Students were also asked to return the replaced showerhead so that the Living Wise staff can measure the flow rate, a key input to the savings calculation. R&A reviewed the flow rate data.

Finally, R&A reviewed all algorithms used to calculate savings from the installations of all energy saving devices distributed by the LWP. R&A checked both the algorithms and a variety of assumptions such as operating hours, effective useful lives, and water temperature to make sure that they are consistent with those used by the CADMAC/CALMAC.

4.3.1.2 Student Pre-Tests and Post-Tests

Pre-tests and post-tests were administered to students who experienced the LWP curriculum in the spring semester of 2001. These pre-tests and post-tests cover the basic material linked to the learning objectives for each curriculum component. Instructions were included in the LWP materials for their completion and return. Teachers were asked to administer the pre-test prior to teaching the LWP and to administer the post-test immediately after completing the LWP.

We expected that the teachers requesting Program materials after December 2000 would very likely implement the Program in the spring semester of 2001 and be able to administer the pre-tests and post-tests (see Appendix A) at that time. We anticipated that a minimum of 500 students would complete the pre- and post-tests.

4.3.1.3 Teacher Surveys

Teachers who used the LWP materials were also surveyed. They were asked to report the following information:

1. Program elements and materials used
2. Rating the Program on: 1) holding students' attention, 2) ease of incorporating in curriculum, 3) helpfulness of Teacher's Binder, and 4) overall quality of Program materials.
3. Overall rating of the Program
4. Number of students in class
5. Grades taught
6. Likelihood of participating again
7. Likelihood of recommending the LWP to fellow teachers

The instrument that was used is contained in Appendix A. All teachers who used the LWP materials were surveyed.

4.3.1.4 Data Collection Summary

Table 4-3 presents the summary of the basic evaluation questions and the planned sources of data.

Table 4-3. Evaluation Question by Source of Data for the LWP

Evaluation Question	Program Database	Teacher Surveys	Student Pre-Tests and Post-Tests	Household Report Cards
How many teachers and students is the LWP reaching?	X			
Which students is the LWP reaching?	X			
How well are students performing on expected outcomes?		X	X	
Does student household behavior change as a result of the LWP?				X
What can be done to improve the LWP?		X		
Are the algorithms and assumptions used to calculate kWh savings correct and consistent with CADMAC/CALMAC guidelines?				X

4.3.1.5 Achieved Sample

The achieved samples are presented in Table 4-4.

Table 4-4. Achieved Samples

Data Source	Attempted	Achieved	Response Rate
Program Database (Schools)	34	34	N/A
Teacher Surveys	134	45	33.6%
Students Pre-Tests and Post-Tests	≈2,900	519	17.9%
Household Report Cards	5,908	1,661	28.1%

4.3.2 Analysis Approach

The evaluation of the LWP involved both a process and impact evaluation. Each is described below.

4.3.2.1 Process Evaluation

All data contained in the LWP database were reviewed. Surveys and in-depth interviews with teachers were also reviewed. This information was used to identify any program design and implementation problems. Once these problems were identified, necessary changes in the design and implementation of the LWP can be made.

4.3.2.2 Impact Evaluation

The evaluation of the impact of the program on the participants was conducted through an analysis of both self-report data provided by students and by teachers, the student pre- and post-tests, and the algorithms used to estimate energy savings.

4.3.2.2.1 Savings Calculations

R&A reviewed both the algorithms and a variety of assumptions such as operating hours. The estimated kWh savings were adjusted based on this review.

4.3.2.2.2 Teacher Surveys

Analysis of completed teacher surveys was conducted. Analysis focused on their perceptions of the LWP.

4.3.2.2.3 Pre-Tests and Post-Tests Completed by Students

A t test was used to determine whether the post-tests were significantly different from the pre-tests.

4.4 Evaluation Methods: PEAK Program

This section covers, for the PEAK, the data collection plan, sample design, and analysis approach.

4.4.1 Data Collection

There are three main sources of data including monthly electricity bills for the homes of students, in-depth interviews with PEAK staff, and in-depth interviews with teachers.

4.4.1.1 Achieved Energy Savings Survey

We reviewed the reports, prepared by ASW Engineering, that provide preliminary estimates of kWh savings based on the monthly electricity bills for the homes of students.

4.4.1.2 In-Depth Interviews with Program Staff

In-depth interviews were conducted with PEAK staff. They were asked to comment on the Program, its successes and failures. They were also asked to provide any ideas on how to improve the Program. Four in-depth interviews were conducted with Program staff.

4.4.1.3 In-Depth Interviews with Teachers

In-depth interviews were conducted with PEAK teachers. They were asked to comment on the Program, its successes and failures. They were also asked to provide any ideas on how to improve the Program. Four in-depth interviews were conducted with teachers at each participating school.

4.4.1.4 Data Collection Summary

Table 4-5 presents the summary of the basic evaluation questions and the planned sources of data.

Table 4-5. Evaluation Questions by Sources of Data for the PEAK

Evaluation Question	In-Depth Interviews	PEAK Database	Analysis of kWh
How have curriculum and software evolved?	X		
How many teachers and students is the PEAK reaching?	X	X	
Which students is the PEAK reaching?	X	X	
What are the kWh savings in students' homes resulting from PEAK?			X
How can the PEAK be improved?	X		

4.4.2 Analysis Approach

This evaluation addressed both process and impact. The analysis approach for each is presented below.

4.4.2.1 Process Evaluation

All data from the in-depth interviews were used to describe the activities over the last 18 months and to identify any program design and implementation problems. Identification of these problems facilitates improvement in design and implementation of the PEAK Program.

4.4.2.2 Impact Evaluation

The evaluation of the impact of PEAK on the participants was conducted through an analysis of self-report data provided by teachers. KWh impacts estimated by PEAK were also explored.

4.5 Data and Database Guidelines

All of the data sets used in the evaluation of the GSP, the LWP, and the PEAK Program have been thoroughly documented. All of the data sets and documentation produced are consistent with respect to format and content and are in accordance with and follow SCE's internal database guidelines. Documentation and data sets include:

1. original hard copies of completed surveys,
2. Excel spreadsheets containing all data,
3. codebooks, and
4. thoroughly documented SAS files.

5. RESULTS

5.1 Literature Review

The results of the literature review are presented in this section and focus on:

1. Descriptive statistics
   - Schools and enrollment
   - Ethnic background of the student population
   - Forecasted school enrollment
   - School Personnel
2. Facilities overload
3. Class size reduction
4. School maintenance and modernization
5. Energy consumption
6. Funding
7. Current energy efficiency programs and resources
8. School management and decision making
9. Barriers to investing in energy efficient equipment

5.1.1 Descriptive Statistics

5.1.1.1 Schools and Enrollment

In this section, we present some basic descriptive statistics. In 1999-2000, there were 1,054 public school districts in California with 5,951,612 students enrolled. Table 5-1 presents the breakdown of the number of districts and enrollments by type of district.

Table 5-1. California Public School Districts by Type, 1999-2000

Type	Number	Enrollment
Elementary	571	1,209,110
High School	93	547,952
Unified	323	4,123,509
Sub-Total	***987***	***5,880,571***
County Office	58	65,850
California Youth Authority	9	5,191
Total	**1,054**	**5,951,612**

In the period 1999-2000, there were 8,563 elementary and secondary public schools in California. Table 5-2 presents the breakdown of the types of schools and their associated enrollments.

Table 5-2. Types of Schools and Enrollment

Grade Level	Number	Enrollment
Elementary	5,311	3,128,262
Middle	1,134	1,040,827
Junior High	20	1 7,726
High School	908	1,538,497
Continuation	523	68,598
Alternative	227	61,221
Special Education	121	29,964
K-12	27	19,849
Community Day	199	7,069
Opportunity	12	1,262
Juvenile Court	56	30,366
County Community	11	2,780
California Youth Authority	14	5,191
Total	**8,563**	**5,951,612**

Although not the focus of this market characterization, some mention must be made of the private school sector. Table 5-3 and Table 5-4 present some basic information on private schools.

Table 5-3. California Private Schools and Enrollment

Type	Number	Enrollment
Church-Affiliated	2,045	441,847
Religious	676	68,127
Other	1,545	130,828
Total	**4,266**	**640,802**

Table 5-4. California Private School Enrollment by Grade Level

Grade Level	Enrollment
Kindergarten	71,058
Elementary (1st through 8th)	428,314
High School (9th through 12th)	141,430
Total	**640,802**

Thus, in California, there are 12,829 elementary and secondary public and private schools with a total enrollment of 6,592,414.

5.1.1.2 Ethnic Background

The ethnic background of students enrolled in California public elementary and secondary schools is presented in Table 5-5.

Table 5-5. Ethnic Background of California Elementary and Secondary School Students

Ethnicity	Number	Percent
American Indian	50,750	0.9%
Asian	479,073	8.0%
Pacific Islander	37,995	0.6%
Filipino	141,045	2.4%
Hispanic	2,513,453	42.2%
African American	509,637	8.6%
White	2,195,706	36.9%
Multiple/No Response	23,953	0.4%
Total	**5,951,612**	**100.0%**

5.1.1.3 Forecasted Enrollment in California Elementary and Secondary Schools

The California Department of Finance (CDF) estimates that the state will add over 300,000 new students in the five years from 1997-98 to 2001-02, bringing the total number of public K-12 students to nearly six million. Assuming a similar percent increase in private schools, would add an additional 32,300 private school students.

5.1.1.4 School Personnel

To attempt to keep up with the demands of increased enrollments and reduced class sizes, the number of certified teachers has grown three percent from 1998-1999 school year to the 1999-2000 school year. Table 5-6 presents the number of administrators, certified teachers and others in these two school years.

Table 5-6. California Full-Time-Equivalent Public School Personnel

	1999-2000		1998-1999	
Full Time Staff	**FTE**	**Pupils Per FTE**	**FTE**	**Pupils Per FTE**
Administrators	21,653	275	20,618	284
Pupil Services[1]	19,887	299	17,357	337
Certified Teachers	284,628	21	276,313	21
Classified[2]	271,721	22	258,688	23

[1] Counselors, librarians etc.

[2] Instructional aides, bus drivers, custodians, secretaries.

The salaries and benefits of these FTEs typically are 80-85 percent of a district's expenditures.

5.1.2 The Facilities Overload

Californians spent over $20 billion on school facilities from 1986 to 1996. But as large as that investment might sound, it has been inadequate to meet a tremendous statewide need. The need arises from three sources. One is the growth in California's student population, described above. Many California School districts are struggling to catch up with the housing needs caused by this enrollment growth. Most recently, high schools have felt increasing pressure as the students who flooded elementary schools in the late 1980s enter the secondary systems. The two other reasons are the effect of reduced class sizes and the number of school buildings in need of repair, renovation, and modernization.

5.1.3 Class Size Reduction

California's class size reduction program (CSR) has had a profound effect on school facilities. In the first years of CSR implementation - 1996-97 and 1997-98 – California's elementary schools added about 28,000 new K-3 classroom spaces through a variety of strategies, including a heavy reliance on portable classrooms. They reduced class sizes to not more than 20 students for an estimated 85 percent of the state's kindergarten through third grade students. If schools throughout the state had reached full implementation in 1997-98, it could have required from 2,000 to 4,000 more classroom spaces.

5.1.4 School Maintenance and Modernization

The California Department of Education (CDE) reports that 55 percent of California's public school buildings are over 30 years old. Due simply to their age, many schools are in need of basic repairs and routine maintenance.

In a national survey completed in 1995 by the U.S. General Accounting Office, California ranked among the worst states in most of the building features below. Seven out of 10 school districts reported at least one inadequate building feature and four out of ten reported at least one inadequate building. The state's schools ranked a little better on some environmental factors, most notably ventilation, indoor air quality, and air conditioning. Table 5-7 and Table 5-8 present these results.

Table 5-7. Percent of California Schools Reporting "Inadequate" Building Features in 1994-95

Building Features	California Respondents	National Survey
Roofs	0.41	0.27
Framing, floors, foundations	0.28	0.18
Exterior walls, finishes, windows, doors	0.42	0.27
Interior finishes	0.47	0.24
Plumping	0.41	0.3
Heating, ventilation, air conditioning	0.41	0.36
Electrical power	0.32	0.26
Electrical lighting	0.43	0.25
Lifesafety codes (such as fire and earthquake)	0.21	0.19

Table 5-8. Percent of California Schools Reporting "Unsatisfactory" Environmental Factors in 1994-95

Environmental Factors	California Respondents	National Survey
Lighting	0.31	0.16
Heating	0.25	0.19
Ventilation	0.29	0.27
Indoor Air Quality	0.22	0.19
Acoustics	0.34	0.28
Space Flexibility	0.70	0.54
Energy Efficiency	0.60	0.41
Physical Security	0.41	0.24
Schools With Air Conditioned Classrooms	0.67	0.51

5.1.5 Energy Consumption

Of the total state budget for California elementary and secondary schools, approximately 2 to 3 percent is spent on energy (Rand, 1996).

5.1.6 Funding

The revenue for California schools is constrained because of the voter-approved initiative, Proposition 13, that limited the collection of property taxes and because of a 20-year-old law that specifies how much money each district may receive for general purposes (its revenue limit). Almost all school districts' income is controlled by the Governor and Legislature. Another voter-approved initiative, Proposition 98, somewhat offsets these limits by guaranteeing a minimum amount of revenue for K-12 education. However, in November 1998, voters approved Proposition 1A, which authorizes $9.2 billion in bonds, with $6.7 billion earmarked for K-12 schools and the remainder for higher education. The money will be used for new construction ($2.9 billion), class size reduction ($0.7 billion), and other needs ($1 billion) over the next four years. However, the CDE has estimated that approximately $20 billion is needed between 1997 and 2002 to address the facilities crisis in California. Of this $20 billion, approximately$15 billion is needed for facility improvements with the remainder going to new construction.

In 2000-2001, the total projected revenue for schools in California is $49.2 billion. This reflects a one-year increase in state funding of $4.5 billion that will become part of the base revenues in future years. About 84 percent of the total – or about $41.3 billion including state funds and local property taxes – is controlled by the State's Governor and Legislature

The breakdown of revenues for public school districts is provided in Table 5-9.

Table 5-9. Breakdown of Revenue Sources for Public Schools

Source	Percent
State Aid	38.9%
Local Property Taxes and Fees	27.5%
Federal Revenue	5.4%
Other State Revenue	21.3%
Lottery	2.2%
Other Local Revenues	4.7%
Total	100.0%

In addition to these sources of funds, there is a wide variety of federal, state, and utility sponsored energy conservation programs that can also make a significant contribution in the construction and renovation of schools. These programs are discussed in the following section.

5.1.7 Current Energy Efficiency Programs and Resources

In the SCE service territory, there are a number of resources and programs that are available to schools. Each is briefly described below.

5.1.7.1 Bright Schools Program

This California Energy Commission Program offers specific services to help schools become more energy wise, such as identifying cost-effective energy-efficient systems to meet their needs and providing design and implementation assistance – at little or no cost to them. This Program has two components: 1) new schools construction, and 2) school modernization, deferred maintenance and energy audits.

5.1.7.1.1 New School Construction

Schools built with energy-efficient designs will cost less to operate, offering continuous savings and leaving more money for education. Many new schools incorporate equipment and building measures that barely meet recommended energy-efficiency standards. However, many of these designs could be improved with little or no additional expense. Bright Schools provides technical assistance early in the design phase, before the plans are solidified. The savings accumulate from the first day of operation. For new school construction, Bright Schools can:

1. provide design consultation,
2. identify cost-effective energy-saving measures,
3. compare different technologies,
4. develop specifications for energy-efficient equipment,
5. help select architects and other design professionals with school construction and energy-efficiency expertise,
6. review construction plans, and
7. complete value engineering of specific energy-efficiency measures.

5.1.7.1.2 School Modernization, Deferred Maintenance and Energy Audits

Bright Schools can help participants get the most from their modernization and maintenance investments. With an evaluation of a school's five-year deferred maintenance plans or an energy audit of its facilities, energy-related projects can be identified that should be implemented immediately as part of a comprehensive Bright Schools energy package. Schools planning major renovations can also benefit from this technical assistance. The program can help schools get loans to obtain the matching funds required by some State programs. For school modernization and deferred maintenance efforts, Bright Schools:

1. conducts energy audits and feasibility studies,
2. reviews existing proposals and designs,
3. provides equipment bid specifications,
4. assists with contractor selection, and
5. assists with installations.

5.1.7.2 Energy Quest

This is the California Energy Commission's web site for kids. This website includes art contests, science projects, literature, puzzles, history, and game shows with a focus on energy, all presented at several levels of difficulty. For example, users can click on Poor Richard's "Energy" Almanac and learn about Benjamin Franklin's experiments with electricity, how energy was used in 1740 and how energy use evolved to the present day, and some of Ben Franklin's energy saving devices.

5.1.7.3 SCE's Nonresidential Standard Performance Contracting (NSPC) and Large Nonresidential Standard Performance Contracting (LNSPC) Programs

Under the NSPC[3] Program and the LNSPC Program, the program administrators offer fixed price incentives to Energy Efficiency Service Providers (EESPs) for measured kWh energy savings achieved by the installation of energy efficiency measures. The fixed price per kWh, performance measurement protocols, payment terms, and all other operating rules of the programs are specified in a standard contract. The role of the program administrator is to manage the programs in a fair and nondiscriminatory manner, promote the programs, educate customers and EESPs on the programs, and enter into contracts with applicants to pay for measured energy savings.

Both programs are pay-for-performance programs. With traditional utility rebate programs, the utility pays an incentive directly to its customer based on an estimate of annual savings from a project. However, under these pay-for-performance SPC programs, the utility program administrator pays a variable incentive amount to a third-party EESP, or to a customer acting without a third-party EESP, based on measured energy savings.

5.1.7.4 SCE's Small Standard Performance Contracting Program (SBSPC)

The SBSPC is also a statewide program. Under this Program, third-party project sponsors (including contractors) are paid for measured, verified savings, based on a fixed schedule for verified savings amounts. End users could not self-sponsor projects. A standard contract between the program administrator (utilities) and third-party sponsors specifies incentives, performance measurement and verification (M&V) options and protocols, payment terms, and other operating rules. Third-party participants submit applications that might or might not be accepted, depending on adherence to program requirements, including detailed justification for expected savings.

A review of the PY 1999 and 2000 SBSPC Program database revealed that participation by elementary and secondary schools was very low (one participating school), despite an application process that was far simpler.

5.1.7.5 SCE's Express Efficiency Program

The Express Efficiency Program is a statewide rebate program targeted to adoption of high-efficiency measures by businesses with electricity demands less than 500 kW. The Program

[3] In 1998, the Program's first year, it was called the "Nonresidential Standard Performance Contract Program." In 1999, the Program was separated into two separate programs based on customer size. The 1999 LNSPC was designed to serve end users with peak demand of 500 kW or more, while the 1999 Small Business SPC Program was designed to serve customers of less than 500 kW peak demand.

has been available to SCE's nonresidential customers in one form or another for almost 10 years (although prior to 1998, there was no customer size requirement). Each of the other utilities has had nonresidential rebate programs in some form or another for most of the past 10 years as well.

The statewide Express Efficiency Program is designed to encourage market transformation and includes two upstream components (HVAC and motors). Small/medium businesses can receive rebates for a number of high-efficiency HVAC, lighting, refrigeration, and other measures. Rebates are paid to customers generally within one month of completed installation paperwork. Payment is subject to utility verification of appropriate installation, at the utility's discretion.

5.1.7.6 Savings By Design

Savings by Design is a program to encourage high performance non-residential building design and construction. Sponsored by four of California's largest utilities under the auspices of the Public Utilities Commission, Savings By Design offers building owners and their design teams a wide range of services such as:

1. Design Assistance provides information and analysis tailored to the needs of projects to help design more efficient buildings.
2. Owner Incentives help offset the costs of energy efficient buildings.
3. Design Team Incentives to reward designers who meet ambitious energy efficiency targets

Savings By Design seeks to improve the comfort, efficiency, and performance of buildings by creating a team approach to design. Between the owner, design team, and utility representatives, every member of the team has a role to play, and the program offers benefits for each.

5.1.7.7 The California High Performance Schools Program (CHPS)

The CHPS seeks to create a new and improved generation of energy-efficient, high performance educational environments. It plans to achieve this goal through the development and promotion of tools, processes and interventions to deliver sustainable energy efficiency in California K-12 schools. More specifically, CHPS will accomplish this objective by:

1. communicating the value of high performance schools through public and professional outreach and educational efforts, and linking that value proposition with specific solutions and resources available through the stakeholders,
2. providing technical assistance, tools, and training to influence the design, specification, construction and operation of energy efficient schools,
3. coordinating the availability of various financial options for design teams and schools,
4. demonstrating the performance benefits of high performance schools through pilot new construction and modernization projects, and

5. collaborating with school facilities planning and approval agencies to institutionalize high performance design methods.

5.1.7.8 SCE School Programs

SCE implemented three programs in the 2000-2001 school year:

1. Living Wise®
2. Green Schools, and
3. PEAK

Each of these programs was described earlier in Section 3.

5.1.8 School Management/Decision Making

Restrictions present in the California Education Code, categorical aid funding restrictions, and previous empirical work, suggest that districts will allocate similar shares of their dollars on particular spending categories. The education code, categorical aid programs, and collective bargaining agreements all lead to high minimum expenditures on classroom personnel and materials. The share of dollars devoted to expenditures on classroom personnel and materials is likely to be similar across districts even though the per pupil spending may vary due to discretionary resources. On other categories of expenditure, which have a smaller base minimum level of expenditures required or where there are less restrictions governing the spending, districts may show greater flexibility in their design decisions. For example, districts are likely to show more variation in the share and level of total expenditures they devote to maintaining school facilities, which have lower minimum spending restrictions and are more discretionary in nature.

This greater discretion with respect to facility-related expenditures suggests that it is possible to get schools to at least consider adopting energy efficient equipment and building designs. That is, they do have some discretion to assume the higher first costs, if the payback is reasonably short.

5.1.9 Decision-Making in the Schools Market

The focus in this section is on decision making in schools in general and decision making regarding capital expenditures in particular. While the local government’s role in controlling education funding decisions has diminished, it is still at the local level that the allocation of resources for education ultimately takes place. The local school district remains the basic administrative unit of schooling. And, despite increased federal and state regulations that have developed throughout the years, practical realities of daily government and the belief in local control of education have kept education a fundamentally local enterprise. Placing restrictions on use is always a matter of degree, and what really matters is how the restrictions affect behavior at the local level.

At the local level, who are the key decision-makers typically involved in planning educational facilities? Castaldi (1994) mentions five key stakeholders:

1. the *school board* holds the ultimate decision making power for all school sites in a district,
2. the *chief administrator at the school* (the principal) has ultimate decision-making power at a specific school,
3. the *facility planner/operations manager* at the school typically oversee the entire planning and design process and act as liaison to the school board and superintendents,
4. the *educational consultant* is responsible for assisting the architect in converting educational concepts into school facilities, and
5. the *architect/engineer* has the primary responsibility for translating educational concepts and functions into educational facilities that are conducive to learning.

The extent to which these stakeholders can overcome the market barriers they face will determine whether opportunities to invest in energy efficiency will be taken. The most significant market barriers facing these stakeholders are discussed in the next section.

5.1.10 Barriers to Investing in Energy Efficient Equipment

One key element in any market characterization is the identification of probable market barriers that might impede the adoption of the efficiency products. For reference purposes, the generic barriers defined in the *Scoping Study*[4] are described in Table 5-10. Then the conclusions of the CHPS Advisory Committee regarding the most significant market barriers facing the schools sector are presented. These market barriers are couched in terms of those defined in Table 5-10.

[4] Eto, Joseph, Ralph Prahl, and Jeff Schlegel. 1996. *A Scoping Study on Energy-Efficiency Market Transformation by California Utility DSM Programs*, Earnest Orlando Lawrence Berkeley National Laboratory, LBNL-39058 UC-1322, prepared for The California Demand-Side Measurement Advisory Committee, Berkeley, CA.

Table 5-10. Market Barrier Descriptions

Barrier	Description
Information or Search Costs	The costs of identifying energy-efficient products or services or of learning about energy-efficient practices, including the value of time spent finding out about or locating a product or service or hiring someone else to do so.
Performance Uncertainties	The difficulties consumers face in evaluating claims about future benefits. Closely related to high search costs, in that acquiring the information needed to evaluate claims regarding future performance is rarely costless.
Asymmetric Information and Opportunism	The tendency of sellers of energy-efficient products or services to have more or better information about their offerings than do consumers, which, combined with potential incentives to mislead, can lead to sub-optimal purchasing behavior.
Hassle or Transaction Costs	The indirect costs of acquiring energy efficiency, including the time, materials and labor involved in obtaining or contracting for an energy-efficient product or service. (Distinct from search costs in that it refers to what happens once a product has been located.)
Hidden Costs	Unexpected costs associated with reliance on or operation of energy-efficient products or services - for example, extra operating and maintenance costs.
Access to Financing	The difficulties associated with the lending industry’s historic inability to account for the unique features of loans for energy savings products (i.e., that future reductions in utility bills increase the borrower’s ability to repay a loan) in underwriting procedures.
Bounded Rationality	The behavior of an individual during the decision-making process that either seems to be or actually is inconsistent with the individual’s goals.
Organization Practices or Customs	Organizational behavior or systems of practice that discourage or inhibit cost-effective energy-efficiency decisions - for example, procurement rules that make it difficult to act on energy-efficiency decisions based on economic merit.
Misplaced or Split Incentives	Cases in which the incentives of an agent charged with purchasing energy efficiency are not aligned with those of the persons who would benefit from the purchase.
Product or Service Unavailability	The failure of manufacturers, distributors or vendors to make a product or service available in a given area or market. May result from collusion, bounded rationality, or supply constraints.
Externalities	Costs that are associated with transactions, but which are not reflected in the price paid in the transaction.
Non-Externality Pricing	Factors other than externalities that move prices away from marginal cost. An example arises when utility commodity prices are set using ratemaking practices based on average costs (rather than marginal).
Inseparability of Product Features	The difficulties consumers sometimes face in acquiring desirable energy-efficiency features in products without also acquiring (and paying for) additional undesired features that increase the total cost of the product beyond what the consumer is willing to pay.
Irreversibility	The difficulty of reversing a purchase decision in light of new information that may become available, which may deter the initial purchase - for example, if energy prices decline, one cannot resell insulation that has been blown into a wall.

Source: Eto, et al., 1996.

5.1.10.1 Information and Search Costs

The information and search cost market barrier is primarily due to a lack of awareness of the value of energy efficiency. This lack of awareness is tied to the low interest in energy efficiency in this sector arising from the fact that energy costs in a given school are such a low percentage (2 percent) of overall operating costs.

In the schools market, schools often do not have the technical expertise to conduct energy audits or conduct the engineering modeling needed to estimate savings. They also do not have information about the benefits of high performance schools, cost effectiveness, and process information. As a result, districts do not know what to ask for when shopping for new equipment or architectural designs.

In addition, those who design schools (architects and engineers) often lack the information and training to design high performance schools.

5.1.10.2 Performance Uncertainty

In the schools, there is little enthusiasm for adopting the more efficient technologies, since they are uncertain about their performance. Put another way, there is a fear of being first to market.

5.1.10.3 Organizational Practices

In the schools market, they have little practice in incorporating efficient technologies in educational or building specifications, since they have traditionally opted only for standard equipment and designs. Decision-makers have usually focused on the first costs rather than consider the stream of future benefits in the form of reduced energy bills. In addition, the current budgetary process does not allow sufficient time to examine all the energy efficient equipment and design options, making the use of standard equipment and building designs, and convenient rules-of-thumb the norm.

5.1.10.4 Split Incentives

This barrier often comes into play when a building is leased. In this situation the building owner would be responsible for the capital expenditure for, e.g., an energy-efficient chiller, but the lease holder would benefit from the purchase by receiving lower energy bills. Thus, the building owner is not motivated to make the investment. This barrier is referred to as misplaced or split incentives.

5.1.10.5 High First Costs

While not technically a market barrier, declines in school funding over the last 20 years have left little or no room in school budgets for incorporating high performance measures. While the effects of Proposition 1A may help, much more money is needed before schools will seriously consider the more energy efficient options.

5.1.11 Conclusions

There are a variety of conclusions that can be made regarding the schools market segment.

- There is a drastic need for additional classrooms owing to increased enrollments and reduced class sizes. Failure to take advantage of energy efficient options when building/adding new facilities represents a significant missed opportunity.
- Because of reduced school funding over the last 20 years, there is a drastic need for major repairs and renovation of existing buildings. This is the case despite the passage of Proposition 1A. Failure to take advantage of energy efficient options during renovation represents a significant missed opportunity.

The market barriers facing schools include information-search costs, performance uncertainty, organizational practices, and high first costs. Organizational practices and high first cost may be the greatest barriers.

5.2 Results for the Green Schools Program

The eight GSP objectives listed below provide the framework for presenting the results:

1. Work with school leaderships, including the state as well as local-level administrators and teachers, to tailor the program to local needs, procedures, and priorities.
2. Align the GSP instructional materials to the California Department of Education standards.
3. Conduct a two-to-three-day training workshop for teams of instructional and facilities staff from each school.
4. Train students in each district to become certified student energy auditors.
5. Provide instructional and program implementation tools to each school district.
6. Broaden the efficiency education to students' families and the larger community.
7. Provide stipends and on-going program support to local project leaders in each district.
8. Develop energy savings estimates for each school.

Before presenting the results for each objective, we present some basic information from the Program database. Table 5-11 presents the participating school and the number of participating teachers and students.

Table 5-11. Participating Schools and the Number of Participating Teachers and Students for the 2000-2001 School Year

School	Number of Teachers	Number of Students
Workman High School	4	139
Sierra Vista Middle School	1	33
Wing Lane Elementary School	1	35
Bassett High School	3	108
Torch Intermediate School	3	107
Edgewood Academy	3	106
Charter Oak High School	3	112
Royal Oak School	4	140
Cedar Grove Elementary School	3	109
East San Gabriel Valley ROP	3	103
Total	28	992

5.2.1 Conduct a Summer Training Workshop for Returning and New School Staff

During July and October, two three-day training workshops were held for school teams[5]. These workshops were designed to achieve the following three GSP objectives:

1. to work with school leaders to tailor the program to local needs, procedures, and priorities,
2. to align the GSP instructional materials to the California Department of Education standards, and
3. to provide instructional and program implementation tools to each school district

The more specific workshop objectives for each day are presented below.

Day 1

- To understand how energy is used in school buildings and how to use energy more efficiently

[5] School teams consisted of administrators, teachers, facility managers, and teachers from the various schools within the participating districts listed in Table 2-1.

- To start the thinking and planning process for linking energy saving behavior to instruction

Day 2

- To become familiar with supporting resources for the Green Schools Program
- To create a plan to integrate energy efficiency behavior, instruction, and school/community involvement with curriculum requirements and school priorities

Day 3

- To create a 4-strand coordinated plan for: a) energy efficiency behavior; b) integration with instruction and curriculum requirements; c) involving the whole school in saving energy; d) involving families in energy efficiency
- To interact with teams from other Green Schools to gain ideas and feedback

5.2.2 Train Students in Each District to Become Certified Student Energy Auditors

Sixty students attended STEM training to become energy auditors. After the training, students were tested with a score of 60 or above (on a scale of 0 to 100) considered as passing. The training appears to have been very effective with 85% of the 60 trainees either meeting or exceeding a score of 60. With the exception of one school, all the students who were trained passed the final examination. Table 5-12 presents the results for each school.

Table 5-12. Training Results by School

School	Number of Students Receiving Training	Number of Sessions	Average Number of Sessions Attended	Number of Students Passing	Percent Passing	Average Post-test Score
Regional Occupational Program	12	5	4.5	12	100%	86.1
Workman H.S.	28	3	2.8	19	68%	54.1
Charter Oaks	9	5	5.0	9	100%	67.8
Bassett High School	11	5	4.8	11	100%	78.1

Once trained, these students conducted energy audits of their school. The results of their audits culminated in a report and a presentation made to their local Board of Education.

We reviewed three such reports and found a variety of mathematical errors as well as a number of questionable engineering assumptions. These errors should be corrected before presentations are made to the school boards. This could be done by having someone with the required engineering expertise (e.g., Rebuild America) meet with the students, review their work, and make final corrections. We emphasize that the educational objectives are just as important as the kWh and therm savings. Therefore, meetings with the students to correct their reports should be done in positive way so as not to diminish the enthusiasm of the students. Once the reports are reviewed, the students could then present these revised recommendations to their school boards. Such recommendations should represent a fairly accurate picture of the major areas of energy savings potential.

During the spring 2001, after the student presentations were made to the school boards, GSP staff and representatives from Rebuild America met with the superintendents of the various districts to discuss in greater detail the estimated savings, the cost of purchase and installation, and various financing strategies. This step is essential if the school boards are to make informed decisions regarding the installation of the recommended efficient equipment.

5.2.3 Mid-Year and End-Of-Year Assessment Meetings

As part of the on-going support provided by the GSP and GSP's on-going desire for feedback needed to improve the Program, two assessment meetings were held during the school year for all participating schools. One was held in February while the other was held in June. The purpose of these meetings was to get feedback from participants, answer their questions, and help them to solve any implementation problems that might have emerged.

5.2.3.1 Mid-Year Assessment

As a part of the meeting, the participants were ask to report whether there has been an improvement in energy-related behavior for themselves, their colleagues, and their own students. Table 5-13 presents these results for 16 participants.

Table 5-13. Percent Experiencing Improvements in Energy-Related Behaviors

Behavior	Participants	Colleagues	Students
Turning off lights when not in use	100%	69%	50%
Turning off lights when leaving a room	100%	69%	69%
Reminding other people at school to turn off lights when they are not being used	75%	56%	56%
Keeping the outside door open no longer than necessary	81%	56%	63%
Taking a drink as soon as you turn on the fountain without waiting for the water to get cold	63%	31%	38%
Washing hands quickly without waiting for the water to get cold	69%	38%	50%
Turning off the computer (screen), TV, radio, or other music when not in use.	100%	56%	38%
Average	84%	54%	52%

They were also asked if there was an improvement in their student's knowledge related to energy and the environment. Table 5-14 presents these results.

Table 5-14. Improvement in Knowledge of Energy and the Environment

Knowledge	Improved
How to conserve energy at school	88%
Ways that energy is lost or wasted	88%
How to conserve energy at home	94%
What kinds of energy your school uses and what the energy is used for	63%
How coal, natural gas, and oil are used	41%
How electricity is made	25%
Potential and kinetic energy	19%
Renewable and non-renewable energy sources	44%
How energy use affects the air and water	63%
How energy use affects trees	56%
How recycling saves energy	81%
How much energy your school uses	50%
How we use energy	75%
Insulators and conductors	31%
Reading and using thermometers	56%
Reading thermostats or electric meters	44%
Average	57%

Two points are worth mentioning. First, most of the lower percentages were due to the fact that the teacher had not as yet covered the relevant material. Second, while there is a core of basic efficiency and conservation principles, teachers can choose to cover a very broad range of energy-related materials making it difficult, but not impossible, to measure student gains in knowledge.

At the mid-year point, these results are encouraging. Of course, whether there is a reduction in kWh and therms will be another important indicator regarding the effectiveness of the GSP. Section 5.2.5 addresses the preliminary estimates of energy savings.

Finally, all participants felt that the meeting was moderately useful to very useful.

5.2.3.2 End-of-Year Assessment

As a part of the year-end meeting, the participants were asked to complete a short questionnaire. First on a scale of 1 to 5, with a 1 meaning "Not Satisfied" and a 5 meaning "very Satisfied", they gate a very high score of 4.8 to both the West Coast GSP representative and the Alliance to Save Energy.

Next, participants were asked their preferences regarding which types of communication between the Alliance and themselves they preferred. This is a critical question given the time constraints faced by most teachers and the fact that they are involved in implementing a new program, making clear communication a must. They were asked to rate their preferences on a 6-point scale with a "1" meaning the least preferred and a "6" meaning the most preferred. The results for nine of the respondents are presented in Table 5-15.

Table 5-15. Preferred Types of Communication

Type of Communication	Preference
Visits from GSP West Coast Representative	4.6
E-Mailed Memos	4.2
GSP Update Newsletter	4.1
Telephone Call from the GSP West Coast Representative	3.6
Large Group Meetings	3.4
Faxed memos	2.4

Clearly, participants prefer personal, face-to-face contact with the West Coast representative followed by e-mails and the GSP newsletter.

Finally, teachers and custodians were asked rate on a 6-point scale (1=Not Adequate and 5=Very Adequate) the extent to which they felt that the GSP provided the support they needed. Teachers gave the GSP a rating of 3.8, while the custodians gave a somewhat higher rating of 4.2. Both groups felt that they received adequate support from the GSP.

5.2.4 Broaden the Efficiency Education to Students' Families and the Larger Community

There were a variety of activities that attempted to reach a wider audience. The first involved the students at the Royal Oaks Middle School who took the SCE energy audit home and completed it. A second activity involved ROP students who are building an energy efficient home from the ground up. They will incorporate the latest energy efficiency building materials such as insulation and energy efficiency windows, HVAC, and lighting systems. The construction of this house will not only provide an opportunity for students to learn about energy efficiency in an applied setting, but the completed house will serve as a showcase for other builders, schools, and the community.

The third activity occurred at Bassett High School and Torch Intermediate School where students created energy efficiency advisory councils. The purpose of these councils is to provide advice to school administrators and students on how to save energy. One of the advisory councils made a presentation to 120 eighth graders who were attending summer school. They presented information regarding safety, conservation, and energy efficiency for both the school site and the home. In addition, they provided information regarding the various residential conservation and appliance rebate programs offered by SCE.

Another advisory council presented information (in both English and Spanish) on energy efficiency and conservation to a group of elderly customers living in a retirement center, in which the dwellings were individually metered. They also passed out 20-watt CFLs to replace 75-watt incandescent light bulbs to the residents.

Finally, in mid-September 2001, a third advisory council will have an energy conservation/efficiency booth at a major car show, with attendance expected to be nearly 100,000. In addition to general information regarding energy conservation and efficiency as well as DSM programs sponsored by SCE, they will give away CFLs.

5.2.5 Develop Energy Savings Estimates for Each School

Energy use and savings were estimated using EZ Sim. These savings estimates are presented in Table 5-16. Note that all estimates of usage and savings are weather-normalized using weather data provided by the National Oceanic and Atmospheric Administration (NOAA). More detailed results for each school are present in Appendix D.

Table 5-16. kWh, Therm, and Dollar Savings by School

School	kWh Savings	kWh Savings @ $.12/kWh	Therm Savings	Therm Savings @ $.60/Therm
Workman High School	122,740	$ 14,729	(5,563)	$ (3,338)
Sierra Vista Middle School	74,968	$ 8,996	1,335	$ 801
Wing Lane Elementary School	9,541	$ 1,145	883	$ 530
Bassett High School	61,369	$ 7,364	22,633	$ 13,580
Torch Intermediate School	35,046	$ 4,206	(530)	$ (318)
Edgewood Academy	13,872	$ 1,665	(1,349)	$ (809)
Charter Oak High School	32,385	$ 3,886	3,705	$ 2,223
Royal Oak School	67,569	$ 8,108	(3,713)	$ (2,228)
Cedar Grove Elementary School	(14,086)	$ (1,690)	(2,087)	$ (1,252)
East San Gabriel Valley ROP	24,669	$ 2,960	(787)	$ (472)
Total	428,073	$ 51,369	14,527	$ 8,716

It is critical to note that for three reasons the energy savings reported in Table 5-16 are preliminary. First, data are still being collected regarding load added to the school sites such as portable classrooms and new computers that could unfairly depress savings estimates unless taken into account in the baseline. Second, adjustments are also being made to take into account such events that could inflate the savings estimates such as the failure of an

HVAC system for a month or more. Finally, these schools have only participated in the GSP for 7 to 8 months. GSP staff expect that over time, as the conservation behaviors take root in each school, the savings will increase, possibly doubling. Final savings estimates will be provided to each school in fall 2001.

Finally, we note that these kWh and therm savings are *gross* impacts and there is no established net-to-gross ratio (NTGR) by which to convert these estimates to *net* impacts. If an impact evaluation of the GSP is conducted in the future, the issue of the NTGR must be addressed at that time.

5.2.6 Earth Apple Award

The Earth Apple Award was given to the East San Gabriel Valley Regional Occupational Program (ROP). Recall that the purposes of the Earth Apple Awards are:

1. To recognize publicly student, teacher, and school efforts to save energy and the environment, and

2. To give teachers a way to assess ongoing student progress.

While the award was based on a variety of ROP activities, only several are mentioned here. First, the ROP involved two outside organizations in their projects: 1) Home Depot and 2) Municipal Water and Power. In addition, the STEM class conducted an energy audit walk-through and as well as a technical walk-through. Next, they identified deficiencies and possible solutions for windows, walls, ceilings, lighting, and appliances and estimated energy savings. Finally, they presented these results to the District's Joint Board of Management.

5.2.7 Ideas for Program Improvement

In-depth interviews were conducted with administrators, teachers, facilities managers and custodians who participated in the GSP during the 2001-2001 academic year. The purpose of these in-depth interviews was to elicit their perceptions about the overall value of the GSP to the students and their ideas on how to improve the program. We emphasize that, while these samples are very small, the information provided can provide some valuable insights.

5.2.7.1 Administrators

Four administrators were interviewed. They have been involved with the GSP for at least one full year and had played a key role in bringing the GSP into the school or at least had to approve its introduction into their school. These administrators felt that the STEM training, the workshops, and the curriculum materials were all effective and that the students responded very well to the GSP. In particular, one of the administrators indicated that the "problem" kids actually got the most out of it.

Administrators were also asked to indicate how the custodians and teachers responded to the GSP. While one administrator indicated that the custodians at his school were very enthusiastic about the GSP, the others indicated that the custodians were only marginally involved, primarily because of their busy schedules. With respect to teachers, the administrators felt that they all responded very well to the GSP. Overall, they rated the GSP as effective to very effective.

One of our concerns was that since the savings were the result of changed *behaviors*, these savings would not persist beyond two years, the current assumption of CADMAC/CALMAC. These conservation behaviors might cease when students were promoted or graduated or when teachers and custodians changed schools or retired. We asked the administrators to indicate what they had done to incorporate these behaviors into school policies and procedures so that they became institutionalized. One responded that they will have administrative procedures and memos that go out regularly reminding teachers, custodians, and students about the importance of saving energy. This administrator also indicated that they now own the STEM training materials and plan to incorporate these materials into their curriculum. Another indicated that they have already purchased lighting controls. A third indicated that they understand the problem and are working on it. It is important for the GSP to emphasize the importance of institutionalizing such policies and procedures since this will go a long way toward extending the lifecycle savings thus making the GSP more cost-effective.

Regarding custodians, the challenges appear to be greater. The challenge is district-wide and as a result is more difficult to achieve uniform conformance with policies. Some indicated that it is simply a matter of changing the expectations regarding the performance of custodians, which seems to ignore the real problems associated with changing organizational behavior. Others suggested that information on energy efficiency should be incorporated into their regular monthly meetings. Still others maintain that they will have administrative procedures and memos that go out regularly reminding custodians about the importance of saving energy. These plans to change and maintain the desired behavior of custodians seem far less concrete than the plans regarding students.

All of the administrators indicated that they would or have already recommended the GSP to other administrators. They did so because they felt that the GSP was relevant and transferred skills from the theoretical to the practical.

When asked which GSP components they felt were the most effective, all mentioned the STEM training. Others also mentioned the fact that focusing on low or no cost behavioral practices was easier than focusing on more expensive retrofits. Some liked the idea of involving all the key staff including custodians, without whose support it would be far more difficult to achieve lasting energy savings. When asked what was the least effective, they mentioned that the GSP was not reaching enough students and that there was not enough time to devote to the GSP.

When asked to list the biggest problems in implementing the GSP, they mentioned that:

1. they had insufficient preparation time,
2. the custodians were overworked,
3. it was difficult to find substitutes for teachers so that they could assist with the GSP,
4. turnover was high among key administrators, teachers, and custodians, and
5. it was difficult to collect all the baseline billing information.

To a large extent, their recommendations reflect these concerns. They would like to see teachers compensated for their time, exposing a larger student audience to the GSP concepts, and more preparation time. One administrator suggested that GSP speak to textbook publishers in order to increase the exposure to the GSP concepts.

5.2.7.2 Custodians/Facility Managers

Two custodians/facility managers, who were involved with the GSP during the 2000-2001 school year, were interviewed. Both attended one workshop and felt that it was very effective. They also felt that the students were very positive about the GSP and were very involved. Overall, they thought the GSP was effective.

When asked what plans they had made to make sure that the conservation behaviors persist, one indicated that they have incorporated these behaviors into their facility plan. Numerous staff, including security officers, are involved in implementing the plan. The other custodian has not implemented any formal plan but is informally spreading the word.

Neither of the custodians knew of any efficient equipment that had been installed as a result of the GSP. However, one of the custodians stated that within the next 12 months, task lighting will be added to teachers' desks as a replacement for overhead lights. This custodian also noted that, since some of the schools in the district are leased, there is little motivation for the building owner to install efficient equipment. This is an example of the split incentives market barrier.

They were asked how to better promote the GSP to other administrators and custodians in their districts. One custodian suggested using past GSP reports as models so that prospective participants could get a clearer idea about the final audit reports. Perhaps developing a report template would make it easier for staff with little time to participate. It would also be useful for past participants to join the GSP staff in publicizing the GSP to other schools. They could provide the perspective of the insider, perhaps allaying the concerns of prospective participants.

One custodian felt that the most effective component of the GSP was having students from marketing, computer, and construction classes working together. In the fall, they are planning to reach out to the homes of parents. The most difficult component was getting the students together for the whole day of STEM training. But the lack of funds remains the biggest problem. Without financial assistance, they cannot install the efficient equipment recommended in the energy audits.

5.2.7.3 Teachers

Two teachers were involved. One teacher taught the GSP in grades 6, 7, and 8 while the other taught in grade 11. One teacher attended the STEM training and thought it was very effective. However, both teachers rated the curriculum as only a three on a five-point scale with a five meaning "very effective." This was essentially the same overall rating that they gave to the GSP.

Neither teacher has any plan to make sure that the energy saving behaviors continue at the school once the students are promoted or graduate.

Next year, one of the teachers will not be using the GSP since he will only be teaching adult education. However, the other teacher plans to use the GSP next year. Both teachers said that they would recommend the GSP to other teachers.

5.2.8 Proposed Measurement and Evaluation Activities

In this section, we recommend that several measurement and evaluation activities be added. The first is that pre tests and post-tests be administered to students in order to more systematically monitor changes in attitudes, knowledge, and awareness. We recommend that the use of pre-tests and post-tests for fall 2001 be explored.

Next, we recommend that the GSP consider the use of simple engineering algorithms to estimate energy savings rather than continuing to rely on EZ Sim. Recall that we recommended that non-program-related changes in equipment and operating conditions should be tracked since such information is essential to obtaining corrects estimates of energy savings. However, it can be quite expensive to track such changes in each school. Engineering algorithms are relatively simple and are unaffected by such changes. Examples of such algorithms are those used by the Living Wise Program described later in Section 5.3.4 and those used by the GSP students in conducting their energy audits. The use of engineering algorithms for the purpose of calculating the official estimates of GSP energy savings should be done by a professional engineer. We hasten to add that students should continue to use engineering algorithms to calculate energy savings and could even analyze their school's energy consumption using EZ Sim since we believe that it can be a very effective pedagogical tool.

5.2.9 PY 2001-2002 GSP Activities

All of the schools participating in the 2000-2001 GSP will continue with the GSP into the second year and will pursue the same activities as the first year. While the GSP will not train additional students as energy auditors, the schools, as a result of their participation, now own the STEM materials and are free to train any additional students as auditors. The plan is that during the second year the GSP concepts and behaviors will be firmly planted within each school and home. During the second year, the GSP and the students will track the installation of any of the measures recommended by the students in their reports that were based on the energy audits they conducted for their schools.

In the spring of 2001, eight additional schools from the original four districts decided to join the GSP. They will begin participating in the fall of 2000.

In addition, the following 10 schools from the Rialto School District will join the GSP in the fall 2001:

1. Bemis Elementary School
2. Hughbanks Elementary School
3. Simpson Elementary School
4. Morgan Elementary School
5. Myers Elementary School
6. Kucera Elementary School
7. Rialto Middle School
8. Eisenhower Elementary School

9. Milor/Zupanic Elementary School
10. ROP/Adult Education

There are two new components that have recently been added to the GSP. The first is the creation of four demonstration classrooms at schools in two school districts. These demonstration classrooms are being developed with the assistance of Rebuild America and will focus on lighting, lighting controls, daylighting, and windows.

The second is a workshop, held in June 2001 that focused on the various available technologies and the savings potential of each. Forty administrators and school facility managers from 14 school districts attended. The workshop included presentations and discussions of real situations by leading manufacturers. Technologies as well as maintenance and operation issues were covered. The presentations addressed

- lighting equipment,
- lamps,
- ballasts, and
- fixtures.

Also discussed were resources for energy efficiency projects. These included:

- Southern California Edison,
- California Energy Commission,
- Rebuild America, and
- Green Schools.

5.3 Results for the Living Wise Program

Recall that there are five objectives established for the Living Wise Program:

1. to conduct 6,000 basic home resource use audits,
2. to install 6,000:
    - compact fluorescent lamps (CFLs),
    - high efficiency nightlights,
    - filter tone alarms, and
    - high efficiency showerheads,
3. to reduce resource consumption in 6,000 SCE households over ten years by:
    - 16,800,000 kWh,
    - 369,000 therms, and
    - 140,580,000 gallons of water and wastewater,
4. to effectively educate two generations of residential customers in 6,000 households, demonstrating the importance, ease, and benefits of energy efficiency.
5. to deliver information on other energy efficiency programs offering products or services to 6,000 households.

For each of these objectives, we provide the results of this evaluation.

However, before presenting the results for each objective, we present in Table 5-17 some basic information about program participants from the Program database.

Table 5-17. Schools, Teachers, and Students Participating in the Living Wise Program

School	City	Teachers	Students	Total
Baldwin Lane Elementary	Sugar Loaf	3	96	99
Bancroft Middle School	Long Beach	3	420	423
Barstow Middle School	Barstow	1	224	225
Bridgeport Elementary	Bridgeport	1	20	21
California City Middle School	California City	5	175	180
Charles Hoffman Elementary	Running Springs	2	66	68
Cummings Valley School	Tehachapi	2	61	63
Encinita Elementary	Rosemead	2	60	62
Felix J. Appleby Elementary	Blythe	2	66	68
Franklin Middle School	Long Beach	3	420	423
Friendly Hills Elementary	Joshua Tree	3	95	98
Golden Hills Elementary	Tehachapi	4	120	124
Grandview Elementary	Twin Peaks	3	99	102
Hill Middle School	Long Beach	2	370	372
Home Street Middle School	Bishop	2	190	192
Hoover Middle School	Lakewood	4	385	389
Janson Elementary	Rosemead	1	35	36
Joshua Middle School	Mojave	2	65	67
Kennedy Middle School	Barstow	3	224	227
Lake Gregory Elementary	Crestline	1	30	31
Mesa Linda Middle School	Victorville	4	339	343
Morongo Valley Elementary	Morongo Valley	2	55	57
Murray Middle School	Ridgecrest	2	260	262
North Shore Elementary	Big Bear Lake	1	95	96
Oasis Elementary	Twenty-Nine Palms	4	112	116
Ruth Brown Elementary	Blythe	1	34	35
Sonrise Christian School	Covina	2	123	125
Stanford Middle School	Long Beach	3	540	543
Stephens Middle School	Long Beach	4	490	494
Twentynine Palms Elementary	Twenty-Nine Palms	3	99	102
Wells Elementary	Tehachapi	4	120	124
West Boron Elementary	Boron	1	60	61
Workman High School	City of Industry	50	250	300
Yucca Mesa Elementary	Yucca Valley	4	110	114
Total		134	5,908	6,042

Thirty-four schools participated in the LWP, involving 134 teachers and providing 5,908 students with Home Resource Kits.

5.3.1 Conduct Home Resource Use Audits

Recall that this objective called for conducting 6,000 home resource use audits. This involved sending home the Household Report Card, which asked the students to provide basic information regarding such things as their main source of heating and cooling, types of transportation used, and whether they installed any of the measures contained in the Home Resource Kit. Teachers distributed Household Report Cards to 5,908 students with 28.1 percent of these students returning completed Report Cards. It is not known how many of the students who received the Household Report Card actually completed it but failed to return it.

5.3.2 Effectively Educate Two Generations of Students and Their Parents

The LWP attempts to educate both the students and their parents about energy efficiency and conservation. A measure of the knowledge gained by students is measured by the pre and post-tests. Based on 519 completed pre and post-tests, the average pre-test score was 41% and the average post-test score was 56%, a gain of 37%. This difference is statistically significant at less than the .0001 level of probability (t=18.06). Whether achieving a mean score of 56 percent is of any practical significance is another question (i.e. does a mean score of 56% constitute mastery of a topic?). However, for the parents, there is no measure of knowledge gained, behaviors changed, of measures installed beyond those captured in the Household Report Card reported in Section 5.2.4.

In terms of effectively educating students, the teachers should find the LWP easy to use, clear, well received by the students etc. All teachers were asked to complete a brief survey as a way of assessing the LWP from their perspective. As a part of the survey, teachers were asked the extent to which they agreed or disagreed with five statements, with a "1" indicating *Strongly Disagree* and a "5" indicating *Strongly Agree*. Table 5-18 presents these results.

Table 5-18. Teacher Survey Mean Responses

Survey Questions	Mean
The materials were attractive and easy to use	4.4
The materials & activities were well received by students	4.3
The materials were clearly written and well organized	4.5
The conservation technologies were easy for students to use	4.2
Students indicated that their parents supported the program	3.8

Teachers were either in strong agreement or very close to strong agreement with all the statements. Parental support for the LWP received the lowest score.

In addition, over 87 percent of the teachers indicated that, given opportunity, they would conduct the LWP again. Over 92 percent indicated that they would recommend the LWP to other colleagues.

5.3.3 Install Energy Efficiency Measures

Five measures that are included in the Resource Kit sent to 134 teachers and their 5,908 students, Table 5-19 presents the installation rates based on the 1,661 Household Report Cards that were returned by the 5,908 students.

Table 5-19. Installation Rates

Measure	Installation Rates
CFL	85.8%
Nightlight	92.5%
Air Filter Alarm	47.4%
Showerhead	66.2%
Faucet Aerator	65.9%

5.3.4 Reduce Resource Consumption

The first step in verifying the claimed energy savings was to review all algorithms used to calculate savings from the installations of all energy saving devices distributed by the LWP. R&A checked both the algorithms and a variety of assumptions such as operating hours, effective useful lives, and water temperature to make sure that they are consistent with those used by the CADMAC/CALMAC.

Table 5-20 presents the modifications to the savings calculations.

Table 5-20. Modifications to Savings Calculations

Measure	Adjustments
CFL	▪ Reduced effective useful life from 8 years to 6
Nightlight	▪ No Changes
Air Filter Alarm	▪ No Changes
Showerhead (natural gas heater)	▪ Added an assumption that 70% of the water used in a shower is hot ▪ Used a 60F temperature rise rather than 55F ▪ Used 8.33Btu/gal F as the specific heat of 1 gallon of water
Showerhead (electric heater)	▪ Added an assumption that 70% of the water used in a shower is hot ▪ Used a 60F temperature rise rather than 55F ▪ Used 8.33Btu/gal F as the specific heat of 1 gallon of water
Education	▪ No evidence, *beyond savings resulting from the Resource Kits*, for any behaviors leading to a reduction in energy use.
Faucet Aerator (natural gas heater)	▪ Used a 60F temperature rise rather than 70F
Faucet Aerator (electric heater)	▪ Used a 60F temperature rise rather than 70F

The final set of engineering algorithms that were used to estimate lifecycle savings are presented below.

Compact Fluorescent Lamp – Electricity Savings

The 20w CFL products used by the Program are designed to replace a 75w or higher incandescent, yielding savings of 55 watts or more. They carry a 10,000 hour guarantee, and have been certified by CSA and approved by Energy Star®. Typical installation rates are in excess of 80%. 4.6 hours of use/day x 365 days = 1,667 hours per year, the measure life is six years.
Electricity: 1,667 hours x 55watts x 85.6% installation = 78.5 kWh x 6 years = 471 kWh

Nightlight – Electricity Savings

The Limelite nightlite uses 3/100th of a watt. For this estimate it is assumed that the night lamp to be displaced is a small incandescent of 7 Watts burning 24 hours/day. In a suitable application annual savings will correspond to 61.3 kWh/yr. The effective life is in excess of 10 years. The annual participant energy savings are:

Electricity: 61.3 kWh/year X 92.5% installation = 56.7 kWh x 10 years = 567 kWh

Air Filter Alarm – Electricity Savings

This product saves electric energy in the context of a heat pump or air conditioning unit by warning of an obstructed air filter. A system with a plugged filter will cause the compressor to work harder and there will be increased thermal losses in the ductwork. An engineering review of this product shows savings of 3% are reasonable in cases where the filters are not well maintained. Assuming an annual energy use by a heat pump or air conditioner of 3000 kWh/yr, the annual energy savings are:

Electricity: 3000 x 3% = 90kWh/year X 47.4% installation = 42.7 kWh X 10 yrs = 427 kWh

Showerhead – Water, Gas, Electricity Savings

The new showerheads have a maximum flow of 2.0 GPM at 80 psi. The mean flow rate value from the tests of the returned showerheads was 4.68 with a median of 3.6, indicating a highly skewed distribution. It was decided that the LWP-assumed flow rate of 4.0 for the returned showerheads should be retained. The installation rate was 66.2%. An additional assumption is that 70 percent of the water used in a shower is hot water. An effective operating life of 10 years is assumed. The energy savings were calculated as follows:

All Water: 2 delta gpm flow reduction X 8 min shower X 2 residents X 365 days X 66.2% X =

7,732.2 gallons of water (and wastewater) per year X 10 years = 77,321.6 gallons

Hot Water: 2 delta gpm flow reduction X 8 min shower X 2 residents X 365 days X 66.2% X 70% =

5,412.5 gallons of water (and wastewater) per year X 10 years = 54,125.1 gallons

Gas: (81% of region water heat)

5,412.5 gal X 8.33 btu/gal F X 60F temp rise /.65 boiler efficiency X 81% mkt share =

4,213,803.8 btu, divided by 100,000 btu/therm = 33.7 therms X 10 years = 337.1 therms

Electricity: (19% of region water heat)

5,412.5 gal X 8.33 btu/gal F X 60F temp rise X 19% market share/ 3413 btu/kwh = =150.6 kWh X 10 years = 1,506 kWh

Faucet Aerator – Water, Gas, Electricity Savings

As in the case of showers, it is assumed that 70 percent of the water used in a faucet is hot water.

All Water: 1 gpm flow reduction X 2.5 min use/day X 365 days X 65.9% = 601.3 gals X 10 years = 6,013.4 gallons

Hot Water: 1 gpm flow reduction X 2.5 min use/day X 365 days X 65.9% X 70%= 420.9 gals X 10 years = 4,209.4 gallons

Gas: (81% of region water heat)

4,20.9 gal X 8.33 btu/gal F X 60F temp rise/.65 boiler efficiency X 81% market share =

= 2,621730.9 btu, divided by 100,000 btu/therm = 2.62 therms X 5 yrs = 13.1 therms

Electricity: (19% of region water heat)

420.9 gal X 8.33 btu/gal F X 60C temp rise X 19% market share/ 3413 btu/kwh =

= 11.7 kWh X 5 years =58.6 kWh

The results of these adjusted algorithms are reflected in Table 5-21, which provides the assumed lifecycle savings for each measure.

Table 5-21. Lifecycle Unit Savings by Measure

Measure	kWh	Therms
CFL	471	n/a
Nightlight	567	n/a
Air Filter Alarm	427	n/a
Showerhead (natural gas heater)	n/a	337.1
Showerhead (electric heater)	1,506.0	n/a
Education	0	0
Faucet Aerator (natural gas heater)	n/a	13.1
Faucet Aerator (electric heater)	58.6	n/a

Table 5-22 presents the lifecycle program savings based on the self-reported installations combined with the lifecycle unit savings.

Table 5-22. Lifecycle Program Savings by Measure

Measure	Lifecycle kWh Savings	Lifecycle Therm Savings
Showerhead (electric heater)	8,897,191	0
Showerhead (natural gas heater)	0	1,991,624
Nightlight	3,349,641	0
CFLs	2,781,486	0
Air Filter Alarm	2,520,353	0
Faucet Aerator (electric heater)	345,972	0
Faucet Aerator (natural gas heater)	0	77,445
Education	0	0
Total	17,894,642	2,069,069

The original goal was to achieve 16.8 million kWh and 369,000 therms. Based on the results reported in Table 5-22, the LWP achieved kWh savings that are 6.5 percent greater than its original goal and therm savings that are 460 percent greater than its original goal. In addition, the LWP saved 492,343,032 gallons of water, which is over 250% greater than its original goal. These kWh, therm, and water savings are *gross* impacts and there is no established net-to-gross ratio (NTGR) by which to convert these estimates to *net* impacts. If an impact evaluation of the LWP is conducted in the future, the issue of the NTGR must be addressed at that time.

Other than the savings related to the items contained in the Resource Kit, there is no evidence in the form of survey data to indicate that residential customers actually changed their behavior in such a way as to reduce energy consumption. A greater effort is planned for the 2001-2002 academic year to influence parental behavior with respect to energy use.

5.3.5 Deliver Information on Other Energy Efficiency Programs

In each of the Household Report Cards, three types of energy efficiency were mentioned:

1. the Refrigerator Recycling Program
2. appliance rebate programs
3. low income programs

Those who expressed an interest in these programs were sent additional information. Of the 1,661 students who returned their Household Report Cards, 35 percent indicated that they were interested in at least one of these programs.

5.3.6 Proposed Measurement and Evaluation Activities

We recommend the use of the longer version of the teacher survey, which allows for the collection of more information by which to judge the effectiveness of the LWP.

5.3.7 Proposed Measurement and Evaluation Activities

During the fall 2002, the LWP will be expanded to a yet-to-be-determined number of schools.

5.4 Results for the PEAK Program

In this section, we present the findings regarding the first three phases of the PEAK Program based on in-depth interviews with Program staff and teachers. We focus on the development of the curriculum and software as well as the methods for estimating kWh savings.

5.4.1 Phase 1: Academic Year 1999-2000

The development of the curriculum and software began in the fall semester 1999 at Harbor Day School (HDS), located in Corona Del Mar, California. One science teacher at HDS was responsible for working with the PEAK Program staff in updating both the curriculum and software. A software development firm was hired to write new software to achieve the same learning objectives as the original version. During the fall, as the software was developed, 3-5 students from HDS actively participated in suggesting new ideas so that the software would appeal to middle and elementary school students and in testing the modules as they were written. The HDS science teacher also updated the original curriculum materials. In the spring semester, approximately 45 students in three sections were exposed to PEAK. The HDS science teacher reported that the PEAK software and curriculum materials worked well and that his students were actively engaged.

In the spring of 2000, the PEAK was beta-tested at an in-service training workshop. At this workshop five teachers were introduced to the curriculum and software.

5.4.2 Phase 2: Summer 2000 – June 2001

Another 9 teachers (8 elementary and 1 secondary) were introduced to the PEAK Program at a second in-service training workshop, conducted in August of 2000. Based on feedback from the teachers at these workshops, both the software and curriculum were modified.

In August 2000, a four-day Summer Science Institute was conducted in which 140 students from the John Adams Middle School participated. The purpose of the Institute was to introduce students to PEAK and use the feedback from the students to improve both the curriculum and the software. A survey was conducted at the conclusion of the workshop that asked a variety of questions regarding the software as well as the math and science components of PEAK. Students were presented with a series of statements with which they could agree or disagree along a five-point scale with agreement indicating a positive evaluation of PEAK. The responses from 86 students are summarized in Table 5-23.

Table 5-23. Mean Ratings for Four Components of the Summer Science Institute

Component	Mean
Software	3.78
Math	3.84
Science	4.16
Overall	3.87

As one can see, the students on average had a positive perception of the PEAK software, math, and science components. Their overall perception of PEAK was equally positive. More detailed results of this survey are presented in Appendix F. Based on the student workshops held in August 2000, additional changes were made to the software. The software was now considered ready for a larger population of students in Phase 3.

Also in August, the PEAK website was launched[6]. The website, designed for English and Spanish speakers (it is also presented in Swedish but this seems of little practical importance to the California experience), introduces the PEAK concept and includes information about developments in PEAK as well as curriculum links.

During this phase, student participation continued to expand. At Harbor Day School, 45 students in the eighth grade were exposed to PEAK in the fall and 45 students in the fifth grade were exposed to PEAK in spring. The PEAK Program was also introduced to approximately 140 students in the magnet school at the John Adams Middle School in the Santa Monica School District. Teachers began by doing exactly what was done at Harbor Day. *For the most part*, the PEAK materials were well received by the teachers and the students. However, certain activities that worked at Harbor Day did not work at John Adams. For example, the students attending John Adams are far less affluent than those at Harbor day making some activities such as reducing the runtime on a swimming pool pump

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[6] http://www.energycoalition.org/peak

irrelevant. However, the teachers at John Adams were able to creatively add activities and materials that achieved the same learning objectives and were more relevant to the lives of their students. In addition, the students in the seventh grade came with academic experiences that were different than those of the students at Harbor Day. Again, the teachers were able to customize the PEAK materials in a way that built on the skills and experiences of *their* students. The teachers emphasized that you have ownership of a curriculum when you can customize it to meet your needs as a teacher *and* the needs of your students.

An important feature at John Adams is that there is a science specialist and a math specialist. Recognizing that the PEAK Program contains both science and math elements, these two teachers attended the summer in-service workshops and continued to collaborate in delivering the PEAK Program. The computer teacher has also been brought into the process since there is a fair amount of data collection, data entry and file manipulation involved with running the PEAK software. Such an integrated approach across several disciplines is arguably a much better approach to learning the PEAK concepts than implementing the PEAK Program in science classes only. However, the teachers did admit that they needed to be more consistent across classes in reinforcing the PEAK messages.

Not only did the two teachers at John Adams collaborate, they continued working with the science teacher at Harbor Day. Throughout the year, these three teachers shared new activities and experiments that they found to be interesting, exciting and meaningful. This often involved exchanging e-mails on a daily basis.

At the end of the school year, the teachers conducted an informal survey, which revealed that the students were enthusiastic about the PEAK Program. They found the software to be interesting, exciting, meaningful, intuitive, and fun. The teachers observed that their students did not require a great deal of external motivation because the PEAK Program was actually about them, their house, their room, and their energy use.

There were two final changes to the PEAK resulting from the Phase 2 experience. Both were in response to the worsening of the energy crisis in spring 2001. First, there was increasing interest to more aggressively pursue kWh and kW savings both in the school and in the students' homes. This meant planning for more formal energy audits at the school sites and in the homes of students in fall 2001. Second, it was decided that there should be as much interest in reducing peak kW demand as there was in reducing kWh consumption. Curriculum materials were changed accordingly. Both of these changes are discussed in greater detail in the next section.

5.4.3 Plans for Phase 3: Summer 2001 – June 2002

The plans for Phase 3 include a greater effort to pursue savings at the school site, teach students about kW demand reduction both at their school and in their homes, more aggressive pursuit of kWh saving and kW demand reduction in the student's home through the use of more formal energy audits, and expanding PEAK to a wider audience.

5.4.3.1 Increased Focus on Savings at the School Site

As a result of increased focus on kWh and kW savings at the school site, an energy audit has already been done at the Edison School (an elementary schools that feeds the John Adams Middle School) in the Santa Monica School District and a preliminary walk-through audit at the John Adams Middle School. PEAK will assist each school in identifying ways to help pay for any recommended retrofits resulting from these audits. The students will also be integrally involved with monitoring and maintaining the energy savings at their school that result from audit-based recommendations regarding behavioral changes. They will be active "energy cops" to make sure that the savings from behavioral changes are sustained.

5.4.3.2 Increased Focus on kW Demand Reductions

The curriculum materials and the software have been modified to increase the emphasis on peak kW demand reductions.

5.4.3.3 Student and Family Energy Audits

For grades 4 through 8, the PEAK software is currently being modified to link it to existing residential audit software. The basic audit information will be collected and input into the PEAK software and then passed to the audit software for processing. The audit software will generate two sets of reports for each participating student that provides household information on electricity usage and recommendations on how to reduce usage. The first report will be designed for the student, have an environmental focus, and provide recommendations with an operational focus. The second report will be designed for the students' parents and will be very similar in format and content to SCE's standard residential audit report.

5.4.3.4 Expanding Participation

During Phase 3, PEAK will continue at the HDS. During this phase, 45 students in the eighth grade will be exposed to PEAK in fall 2001 and 45 students in the fifth grade will be exposed to PEAK in spring 2002.

In the summer of 2001, approximately 215 seventh-grade students who are enrolled in the magnet school that operates within the John Adams Middle School will be introduced to PEAK. The remainder of the seventh-grade (approximately 175 students) will be exposed to PEAK beginning in September.

The 140 students who were exposed to PEAK at the John Adams Middle School in the 2000-2001 school year will again be exposed to additional PEAK materials during the eighth grade. They will continue to track their energy bills, and learn about the efficient light bulbs as compared to incandescent bulbs. In addition, they will cover new material including the electron, electromagnetic spectrum, and various forms of energy generation such as nuclear, hydroelectric, turbine, and biomass. While the focus may change somewhat, there will be a consistent effort to always tie these lessons back to the PEAK concepts.

Teachers at the John Adams Middle School are also starting to work with the 6th grade class in the Edison School, which is one of their feeder schools. As the students experience the PEAK Program in the 6th grade, they will come better prepared to take on the challenges of PEAK in the 7th and 8th grades. Of course, this will require the 7th and 8th grade teachers to modify their PEAK materials to handle these more knowledgeable students. The teachers felt that this would be relatively easy since the PEAK curriculum materials are contained in the resource binder, which allows the teacher to recycle certain activities but also to add to them. Also, just because an activity is suggested for the middle school does not mean that an elementary teacher or a high school teacher cannot take advantage of it. The teachers felt very strongly that the PEAK curriculum provides the flexibility needed by teachers to meet the evolving needs and interests of their students.

There have also been some recent developments at the Irvine Unified School District (IUSD) At the June 5, 2001 meeting of the IUSD Board of Education, 5th grade students from Meadow Park Elementary School gave a special presentation on their PEAK project, an energy conservation program provided to the school by the California Energy Coalition. At the conclusion of the presentation, the IUSD Curriculum Coordinator announced that their science program will be modified in order to incorporate PEAK elements into the 4th, 5th, and 6th grade curricula. Expanding the program to over 5,500 students in IUSD holds the promise of a measurable impact on the city's energy use as well as enduring changes in the community's attitudes and skills in energy conservation.

In preparation for the introduction of PEAK into the IUSD, an in-service workshop will be conducted in August for three science coordinators and computer specialists. At this workshop, they will be introduced to PEAK and will address how they will customize PEAK so that it can be incorporated into their schedule, their school and their curriculum. In mid-September, based on the result of the August workshop, they will conduct an in-service workshop for the remaining 20 science coordinators in IUSD.

5.4.4 KWh Impacts

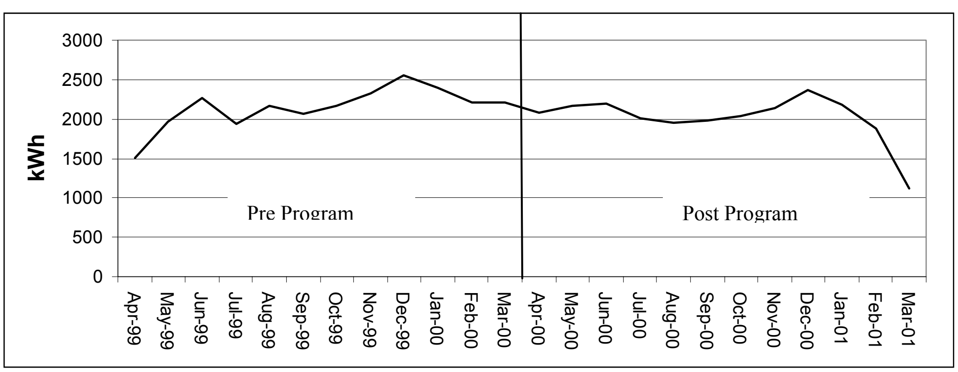
Attempts to measure kWh impacts were made by comparing the kWh consumption of students before the start of the PEAK Program with their kWh consumption after the start of the PEAK Program. For example, comparisons are made on a monthly basis such that the pre-April kWh is subtracted from the post-April kWh. Table 5-24 and Figure 5-1 illustrate the type of data and analysis for a particular student's home that were part of this effort. We emphasize that this is an illustration only and that we have serious reservations about this approach to estimating savings as it is highly error-prone.

Table 5-24. Pre and Post Energy Consumption by Month

Pre	kWh	Post	kWh
April-99	1,514	April-00	2,080
May-99	1,973	May-00	2,168
June-99	2,275	June-00	2,203
July-99	1,931	July-00	2,005
August-99	2,174	August-00	1,957
September-99	2,062	September-00	1,977
October-99	2,162	October-00	2,036
November-99	2,321	November-00	2,144
December-99	2,550	December-00	2,362
January-00	2,404	January-01	2,178
February-00	2,214	February-01	1,876
March-00	2,214	March-01	1,122
Total	25,793	Total	24,108

From Table 5-24 one can see that this particular student was exposed to the PEAK beginning in April 2000 and that the estimated savings are 1,685 kWh (25,793 kWh – 24,108 kWh).

Figure 5-1. kWh Consumption: Pre Consumption Versus Post Consumption



However, it is very difficult if not impossible to obtain accurate estimates of savings. First, the kWh data are not weather-normalized. Second, there was no attempt to control for other factors at each residence that could also affect consumption. Third, this approach cannot estimate kW demand reductions. Nevertheless, this represents a good first effort to estimate savings in a cost-effective manner. It also has great value as a pedagogical tool and should be kept regardless of how savings are eventually estimated. In the next section, we present our reasons why such an approach is error prone and recommend a very different method.

Using engineering algorithms produces estimates of *gross* savings only. There is no established net-to-gross ratio (NTGR) by which to convert these *gross* estimates to *net* impacts. If an impact evaluation of PEAK is conducted in the future, the issue of the NTGR must be addressed at that time.

5.4.5 Proposed Measurement and Evaluation Activities

5.4.5.1 Testing

Two important components of any educational evaluation are pre and post-tests that measure gains in knowledge and changes in attitudes. These components have never existed for the PEAK Program and needed to be created. In May 2001, we urged the Program staff to create these tests. By mid-July, a pool of test questions was delivered to the evaluation team. From this pool of questions, an elementary school version and a middle school version will be developed for use in the 2001-2002 academic year. Because the PEAK Program has a core set of learning objectives, the tests for a given grade should be roughly the same across classes in a given grade. This is important since we will need to compare, for example, 5th grade classes within a given school and across schools. However, there will be some differences in order to measure the achievement of learning objectives that may be unique to a particular class. For example, more advanced students may have additional test questions that reflect a more advanced curriculum that seeks to transmit a deeper understanding of certain concepts. The pool of available questions is presented in Appendix B.

5.4.5.2 Savings Estimates

In addition, we recommend the use of engineering algorithms as a way of estimating kWh savings and kW demand reductions rather than relying on an analysis of energy bills. We have two reasons for this recommendation.

First, relying on pre and post graphs of monthly energy use as a way of measuring savings is highly error prone. There are two basic reasons for this. The first is that variations in weather from the pre to the post period can distort savings estimates. For example, a cool month in a summer post period will be misinterpreted as savings. Second, there are changes in the living patters of families that can also distort savings estimates. For example, a family who, in the post period, assumes responsibility for an aging grandmother may, as a result, *increase* their energy use. This would be the conclusion despite the fact that they changed their behavior as a result of a DSM program in order to *reduce* energy consumption.

The only way to adequately address both of these concerns is to conduct a more rigorous billing analysis using multiple regression. Such an analysis uses weather-normalized kWh and incorporates additional variables that capture the non-program-related changes in equipment and living conditions in each household. Such an approach increases the chances of identifying program-induced savings. However, where savings are very small relative to natural variation in usage, as is the case here, the savings probably couldn't be identified by regression methods. Thus, to estimate savings, algorithms, similar to those used by the Living Wise Program, should be used (see Section 5.3.4). We hasten to add that students should continue to analyze their energy consumption since we agree with the teachers that this is a very useful pedagogical tool.

We also recommend tracking any energy savings resulting from the residential energy audits. This would require a follow-up survey of a sample of participating students. Based on the survey results, engineering algorithms could be used to estimate additional energy savings.

5.5 Overall Conclusions

All three programs have been actively involved in implementing their respective programs and will continue to do so through fall 2001. All three programs have evolved considerably over the last 12 to 18 months in response to changing district and student needs and have been well received by students, teachers, and administrators. While some have been more successful than others in measuring energy impacts, some have made great strides in developing sound approaches to estimating such impacts. They have also occasionally incorporated or are considering incorporating certain features from other programs that complement their programs. This kind of cross-fertilization is a key to their continuing improvement and demonstrates flexibility on the part of the program designers and openness to new ideas.

Because all three of these programs are pilot programs, there is a greater emphasis on process evaluation with the main objective of improving the programs and the methods for estimating impacts than on impact evaluation itself. Once the programs are further developed and program designs stabilize, greater emphasis will be placed on impact evaluation. Thus, it is premature to judge how effective the programs are in achieving their educational and energy saving objectives.

However, when conducting the impact evaluations of these programs, one should take into account, in addition to these educational and energy saving objectives, at least three additional attributes:

1. the energy education policy objectives of California,
2. the measurement of all the benefits, and
3. the degree to which the programs can be customized.

5.5.1 The Policy Objectives of California

Some programs invested considerable resources in developing curricula and teacher supports that would foster savings over the long term because the effects would continue after a particular class of students graduated. Students would have learned the benefits of conservation for life, and the curriculum would be used with new students entering these classes. Other programs focused more attention on near-term kWh savings by providing students with technologies to install at home. This latter approach has an effect primarily for those students participating in a given program year with less of an impact for the students in subsequent school years. Of course it would be possible to address both, but this requires more funding than either approach by itself.

5.5.2 Measuring All the Benefits

We emphasize that one should not place too great an emphasis on kWh and kW impacts since these impacts represent only a portion of the total impact. The other portion is comprised of educational outcomes that include knowledge gains and attitudinal changes with respect to energy efficiency and conservation. For such educational programs, those applying such benefit-cost tests, such as the Total Resource Cost Test, must find a way of valuing (monetizing) not only the kWh and kW impacts but also educational impacts. To ignore such educational impacts would do a disservice to such educational programs.

5.5.3 Customized Programs

Professionals are more likely to use a tool if they can customize the tool to meet their own interests, needs, and schedules. Teachers are such professionals. They operate within unique school and district administrative systems and student populations, requiring programs that can be modified without any significant degradation of the learning experience. Programs that can be effectively customized will be ones that are used in a serious way; programs that force teachers to engage in a rigid set of learning activities will not be taken seriously by teaching professionals.

Appendix A. Living Wise Questionnaires

V. HOUSEHOLD REPORT CARD

NATURAL RESOURCES

Does your family recycle? If so, which ones?

❑ 1. No Recycling ❑ 2. Glass
❑ 3. Aluminum ❑ 4. Plastic

Which means of transportation does your family use?

❑ 1. Drive own car only ❑ 2. Ride bikes
❑ 3. Public transportation ❑ 4. Car pool

ELECTRICITY

What is the **main** heating source in your home? (please mark only one)

❑ 1. Electric Forced Air ❑ 2. Gas Forced Air ❑ 3. Heat Pump
❑ 4. Oil Forced Air Furnace ❑ 5. Electric Wall/Baseboard ❑ 6. Gas Unit Heater
❑ 7. Wood Stove/Fireplace ❑ 8. Other__________

What is the **main** cooling source (A/C) in your home? (please mark only one)

❑ 1. Electric Window/Wall Unit ❑ 2. Central Electric ❑ 3. Central Gas
❑ 4. Evaporative "Swamp" Cooler ❑ 5. Central Fan ❑ 6. Heat Pump
❑ 7. Open Window ❑ 8. Other__________

Did you install your LimeLite® Nightlight? ❑ 1. Yes ❑ 2. No

Did you install a Compact Fuorescent Lamp? ❑ 1. Yes ❑ 2. No

NATURAL GAS

Did you install the energy-efficient showerhead? ❑ 1. Yes ❑ 2. No

Did you install the FilterTone® alarm? ❑ 1. Yes ❑ 2. No

Did you have to replace or clean a dirty air filter? ❑ 1. Yes ❑ 2. No

Is your home insulated? ❑ 1. Yes ❑ 2. No

WATER

How is your water heated? ❑ 1. Gas ❑ 2. Electric

Did you install the kitchen faucet aerator? ❑ 1. Yes ❑ 2. No

Does your toilet have a leak? ❑ 1. Yes ❑ 2. No

27

REVIEW

Were you already familiar with any of Southern California Edison's Energy Star® or Rebate Programs? ❑ Yes ❑ No

Please send me more information on the following programs:

❑ 1. Refrigerator Recycling Program - SCE pays you $35 and hauls it for free!

❑ 2. SAVE $$$ on Energy Star® refrigerators, clothes washers, lighting, etc.

❑ 3. Low income programs - Free energy audits, free energy-saving products and save up to 15% off your electric rates.

LivingWise Pledge

I completed the program activities and pledge to save energy and water and help our environment.

____

Student Signature

Activity Completion

I hereby confirm that this student completed the program activities as answered.

____

Parent/Guardian Signature

WIN A PRIZE! All students who return their completed Household Report Card and removed showerhead by December 15, 2000 (or parent signature required if you are not returning a showerhead) will be entered in a drawing to win a Magic Mountain Getaway Vacation for four. The drawing will be held on January 30, 2001 and winners will be notified by mail.

❑ **Yes, I completed the Household Report Card and qualify for the Magic Mountain Getaway Vacation!** (name and address required)

Name ______________________________

Address ______________________________

City/State/Zip ______________________________

School ______________________________

Teacher ______________________________

Return this to your teacher or mail to:
LivingWise® Program Center
2351 Tenaya Drive
Modesto, CA 95354
Phone: 1-888-438-9473
Fax: 209-529-0266
www.livingwise.org

LivingWise® 2000 Resource Action Program

22

LivingWise

Saving Resources · Building Awareness · Shaping Habits

Program Evaluation

School:______________________ Date:______________

Name of Sponsor:______________________

In an effort to continually improve our program, we would like your assessment regarding **LivingWise™**. *Please take a few moments to complete this evaluation form. Upon completion, please return the form in the Self Addressed Return Envelope.*

Please circle the number that best describes your feelings.

	Strongly DISAGREE				Strongly AGREE
Materials:					
The teacher's binder was easy to follow	1	2	3	4	5
The teacher's binder provided adequate instructions for classroom implementation.	1	2	3	4	5
The student materials were attractive and easy to use	1	2	3	4	5
The student materials and activities were well received by my students	1	2	3	4	5
The materials were clearly written and well organized	1	2	3	4	5
Student Participation:					
Students enjoyed the activities and instruction	1	2	3	4	5
Students participated actively in the program	1	2	3	4	5
The conservation technologies were easy for students to use	1	2	3	4	5
Students reported that they experienced success at home	1	2	3	4	5
Students indicated that their parents supported the program	1	2	3	4	5

Total number of students participating and receiving certificates in the program:_______

Total number of showerheads installed:________

Sponsor Assistance and Support					
It was easy to determine who sponsored my program	1	2	3	4	5
Delivery of materials took place in an effective and efficient manner	1	2	3	4	5
Sponsor support was readily accessible	1	2	3	4	5
Appropriate and timely communication occurred with the sponsor	1	2	3	4	5

New LW Binder\LW Section 08.pm6

8-3

Please check one.

Did you implement this program in conjunction with university graduate credit? ❒ Yes ❒ No

If not, why didn't you enroll to earn credit?

- ❒ I didn't need or want credit
- ❒ I didn't have funds for the credit
- ❒ I didn't understand or know about the credit
- ❒ Other reason (please specify) ______________________________

If you had the opportunity, would you conduct this program again? ❒ Yes ❒ No

Would you recommend this program to other colleagues? ❒ Yes ❒ No

In my opinion, the thing students liked best about the materials / program were:

In the future, one thing I would change would be:

If more materials were available in the future, how would you like to see the program expanded?

Include learning about ❒ Recycling ❒ Appliances ❒ Science

❒ Technology ❒ Transportation

❒ Other (please specify): __________________________

Other comments:

New LW Binder\LW Section 08.pmd

Living Wise™

Saving Resources • Building Awareness • Shaping Habits

Pre Program Survey

Name: ____________________ Date: ________

Fill in the Blank

1. ___________, Reduce, Reuse and Recycle are the four "R's" and ways you can demonstrate environmental responsibility.
2. A kilowatt equals __________ watts.
3. A resource efficient showerhead can save __________, __________ and __________ .
4. About _____ of the earth is water.
5. _____ of our energy needs come from natural gas.
6. How much water is used each time you flush an ultra-low-flush toilet? _____ gallons/liters.
7. How much energy is used for every hour you use a compact fluorescent lamp? _____ watts

True or False

8. Coal is a renewable resource.
   ❐ True ❐ False
9. A FilterTone™ alarm tells you when to change your car filter.
   ❐ True ❐ False
10. A "LimeLite" is a fruit with less calories.
   ❐ True ❐ False
11. The average car will use less fuel per mile at 75 mph/ 120 km/h than the same car driven at 55 mph/85 km/h.
   ❐ True ❐ False

Match the Following

12. Earth heat, geysers	a. Biofuel
13. Rain, snow, hail	b. Xeriscape
14. Native plants, mulch, lawn design	c. Geothermal
15. Kelp, wood, corn stalks	d. Hydro Logic Cycle

Multiple Choice

16. What percentage of the human body is water?
   a. 20%
   b. 50%
   c. 70%
   d. 95%
17. Which of the following is not a form of energy?
   a. Friction
   b. Electricity
   c. Sound
   d. Light
18. Which is not an example of environmental pollution?
   a. Graffiti
   b. Cistern
   c. Litter
   d. Loud noises
19. Which one is not a renewable resource?
   a. Solar
   b. Geothermal
   c. Oil
   d. Wind

Tell A Story

1. List some of the natural resources you impact every day.

____
____
____
____
____

2. List some of the ways to save energy and water.

____
____
____
____

New LW Binder\LW Section 02.pm6

2-2

Living Wise™

Saving Resources • Building Awareness • Shaping Habits

Post Program Survey

Name: ____________________ Date: ________

Fill in the Blank

1. ___________, Reduce, Reuse and Recycle are the four "R's" and ways you can demonstrate environmental responsibility.
2. A kilowatt equals _________ watts.
3. A resource efficient showerhead can save _________, _________ and _________ .
4. About _____ of the earth is water.
5. _____ of our energy needs come from natural gas.
6. How much water is used each time you flush an ultra-low-flush toilet? _____ gallons/liters.
7. How much energy is used for every hour you use a compact fluorescent lamp? _____ watts

True or False

8. Coal is a renewable resource.
   ❒ True ❒ False
9. A FilterTone™ alarm tells you when to change your car filter.
   ❒ True ❒ False
10. A "LimeLite" is a fruit with less calories.
    ❒ True ❒ False
11. The average car will use less fuel per mile at 75 mph/ 120 km/h than the same car driven at 55 mph/85 km/h.
    ❒ True ❒ False

Match the Following

12. Earth heat, geysers	a. Biofuel
13. Rain, snow, hail	b. Xeriscape
14. Native plants, mulch, lawn design	c. Geothermal
	d. Hydro Logic Cycle
15. Kelp, wood, corn stalks	

Multiple Choice

16. What percentage of the human body is water?
    a. 20%
    b. 50%
    c. 70%
    d. 95%
17. Which of the following is not a form of energy?
    a. Friction
    b. Electricity
    c. Sound
    d. Light
18. Which is not an example of environmental pollution?
    a. Graffiti
    b. Cistern
    c. Litter
    d. Loud noises
19. Which one is not a renewable resource?
    a. Solar
    b. Geothermal
    c. Oil
    d. Wind

Tell A Story

1. List some of the natural resources you impact every day.

____

____

____

____

____

2. List some of the ways to save energy and water.

____

____

____

____

____

Living Wise®

Saving Resources • Building Awareness • Shaping Habits

Pre & PostProgram Survey
Answer Key

Name: ____________ Date: ________

Fill in the Blank

1. *Rethink*, Reduce, Reuse and Recycle are the four "R's" and ways you can demonstrate environmental responsibility.
2. A kilowatt equals *1,000* watts.
3. A resource efficient showerhead can save *water*, *energy* and *money*.
4. About *3/4* of the earth is water.
5. You can reduce the energy needed by an air conditioner by *raising* the thermostat and *closing* drapes to block the sun.
6. Energy Star appliances and products use less *energy* and are recommended by the Department of *Energy* and your local utility.
7. How much energy is used for every hour you use a compact fluorescent lamp? *15-25* watts

True or False

8. Coal is a renewable resource.
   ☐ True ☑ False
9. A FilterTone™ alarm tells you when to change your car filter.
   ☐ True ☑ False
10. A "LimeLite" is a fruit with less calories.
    ☐ True ☑ False
11. The average car will use less fuel per mile at 75 mph (120 km/h) than the same car driven at 55 mph (85 km/h).
    ☐ True ☑ False

Match the Following

12. Earth heat, geysers
13. Rain, snow, hail
14. Native plants, mulch, lawn design
15. Kelp, wood, corn stalks

a. Biofuel
b. Xeriscape
c. Geothermal
d. Hydro Logic Cycle

Multiple Choice

16. Compact Fluorescent Lamps (CFLs) save energy and money because they:
    a. last longer than regular incandescent bulbs
    b. use less energy than regular incandescent bulbs
    c. don't break easily
    d. both a and b
17. Which of the following is not a form of energy?
    a. Friction
    b. Electricity
    c. Sound
    d. Light
18. If you become more energy efficient, you can:
    a. save electricity and other resources
    b. save money on utility bills
    c. reduce air pollution
    d. all of the above
19. Which one is not a renewable resource?
    a. Solar
    b. Geothermal
    c. Oil
    d. Wind

Tell A Story

1. List some of the natural resources you impact every day.
   Water
   Trees
   Oil and Gas
   Others
2. List some of the ways to save energy and water.
   Making informed choices
   Reuse, Recycle, Reduce
   Carpool
   Use energy efficient devices
   Others

Appendix B. Green Schools Questionnaires

In-Depth Interview Guide: Program Staff

Green Schools Program

ID: _______

Date: _______

Name: ____

Title: ____

School:____

Address: ____

Introduction: Hello. I'm __________ with Equipoise Consulting and I've been hired by the Southern California Edison Company to evaluate the Green Schools Program. The California Public Utilities Commission has required that SCE evaluate this program. Our records indicate that you've been involved with this Program and I'd like to talk with you a few minutes about your participation. I want to emphasize that all of your answers will be kept strictly confidential. [IF THE RESPONDENT WISHES TO CONTACT A PG&E REPRESENTATIVE TO VERIFY THE LEGITIMACY OF THIS EVALUATION, PROVIDE THE NAME OF ANGELA JONES AT (415) 972-5333.]

IF RESPONDENT REFUSES, GO TO NEXT SAMPLE POINT.

IF RESPONDENT CANNOT BE INTERVIEWED AT THIS TIME SCHEDULE A CALLBACK FOR: Date/Time: ____

1. In which grade levels did you use the Green Schools Curriculum?

2. In your class(es), how many students in all were exposed to the Green Schools curriculum?

3. During which months did you use the Green Schools curriculum?

4. In each class, approximately how many classroom hours did you devote to the Green Schools curriculum?
   ___ class #1
   ___ class #2
   ___ class #3
   ___ class #4
   ___ class #5

3. On a scale of one to five, with a one indicating "not at all effective" and a five indicating "very effective," how effective do you think the each of the following were (READ) . . .

   ___ [READ ONLY IF RECEIVED STEM TRAINING] the STEM training

   ___ the workshops
   ___ Guide to Project Resources

4. Approximately how many classroom hours (or periods) did you spend using the Guide to Project Resources?

   ___ # Hours ___ # Periods

5. Overall, how did your students respond to the lessons and student activities in the Guide to Project Resources?

6. What components of the Green Schools Program did you find to be most effective? The least effective?

7. On a scale of one to five, with a one indicating "not at all effective" and a five indicating "very effective," how would you rate, *as a teacher*, the overall educational effectiveness of the Green Schools Program for your grade level?

8. Do you have any specific recommendations to enhance the Green Schools Program?

9. Would you recommend the Green Schools Program to other teachers in your own school or district or to teachers in other school districts?

   If no why not?

   If yes, a follow up could relate to recommending the Green Schools Program to administrators, curriculum coordinators and other staff.

10. Do you have any suggestions for promoting the Green Schools Program to more teachers in the state?

In-Depth Interview Guide: Administrators

Green Schools Program

ID: _______

Date: _______

Name: ____

Title: ____

School:____

Address: ____

Introduction: Hello. I'm __________ with Equipoise Consulting and I've been hired by the Southern California Edison Company to evaluate the Green Schools Program. The California Public Utilities Commission has required that SCE evaluate this program. Our records indicate that you've been involved with this Program and I'd like to talk with you a few minutes about your participation. I want to emphasize that all of your answers will be kept strictly confidential. [IF THE RESPONDENT WISHES TO CONTACT A PG&E REPRESENTATIVE TO VERIFY THE LEGITIMACY OF THIS EVALUATION, PROVIDE THE NAME OF ANGELA JONES AT (415) 972-5333.]

IF RESPONDENT REFUSES, GO TO NEXT SAMPLE POINT.

IF RESPONDENT CANNOT BE INTERVIEWED AT THIS TIME SCHEDULE A CALLBACK FOR: Date/Time: ____

1. When did you begin your involvement with the Green Schools Program?

2. What role did you play in implementing the Green Schools Curriculum?

3. On a scale of one to five, with a one indicating "not at all effective" and a five indicating "very effective," how effective do you think the each of the following were (READ) . . .

   ___ [READ ONLY IF RECEIVED STEM TRAINING] the STEM training
   ___ the workshops
   ___ Green Schools curriculum materials

4. Overall, how did your students respond to the Green Schools Program?

5. Overall, how did your custodians respond to the Green Schools Program?

6. Overall, how did your teachers respond to the Green Schools Program?

7. On a scale of one to five, with a one indicating "not at all effective" and a five indicating "very effective," how would you rate, *as an administrator*, the overall effectiveness of the Green Schools Program?

8. What have you done to make sure that, when your school completes the Green Schools Program and students exposed to the Green Schools Program graduate from your school, the energy saving behaviors, such as turning out the lights when rooms are not being used, continue?

9. What have you done to make sure that, when the custodians who were exposed to the Green Schools Program move on to another position, the energy saving practices and behaviors continue?

10. Would you recommend the Green Schools Program to other administrators in your own school or district or to administrators in other school districts?

    If no why not?

11. What components of the Green Schools Program did you find to be most effective? The least effective?

12. What were the biggest problems in implementing the Green Schools Program in your school?

13. Do you have any specific recommendations to enhance the Green Schools Program?

In-Depth Interview Guide: Teachers

Green Schools Program

ID: _______

Date: _______

Name: ____

Title: ____

School:____

Address: ____

Introduction: Hello. I'm __________ with Equipoise Consulting and I've been hired by the Southern California Edison Company to evaluate the Green Schools Program. The California Public Utilities Commission has required that SCE evaluate this program. Our records indicate that you've been involved with this Program and I'd like to talk with you a few minutes about your participation. I want to emphasize that all of your answers will be kept strictly confidential. [IF THE RESPONDENT WISHES TO CONTACT A PG&E REPRESENTATIVE TO VERIFY THE LEGITIMACY OF THIS EVALUATION, PROVIDE THE NAME OF ANGELA JONES AT (415) 972-5333.]

IF RESPONDENT REFUSES, GO TO NEXT SAMPLE POINT.

IF RESPONDENT CANNOT BE INTERVIEWED AT THIS TIME SCHEDULE A CALLBACK FOR: Date/Time: ____

---

1. In which grade levels did you use the Green Schools Curriculum?

2. In your class(es), how many students ***in all*** were exposed to the Green Schools curriculum?

3. During which months did you use the Green Schools curriculum?

4. In each class, ***approximately*** how many classroom hours did you devote to the Green Schools curriculum?

   ___ class #1

   ___ class #2

   ___ class #3

   ___ class #4

   ___ class #5

5. On a scale of one to five, with a one indicating "Not At all Effective" and a five indicating "Very Effective," how effective do you think the each of the following were (READ) . . .

   ___ [READ ONLY IF RECEIVED STEM TRAINING] the STEM training
   ___ the Green Schools workshops
   ___ The Green School Guide to Project Resources/curriculum materials

6. On a scale of one to five, with a one indicating "Not At All Effective" and a five indicating "Very Effective," how would you rate, *as a teacher*, the overall educational effectiveness of the Green Schools Program for your grade level? ________

7. What have you done to make sure that, when your school completes the Green Schools Program and students exposed to the Green Schools Program graduate from your school, the energy saving behaviors, such as turning out the lights when rooms are not being used, continue.

8. Will you continue to use the Green Schools curriculum during the next school year?
   __ Yes

   __ No

__ Don't Know

9. Do you have any specific recommendations to enhance the Green Schools Program?

10. Would you recommend the Green Schools Program to other teachers in your own school or district or to teachers in other school districts?
    __ Yes

    __ No

    __ Don't Know

In-Depth Interview Guide: Facility Managers/Custodians

Green Schools Program

ID: _______

Date: _______

Name: ____

Title: ____

School:____

Address: ____

Introduction: Hello. I'm __________ with Equipoise Consulting and I've been hired by the Southern California Edison Company to evaluate the Green Schools Program. The California Public Utilities Commission has required that SCE evaluate this program. Our records indicate that you've been involved with this Program and I'd like to talk with you a few minutes about your participation. I want to emphasize that all of your answers will be kept strictly confidential. [IF THE RESPONDENT WISHES TO CONTACT A PG&E REPRESENTATIVE TO VERIFY THE LEGITIMACY OF THIS EVALUATION, PROVIDE THE NAME OF ANGELA JONES AT (415) 972-5333.]

IF RESPONDENT REFUSES, GO TO NEXT SAMPLE POINT.

IF RESPONDENT CANNOT BE INTERVIEWED AT THIS TIME SCHEDULE A CALLBACK FOR: Date/Time: ____

1. When did you begin your involvement with the Green Schools Program?
2. What role did you play in implementing the Green Schools Curriculum?

3. **IF ATTENDED A WORKSHOP**: On a scale of one to five, with a one indicating "not at all effective" and a five indicating "very effective," how effective do you think the workshops were?

   ____

4. Overall, how did the students in your school respond to the Green Schools Program?

5. On a scale of one to five, with a one indicating "not at all effective" and a five indicating "very effective," how would you rate the overall effectiveness of the Green Schools Program?

6. What have you done to make sure that, if you were to move on to another job, the energy saving behaviors, such as turning out the lights when rooms are not being used and turning up the air conditioner thermostat, continue?

7. Have you installed any energy efficient equipment as a result of the Green Schools Program?

   ___ Yes (PLEASE EXPLAIN:____)

   ___ No (CONTINUE)

8. Over the next 12 months, do you plan to install any (more) energy efficient equipment as a result of the Green Schools Program?

   ___ Yes (PLEASE EXPLAIN:____)

   ___ No (CONTINUE)

9. Do you have any suggestions for promoting the Green Schools Program to more administrators and custodians in your district or in the state?

10. What components of the Green Schools Program did you find to be most effective? The least effective?

11. What were the biggest problems in implementing the Green Schools Program in your school?

12. Do you have any specific recommendations to enhance the Green Schools Program?

Appendix C. Preliminary PEAK Questionnaire

Note to teachers: This bank of test questions was developed to help the project establish pre and post measures of student learning during the use of this teaching unit. For both the pre and post-tests, please identify a minimum of twenty (20) questions that you will administer just before and just after teaching the PEAK Project. For project evaluation purposes, it is very important that the same questions be used for both pre and post testing.

We have attempted to supply you with a broad range of questions so that you can choose those most applicable to the topics you choose to emphasize during your instruction. The bank includes true/false, multiple choice, fill-in-the-blank, short answer, matching and essay questions.

True or False

Water is a form of energy.	**T**	F
Coal is a form of energy.	**T**	F
Electricity is a form of energy.	**T**	F
E is anything that has mass and occupies space.	T	**F**
Efficiency is the effective use of time and energy.	**T**	F
Energy is the ability to do work.	**T**	F
Electrical energy is the energy of charged particles.	**T**	F
The formula for area is L x W.	**T**	F
Volts are the potential for electricity to do work.	**T**	F
One form of electricity is called static electricity.	**T**	F
Lightning results from an imbalance of electrical charges.	**T**	F
Static electricity flows through a conductor.	T	**F**
Current electricity is the flow of charged particles.	**T**	F
Opposite charges repel each other.	T	**F**

Charged objects attract neutral objects.	**T**	F
Friction can cause the loss or gain of electrons.	**T**	F
electricity is produced from a generator.	**T**	F
An insulator reduces the flow of electrons.	**T**	F
An electroscope is a device that demonstrates static electricity.	**T**	F
Lights in the average home are fluorescent.	T	**F**
A fluorescent light is more efficient than an incandescent light.	**T**	F
An electromagnet's motion generates electricity.	**T**	F
An electric current in a motor causes an electromagnet to rotate.	**T**	F
It is safe to use a hairdryer in the bathroom.	T	**F**
Electricity can jump through the air.	**T**	F
A calculator will help you solve kilowatt usage.	**T**	F

Multiple Choice Questions

One form of energy is:

a. coal

b. electricity

c. minerals

d. gas

The smallest point of an element is called:

a. an atom
b. a molecule
c. a cell
d. a nucleus

The part of the atom that conducts electricity is called the:

a. proton
b. neutron
c. electron
d. quark

______ is the flow of electrons through a wire.

a. current
b. tide
c. waves
d. volts

A D cell battery has how many volts?

a. five
b. nine
c. ten
d. twelve

The instrument used to measure electric current is:

a. an amp meter
b. a calculator
c. a thermometer
d. a generator

The flow of electrons in a wire is measured in:

a. amps
b. inches
c. grams
d. liters

Thomas Edison invented the:

a. light bulb
b. electricity
c. television
d. battery

The light produced by a light bulb is measured in:

a. watts
b. degrees
c. grams
d. electrons

Static electricity is caused by:

a. the build up of an electrical charge
b. higher temperatures
c. a loss of atoms
d. an increase in mass

A wire used in light bulbs is:

a. silver
b. tungsten
c. gold
d. iron

A force of attraction or repulsion is called:

a. magnetism
b. energy
c. water
d. heat

The formula for area is:

a. E=MC2
b. L X W X H
c. Mass X Volume
d. L X W

Power is measured in:

a. watts
b. degrees
c. grams
d. amps

A material that allows an electric current to pass through it easily is a:

a. conductor
b. resistor
c. insulator
d. magnet

An incandescent light bulb contains:

a. a filament
b. gas
c. a battery
d. a magnet

A kilowatt is:

a. 1,000 watts
b. 100 watts
c. 60 watts
d. 1,000,000 watts

What is the peak period of electrical demand?

a. 6 AM – Noon
b. 6 PM - Midnight
c. Midnight- 6 AM
d. Noon - 6 PM

What is the greatest energy user in the average home?

a. refrigerator
b. television
c. computer
d. hair dryer

Of the following what is the greatest energy user in the average home?

a. lights
b. computer
c. electric stove
d. television

Which of these does not use electricity?3-5

a. **Book**
b. Light
c. Fridge
d. computer

What is the only thing you should put in an outlet?3-5

a. fingers
b. cat's Tail
c. plug
d. pencil

What doesn't mix with electricity?3-5

a. switches
b. water
c. fuses
d. extension cords

What controls a light?3-5

a. an adult
b. a switch
c. electricity
d. the power station

Why is it safe to use an electric toothbrush in the bathroom?6-8

a. the dentist recommended it
b. it is low voltage and runs on batteries
c. that's the place you keep the toothpaste
d. it doesn’t use electricity

Which of these appliances uses the most electricity?6-8

a. electric heater
b. television
c. computer
d. stereo

How many extensions is it safe to run off one outlet?6-8

a. One
b. Two
c. Three
d. four

What does a fuse do?6-8

a. holds the plug together
b. prevents too much electricity from flowing into an appliance
c. keeps the electricity bill down
d. alternates the current

Why should you never have an extension cord coiled up when it’s in use? 6-8

a. it doesn't look nice
b. you might trip over it
c. to prevent it from overheating
d. it might short out

Before cleaning an appliance you should always:6-8

a. turn it off
b. turn it off then unplug it
c. move it away from the wall
d. take it apart

What would you do if you found a damaged plug on an extension cord? 6-8

a. unplug it and cut off excess wires
b. unplug it, cut the cord and replace it with a new one
c. ask an expert to fix it
d. call the electric power company

Why are appliances grounded?8-12

a. so they stay on the ground
b. to prevent you from getting an electric shock if they break
c. so you don't need a fuse
d. in order to complete the circuit

Which of the following is the best conductor?8-12

a. Copper
b. Plastic
c. glass
d. wood

Which of the following is the best insulator?8-12

a. air
b. plastic
c. copper
d. iron

Why should you never leave a computer on standby overnight?8-12

a. it might overheat
b. they may use 60% as much electricity as when they are on
c. you might run out of electricity
d. it might damage the computer

What should you do if someone gets an electric shock?8-12

a. call 911

b. call the power company
c. throw water on them to revive them
d. take them to the doctor

There are 3 wires connected in a plug top. What is the color of the live wire? 8-12

a. black
b. brown
c. yellow
d. green

How many hours can you use a 100-watt bulb for 1 unit of electricity?8-12

a. One hour
b. Ten hours
c. Fifteen hours
d. One hundred hours

In a wide, thick wire, the flow of electrons will be ________ in a thin, narrow wire.

a. the same as
b. lesser than
c. greater than
d. warmer than

The reaction taking place in a battery that supplies the eletrical current is

a. electrical
b. kinetic
c. mechanical
d. chemical

Short Answer

How can you maintain efficiency in an electric dryer?

How is electricity made?

How can you get your freezer to work more efficiently?

Is your oven more efficient than your microwave?

How would you define energy?

What is the easiest way to conserve electricity?

Why can birds sit on electrical wires without being electrocuted?

What is one of the promising renewable sources of energy?

What unit is used to measure the amount of energy a battery holds?

What materials don't conduct electricity?

Electricity caused by negative and positive energy in the clouds is called what?

What is the natural source of electricity?

Which part of the light bulb gives out light?

Is there evidence of any other form of energy besides light coming from the light bulb?

About how many years has the incandescent bulb been in use?

How many kilowatts are there in 47,500 watts?

What is meant by a peak energy period?

Approximately what percentage of the world's electricity is generated by the earth's 350 to 400 nuclear power plants?

Why is it important to know what ".txt" means?

What does “default” mean when working with a computer?

What is meant by the expression “floor plan”?

What does a switch do to an electric circuit?

In using the room building program, what should you do after naming your file?

How do you input your name and the price per kW into the program?

Where can you find the calculator in the program?

Why is it important to save frequently?

How do you view your monthly bill on the room building program?

How do you create an appliance that is not on the default list?

How do you access the PEAK web links?

If you keep adding light bulbs in a series circuit attached to a battery, what will happen?

If you keep adding light bulbs in a parallel circuit attached to a battery, what will happen?

Fill In the Blank

The substance that conducts ions in a battery is called an electrolyte.

A pencil lead added to a circuit is a resistor because it alters the flow of electricity.

Electromagnets are produced by placing a metal core inside a coil of wire carrying an electric current.

The negative electrode supplies the current that flows through the load and is accepted by the positive electrode. (Same word for each blank.)

Conduction occurs when heat is transmitted through an object.

An ammeter can be used to measure current.

Each quark has either a positive or negative charge.

Galvanometers are used to indicate that currents are being produced by a generator.

In an atom, the negatively charged particle is the electron.

An electric cell produces electricity from a chemical reaction.

The purpose of a rheostat is to control the flow of energy in order to control the amount of energy a device puts out.

A unit of current is called an ampere.

Current occurs when a negative charge moves around an electric circuit.

The Electromagnetic Force is the result of atoms being composed of positively, negatively or neutrally charged particles.

If the resistance increases, the current decreases and the voltage increases.

The lights typically found in the home are the incandescent type.

Light output from a bulb or other light source is measured in lumens.

Halogen bulbs are filled with a special gas and create a very white light. They are especially good for viewing colors.

Fluorescent lights are by far the most efficient bulbs.

If two materials are rubbed together and the electrons from one are rubbed onto the other, the build up of electrons is called static electricity.

Match the Following

1. 1000W =
2. Energy =
3. Power =
4. V =
5. P =
6. Desk lamp
7. R =
8. Rechargeable toothbrush
9. Pancakes
10. Fireplace
11. Switch
12. Circuit Breaker
13. Light
14. Battery

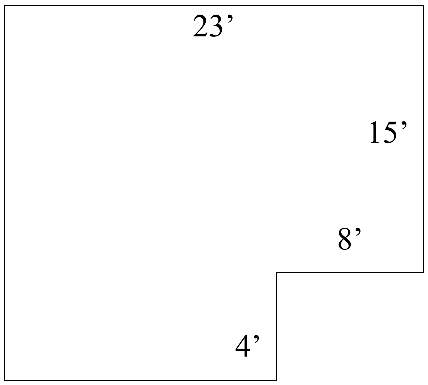
A. Resistance Volts x Amps
B. Voltage
C. Power (watts) x Time
D. Electrical Energy
E. Chemical Energy

F. Heat Energy
G. Resistance
H. Light Energy
I. Voltage in volts x Current in amps
J. Current
K. Kw
L. (breaker symbol)
M. (light symbol)
N. (battery symbol)

[The A, B… list will be reordered when we get the content we want.]

Essay Questions

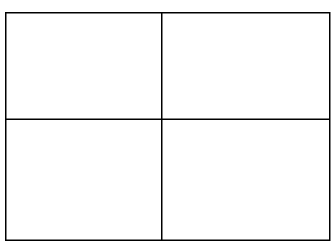
Illustrate and explain how you would find the area of the room drawn below.



Explain why you need a different kind of wire inside a light bulb and to get power to the light bulb.

Trace the energy flow from a dry cell to a flashlight bulb. Four forms of energy should be listed.

On the graph below, label the *x* and *y* axes. Then correctly label them kW and time.



If you compare just fluorescent bulbs, which are the best? Explain your answer.

Which bulbs are the most efficient and why?

If you focus on incandescent bulbs only, which are the best? Explain your answer.

Picture a coal burning power plant that supplies electricity to a large city. Beginning with a building in that city, trace back the energy conversions that had to have taken place between the building and the original source of energy.

Explain why fluorescent bulbs are more efficient than incandescent bulbs.

What is the advantage of a Combined Heat and Power (CHP) station over an ordinary power plant?

Name and briefly describe three alternative energy sources that can be tapped to provide electricity. Explain why each is environmentally preferable.

Explain the difference between KW and KWH.

How can you reduce the kilowatts used in your home and in your school?

What do save, transfer and delete mean when you are using the computer?

In the room building program, describe the processed used to save your file.

Describe the process of adding a room to an existing house in the room building program.

Appendix D. Weather-Adjusted kWh Savings Estimates for the Green Schools Program

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH MARCH 2001

Workman High School

ELECTRICITY (KWH)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $.12/kWh**
Sept	235,386	233,993	1,393		
Oct	221,427	232,402	-10,975		
Nov	233,628	204,600	29,028		
Dec	202,428	220,667	18,239		
Jan	240,715	188,232	52.483		
Feb	226,225	196,244	29,981		
March	218,846	179,776	39,070		
Total	**1,578.645**	**1,455,914**	**122740**	**7.7**	**$14,729**

GAS (THERMS)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $ .60/Therm**
Aug	1,455	589	866		
Sept	2,664	1,015	1,649		
Oct	4,868	4,700	168		
Nov	8,188	9,702	-1,514		
Dec	7,207	8,966	-1,759		
Jan	9,051	11,308	-2,257		
Feb	9,999	10,550	-551		
March	5,034	7,199	-2,165		
Total	**48,466**	**54,029**	**-5,563**	**-11.5**	**-$3,338**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH MARCH 2001

SIERRA VISTA MIDDLE SCHOOL

ELECTRICITY (KWH)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $.12/kWh**
Sept	64,195	56,880	7,315		
Oct	55,714	55,800	-86		
Nov	50,636	41,250	9,386		
Dec	54,237	41,040	13,197		
Jan	79,723	53,040	26,683		
Feb	48,236	43,280	4,956		
March	56,877	43,360	13,517		
Total	**409,618**	**334,650**	**74,968**	**18.3**	**$8,996**

GAS (THERMS)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $ .60/Therm**
Aug	133	25	108		
Sept	393	51	342		
Oct	898	89	809		
Nov	1,560	1,299	261		
Dec	1,532	1,500	32		
Jan	1,688	1,681	7		
Feb	1,963	2,383	-420		
March	1,034	838	196		
Total	**9,201**	**7,866**	**1,335**	**14.5**	**$801**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH MARCH 2001

WING LANE ELEMENTARY SCHOOL

ELECTRICITY (KWH)

Month	Baseline	Actual	Savings	Percentage	Dollars @ $.12/kWh
Sept	27,334	21,200	6,134		
Oct	23,028	26,240	-3,212		
Nov	22,391	23,680	-1,289		
Dec	18,257	19,360	-1,103		
Jan	20,353	20,080	273		
Feb	10,518	11,680	-1,162		
March	19,831	19,520	311		
Apr	26,469	16,880	9,589		
Total	**168,181**	**158,640**	**9,541**	**5.7**	**$1,145**

GAS (THERMS)

Month	Baseline	Actual	Savings	Percentage	Dollars @ $ .60/Therm
Aug	119	51	68		
Sept	282	64	218		
Oct	682	231	451		
Nov	1,192	693	499		
Dec	1,076	444	632		
Jan	1,377	1,809	-432		
Feb	1,494	1,919	-425		
March	631	759	-128		
Total	**6,853**	**5,970**	**883**	**12.9**	**$530**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH MARCH 2001

Bassett HIGH SCHOOL

ELECTRICITY (KWH)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $.12/kWh**
Sept	202,892	171,723	31,169		
Oct	164,054	150,288	13,766		
Nov	141,611	145,046	-3,435		
Dec	139,240	166,186	-26,946		
Jan	128,143	81,360	46,283		
Feb	110,583	136,176	-25,593		
March	167,220	141,597	25,623		
Total	**1,053,745**	**992,376**	**61,369**	**5.8**	**$7,364**

GAS (THERMS)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $ .60/Therm**
Aug	5,296	1,523	3,773		
Sept	5,517	3,601	1,918		
Oct	6,748	5,027	1,721		
Nov	7,385	3,746	3,639		
Dec	7,622	3,926	3,696		
Jan	8,244	5,829	2,415		
Feb	7,856	6,964	850		
March	8,756	4,133	4,623		
Total	**57,382**	**34,749**	**22,633**	**39.4**	**$13,580**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH MARCH 2001

TORCH INTERMEDIATE SCHOOL

ELECTRICITY (KWH)

Month	Baseline	Actual	Savings	Percentage	Dollars @ $.12/kWh
Sept	62,678	51,800	10,878		
Oct	55,319	52,000	3,319		
Nov	53,011	47,640	5,371		
Dec	44,676	30,920	13,756		
Jan	42,323	40,600	1,723		
Feb					
March					
Total	**258,006**	**222,960**	**35,046**	**13.6**	**$4,206**

GAS (THERMS)

Month	Baseline	Actual	Savings	Percentage	Dollars @ $ .60/Therm
Aug	412	119	293		
Sept	462	213	249		
Oct	642	458	184		
Nov	766	906	-140		
Dec	823	1,121	-298		
Jan	794	1,186	-392		
Feb	862	1,392	-530		
March	639	535	104		
Total	**5,400**	**5,930**	**-530**	**-9.9**	**-$318**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH APRIL 2001

EDGEWOOD ACADEMY

ELECTRICITY (KWH)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $.12/kWh**
Sept	39,338	29,720	9,618		
Oct	37,721	30,260	7,461		
Nov	31,028	30,880	148		
Dec	24,508	30,580	-6,072		
Jan	27,176	16,180	10,996		
Feb	19,334	31,740	-12,406		
March	28,894	31,260	-2,366		
Apr	35,313	28,820	6,493		
Total	**243,312**	**229,440**	**13,872**	**5.7**	**$1,665**

GAS (THERMS)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $ .60/Therm**
Sept	826	437	389		
Oct	1,305	571	734		
Nov	1,517	994	523		
Dec	1,544	2,015	-471		
Jan	2,173	3,004	-831		
Feb	1,977	3,157	-1,180		
March	2,474	2,716	-242		
Apr	1,071	1,343	-272		
Total	**12,888**	**14,237**	**-1,349**	**-10.5**	**-$809**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH APRIL 2001

CHARTER OAK HIGH SCHOOL

ELECTRICITY (KWH)

Month	Baseline	Actual	Savings	Percentage	Dollars @ $.12/kWh
Sept	107,435	103,800	3,635		
Oct	99,427	110,700	-11,273		
Nov	45,104	55,800	-10,696		
Dec	123,259	74,800	48,459		
Jan	85,548	40,800	44,748		
Feb	78,843	79,600	-757		
March	71,280	104,000	-32,720		
Apr	97,389	106,400	-9,011		
Total	**708,285**	**675,900**	**32,385**	**4.6**	**$3,886**

GAS (THERMS)

Month	Baseline	Actual	Savings	Percentage	Dollars @ $ .60/Therm
Aug	7,083	641	6,442		
Sept	6,751	2,992	3,759		
Oct	9,280	10,374	-1,094		
Nov	11,800	14,922	-3,122		
Dec	12,676	15,471	-2,795		
Jan	12,210	15,780	-3,570		
Feb	13,710	12,049	1,661		
March	8,714	7,141	1,573		
Apr	6,430	5,578	852		
Total	**88,653**	**84,948**	**3,705**	**4.2**	**$2.223**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH MARCH 2001

ROYAL OAK SCHOOL

ELECTRICITY (KWH)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $.12/kWh**
Sept	81,041	116,520	-35,479		
Oct	106,062	107,280	-1,218		
Nov	104,258	87,060	17,198		
Dec	97,528	81,720	15,808		
Jan	99,305	60,960	38,345		
Feb	47,668	51,660	-3,992		
March	95,063	88,080	6,983		
Apr	116,564	86,640	29,924		
Total	**747,489**	**679,920**	**67,569**	**9.0**	**$8,108**

GAS (THERMS)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $ .60/Therm**
Sept	149	148	1		
Oct	773	621	152		
Nov	1,217	1,518	-301		
Dec	1,335	1,700	-365		
Jan	1,524	2,969	-1,445		
Feb	1,724	3,333	-1,609		
March	804	901	-97		
Apr	327	377	-50		
Total	**7854**	**11,567**	**-3713**	**-47.3**	**$ -2,228**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH MARCH 2001

CEDAR GROVE ELEMENTARY SCHOOL

ELECTRICITY (KWH)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $.12/kWh**
Aug	31,055	31,200	-145		
Sept	38,328	49,560	-11,232		
Oct	35,660	36,640	-980		
Nov	31,010	31,360	-350		
Dec	29,339	22,240	7,099		
Jan	30,661	28,160	2,501		
Feb	29,044	28,320	724		
March	35,233	28,480	6,753		
Apr	34,037	24,320	9,717		
Total	**294,336**	**280,280**	**-14,086**	**-4.8**	**-$1,690**

GAS (THERMS)

Month	**Baseline**	**Actual**	**Savings**	**Percentage**	**Dollars @ $ .60/Therm**
Aug	175	12	163		
Sept	94	65	29		
Oct	355	226	129		
Nov	507	635	-128		
Dec	555	587	-32		
Jan	560	1,321	-761		
Feb	615	1,389	-774		
March	297	649	-352		
Apr	111	473	-362		
Total	**3,270**	**5,357**	**-2,087**	**-63.8**	**-$1,252**

Revised Summary of Savings 6/1/01

SEPTEMBER 2000 THROUGH MARCH 2001

East San Gabriel Valley ROP

ELECTRICITY (KWH)

Month	Baseline	Actual	Savings	Percentage	Dollars @ $.12/kWh
Sept	26,541	29,440	-2,899		
Oct	28,468	23,420	5,048		
Nov	23,610	18,440	5,170		
Dec	25,351	20,320	5,031		
Jan	14,496	16,400	-1,904		
Feb	26,150	19,240	6,910		
March	27,053	19,740	7,313		
Total	**171,669**	**147,000**	**24,669**	**14.4**	**$2,960**

GAS (THERMS)

Month	Baseline	Actual	Savings	Percentage	Dollars @ $ 60/Therm
Aug	157	29	128		
Sept	175	37	138		
Oct	420	226	194		
Nov	602	888	-286		
Dec	660	990	-330		
Jan	742	1,180	-438		
Feb	642	1,111	-469		
March	524	248	276		
Total	**3,922**	**4,709**	**-787**	**-20.1**	**-$472**

Appendix E. Evaluation Results of the PEAK Summer Science Institute

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Report of Student Survey Responses 1

PEAK Project
August 21 – 24, 2000
Summer Science Institute – Student Evaluations
John Adams Middle School, Santa Monica, CA

Students were asked to rate each statement below on a scale of 1 to 5. The directions asked them to circle: *5 if you **strongly agree** with the statement*
*4 if you **agree** with the statement*
*3 if you **neither agree nor disagree** with the statement*
*2 if you **disagree** with the statement*
*1 if you **strongly disagree** with the statement*

Eighty-six (86) students responded to this survey. Of 1,376 possible responses, 35 were left blank, a response rate within the survey of 97.5%. The statements are reproduced below with the mean of all responses to each question appearing in the column to the right of the question. The average response for each cluster of questions appears to the right of the section title. Taken as clusters, the science questions elicited the most positive responses and the software questions the least positive responses. However, these responses ranged from a low average of 3.78 to a high average of 4.14. The low end of this range represents very positive responses on a one to five scale. Mean responses to individual questions ranged from a low of 3.58 (question 2) to a high of 4.21 (question 11).

Item	Mean
SOFTWARE	**3.78**
1. The software was useful in understanding and implementing home energy efficiency.	3.76
2. The software program's graphics made it easy to use.	3.58
3. It was easy to use the different features of the software.	3.82
4. The software was easy to use the very first time.	3.94
MATH	**3.84**
5. The area and measurement portions were understandable.	3.71
6. The energy log taught me that electricity is the most commonly used energy source in my house.	4.02
7. I understood how to fill out the Energy Log for the morning.	3.70
8. The Home Energy Survey was understandable and easy to fill out.	3.94
9. The Wattage Worksheet was easy to understand and complete.	3.85
SCIENCE	**4.14**
10. The electroscope lab taught me about electrons, their flow, and their positive and negative charges.	4.19
11. I learned from the light bulb lab that brighter lights require more energy.	4.21

Report of Student Survey Responses

2

Item	Mean of all Responses
12. The motor lab demonstrated the concept of converting electrical energy to mechanical energy well.	4.01
MISCELLANEOUS	**3.97**
13. The worksheets (wattage worksheet, room map, home energy survey, etc.) supported the software well.	3.93
14. It is important to have lots of graphics and color in the software and on the papers.	4.00
OVERALL	**3.87**
14. I enjoyed the PEAK Project.	3.57
15. I know more about electricity now than I did before I did PEAK.	4.17

COMMENTS

Students were asked to respond to two open ended questions. The first was:
How can we improve the software program?

Seventy-five (75) comments were offered in response to this question.

Sixteen responses, 21.3% asked for

- More appliances such as "more graphics … like fish tanks" and
- By adding a printer or
- Clocks

or included comments about moving the appliances such as

- Being able to put the furniture where it is on the program.

Another thirteen responses, 17.3% mentioned graphics specifically. Of these thirteen, six made general statements such as "fix the bugs" or "make it better." The remaining seven made the following specific suggestions or requests:

- Have people in the house that tell you about stuff
- Make it so that you can make pictures of them from different angles
- By just giving us a room without plants and other space consuming objects
- Make it easier to navigate
- Make it more realistic
- Making it more fun, realistic.
- Make smaller appliances

Six responses, 8% dealt with time and clocks. Four suggested 24 hour clocks or made statements such as

- Make appliances run for 24 hours
- Putting the time on 24 hours

Report of Student Survey Responses

The two other comments about time were:

- Make it so that you can type the hours in. Make it so that you can do one day and make it so it does the rest of the week.
- Fix the zero thing

There were six comments, 8% about lights. These included:

- By making the lights a little easier to make
- When you put in the lights you should be able to change the wattage.
- Easier to do the lights in the house
- Change the way the lights were done (add lamps to appliance etc.)
- Make the lightball thing better

Nine comments, 12% asked that things be "more understandable" or "easier." Specific comments in this vein were:

- Making the worksheet more explainable
- Having less homework
- Have less math
- Have auto calculations on wattage thing
- You can probably make it a little easier but not really easy
- Make it more understandable – mathwise.
- By making more graphics and making the amount of hours you use the appliances for easier to use and understand.
- You make it easier to understand the electric energy bill. Make it easier to do the appliance settings.

Twelve comments, 16% said that it could not be improved and included:

- And I think everything is fine.
- I think there's no changes to be made
- It doesn't need improvement
- I think it's great already
- No way.
- You can't it's really good.

The remaining eleven comments, 14.6% covered a variety of ideas that did not fit clearly into any of the previous categories.

- Another thing is that a few people got negative amounts and it was very confusing. Other than that it was easy to use and it was fun too.
- By letting us use animals like cats and dogs!
- Making sounds
- Make the sheets and program the same.
- Maybe we can check over the program better.
- You can improve it by doing more rooms.

Report of Student Survey Responses 4

- Make it more fun and exciting.
- By teaching more about household item not just the big things.
- Have somewhere to do the math for wattages
- More choices, more understandable graphs
- I'm not sure, but I just did not want to so much work but some of it was fun and I learned a lot!

The second question was:
How can we improve the math and science parts of PEAK?

Students offered fifty-eight (58) responses to this question.
Twenty-two, 37.9%, said that these parts could not be improved. The comments included:

- Can't
- It's ok
- It's fine
- Nothing
- I think that it was perfect. You don't need any changes.
- The math was good and so was the science.
- I like the math and science part of peak.

Six students, 10.3%, said that they didn't know how to improve the science or math.

Eight students, 13.7%, answered that things should be made easier or more understandable without specifying changes. Their comments included:

- Make the directions easier to understand
- Make it more understandable
- Make the Math part easy accessible
- You can probably make it a little easier but not really easy
- Don't making it confusing!

Five students, 8.6%, suggested that these sections be made more interesting or more fun.

Fifteen students, 25.8%, had a variety of somewhat more specific suggestions.

- It was just like what I said before but the light part was a little hard.
- Make the problems easier to solve
- More clarity
- More experiments
- Just make sure everyone gets it
- Explain better
- Make it so that we can do this as a daily thing
- Explain things a little better

Report of Student Survey Responses

- Doing more examples
- Working more with peak.
- Give better instruction
- Put the pages in order
- Have more directions
- Give out sheets on how to read and understand watts
- Talk more about it

And one, 1.7% of the sample, asked simply that there be:
- Less math, PLEASE!

Students were than asked if they had any additional comments and were encouraged to *"tell us anything!"* Thirty students responded to this item.

Twenty comments, 66% were very positive and enthusiastic. Most were general expressions and a few were very specific. They were:
- It was worth learning
- Jeremy is really cool!
- It was Great!
- I loved the teachers and the material
- The teachers were great
- It helped me with science
- I learned what the watts meant on light bulbs
- Thanks for being concerned about wasting energy
- It was a lot of fun. I learned a lot. My parents really thought I it was interesting and neat that we were learning about electricity in our school curriculum
- It is a fun and interesting program
- Nice job!
- It was fun
- I was fun doing the peak program
- It's good
- I liked racing the snails
- It was very fun
- Great
- Peak is a very good program
- I liked the magnet classes and I learned a lot.
- Great Job
- Thanks for Everything!! ☺

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Another four comments, 13.3% might be characterized as moderately or reluctantly positive.

- I enjoyed the peak program but we had a little bit of time
- It's fine
- It was fun sometimes
- I don't like work, but this was o.k.

Five comments, 16.6% added specific ideas or reiterated prior statements.

- On the worksheet you say to measure in meters. On the program you have to convert into ft.
- Make it interesting to use?
- MAKE IT MORE UNDERSTANDABLE
- Give a little less homework
- Bugs: can't make anything on a 24h day. Putting no wattage makes the program unstable. Other than that: Good Program

One student representing 3.3% of the sample was skeptical.

- What I answered above had to do with my thoughts. Maybe this program was all about preventing brown outs, but sometimes I think it's boring and just a program to save money for low budget school. Not that that's bad, it's just we already do turn off lights when we leave a room. (most of us)

Appendix F. References

References

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