Evaluation of the School Energy Efficiency Program

Final Report

Program 1190-04

Prepared for D&R International and the
California Public Utilities Commission

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Overview

Itron, Inc (Itron) respectfully submits this final report of the School Energy Efficiency Program (SEE) evaluation. The SEE Program was implemented by D&R International (D&R) and funded by Public Goods Charges (PGC) paid by utility ratepayers under the auspices of the California Public Utilities Commission (CPUC). This program provided participants with information and recommendations for energy efficiency improvements of school facilities and provided educators with education materials for teaching students about energy use and energy efficiency. D&R implemented this program from mid-2004 through June 2006.

California's K-12 public education sector faces financial and administrative barriers that pose considerable challenges in educating the state's youth, as well as institutional barriers in facility development, procurement, and operations and maintenance budgets that limit districts from developing long-term energy-use reduction strategies. Specific barriers facing schools with respect to the adoption of energy efficient technologies and energy-related education are summarized below.[1]

- ***Organizational practices barrier.*** District equipment procurement practices for modernization/renovation projects often do not incorporate energy efficient technologies. Moreover, decision makers tend to focus on first costs rather than the stream of benefits in the future. Budgetary and state funding timelines often force districts to complete plans in a very short period in order to secure funding, which is often awarded on a first-come, first-served basis. Compounding the issue is the cost of maintenance for energy efficient equipment that can be more complex than the less efficient standard equipment (chiller versus rooftop air conditioning units, for example) and the training required for such maintenance by facility staff.

  Educators also face institutional barriers. Some districts have more oversight and involvement in selecting the materials and lessons to be used at each grade level (an established district curriculum or through district science coordinator, for example). Additionally, because lessons are often planned far in advance and follow a well-established schedule, it is difficult for teachers to incorporate new

[1] A discussion of market barriers in the education sector can be found in:
Ridge & Associates. *California Schools Market Characterization.* September 20, 2005.

materials into their lesson plans. Doing so often takes six months or more in advance.

While not a market barrier, *per se*, California's Learning Standards strongly influence what and how subjects are taught in the classroom. The California Learning Standards were designed to "encourage the highest achievement of every student by defining the knowledge, concepts, and skills that students should acquire at each grade level."[2] The Standardized Testing and Reporting (STAR) program is administered to hold schools (and students) accountable to the established learning standards. Because of the emphasis placed on teaching to the Standards and the STAR program results, educators are reluctant to implement any materials, activities, or lessons not correlated to the Learning Standards. Moreover, educators are reluctant to even *try out* new materials for fear that they might not be effective in teaching required concepts or skills.

- ***Information and search costs barrier.*** Lack of awareness of the value of energy efficiency, ultimately due to the fact that energy costs are a fairly low percentage of overall operating costs and the relatively low interest/importance of energy efficiency compared to other education-related priorities. Many schools do not have (or cannot afford) in-house technical expertise to identify and analyze energy use reduction opportunities. Moreover, professionals on the design team (architects, engineers, lighting designers, etc.) lack the information and/or experience to specify energy efficient technologies.

  Educators also face information and search cost barriers with respect to identifying appropriate educational materials that teach students about energy use and energy efficiency. Under time and financial constraints, educators often fall back on well-established curriculum and materials used and recommended by their district, school, or peers.

In California, there are many energy efficiency programs targeted to schools to reduce these barriers. Those with a facility focus are designed to encourage equipment installations and behavioral changes to reduce energy use and demand. Curriculum-based programs strive to introduce educational materials about energy use and conservation into the classroom with the hopes the materials will ultimately be adopted as part of the district's or school's established curriculum. A recent characterization of the California K-12 schools market identified 18 facility- or curriculum-based programs in the state.[3]

The 2004-06 SEE Program was an "information-only" program designed to provide K-12 districts with the resources and information that will help reduce some of these barriers and instill sustainable energy-conscious behavior and practices in both students and district staff. The basic premise of the program was to encourage energy-conscious behavior and

[2] California State Board of Education, http://www.cde.ca.gov/be/st/ss/.

[3] Ridge & Associates. *California Schools Market Characterization.* September 20, 2005.

behavioral changes throughout the public education community that would lead to sustainable reductions in energy use.

This program was an extension of the 2002-03 program of the same name administered by the State and Consumer Services Agency (SCSA) and later the CIWMB. Building on the SCSA/CIWMB program, the overarching objectives were to educate school facility staff and district administrators about energy efficiency concepts and practices and to provide educators with a conduit to energy efficiency related curriculum.

The program offered participating districts general information, energy education teaching materials and student activities, teacher and facility staff training workshops, facility energy-use benchmarking and audits, and technology demonstration projects. The premise of the SEE Program model was not to replicate valuable resources already available, but rather to streamline the process by which districts access them. The delivery of the program was somewhat complex because not all participating districts received all services offered. Rather, the program offered resources to each district based on district needs and the availability and interest of staff to devote time to work with the program.

The remainder of this section summarizes the SEE Program model, characterizes program participation, and presents key evaluation results. The final subsection provides an outline of the remainder of this report.

1.1 Program Background

The SEE Program began as a pilot program in 2001 with the Fresno Unified School District. It was implemented by the SCSA with "back office" implementation support from D&R. SCSA proposed and was awarded PGC funding to implement an expanded SEE Program as a third-party implementer in the 2002-03 energy efficiency program term. Due to changes in the administration of the SCSA (resulting from the State of California's gubernatorial changes), the administration of the SEE Program was transferred to the California Integrated Waste Management Board (CIWMB). The SCSA/CIWMB program model involved co-funding numerous agencies and organizations, as partners of the SEE Program, to offer a menu of educational and technical services to a target of 55 school districts. The primary role of SCSA, and later the CIWMB, was coordination of services available through the established network of program partners.

D&R submitted a program proposal and subsequently received funding to implement the program in the 2004-05 program term.[4] Recognizing that some aspects of the SCSA/CIWMB program were successful and others were not, D&R researched the

[4] D&R International. *Schools Energy Efficiency Program: Program Implementation Plan.* March 12, 2004.

SCSA/CIWMB program in-depth and continued elements that worked and discontinued those that were unsuccessful. The evaluation of the SCSA/CIWMB program[5] identified several shortcomings, many of which were attributed to implementation by a state agency (SCSA) that was transferred to another state agency (CIWMB) midstream. Additionally, the SCSA/CIWMB program was based on a partnership model that involved nine partnering agencies and organizations to provide facility and education services to participating districts. While individually the program partners could provide valuable services and information to schools, the program delivery did not have a clear and established coordination and communication plan and the number of organizations providing services confused participants. Thus, D&R streamlined the new SEE Program model by virtually eliminating the SEE partnership functions, which improved operational efficiency and minimized administrative and reporting burdens.

The implementation period of D&R's SEE Program began in mid-2004 and ended in June 2006. The program implementation timeline included an initial period of research and program development, a second stage of intense marketing and outreach, followed by a long period of providing services to participating districts. One-third of the program participants signed agreements to work with the SEE Program within the first three months after the program launch date; 90% had entered into agreements to participate by the end of the second quarter of 2005.

In August 2005, D&R submitted a request to transfer unspent funds from the SCSA/CIWMB program to the current program to offer additional services to SEE Program participants.[6] The unspent funds were determined to result from unexpected program delays (such as the transfer of the program from the SCSA to the CIWMB) rather than lack of demand. In the request, D&R noted that without the additional funds, the current program would be over-subscribed. In response, the CPUC ordered that D&R's SEE Program "shall be allocated any remaining funds related to the [CIWMB]'s 2002-03 School Energy Efficiency Program…"[7] In this same decision, the CPUC awarded D&R a no-cost extension through the end of the academic school year (June 2006), comparable to that awarded to other school sector programs. After receiving the time extension and funding increase, D&R ramped up marketing and outreach. Three additional districts signed agreements to participate in the latter part of 2005 and in early 2006. The reporting for the CIWMB program, however, was

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5 Evaluation results of the 2002-03 program are documented in:
Vanward Consulting, Equipoise Consulting Inc., Ridge & Associates, and Shel Feldman Management Consulting. *Final Report for the Evaluation of the 2002-2003 School Energy Efficiency Program.* February 14, 2005.

6 *Motion of D&R International and California Integrated Waste Management Board for Transfer of Funds between School Energy Efficiency Programs.* August 22, 2005 (served May 4, 2005).

7 California Public Utilities Commission. D. 05-10-024. *Opinion Modifying Decision 03-12-060 in Response to Various Motions Asking to Shift Funds or Extend Time.* Ordering Paragraph 6. October 28, 2005.

not completed in order for the unspent funds to be verified and thus transferable to D&R's 2004-05 program. D&R abruptly closed the program in the spring of 2006 and was unable to provide comprehensive services to some of the late participants.

1.2 Program Objectives and Model

The overarching objectives of the SEE Program are to provide program services that would result in the following:

- Increased energy efficiency awareness, and
- Increased energy efficiency of California school buildings.

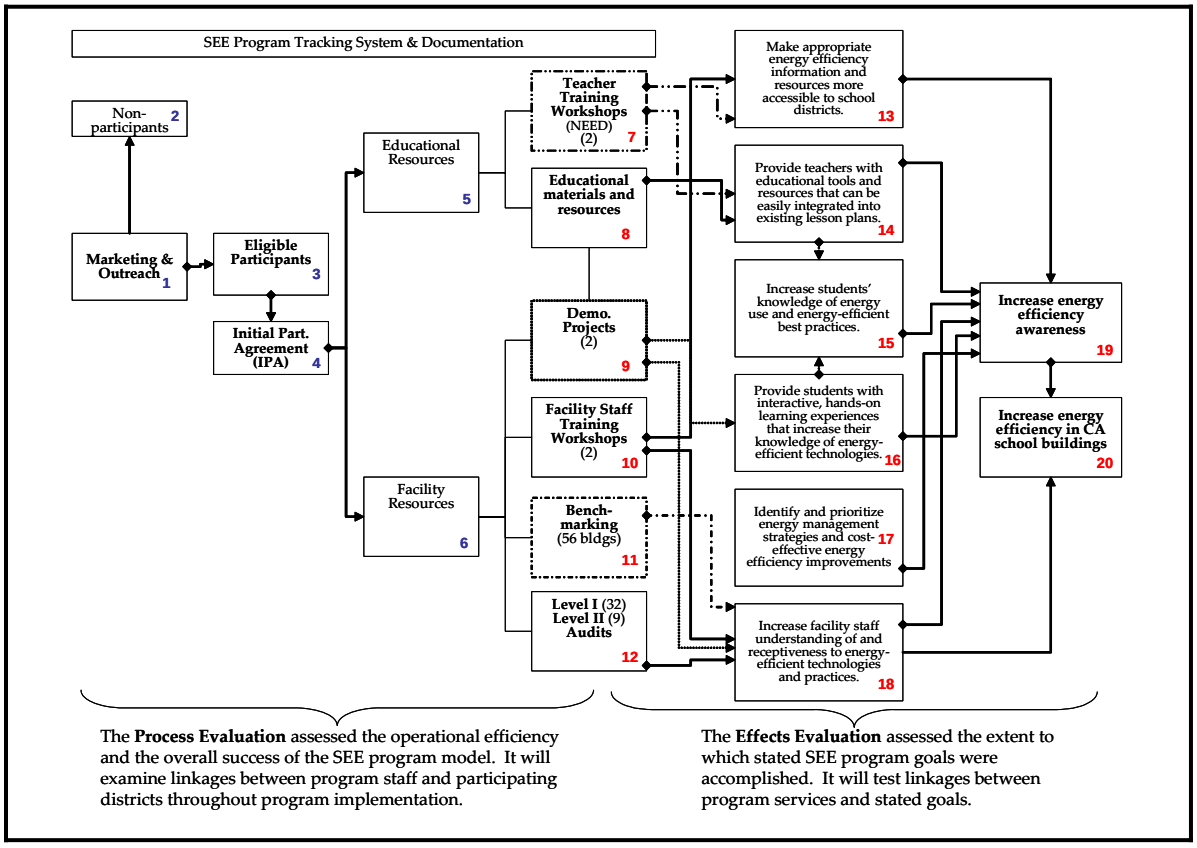
Figure 1-1 depicts the SEE Program model.[8] The left portion of the figure (boxes 1 through 12) depicts program services and delivery mechanisms, while the right half (boxes 13 through 20) represents program objectives (as stated in the Program Implementation Plan, or PIP[9]). In totality, the figure illustrates how the SEE Program was designed to deliver services to participating districts that will ultimately achieve these broad objectives.

Once an eligible district expressed interest and committed to participate, the district representative signed an Initial Participation Agreement (IPA). The IPA provided an overview of the program and represented district commitment. One or more district representatives would then work with SEE Program staff to identify appropriate program services—facility and/or education—that would be provided to the district. As shown in Figure 1-1, once a district was determined to be eligible and signed an IPA, the SEE Program offered two categories of services: educational or facility (boxes 5 and 6, respectively).

[8] Itron developed this diagram as a result of periodic meetings, informal discussions, and in-depth interviews with D&R's implementation team and has updated the model when changes were made to the program model and/or delivery.

[9] D&R International. *Schools Energy Efficiency Program: Program Implementation Plan.* March 12, 2004.

Figure 1-1: SEE Program Model



Numbers in parentheses in boxes 7-12 are quantitative goals, per the PIP.
Broken lines between boxes 7-12 and boxes 13-17 are used only to help the reader follow the linkages.

1.2.1 Facility Services

The overall objectives of the facility component of the SEE Program were to increase decision maker understanding of the benefits of energy efficiency and to increase their knowledge and awareness of school energy use by:

- Developing an energy-use baseline that provides districts with a basis for prioritizing investments, and implementing energy management strategies,
- Identifying cost-effective energy efficiency opportunities that the participating district can implement to reduce annual energy use, and
- Providing districts with an energy management plan to use as a template for next steps in identifying and developing energy efficient improvement projects.

Facility-related services available through the SEE Program included the following:

- Facility management training workshops on energy efficient operations and maintenance practices and energy efficient technologies (box 10 in Figure 1-1),

- Energy use benchmarking to understand current facility energy use and to identify sites in most need of energy efficient modernization (box 11),
- Energy performance facility audits to identify specific retrofit opportunities and estimate savings (box 12), and
- Technology demonstration sites to highlight energy efficient technologies in a real-world application. The demonstration projects were also intended to benefit educators (and students) by providing a learning lab for educators to develop energy-related lessons and projects for students (box 9).

D&R used the U.S. Environmental Protection Agency's Energy Performance Rating system, available through ENERGY STAR's® Portfolio Manager program, to benchmark school site energy performance for selected school sites of participating districts.[10] Portfolio Manager is an Internet-based interface through which monthly energy usage and site characteristics are uploaded into the program.[11] Portfolio Manager produces two energy performance metrics: an overall, non-fuel specific energy use intensity (kBtuh/ft^2) and an Energy Performance Rating (EPR). The EPR is a score on a scale of 1 to 100 that indicates how the evaluated site compares to similar sites nationwide. An EPR score of 50 means that 50% of comparable facilities nationwide are less energy efficient and 50% of comparable buildings nationwide are more energy efficient. For each site, a Statement of Energy Performance document is produced that summarizes key site characteristics and the benchmark results.

One value of the EPR is that it provides an apples-to-apples comparison, or ranking, of similar facilities within a customer's building "portfolio" or to other similar buildings with respect to energy consumption. This comparison allows school district facility managers, for example, to identify the school sites most needing energy efficiency improvements.

In addition to energy use benchmarking, the SEE Program conducted facility audits at select school sites to further assist districts in the identification and prioritization of cost-effective energy efficiency improvement opportunities. SEE Program staff conducted facility audits for participating districts at school sites specifically selected by the district, most likely to implement energy efficiency upgrades, or potentially had the greatest building upgrade opportunities. Two types of audits were offered through the program, depending on the complexity of the school site. The Basic Level I audit covered measures such as lighting retrofits, occupancy sensors, vending misers, variable frequency drives, and high efficiency motors. The Advanced Level II audit covered more complex measures/systems, such as boilers/boiler replacements, and chillers/cooling tower replacements.

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[10] See: http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.

[11] Energy use is benchmarked against energy consumption and building characteristics data obtained from the 1999 Commercial Buildings Expenditures and Consumption Survey (CBECS).

The result of each audit was summarized in an Energy Management Plan (EMP) and presented to the district representative. The EMP summarized key site characteristics, presented energy efficiency recommendations, and provided lifecycle and cost analysis for all recommended energy efficiency measures. The EMP also recommended "next steps" for implementing the recommendations.

In select districts, demonstration projects were installed to showcase energy efficient technologies in a "real-world" setting. All participating districts were eligible to host a demonstration project. Final site selection was jointly determined by SEE Program representatives and district decision makers. The demonstration projects were to be installed in districts that had a high potential for expansion into a full-scale retrofit and that would provide educational opportunities for facility personnel (within the district and those in other districts) with respect to technology benefits. The demonstration projects were also used to engage students by providing hands-on learning opportunities.

1.2.2 Education Services

The overall objective of the education component of the SEE Program was to help educators identify and integrate energy efficiency education into the classroom by:

- Creating an effective, interactive learning experience for K-12 students that focused on energy and encouraged behavioral changes that reduce school energy use, and
- Providing effective educational resources and support to teachers, resulting in an integration of efficiency education into their lesson plans and/or school curricula.

Program services offered to participating districts as a means of achieving these goals included the following:

- Professional development training on energy efficiency related educational materials (box 7 in Figure 1-1),
- Provision of a variety of educational materials for all grade levels (box 8), and
- Development of learning activities based upon technology demonstration sites installed through the facility services component of the program (box 9).

To develop a "menu" of offerings to teachers in participating districts (box 8 in the figure), D&R conducted a comprehensive review of the materials included in the SCSA/CIWMB program educational components and other energy efficiency and conservation educational tools and available resources. Primary considerations for selecting materials for the program included the following:

- Correlation to the California Learning Standards,

- Education of students about energy, energy use, and/or energy efficiency (energy production, energy consumption, how energy and energy use relate to the environment, the economy, and society),
- Likelihood of use beyond the program period,
- Ability to engage students,
- Ease of use,
- Ability to encourage the use of the school site as a learning lab, and
- Grade level.

The final "menu" included a selection of materials developed by the National Energy Education Development Project (NEED)[12] and an array of other educational resources. The NEED materials and some, but not all, of the supplemental resources are correlated to the California Learning Standards. Collectively, the selected resources identified in the early stage of program development were intended to provide educators with a comprehensive offering of materials and activities for all grade levels. The premise was to review the "menu" with participating educators and to identify an assortment of materials that fit well into their lesson plans and unique teaching styles. D&R soon recognized that the NEED materials were comprehensive enough and met the needs and interests of most participating educators. The NEED materials became the core of the educational services offered through the program and the remaining resources were offered but considered supplemental. The final inventory of educational materials available through the SEE Program is provided in Appendix H.

In addition to offering the materials at no cost to teachers, D&R provided, through a subcontract with NEED, training on the NEED materials (box 7 in Figure 1-1). This training was a logical offering of the program, since the majority of materials provided through the program were developed by the NEED Project.

No direct student education was offered through the SEE Program, but it was assumed to occur as a result of the educational materials and NEED training offered to teachers who chose to integrate the SEE Program materials into their curriculum.

The educational services of this program were delivered at the teacher and school levels rather than at the district level. SEE Program representatives worked individually with interested educators at participating districts to identify materials and resources that best fit their lesson plans and teaching styles, and thus most likely to be implemented. Once teachers

[12] https:www.need.org.

received the identified materials, the SEE Program provided follow-up support to ensure successful implementation of the lessons and activities.

1.2.3 Target Market

The target market for the SEE Program was K-12 public school districts located in PG&E's service territory. This area encompasses 46 counties and 681 school districts, with total enrollment well over two million students.[13] Districts participating in other school programs funded with PGC funds could participate in the SEE Program as long as the service or services provided were not duplicative of those provided by the other program(s).[14] Through the course of implementation, and particularly in the early outreach phase, D&R coordinated with other program implementers to prevent overlap and duplication of efforts between the programs. D&R worked closely with PG&E's School Resources Program (SRP) and the Alliance to Save Energy's (ASE) Program in the initial phase of the program and throughout implementation to minimize customer confusion and align program activities. The SEE team also coordinated activities in the initial phase of the program with the CIWMB to insure a smooth transition between the previous SEE Program and the 2004-06 SEE Program. Working with the CIWMB, PG&E, and the ASE allowed each implementer the opportunity to leverage resources and optimize services to the K-12 sector.

1.2.4 Program Eligibility

All school districts in the PG&E service area were eligible to participate in the SEE Program. Carry-over districts from the SCSA/CIWMB program, however, were only eligible to receive services different in the current program from the 2002-03 period to be considered a participant. In addition to K-12 public school districts, COEs and Offices of the Superintendent, which have oversight over facility management and student education (some of which have their own schools/classroom buildings), were eligible to participate in the program.

1.2.5 Marketing and Outreach and District Recruitment

D&R's marketing and outreach strategy appears to have been comprehensive and effective. D&R developed and used a mix of outreach materials to market the SEE Program to eligible districts, and identified key decision makers in the K-12 education sector to successfully identify decision makers and recruit districts into the program. Brief descriptions of program outreach and marketing materials and efforts are provided below.

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[13] Information available at www.cde.ca.gov.

[14] Overlapping programs in the 2004 – 2005 program cycle included PG&E's School Resource Program and the Alliance to Save Energy's Green Schools Program.

- **Program Literature.** Program literature, including both print and electronic pieces, provided varying ranges of program information and detail and targeted different audiences and decision makers.
- **Outreach Methods.** D&R disseminated program information through a variety of methods including postal mail, e-mail, industry newsletters, web site postings, web site links, one-on-one meetings, group presentations, and displays and presentations at industry conferences. Additionally, D&R sent letters to District Superintendents and made presentations at monthly superintendents' meetings, which were also attended by school principals.
- **Geographic Targeting.** The service area defined for this program is very large, geographically and in terms of number of districts and enrolled students. Though all districts throughout this region were eligible to participate, D&R focused marketing and outreach efforts in specific areas, mainly the Central Valley, the San Francisco Bay, and Santa Clara County areas.
- **Timing.** The K-12 education sector presents many challenges to effective program recruiting and delivery. One of the largest challenges to implementing a program in the school sector is the school calendar. That is, the program implementation must work around periods during which schools are closed and key contacts are not available. There are also "blackout" periods in the school year during which educators are inaccessible, such as testing periods near the end of the school year. D&R's most aggressive (broad-scale and wide-reaching) marketing and outreach efforts were conducted during the fall of 2004.
- **Program "Kickoff" Workshop.** D&R conducted a program information workshop in October 2004 to introduce the program and available services to decision makers at districts in the target region. The workshop was held at the Fresno County Office of Education.
- **Leverage County Offices of Education.** Through presentations made at COE board meetings and dissemination of information through COE web sites, D&R was able to reach a larger district audience and use the support of the county offices to introduce program information and encourage program participation.

Interviews with SEE Program staff revealed that although the recruiting strategy needed to change according to the needs (and receptiveness) of each specific district, the most successful outreach efforts were through COEs. Having the support of the COE and being able to provide program services to them gave instant credibility to the program and served as an entry point to contacts at individual districts and schools within the targeted regions.

Once district participation was established (through an IPA), a SEE Program lead and sometimes a team coordinator were assigned to the district. The primary responsibility of these individuals was to oversee district program activities and coordinate the program team working with that district. Each participating district was also assigned a facility services and an education services lead who worked with each district to determine which services

would best meet district needs and provide ongoing direct support to ensure successful provision of all program services.

1.3 Program Goals

The 2004-06 SEE Program is classified as an "information only" program, thus verifiable energy and demand impacts are not required. Table 1-1 and Table 1-2 include the quantitative and qualitative program goals, respectively, as enumerated in the PIP. How effectively these goals were achieved is central to the evaluation effort summarized in this report.

Table 1-1: Quantitative Program Goals

Program Service	Goal
Participating Districts	20 districts
Benchmark Building Energy Use	56 buildings
Level I (Basic) Audits	32 buildings
Level II (Advanced) Audits	9 buildings
Demonstration Projects	2 projects
Facility Staff Training	2 workshops
Teacher Training	2 workshops

Quantitative goals correspond to boxes 7 through 12 in Figure 1-1.

Table 1-2: Qualitative Program Goals

Program Component	Goal
Education Services	Increase student knowledge of energy use and energy-efficient best practices
	Make appropriate energy efficiency information and resources more accessible to school districts in PG&E's service territory through marketing and outreach.
	Provide teachers with educational tools and resources that can be easily integrated into existing lesson plans.
	Provide students with interactive, hands-on learning experiences that increase their knowledge of energy-efficient technologies.
Facility Improvement Services	Increase facility staff understanding of and receptiveness to energy-efficient technologies and practices.
	Identify and prioritize energy management strategies and cost-effective energy efficiency improvements.

Qualitative goals correspond to boxes 13 through 17 in Figure 1-1.

1.4 Summary of District Participation

Since district participation was established as a quantitative goal in the PIP, it became important early in the implementation to reach consensus between D&R and the evaluation team on the definition of a participant. This required careful consideration because not all districts follow the same path and receive the same services through the program. Moreover, the variety of services available through the program target different individuals, with vastly different responsibilities, who seldom coordinate or interact.

For the SEE Program evaluation, a district participant is defined as the following:

- A district representative has signed the IPA and agrees to receive or participate in at least one program service/activity.
- A district has completed at least one program service or activity.

To confirm program participation, Itron reviewed the following documentation provided by D&R, which is described in Subsection 5.

- Program tracking database,
- District-specific documentation (signed agreements to participate, district participation plans, energy use benchmarking results, and facility audit reports), and
- Demonstration project documentation (summaries of each project, before/after photographs, descriptions of education activities, etc.).

To substantiate this program documentation, Itron spot-checked the information documented in these materials against data obtained by district representatives who completed evaluation surveys. No inconsistencies were identified.

Itron confirmed that 21 school districts, five COEs, and one school signed IPAs to participate in the SEE Program. Seven of the participating districts also participated in the SCSA/CIWMB program. According to a school district demographic database maintained by the California Department of Education, the participating districts represented 317 schools and nearly 216,756 enrolled K-12 students. District enrollment of participants ranged from 121 to 80,421 students. Note that 18 participating districts are located in what are considered to be geographic hard-to-reach (HTR) areas.[15]

Table 1-3 summarizes program participation for each service offered by the SEE Program. As shown, the program exceeded all quantitative goals set forth in the PIP.

[15] In the PG&E service area, hard-to-reach areas are counties outside the greater San Francisco Bay area as defined by the Association of Bay Area Governments.

Table 1-3: SEE Program Participation, by Type of Program Service

Program Service	Goal	Achieved	Representation of Individuals, Schools, Districts/COEs
TOTAL PARTICIPANTS (Districts/COEs) [a]	**20**	**26**	**--**
Education Services			
Received NEED Materials	n/a	n/a	107 Educators 17 Schools 12 Districts/COE
Received Supplemental Materials [b]	n/a	n/a	5 Educators 2 Districts/COE
Training Workshop [c]	2	4	129 Attendees
Facility Services			
Benchmark Energy Use (# of sites)	56	89	89 Schools 21 Districts/COE
Facility Audits (# of sites)	41	55	55 Schools 23 Districts/COE
Training Workshops	2	3	25 Attendees 33 Districts/COE
Technology Demonstration Projects	2	3	3 Districts/COE

a. In addition to the 26 districts/COEs, a single school site also signed an IPA and participated in the program.
b. Represents the number of educators for which materials were *ordered and paid for* through the SEE program. Because some supplemental materials are downloadable from the Internet and/or available at no cost (to anyone), these figures underestimate the number of educators that received supplemental materials as a direct result of the Program.
c. The number of schools and districts represented by these attendees was not convenient to determine from the tracking database.

1.5 Evaluation Highlights

Results and general conclusions of this evaluation with respect to stated program goals are summarized below.

1.5.1 Facility Services Evaluation

As shown in Table 1-3, D&R exceeded the quantitative program goals set forth in the PIP, as confirmed by Itron's review of program tracking and documentation and through surveys of program participants.

Energy use benchmarking improved participants' understanding of energy use at their districts, and some of the surveyed facility managers and decision makers learned that their facilities used energy less efficiently than they thought. Some benchmarking results were

extreme (very high or very low scores) that could indicate missing or erroneous data inputs and should be further investigated. Participants anticipated re-benchmarking only one to two times per year, and will use benchmarking to track progress of the benchmarked facility rather than compare scores across a group of similar facilities.

Itron's engineering review of facility audit results and participant interviews confirmed that the audit reports, or EMPs, were both informative and useful to program participant decision makers. Although the EMPs were not intended to be "investment-grade" audits, they did provide decision makers with a quick glance at short-term and long-term energy efficiency improvement opportunities, as well as increasing their awareness of energy efficient measures. The EMPs were viewed by participants as very valuable and the appropriate level of detail for decision makers.

Overall, recommendations for energy efficiency improvements presented to districts in EMPs were sound and reasonable, and the quality and scope of audits exceeded expectations for an "information only" program. However, Itron found some assumptions in savings calculations that overstated estimated impacts as well as some isolated errors and inconsistencies between the calculation spreadsheets and the information reported in the EMPs.

Demonstration projects provided the host districts/COEs with the opportunity to experience energy efficient technologies that they might not have otherwise specified for a full-scale renovation/retrofit modernization project. Though somewhat difficult to coordinate with the host sites' school schedule, all projects were installed successfully from the perspectives of the host district and the program implementation team. Districts that hosted a demonstration project were satisfied with the project design and operation of the installed equipment.

1.5.2 Education Services Evaluation

D&R exceeded the quantitative goals associated with the education services by providing four training workshops, which were attended by at least 129 educators. Additionally, at least 107 educators ordered and received energy-related educational materials through the SEE Program. The materials and resources available through the program covered all grade levels and included a variety of lessons and activities to encourage and engage students to learn about energy and energy efficiency.

D&R selected materials from the NEED Project as the core of the educational services of the SEE Program. The materials were considered high quality and effective in teaching students about energy, energy use, and energy efficiency. The training workshops and follow up support provided through the SEE Program contributed to the high rate of implementation of these materials by participating teachers and educators. Eighty-three percent of the educators

who received materials through the program had already used them in the classroom, involving an average of 85% of each teacher's students. Thus, at the time of the evaluation, 71% of the students of participating educators had participated in the lessons/activities or been exposed to the materials distributed through this program.

The SEE Program facilitated the use of the school site as a learning lab for students by providing a customized set of materials and learning activities to educators that directly related to the technology demonstration projects. Additionally, many of the NEED materials provided to educators through the program were activity-based lessons through which students used their classroom or school to teach energy-related concepts.

1.5.3 Program Model and Implementation

Through meetings with the implementation team early in the development phase of this program, Itron found the team to be well organized with a global understanding of the program mission and overall implementation strategy. Moreover, roles and responsibilities of all individuals on the implementation team were established, understood, and maintained throughout the implementation period.

SEE Program staff was successful in recruiting districts and following through with program services in a timely manner and within the constraints of the school year schedule. SEE Program staff exhibited strong commitment and dedication in providing participants with as much support and information as possible within the constraints of an "information only" program.

Shifts in the delivery and scope of program services from the 2002-03 SCSA/CIWMB program were necessary and contributed to the success of this program. In particular, D&R eliminated the partnership model and provided all services to participants with its own staff, reduced the scope of services available to participants (education services, in particular). This streamlined version of the program reduced customer confusion and enabled D&R to provide quality services and information to participants.

1.5.4 Recommendation

It is Itron's professional opinion that there is a need for this program model, as implemented by D&R and if suggested improvements in the facility audit calculations and benchmarking are implemented.[16] With respect to facility services, market studies and anecdotal feedback from SEE Program participants indicate the many K-12 public school districts lack the resources to identify energy efficiency opportunities and when they do, they have difficulty selling district administrators and school boards on the financial benefits of such projects.

[16] Itron understands that D&R has been awarded a contract to continue the facility component of the SEE Program for the 2006-08 program term.

The SEE program clearly provides the "missing link." With respect to the education component, the SEE program model provided much needed training and follow up support to educators that are not typically provided by the organizations that develop education materials that are correlated to the California Standards. Again, the SEE program model has successfully developed an approach that provides the "missing link" with respect to integration of energy-related education in the classroom.

1.6 Organization of Report

The remainder of this report includes the following:

- Section 2 summarizes the evaluation objectives and approaches and data sources established for this evaluation,
- Sections 3 and 4 present the results of the facility and education services offered through the program, respectively,
- Section 5 reviews the SEE Program tracking and documentation, and
- Section 6 presents conclusions.

Appendices include the following:

- The development and administration of surveys and in-depth interviews conducted for this evaluation are provided in Appendices A through G. Recruiting materials and survey instruments are also provided. Each of these Appendices also summarizes the survey respondents and presents the response rate for each data collection effort.
- The menu of educational materials available through the SEE Program is provided in Appendix H.

2

Evaluation Approach

2.1 Introduction

The evaluation approach was designed to assess how successfully the SEE Program achieved its intended goals in reducing barriers to more efficient resource use that are symptomatic in the state's public education sector. The evaluation of an informational only program, like the SEE Program, does not require verification of energy and demand savings. The benefits of such programs are most often realized in the longer term and are more difficult to attribute to specific program intervention strategies. The overall evaluation objective of an information and training program, therefore, is to assess *program effects* in terms of changes in behaviors and attitudes that can be directly linked to program offerings.[17] Examples of research objectives associated with such programs include the following:

- Determine the specific knowledge gained through the program,
- Determine the relevance and usefulness of the training, and
- Ascertain the extent to which the knowledge gained through the program is or will be applied in the short and long-term.

Another aspect of evaluation is to assess program and implementation processes to determine their effectiveness and operational efficiency. Research objectives associated with a *process evaluation* are as follows:

- Assess the products and services provided by the program,
- Assess the program's approach for providing products and services to the target market, and
- Identify and recommend improvements to increase program cost-effectiveness.

The evaluation approach presented herein includes both an effects evaluation of the SEE Program's education and facility improvement components, and an overall program process evaluation. The research objectives bulleted above form the basis of this evaluation approach and serve as key research questions to be answered.

[17] It should be noted that, given the timeframe required for program implementation and evaluation, the evaluation can only determine short-term program effects. Longer-term program impacts would require evaluation at least two or more years post-implementation.

In reference to the program model presented in Figure 1-1, the objective of the evaluation was to examine the operational efficiency and success of the program model, or conduct process evaluation research (examine linkages between boxes 1 through 12) and determine success in achieving program goals to determine near-term program effects (progress in achieving boxes 7 through 12).

The development of this evaluation approach is consistent with the CPUC's requirements and objectives and are enumerated in the Energy Division's August 2003 Energy Efficiency Policy Manual, as shown in Table 2-1. It is important to note that because the SEE Program is an information only program, not all evaluation, measurement, and verification (EM&V) objectives apply.

Table 2-1: Correlation of Evaluation Approach with CPUC Objectives

CPUC Objective [a]	Evaluation Plan
Measuring level of energy and peak demand savings achieved (except information-only)	Not applicable.
Measuring cost-effectiveness (except information-only)	Not applicable.
Providing upfront market assessments and baseline analysis, especially for new programs	Market assessments previously developed were referenced for the SEE evaluation. Baseline information was obtained from participating districts through a pre-participation implementation survey.
Providing ongoing feedback, and corrective and constructive guidance regarding the implementation of programs	Itron submitted a mid-term progress report summarizing results of each workshop evaluation, and progress to date. Itron also submitted periodic progress reports and participated in numerous conference calls and meetings with D&R.
Measuring indicators of the effectiveness of specific programs, including testing of the assumptions that underlie the program theory and approach	Program effectiveness was assessed through surveys of "market participants" targeted by the program (educators, facility managers, and facility staff) and interviews with program staff.
Assessing the overall levels of performance and success of programs	The ultimate objective of the evaluation was to determine if the SEE objectives were successfully met. This final report presents those evaluation findings.
Informing decisions regarding compensation and final payments	Not applicable.
Helping to assess whether there is a continuing need for the program	As a result of the evaluation activities and results presented herein, it is Itron's professional opinion there is a need for continuing this program model, as stated in Section 1.5.4.

a. Energy Efficiency Policy Manual. August 2003. Chapter 6.

It is important to note that Itron coordinated with D&R throughout the program implementation period to provide feedback and constructive input when needed and appropriate. The primary avenue through which feedback was provided was the development and submission of a mid-term progress report that summarized results of in-

depth interviews with program participants and a preliminary review of program documentation.[18] Moreover, in planning evaluation activities, Itron consulted and coordinated closely with D&R to ensure survey instruments and administration methods were appropriate and sensitive to the schedules and work environments of respondents. (For example, teachers are generally not accessible by telephone. Thus, in consultation with D&R, Itron opted to administer the Education Services Evaluation Survey over the Internet.) This coordination contributed to acceptable response rates of the survey and interview efforts.

2.2 Data Sources

Both primary and secondary data were used to conduct this evaluation. Primary data collection included in-depth interviews with program staff and representatives of participating districts, training workshop evaluation surveys, an educator baseline practices survey, facility services evaluation survey, and an education services evaluation survey.

Primary data collection and analysis occurred in two phases. The first phase was conducted in August 2005 to support a mid-term progress report intended to provide the implementation team with process-related feedback so that mid-course corrections could be made if necessary. The majority of in-depth interviews with facility and education program participants were completed during this time. The second phase of data collection began in May 2005 to support the final program evaluation. This second phase included the administration of several evaluation surveys to gain insight into the successfulness of various services offered through the SEE program. Finally, throughout the program implementation period, training workshop evaluations were administered at most events.

In-Depth Interviews. Itron conducted interviews with participants involved with different aspects of the program in an attempt to obtain feedback regarding program administration, and the effectiveness and usefulness of the resources and services offered by it. The number of completed in-depth interviews for each target group is noted in Table 2-2. The in-depth interview guides and a summary of the interview administration are provided in Appendix C.

Educator Baseline Practices Survey. The goal of this survey is to obtain information on educator baseline practices with respect to energy, energy efficiency, and energy conservation education prior to participating in the SEE program. The administration of the Baseline Practices Survey and the survey instrument are provided in Appendix G.

[18] Itron, Inc. *Mid-term Progress Report to Support the Implementation and Evaluation of the Schools Energy Efficiency Program.* January 31, 2006.

Education Services Evaluation Survey. To assess the value and effectiveness of the educational services provided through the SEE Program, Itron surveyed participating educators who received materials and/or training. Specifically, the survey aimed to determine if the materials were useful, could be integrated into their lesson plans, and if they were successfully implemented. The administration of the Education Services Evaluation Survey and the survey instrument are provided in Appendix B.

Facility Services Evaluation Survey. The objectives of the Facility Services Evaluation survey were to assess the usefulness and effectiveness of the services received through the program and to obtain feedback on their overall experience with the program. The administration of the Facility Services Evaluation Survey and the survey instrument are provided in Appendix A.

Workshop Evaluation Surveys. The objectives of the facility training workshop evaluation surveys were to determine if the workshops increased understanding of and receptiveness to energy-efficient technologies and practices, assess the quality and appropriateness of information presented, and to determine how likely facility staff and other decision makers would recommend implementing energy efficiency improvements. The administration of the facility training workshop evaluation survey and the survey instrument are provided in Appendix E.

The objectives of the NEED training workshop evaluation surveys were to assess the quality of the workshop and professionalism of training and how likely participants would be to implement the materials in their classrooms during the current school year. The administration of the NEED training workshop evaluation survey and the survey instrument are provided in Appendix F.

Table 2-3, Table 2-3, and Table 2-4 present the number of completes and response rates for each of these data collection efforts.

Table 2-2: Completed In-Depth Interviews

Interview Group	Number of Completed Interviews	Response Rate
SEE Program Staff	2	100.0%
Facility Services Participants	6	54.5%
Education Services Participants	5	83.3%

Table 2-3: Completed Participant Surveys

Survey Type	Number of Completed Surveys	Response Rate
Educator Baseline Practices Survey	101	n/a
Education Services Evaluation Survey	43	50.0%
Facility Services Evaluation Survey	12	44.4%

Table 2-4: Completed Workshop Evaluation Surveys

Survey Type	Number of Completed Surveys	Response Rate
NEED Training Workshop Evaluation Survey	118	91.5%
Facility Workshop Evaluation Survey	11	78.6%

Secondary information sources utilized for this report include numerous files of documentation of district participation and services provided to each district. Such documentation includes the following:

- Program tracking database,
- Copies of audits, benchmarking results, and EMPs,
- Descriptions and samples of program marketing pieces,
- Demonstration project documentation, and
- Calculations to estimate savings and audit results and recommendations.

Itron's review of program documentation is described in Section 5.

2.3 Program Effects Evaluation Activities

2.3.1 Facility Services Evaluation Approach

The facility improvement component of the SEE Program provides information and resources to help districts examine their existing operation and energy use in order to develop an appropriate energy use reduction plan that would incorporate energy use reduction strategies and facility improvements. The program objectives with respect to facility improvements include the following:

1. District facility staff will learn more about energy efficient technologies and practices.
2. District decision makers will understand the benefits of energy efficiency.
3. Encourage facility upgrades and implement demonstration projects that will improve the learning environment and reduce district energy costs.

4. Cost-saving energy efficiency recommendations will support facility improvement strategies.

Itron's evaluation strategy was designed to assess the effectiveness of the SEE Program in reaching these goals, and included the following:

- Surveys and in-depth interviews with facility managers and staff of participating districts to:
  - Determine if the SEE Program improved their understanding of their district's energy use,
  - Evaluate the appropriateness and effectiveness of facility training workshops, especially in disseminating information from the district level to facility personnel for the individual schools,
  - Assess the extent to which participating districts integrated (or intend to integrate) facility improvement recommendations into their short or long-term facility plans.
- Review and analysis of benchmarking and facility audit results to assess the accuracy, completeness, and soundness of the resulting recommendations provided to the districts. :
  - Validating energy and demand savings estimates,
  - Review hardcopy and electronic benchmarking and audit data for a sample of facilities, and
  - Spot-check energy savings estimates and underlying assumptions and data to provide a "sanity check" versus actual electric and gas bills.

The results of the evaluation of the facility component of the program are presented in Section 3.

2.3.2 Educational Services Evaluation Approach

The education component of the SEE Program strives to increase student knowledge about energy and energy use by introducing educators to existing energy-related educational materials and helping them integrate energy efficiency education into their individual and district-wide curricula. The evaluation approach sought to establish how successfully the SEE Program's education component helped to integrate energy efficiency education into classrooms of participating districts.

Specific tasks of this evaluation included the following:

- Review program records to:
  - Document the number of schools that received education materials, and
  - Document the number of training workshops conducted and the number of educators that attended each session.
- Conduct in-depth interviews with and survey educators of participating districts to:
  - Determine the extent to which education materials and resources have been integrated into teaching plans and district curricula,
  - Assess the effectiveness of the workshops and the appropriateness of education materials with respect to grade-levels, content standards, and overall quality, and
  - Assess how successfully the demonstration projects were integrated into teaching plans at the host schools.

The results of the evaluation of the education component of the program are presented in Section 4.

2.4 Process Evaluation Activities

The primary objective of the process evaluation is to assess the overall effectiveness and operational efficiency of the SEE Program in reaching its stated goals. Specific evaluation objectives of the process evaluation were as follows:

- Review program tracking and documentation procedures,
- Assess the quality of *services* provided by the program, and
- Assess the quality of *information* provided to program participants.

Research methods with respect to the process evaluation include:

- Interviews with SEE Program staff to determine how well program implementation processes corresponded to implementation plan and overall program logic.
- Review of program documentation to document and describe program activities, including marketing and outreach, district recruitment, the provision of program services to participating districts, and logistics associated with program activities.

Additionally, the surveys and interviews conducted for the impact evaluation described above included questions to solicit information useful for the process evaluation where appropriate.

The feedback obtained from program staff and participants with respect to program delivery are presented in Sections 3 and 4.

2.5 Mapping of Data Sources to Evaluation Objectives

This evaluation involved several primary and secondary data collection efforts, which are detailed in appendices so as not to distract the reader from gleaning meaningful observations and conclusions summarized in this report. It is useful, however, to understand which data were used to inform the observations and conclusions presented herein. Figure 2-1 provides a mapping between the various data collection activities and the evaluation objectives.

Figure 2-1: Mapping of Data Sources to Evaluation Objectives

Evaluation Objective	SEE Program Staff Interview	District Participant Interview	Education Services Evaluation Survey	Workshop Evaluation Surveys	Facility Services Evaluation Survey	Review Program Documentation
Facility Services Effects Evaluation						
Confirmation of Facility Services Participation				X	X	X
Effectiveness and Quality of Facility Training Workshops				X		
Extent the Program Improved Decision Makers' Understanding of District Energy Use		X		X	X	
Reasonableness of Energy Efficiency Recommendations Provided to Participants		X			X	X
Potential for Energy Efficiency Facility Improvements					X	
Assessment of Delivery of Facility Services		X			X	
Education Services Effects Evaluation						
Confirmation of Education Services Participation			X	X		X
Effectiveness and Quality of NEED Training Workshops				X		
Likelihood of Implementation of Education Materials			X			
Appropriateness of Energy Education Materials			X			
Assessment of Delivery of Education Services		X			X	
Process Evaluation & Review of Program Tracking and Documentation	X	X	X		X	X

3

Facility Services Evaluation

This section provides the results of the evaluation of the facility services provided by the SEE Program. Program objectives and corresponding evaluation objectives are summarized in Table 3-1 below.

Table 3-1: Evaluation Objectives for Facility Component

Program Objective	Evaluation Objective
Make appropriate energy efficiency information and resources more accessible to school districts	Confirm the facility services provided to each participating district
	Assess the effectiveness of facility training workshops
Increase facility staff understanding of and receptiveness to energy efficient technologies and practices.	Determine the extent to which the Program improved district decision makers' understanding of energy efficient technologies and practices
Identify and prioritize energy management strategies and cost-effective energy efficiency improvements	Assess reasonableness of energy efficiency recommendations provided to participants
	Assess the potential for energy efficiency facility improvements

Key findings from the program effects evaluation of facility services are enumerated below and discussed in more detail in the remainder of this section.

- D&R exceeded the quantitative program goals set forth in the PIP, as confirmed by Itron's review of program tracking and documentation and through surveys of program participants.
- The training provided through the program was viewed as valuable and provided attendees with concise yet comprehensive information about energy efficiency opportunities.
- Benchmarking improved participants' understanding of energy use at their districts, and some of the surveyed participants learned that their facilities used energy less efficiently than they thought. The benchmarking helped participants identify facilities with poor energy performance and some participants plan to re-benchmark their facilities to track progress over time. However, some benchmarking results were extreme (very high or very low scores) that could indicate missing or erroneous data inputs and should be further investigated.

- Overall, recommendations for energy efficiency improvements presented to districts in EMPs were sound and reasonable, and the quality and scope of audits exceeded expectations for an "information only" program. However, Itron found that some assumptions in savings calculations overstate estimated impacts.
- Deliverables to participating districts (primarily EMPs) were viewed by participants as very valuable and the appropriate level of detail for decision makers.
- Some errors and inconsistencies were found between the calculation spreadsheets and the information reported in the EMPs. Such errors could be prevented by better tracking database and double-checking documents. These errors were isolated and not systematic across all documents.
- Demonstration projects provided the host district/COEs with the opportunity to experience energy efficient technologies that they might not have otherwise specified for a full-scale renovation/retrofit modernization project. Though somewhat difficult to coordinate with the host sites' school schedule, all three projects were installed successfully from the perspectives of the host district and the program implementation team. Additionally, two of the three demonstration projects served as educational opportunities for classrooms at the host schools.

3.1 Confirmation of Facility Services Participation

Through a review of program documentation that was also cross-referenced with participant evaluation survey data, Itron has confirmed that D&R exceeded the quantitative goals for facility services set forth in the PIP. Table 3-2 summarizes participation of facility-related services offered through the SEE Program. As shown, D&R benchmarked the energy use of 89 school sites and conducted facility audits for 55 school sites. Of the 55 facility audits, 43 were Basic/Level I and 12 were Advanced/Level II. Three technology demonstration projects and three facility manager training workshops were also completed. Itron determined that 22 different districts or COEs received facility-related services through the SEE Program.

Table 3-2: Facility Services Participation Summary

Activity	Program Goal	Completed
Energy Performance Benchmarking	55 buildings	89 buildings
Level I Audits (Basic)	32 buildings/schools	43 sites
Level II Audits (Advanced)	9 buildings/schools	12 sites
Demonstration Projects	2 projects	3 projects
Facility Staff Training	2 workshops	3 workshops

Table 3-3 summarizes the benchmarking and audit services provided by facility type. As shown, over half (55%) of the benchmarked facilities were primary schools and 25% were middle or high school campuses. Administrative or office buildings comprise a small portion of the facilities, and 16% are categorized as "other" and include a variety of buildings (warehouses, special education). The audited sites fall into a similar distribution, but with slightly higher percentage of middle and high schools.

Table 3-3 Summary of Benchmarked and Audited Sites, by Facility Type

Facility Type	# of Sites Benchmarked	# of Sites Audited
Primary School	49	29
Middle School	10	8
High School	12	10
Administration Building(s)	4	3
Other	14	5
Total	**89**	**55**

In addition to conducting energy use benchmarking and facility audits, D&R installed three technology demonstration projects. Descriptions of each project, obtained from program documentation reviewed by Itron, are provided below.

Demonstration Project #1. This demonstration project upgraded lighting in a multi-use room and a hallway at the selected school site. The costs of operations and maintenance of this facility and the equipment were high, making this an appropriate and relevant demonstration project. The project consisted of replacing ceiling tiles and inefficient high bay high intensity discharge (HID) light fixtures and old, surface mount wrap around fluorescent fixtures with high efficient T5 and T8 fluorescent fixtures. The program estimated that changing the 12 main multi-use room HID fixtures with four-lamp, T5 high output fluorescent fixtures would reduce energy consumption by 49%. The less expensive fluorescent lamps, which last 20% longer than the HID lamps, would reduce lamp replacement and maintenance costs. Additional maintenance savings could be realized with the high output four-lamp fixtures since group relamping would not be needed until 50% of the lamps burn out in a fixture.

Demonstration Project #2. This demonstration project included an upgrade to the heating, cooling, and lighting systems in the school's computer lab. The project consisted of replacing inefficient and outdated standard fluorescent light fixtures with new energy efficient fixtures and installing a new ultra-high energy efficient air conditioning and furnace unit.

Flush-mount T-12 fluorescent fixtures were replaced with suspended T-8 direct/indirect fixtures. In a typical classroom setting, the SEE Program estimated that this new lighting system could reduce energy consumption by up to 50%. In addition, a new heating and air conditioning system with a 19 SEER condensing unit and a 92 AFUE furnace was installed at the site. The program estimated that this new equipment could save 40% of cooling costs and 15% of heating costs in a typical classroom setting.

Demonstration Project #3. This demonstration project site was selected for its high visibility to school district administration to demonstrate projects that could be installed in classrooms. Although a school site was initially selected for the lighting project, the final site chosen was the most highly used conference room in a facility where most superintendents and chief business official meetings are held. The conference room was also frequented by teachers for various meetings. Part of the intent here was to incorporate this type of lighting into other modernization projects being planned and designed at the district.

The previous system consisted of lay-in 2' x 4' fluorescent fixtures, two T-8 lamps and electronic ballasts, a single switch on-off control and direct lighting with all light focused down. This system was replaced with indirect/direct lighting, white board luminaires, multi-mode controls in the front of the room and two 40' row fixtures. A new audio-visual lighting mode was also installed, which ensures no veiling reflections on the screen and accommodates movies and interactive presentations. The new system ensures improved light quality and provides the ability to control lights at the activity level. According to savings estimates developed by program staff, this project will reduce lighting energy use in the space by approximately 50%.

Educational activities implemented in association with these demonstration projects are described in Subsection 4.4.2

3.2 Effectiveness and Quality of Facility Training Workshops

Throughout the implementation period, D&R conducted three facility improvement related training workshops covering a variety of topics aimed at increasing facility manager and district decision maker understanding of energy efficient technologies, operations and maintenance practices, and the fiscal benefits of energy efficiency.

While Itron intended to obtain completed workshop evaluations for attendees at all workshops, evaluation forms were only distributed by SEE Program staff at the first workshop in May 2005. Thus, the results summarized below are representative of that particular training event.

Overall, the workshop can be considered successful and effective in providing quality information about energy efficient technologies and building operation practices. The workshop received a very favorable rating regarding the relevance of the workshop subjects (an average rating of 4.5 on a scale of 1 to 5). The attendees were asked to rate the effectiveness of the information in meeting the stated workshop objectives and the attendees' expectations, on a scale of 1 to 5, with 1 representing "Not Effective" and 5 representing "Highly Effective." As shown in Table 3-4, attendees had higher than average ratings for all workshop topics. On the same scale, workshop attendees assigned very positive ratings on the workshop's effectiveness at educating attendees on various strategies and resources for reducing district energy use, as presented in Table 3-5.

Table 3-4: Effectiveness of Workshop Topics

"Indicate how effective each of the presentations and subject areas were in meeting the workshop objectives and your expectations."	**Mean Rating [a, b]**	**Std. Deviation**
SEE Program Summary	4.3	0.6
Lighting technologies and opportunities	4.5	0.7
HVAC technologies and opportunities	4.0	0.6
Controls and controls strategies	3.9	0.9
Building the financial case for energy efficiency	4.1	0.9
PG&E Incentive Programs	4.2	0.9
California Energy Commission's Bright Schools	3.9	1.1

a. Ratings on a scale of 1 to 5, with 1 being "Not Effective," a 3 meaning "Effective," and 5 meaning "Highly Effective."
b. Sample size is 11 for first six topics and 7 for the last topic.

Table 3-5: Effectiveness of Informing Workshop Participants

"Indicate how effective the information presented during this workshop was in providing you with the following …"	**Mean Rating [a, b]**	**Std. Deviation**
Understanding the value of an energy management plan	4.5	0.7
Awareness of energy efficient technologies	4.1	0.7
Understanding of how to identify and implement energy efficient renovation/modernization projects	4.3	0.6
Understanding of energy efficient building operation and maintenance of "best practices"	4.2	0.9
Understanding of energy efficient building operation and maintenance of "best practices"	4.2	0.9
Understanding of the financial value of energy efficiency	4.5	0.7
Where to find support and resources	4.5	0.7

a. Ratings on a scale of 1 to 5, with 1 being "Not Effective," a 3 meaning "Effective," and 5 meaning "Highly Effective."
b. Sample size is 11 for first six items 10 for last item.

On average, the workshop attendees reported that they were "very likely" to take action to reduce their districts energy use as a result of the information presented at the workshop. The attendees' plans to pursue energy efficiency improvements in their districts, as indicated on workshop evaluations, included the following:[19]

- Involving D&R in helping with a gym/multi-purpose room at a site that already had an energy audit,
- Installing door lock-outs on HVAC,
- Continuing lighting retrofits,
- Connecting HVAC to motor sensors and door sensors in portable classrooms,
- Installing lighting controls, and
- Defining an energy team and district energy policy.

3.3 Extent the Program Improved Decision Makers' Understanding of District Energy Use

The SEE Program offered several services to help district facility managers and other decision makers understand their districts' energy use patterns and the potential for reducing energy usage. In addition to the training workshops, the program offered energy use benchmarking and facility audits to help district facility managers understand the energy consumption characteristics of specific school sites. The rationale is that facility managers and other district decision makers are more likely to integrate energy efficient equipment and design into future modernization and renovation projects if they have a better understanding of how their school facilities use energy. Moreover, decision makers are more likely to take action if they know which facilities are less efficient and most in need of improvements.

As noted in Table 3-2, D&R benchmarked the energy use of 89 facilities of participating districts. Table 3-6 presents the distribution of benchmarked facilities by school type. As shown, just over half of the facilities benchmarked were primary schools (55%), 11% were middle schools, 13% were high schools, 4% were administration/office buildings, and 16% were classified as "other."

Across all benchmarked sites, the average EPR, on a scale of 1 to 100, was 67. As one would expect, the average rating by school type decreases as the complexity of the school type increases. That is, high schools, which traditionally have higher energy consumption

[19] While these results are positive and encouraging, the reader should be cautioned that responses were provided directly after the event, when attendees are most likely to claim they will "take action." It was not in the scope of this evaluation to conduct follow-up surveys to inquiry into steps taken to pursue energy efficient modernization projects.

per square foot, have lower scores than do middle schools and elementary schools. The lowest score was 4 and the highest score achieved was 100.[20]

Table 3-6: Summary of Energy Performance Ratings, by Facility Type

Facility Type	# of Facilities Benchmarked	Average Energy Performance Rating	Minimum Rating	Maximum Rating
Primary School	49	76	29	96
Middle School	10	64	25	100
High School	12	49	13	95
Admin./Office Building(s)	4	46	4	98
Other	14	59	16	95
Total	**89**	**67**	**4**	**100**

Table 3-7 presents the distribution of EPRs on the 1 to 100 scale. As shown, 45 out of the 89 sites benchmarked (51%) received an EPR score of 75 or higher, which is the qualifying threshold for the ENERGY STAR Building label.[21] For those schools with rating above 75, the ENERGY STAR threshold could provide a disincentive for districts to take additional action to improve building performance. D&R's objective for benchmarking, however, was not to award high performing schools, but to use the benchmarking results as a means to identify under-performing facilities and target program and district facility improvement activities to the schools with the greatest potential for improvement.

Table 3-7: Range of Energy Performance Ratings

Energy Performance Rating	# of Sites (%)
75 +	45 (50%)
50 - 74	22 (25%)
25 - 49	12 (13%)
< 25	10 (11%)

According to D&R, an indirect benefit of benchmarking is that some districts favor the concept of being recognized for their energy efficiency efforts for schools that did score high (and requested assistance to award high performing school campuses), but even so, used the information primarily to determine how to improve the performance of schools that did not score high. One in-depth interview respondent explained that they intended to use and

[20] These very high and very low ratings might indicate data error or omission and should be further examined.

[21] In addition to an EPR of 75 or higher, a building must be professionally verified by a Professional Engineer to meet current indoor environment standards.

update the Portfolio Manager account periodically to re-benchmark as a means for tracking progress and improvements over time.

Results of the Facility Services Evaluation Survey provide insight into the usefulness of the benchmarking results and the likelihood that the facility managers will re-benchmark to track progress over time. Seventy-eight percent of the respondents had received benchmark reports of the energy use for one or more of the audited sites. Interestingly, less than half (43%) felt that the energy use per square foot ($kBtu/ft^2$) result was about what they expected; the same portion of respondents indicated the result was lower than they had expected. Just 14% thought that the result was higher than they had expected.

Half the respondents indicated that the $kBtu/ft^2$ result was "useful," one-third indicated it was "somewhat useful," and 17% found this metric "very useful." In contrast, 83% of the respondents indicated that the EPR was "useful" and the remaining felt that it was "very useful." Customers, in this case facility managers, do not pay their energy bills in Site/Source energy kBtu, therefore it is not surprising they found the $kBtu/ft^2$ less useful than the EPR.

When asked whether they planned to update their ENERGY STAR Portfolio Manager account to re-benchmark energy use of the site(s), 86% of the respondents indicated that they planned to do so about one or two times a year, while the remaining did not plan to ever re-benchmark. Those not likely to re-benchmark indicated that they would not be able to find the time to manage the account.

Almost 90% of the Facility Services Evaluation Survey respondents indicated that they had received an EMP summarizing the results of the audits and included the Statement of Energy Performance. Survey respondents were asked to rate the usefulness of the EMP in providing them with information about energy efficient facility improvements. Table 3-8 presents respondent ratings of the usefulness of the EMPs, on a scale of 1 to 4 with 1 being a rating of "Very Useful" and 4 being a rating of "Not Very Useful," according to several criteria. As shown, program participants viewed the EMP as a fairly useful document. Though respondents felt the EMP identified incentives and loans for energy efficiency improvements, it was less useful in this respect.

Table 3-8: Rated Usefulness of Energy Management Plan

Criteria	Mean Rating [a, b]	Std. Dev.
Identifying cost-effective energy efficiency improvements	1.63	0.52
Identifying incentives and loans for energy efficiency improvements	2.00	0.93
Understanding the energy use of the school site(s)	1.50	0.53
Prioritizing renovation/retrofit projects	1.63	0.52
Economically justifying energy efficiency improvement projects to other decision makers	1.50	0.53
Identifying low-cost energy efficient "best practices"	1.63	0.52

a. Ratings on a scale of 1 to 4 with 1 equal to "Very Useful," a 2 equal to "Useful," a 3 equal to "Somewhat Useful," and a 4 equal to "Not Very Useful."
b. Sample size is 8 for all statistics.

A detailed study to "test" participants on their knowledge of energy efficient technologies and facility operation practices before and after participating in the SEE Program was not in the scope of this evaluation effort, however, these results indicate that the Portfolio Manager results gave participants a better understanding of their district's energy use and the EMPs provided information considered useful.

3.4 Reasonableness of Energy Efficiency Recommendations Provided to Participants

One key evaluation objective for an information-only program is to determine the validity and reasonableness of the information provided to participants. With respect to facility services, the objective was to determine the reasonableness of the recommendations for energy efficient improvements and the corresponding energy and demand impacts specified in each EMP.

Table 3-9 provides a summary of all audits completed by the program, including the potential energy and demand savings estimated for all resulting recommendations. SEE Program staff conducted 43 Basic Level I audits and 12 Advanced Level II audits between November 2004 and March 2006. Seventy-eight percent of the audited school sites are located in a hard-to-reach county. The energy efficiency improvements recommended as a result of these audits were estimated to result in 111,774 Therms and 4,825,106 kWh annual savings and almost 2 MW of demand reduction.

Table 3-9: Summary of SEE Program Facility Audits

District #	Site #	Audit Type	Estimated Therm Savings	Estimated kW Savings	Estimated kWh Savings
District 1	1-A	Advanced	2,992	200.47	474,310
District 6	6-B	Advanced	13,818	1.55	36,223
District 3	3-A	Advanced	0	42.22	156,194
District 4	4-B	Advanced	0	13.83	126,196
District 15	15-A	Advanced	0	47.3	192,090
District 16	16-A	Advanced	5,571	37.38	145,194
District 3	3-C	Advanced	4,128	103.94	221,796
District 18	18-E	Advanced	0	34.11	152,674
District 18	18-F	Advanced	0	123.02	104,563
District 16	16-B	Advanced	4,337	43.05	149,016
District 17	17-A	Advanced	20,463	356.03	640,028
District 17	17-G	Advanced	0	41.93	125,978
District 6	6-A	Basic	0	7.14	10,570
District 3	3-B	Basic	0	5.36	13,390
District 4	4-A	Basic	1,391	11.18	27,970
District 2	2-A	Basic	0	10.15	15,248
District 9	9-A	Basic	0	0.45	6,251
District 5	5-A	Basic	2,614	35.32	82,464
District 5	5-B	Basic	2,820	38.79	94,706
District 12	12-A	Basic	2,590	21.88	40,872
District 7	7-A	Basic	2,201	15.21	32,871
District 7	7-B	Basic	2,911	16.69	56,105
District 8	8-A	Basic	0	4.33	14,652
District 8	8-B	Basic	0	2.94	8,314
District 11	11-A	Basic	0	0	3,206
District 11	11-B	Basic	0	0	4,455
District 14	14-A	Basic	15,491	51.85	136,868
District 10	10-B	Basic	3,508	31.4	114,147
District 10	10-H	Basic	0	14.5	29,938
District 13	13-A	Basic	0	15.28	52,269
District 13	13-B	Basic	0	3.66	22,186
District 13	13-C	Basic	0	1.89	17,170
District 13	13-D	Basic	0	22.81	83,309

Table 3-9 (cont'd.): Summary of SEE Program Facility Audits

District #	Site #	Audit Type	Estimated Therm Savings	Estimated kW Savings	Estimated kWh Savings
District 21	21-R	Basic	2,442	11	26,256
District 21	21-S	Basic	2,664	4.74	20,795
District 3	3-D	Basic	0	25.14	27,908
District 18	18-A	Basic	0	21.93	56,479
District 18	18-B	Basic	153	8.6	33,920
District 21	21-B	Basic	*	*	*
District 7	7-C	Basic	153	29.63	71,171
District 7	7-D	Basic	0	27.6	66,743
District 21	21-M	Basic	1,861	8.23	133,939
District 7	7-E	Basic	0	18.4	60,664
District 7	7-F	Basic	0	17.6	57,799
District 19	19-A	Basic	0	31.34	78,589
District 19	19-B	Basic	*	*	*
District 16	16-C	Basic	3,316	13.48	69,587
District 26	26-A	Basic	0	8.18	40,722
District 26	26-B	Basic	13,171	0	16,124
District 27	27-A	Basic	0	6.48	18,170
District 17	17-D	Basic	0	16.43	51,868
District 17	17-B	Basic	3,179	155.25	204,902
District 17	17-C	Basic	0	63.39	135,624
District 17	17-E	Basic	0	65.97	133,651
District 17	17-F	Basic	0	77.28	128,972

* Though these sites were audited, the district had already implemented a number of modernization upgrades and cost-effective opportunities for energy savings were limited. Thus, D&R did not present any recommendations for improvements to the district.

Table 3-10 presents a summary of the energy efficiency measures and the percentage of sites for which they were recommended. Itron found the list of measures recommended to be comprehensive, reflecting the nature of the general approach pursued by D&R to create a customized report for each audited site. Measures most frequently recommended include lighting retrofits, vending misers, occupancy sensors, and energy efficient motors. Boiler replacements were the most commonly recommended gas measure.

Table 3-10: Summary of Recommended Measures

Measure	# of Sites for Which Measure was Recommended	% of Sites [a]
Lighting Retrofits	**48**	**87%**
Vending Misers	**29**	**53%**
Occupancy Sensors	**28**	**51%**
Energy Efficient Motors	**16**	**29%**
Refrigerator Removal	14	25%
Boiler Replacement	**12**	**22%**
HVAC Door Lockout	11	20%
VFD	10	18%
New HVAC Unit	6	11%
New Heat Pump Unit	6	11%
Chiller Replacement	4	7%
Air Handler VFD	4	7%
New Cooling Tower	2	4%
Plug Load Sensors	2	4%
Computer Room AC	1	2%
Pump Operation	1	2%
Pool Cover	1	2%

a. Percent of 55 audited sites.

To determine the reasonableness of the recommendations presented to participating districts, Itron validated savings and demand estimates and reviewed the EMPs and supporting calculations for a sample of audited sites. In particular, Itron examined facility characteristics (i.e., size, existing equipment, school type), total energy consumption at the site, and the inputs and assumptions of the calculations to estimate impacts from the recommended energy efficiency improvements. The evaluation paid particular attention to the technologies commonly recommended and/or accounting for a large portion of the total estimated savings.

The sample for this review included nine of the 12 Level II Advanced audits. The sites were randomly selected, but the final sample was adjusted to ensure at least one site of each facility type (i.e., high school, middle school, primary school, office, and other) was reviewed.

Itron's observations with respect to the estimated energy and demand impacts of specific measures as well as observations regarding each reviewed site are provided below.

3.4.1 Review of Measure-specific Energy and Demand Impact Estimates

Itron focused the validation effort on the measures most commonly recommended (also likely to represent the majority of the total estimated energy savings that would result from all recommendations). Itron originally intended to conduct a systematic review of each selected site for comparability across the sample. However, the audits and resulting recommendations were customized for each site so much so that a systematic comparison across audits was not possible. Focusing on the calculations for the most commonly recommended measures allowed for a detailed review of audit results without having to judge all audits against the same set of criteria. The five measures were reviewed to assess reasonableness of recommendations and corresponding estimated savings.

- Lighting retrofits,
- Vending misers,
- Occupancy sensors,
- Premium efficiency motors, and
- Boiler replacements.

Lighting Retrofits. Lighting retrofits were recommended for 87% of the audited schools. Indoor lighting recommendations were most common and included retrofit options such as T-12 to T-8 conversions and HID-to-T8 conversions. Outdoor lighting retrofits were much less common. Savings calculations included detailed information on location (i.e., gym, classroom, office), operating hours, and associated lighting fixture information (number of fixtures, number of lamps per fixture, fixture watts, etc.).

The operating hours used for the calculations appeared to be sensible and were obtained during the audit, but school operating hours were not tabulated within the calculation spreadsheet. D&R appears to have used an extensive PG&E lighting measure database as the source for their fixture configurations and wattage values. The calculations also referenced a table of detailed lighting system costs.

Vending Misers. Vending misers were recommended for 53% of the audited sites. This technology uses a motion sensor and the miser itself to reduce vending machine consumption by shutting off the machine for periods when the room in which the machine is located is not occupied. It does not affect the internal thermostat of the vending machine compressor. One study reports estimated energy use for a refrigerated vending machine without the vending miser is 3,468 kWh and with the vending miser is 1,716 kWh (or about 1,752 kWh savings per year per machine).[22] Lower estimates of savings are assumed in the Northwest (1,292 kWh per year for illuminated machines and 861 kWh per year for non-illuminated

[22] "Vending Misers: Facts and Issues", http://www.tufts.edu/tie/tci/excel%20and%20word/Vending%20Miser%20Handout.doc

machines)[23,24] and by various programs implemented in California (1,200 – 1,590 kWh per year) [25,26].

It appears that D&R used defaults for two types of vending machines: a 400 W refrigerated (cold soda) machine and a 150 W snack machine. In both cases, annual operating hours of 8,760 hours were used to calculate savings, which is high for the refrigerated machine and which would not have a cycling compressor on all the time. Savings of 40% was assumed for the refrigerated machine and 60% for the snack machine, which for a single machine yields 1,402 kWh and 788 kWh, respectively. .

Occupancy Sensors. Occupancy sensors were recommended for 51% of the school sites for which audits were conducted. Both wall- and ceiling-mounted sensor controls of lighting fixtures were considered. The measure was most typically specified for office and classroom spaces. Savings were calculated as the percentage reduction in annual operating hours, typically assumed to be 10%. Calculations were based on fixture watts, fixture quantity, and number of applications (sensors or circuits controlled). Only a single, representative value of annual operating hours was used for this calculation, even if there were multiple operating hour schedules indicated in the lighting calculations. However, the assumptions are reasonable for a measure that is dependent on occupancy.

Boiler Replacement. Boiler replacement is the primary natural gas measure and was recommended for 22% of the audited sites. This measure includes boilers used for space heating, service hot water heating, and pool heating. Existing boilers were typically assumed to be 75% efficient, and the measure was assumed to be a 95% high efficiency condensing boiler. It appears that base consumption calculations were adjusted to the actual gas usage by use of an "estimated average load" factor.

Energy Efficient Motors. Energy efficient motors, otherwise known as premium-efficiency motors, were recommended for 29% of the sites. These are NEMA premium-efficiency motors and their applications include fan and motor pumps, which are primarily HVAC equipment but also apply to pool pumps. Actual motor sizes, quantities, and nameplate efficiencies (whenever possible) were gathered during the audit. A default loading of 80% is assumed, which is reasonable. Efficiency values for existing and premium-efficiency motors were referenced from a table in D&R's calculation spreadsheet of default efficiencies that vary by size. The baseline and high efficiency values used in the

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23 See http://www.nwcouncil.org/rtf/supportingdata/VendingMiser.xls (visited in September 2006).

24 Nadel, Steven. *Packaged Commercial Refrigeration Equipment: A Briefing Report for Program Planners and Implementers.* December 2002.

25 Ecos Consulting. *PY 2002 Energy Efficiency Program Implementation Plan for LiteVend*. May 23, 2002.

26 Richard Heath & Associates, Inc. *2004-2005 Program Implementation Plan for the Energy Fitness Program for the Northern Sacramento Valley.* March 2004.

calculations appear to be slightly different from NEMA standard-efficiency and premium-efficiency motor efficiencies.[27] However, the baseline values used by D&R may be an attempt to develop a more realistic motor efficiency value based on age, wear, etc. Example comparisons for 5, 10, and 15 horsepower (hp) motors are provided in Table 3-11 below. As shown, although there are a few discrepancies with the efficiency values used, the percentage savings estimates are very similar, although D&R estimates slightly higher savings.

Table 3-11: Default Motor Efficiency Values Comparison

Motor Size (hp)	D&R Default Values			NEMA Reference Values			
	Standard Efficiency	Typical Retrofit Efficiency	Percent Savings	Standard Efficiency	EPACT Efficiency	NEMA Premium Efficiency	Percent Savings
5	84.0	90.2	7.4%	84.0	88.2	90.5	7.7%
10	85.0	91.7	7.9%	86.8	90.0	92.2	6.3%
15	86.0	92.4	7.4%	87.6	91.0	92.6	5.8%

3.4.2 Site-specific Observations of Reviewed Audits

Overall, Itron found the facility audits provided through the SEE Program to be professional, comprehensive, and represented a level of effort that exceeded expectations for an information only program. This subsection summarizes Itron's observations for each of the nine reviewed audits with respect to key site energy use and total square footage, the energy use benchmarking results (Statement of Energy Performance), recommended energy efficiency measures, and technical and/or general observations about the analysis and corresponding results and narrative provided in each EMP.

Site 1-A

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
1,300,000	97,000	55	66	Lighting Retrofit Computer Room A/C Chiller Replacement Motors New Cooling Tower Boiler Changeout Air Handler VFD	477,303	37%

[27] "Introduction to Premium-Efficiency Motors," http://www.copper.org/applications/electrical/energy/motor_text.html

Observations regarding the Site 1-A audit include the following.

- First-year savings estimate appears to be too high as a percent of actual bills ($92,490 versus $195,000 + $17,000 = $212,000, which is a 43% reduction). This is the equivalent of eliminating the lighting system, which was reported to use 44% of the total site electric energy. Lighting operating hours may be high—primarily 3,120 and 4,420 full-load hours per year indicated in calculation worksheet, which translates to 12 to 17 hours at 100% on per day for a five-day work week.
- Electric and gas intensities are reasonable for an office site.
- The "Facility Description" section of the EMP does not include full-year or part-year/seasonal operation, but does include an extensive description of the facility, HVAC systems, and lighting equipment.
- The EMP includes a unique "Energy Balance" section with a pie-chart illustrating electricity usage by end use.
- The savings estimates table did not include a simple payback calculation.

Site 3-A

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
Not available from EMP, which only focuses on space heating and pool heating boilers (gas measures)	130,000	68	20	Space Heating & Pool Heating Boilers Premium-efficiency pump motors and VSD	50,042	----

Observations regarding the Site 3-A audit include the following.

- The measure savings table presented in the savings calculation spreadsheet was different from the one in the EMP. However, savings for measures recommended in the EMP were consistent with those in the calculations. In addition, the measure savings table on page one of the EMP is different from the table on page six.
- Pool boiler cost savings is incorrect; the formula refers to the wrong cell in the pool boiler tab in the calculation spreadsheet. This error was carried over into the EMP.
- Therms and kWh savings values are incorrectly added together in the calculation worksheet ("Opportunities Summary" table). This error was carried over into the

"Energy Conservation" section of the EMP, where boiler therm savings were reported as "kWh Saved" and in the "Life Cycle Cost Analysis" table. The "kWh Saved" is reported as 50,042 kWh instead of 36,223 kWh and 13,818 therms.

- The only report that Itron received focused on the central heating system and pool mechanical system. Benchmark results were recorded in the program tracking database, but the Statement of Energy Performance was not included in the documentation reviewed for this evaluation, nor were the benchmarking results reported in the EMP.
- The measure savings table in the calculation spreadsheet differed from saving reported in the final EMP. However, savings for measures as shown in the EMP were consistent with those in the calculation sheet. In addition, the measure savings table on page one is different from that on page six of the EMP.
- Two calculation sheets existed for this site, but there was only one audit report.

Site 7-C

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
1,200,000	110,000	109	16	Lighting Retrofit Cooling Tower VFD Energy Efficient Motors	156,194	13%

Observations regarding the Site 7-C audit include the following.

- The kBtu/ft^2 rating of 108.9 and Energy Performance Rating of 16 are likely indicators that the reference used for benchmarking was not correct, rather than an indication of potential to improve energy use. This may be because this site is an administrative office rather than a true school. Electric intensity is 8,218,744/3.4 kWh for 110,000 ft^2), which yields an electric intensity of 21.98 kWh/ft^2 per year. This is about right for a large office. (Note that actual electric use was not included in the audit report.)
- The calculations specify fan operating hours of "24 hours per day during the summer," which is questionable.
- One record in the lighting retrofit calculation spreadsheet specifies 8,976 hours, which is incorrect.

Site 15-A

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
1,500,000	180,696	39	56	Lighting Retrofit Occupancy Sensors HVAC VAV conversion Vending Miser Pool Motor VFD	192,090	13%

Observations regarding the Site 15-A audit include the following.

- All measures are electric, so the audit should present savings and costs as a percent of current expenditures on electricity, rather than the overall bill.
- HVAC conversion is the largest cost and savings measure, but also the riskiest.
- The measure cost is 45% of the annual electric bill.
- VAV conversion is a major retrofit and should not be recommended lightly. Installed costs and savings estimates should be based on actual operation and building simulation.
- No savings estimates for windows were provided, but should have been included. Low-e or spectral low-e windows could have been specified, depending on where the school is located (heating or cooling predominant climate).
- The "Facilities Description" in this EMP is excellent and contains almost all of the information that the audit was originally designed to capture (i.e., type of HVAC system is specified), though total floor area was not found.
- The EMP separates gas and electric usage and costs, which is excellent (this was not done in other EMPs).

Site 16-A

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
1,500,000	180,515	77	77	Lighting Retrofit Energy Efficient Motors Refrigerator Removal Vending Miser Pool Boiler Pool Motor VFD	149,571	10%

Observations regarding the Site 16-A audit include the following.

- This school already uses T8 lighting, yet lighting still has the largest share of estimated savings.
- The kBtu/ft^2 and Energy Performance Rating are both 77; this is coincidental and the results are valid.
- Pool boiler savings are reported incorrectly as kWh savings in the "Opportunities Summary" table in the calculation sheet and in the "Life Cycle Cost Analysis" table of the EMP. Moreover, the kWh savings reported in the EMP is not consistent with that in the calculation sheet.
- The "Facility Description" of the EMP excludes some details that would help substantiate savings calculations. For example, total floor area was not included. This observation was noted for several of the reviewed audits.
- The EMP includes detailed summary of lighting retrofits.
- The EMP does mention that this is a nine-month school (summer shut-down).

Site 16-B

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
1,500,000	178,613	60	52	Energy Efficient Motors Lighting Retrofit Pool Boiler Pool Motor VFD Vending Miser	153,393	10%

Observations regarding the Site 16-B audit include the following.

- The source of operating hours was not apparent; there was no indication if it is nine-month or year-round school site.
- The estimated electric and gas intensities are reasonable.
- The estimated measure costs ($143,498) are almost equal to annual energy costs.
- The majority of this school already has T-8 lighting and some T-5 fixtures, yet lighting is still the largest contributor to the site's energy savings estimate (54%). This is noted in the "Energy Conservation" section of the EMP.
- The average simple payback for the recommended measures is 5+ years.
- The calculations appear to use the actual capacities and sizes of equipment found onsite. The calculations include detailed lighting calculations by activity type, but does not include associated area (would have been useful for an LPD check).

- The "Facility Description" of the EMP includes a good general description of the existing HVAC units and associated controls.
- The "Energy Benchmarking" section of the EMP includes a discussion of kBtu/ft^2, which was not observed in the EMPs completed early in the program. The text also clarifies that this is a building-based benchmarking tool.

Site 18-E

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
1,400,000	Not avail.	----	Not benchmarked, gas use not available	Lighting Retrofit Pump Operation HVAC VFD Vending Miser	152,674	11%

Observations regarding the Site 18-E audit include the following.

- Total floor area was not found in the EMP or the calculation spreadsheet.
- The EMP includes an "Energy Balance" section with a pie chart illustrating electric consumption by end use.
- A simple payback calculation is not included in measure table.
- An appendix with the lighting retrofit details is included.

Site 18-F

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
542,000	54,200	----	Not benchmarked, gas use not available	Lighting Retrofit Vending Miser Chiller	104,563	19%

Observations regarding the Site 18-F audit include the following.

- The largest and most significant measure recommended for this site is a chiller retrofit.
- This site already has mostly T-8 lighting; only portable classrooms use T-12s so potential lighting savings could be minimal.
- The total floor area was not specified in the EMP or other supporting documentation.

- The EMP includes an "Energy Balance" section. Lighting, chiller cooling, and "miscellaneous" end uses are predominant. Energy consumption for chiller cooling is unusually high, at 28% of the total facility energy consumption.

Site 17-G

Annual kWh	Total Floor Area	Energy Use Benchmarking		SEE Program Recommendations		
		kBtu/ft^2	Energy Performance Rating	Recommended Measures	Estimated kWh Saving	% kWh Saving/yr
Not available from EMP, but must have been obtained for benchmark	88,243	43	81	Lighting Retrofit Occupancy Sensors Vending Miser	123,549	----

Observations regarding the Site 17-G audit include the following:

- There is no summation of the calculation sheets for each of the seven schools covered by this EMP.
- This site was one of seven covered in a single EMP; this is a very unique EMP in that it appears to address energy efficiency potential for the entire district rather than a single school site.
- This site was benchmarked but the results were not reported in the EMP (for this or any of the other seven sites).
- Measures were not evaluated and recommended separately for this school, but instead were recommended as a whole for the seven audited schools covered by the EMP.

Overall, the audits reviewed by Itron, as summarized above, were found to be reasonable and provided sound recommendations to the program participants. Itron is mindful of the fact that the objective of the audits was to provide program participants with a concise document summarizing energy efficiency opportunities to be referenced by decision makers when districts develop full-scale facility modernization projects. The audits were not necessarily intended to be "investment-grade," although some involved calculations that are comparable to what would be conducted for an investment-grade audit, particularly for measures with relatively short pay-back periods that do not require simulations or end-use metering/monitoring.

Itron offers the following recommendations to improve the analysis and the data presented in the calculations and/or EMPs.

- Operating hours and schedules of each site need to be documented as part of the calculations, particularly seasonal operation periods (winter, spring, summer breaks).
- A building simulation program should be used to assess HVAC energy usage, and the closest available weather files/data should be used for the assessment. An alternative would be to use the Database for Energy Efficient Resources (DEER) data, although the audits are probably detailed enough that a simple model could be produced.
- Electric and gas utility bills should be analyzed to determine actual weather-sensitive energy use (summer usage especially important), which can be used as a sanity check for HVAC savings calculations.
- Electric and gas energy consumption and total floor area should be recorded in project documentation (savings calculation spreadsheets and EMP, for example). These data will provide a better benchmark than total consumption in kBtu (where electricity consumption is converted to kBtu).
- Demand impacts—not just kWh—should be estimated and reported. It appears that D&R recognized this toward the end of the program, since some of the calculation workbooks incorporated a kW savings assessment.

3.5 Potential for Energy Efficiency Facility Improvements

The final evaluation objective for the SEE Program facility services was to determine the likelihood that the information provided through the program—via benchmarking, facility audits, training, and demonstration projects—will facilitate full-scale retrofits or modernization projects that specify more energy efficient technologies.

The Facility Services Evaluation Survey asked, *"Within the next year, how likely will your district be able to implement one or more of the energy conservation recommendations presented in the Energy Management Plan(s)?"* Fifty percent of the respondents indicated that they were "very likely" or "likely" to be able to implement one or more of the energy conservation recommendations presented in the EMP within the next year. Thirty-eight percent of the respondents, however, indicated they were "somewhat unlikely" that they would be able to do so, and 13% felt that following the recommendations was "not at all likely." The reasons cited for being unable to implement recommendations included budget restraints, being contracted with another vendor, and having new management.

Though these results are fairly optimistic, self-reports on the likelihood of "taking action" suffer from social desirability bias, or the tendency for people to give answers that they believe (consciously or unconsciously) will make them look good rather than those that are most accurate. Such biases are more important considerations in the estimation of free-ridership to determine net impacts attributable to an energy efficiency program. Because the

Facility Services Evaluation Survey was not intended to draw conclusions of statistical significance what participants *might* do in the future, nor was it extensive enough to attempt to identify the extent of such biasedness in responses, it is important for the reader note that results of this survey could overstate the likelihood that full-scale retrofits will likely occur as a direct result of the audits performed.

The three demonstration projects installed through the program are most likely to lead to full-scale retrofits at the participating districts. One of the key site selection criterion for developing a project at a particular school site was the likelihood the project would lead to the development of a full-scale project. One in-depth interview conducted with the facility director of a district that installed a demonstration project stated rather emphatically that they planned to specify the lighting equipment in the demonstration project in modernization projects when they were in the development stage. This individual further explained that they wanted D&R on their design team as a subcontractor to review the architectural plans and specify energy efficient measures that should be included instead of the "standard equipment." This district representative had experienced a lot of resistance from architects and the design team to specifying equipment or designing projects that were not familiar or "easy," regarding the energy plan and recommendations for products. This interview revealed a willingness to change and overcome the organizational barrier that many school districts face but also emphasizes the presence of this barrier that extends beyond districts, themselves, and into the design community.

3.6 Process Evaluation of Facility Services

As explained in Section 2, the objective of the process evaluation of the SEE Program is to assess the overall operational efficiency and of the program and the quality of services provided to participating districts. With respect to the facility component of the program, Itron's objective was to determine if the process through which benchmarking and audits were conducts worked well and if the results were provided to districts in a manner that was useful and valuable to them. Most of the insight provided here was gleaned from the in-depth interviews with SEE Program staff and district facility contacts.

In terms of overall logistics, program participants had pleasant program experiences and the delivery of program services appears to have been fairly smooth and uncomplicated. When learning about the program and during initial discussions with SEE Program staff, the respondents felt that D&R provided adequate and accurate information about the program, answered all of their questions, and completely described program services and participation requirements. All interview respondents noted that they understood who their SEE Program contacts were and how to reach them when they had questions or needed information. Interviewees indicated their SEE Program representatives contacted them anywhere from

three to four times per week to one to two times per month. This seemed to be the right level of interaction from the district perspective and none of the interviewees expressed dissatisfaction with the level of interaction with D&R.

In general, all respondents indicated their expectations for the SEE Program were met, and for a few respondents *exceeded*. One wanted to learn how the schools' money was being spent on energy consumption and said that a motivating factor in participating was that it was a "free program." Others explained they wanted to have an independent evaluation of their district buildings that was "free and honest," instead of from a company or organization that would have a vested interest to recommend specific changes.

Energy Use Benchmarking

All the respondents who had received their benchmarking results before the interview felt that the process met their expectations and that benchmarking results were valuable. Some had benchmarked all of their buildings while others benchmarked some with plans for further benchmarking at a future date. One of the respondents who chose to have only a few buildings benchmarked chose the worst performing schools (in terms of energy usage) or those that have had the least modernization to be benchmarked. One interviewee explained that the district high school was benchmarked because it had the highest energy usage and the greatest potential for cost reductions. The district's elementary school was also benchmarked because it represents the average elementary school and the results can be applied to other schools. One respondent who said that they had not yet benchmarked anything said that they were likely to do so in the future and that they currently had an energy management system in place. Other insightful comments are included below.

- Benchmarking revealed the facilities to be in worse shape than they had thought and another explained that the benchmarking results would help them to plan for future facility improvements.
- Benchmarking results will be used as the districts go forward in implementing recommendations and will help the districts develop modernization plans that require lighting and HVAC specifications.
- One respondent has already utilized the results for improvements at other sites.
- One respondent said that the process of ranking (comparing scores between facilities) did not mean much as they are mostly interested in improvement of their facility rather than comparing it to other facilities.
- One respondent did not value benchmarking highly since "the very bad facilities could not be improved much anyway" and it was not meaningful to compare those facilities with others in their district.
- Another commented that the benchmarking results (both the kBtuh/ft^2 and the Energy Performance Rating) were not useful if compared to similar school sites in

other districts because no other district's facility situation would be close enough to warrant such a comparison. The results, however, are useful to track energy use improvements over time.

General recommendations with respect to benchmarking using the ENERGY STAR Portfolio Manager and interpretation of results are provided below.

- **Configuration of California Schools versus National Average.** Nearly all K-12 schools in California utilize portable classrooms, and many schools are campus-style. A benchmark methodology that compares California schools to other schools in the U.S., as does the Portfolio Manager, that do not have these characteristics renders the absolute EPR less meaningful. A recent report by the California Energy Commission (CEC) on benchmarking systems for California states "Until an improved California-specific system is available, we recommend that benchmarking be accomplished by using the existing version of ENERGY STAR."[28] The same report also states, however that "since ENERGY STAR uses national data, it does not adequately represent the relative efficiency of California buildings." Itron recommends that D&R monitor the progress of the CEC's Green Building Action Plan, which is charged with developing a "simple, California-specific energy efficiency benchmarking system." If this group endorses a different benchmarking tool in the future, D&R should evaluate the tool for use in the 2006-08 SEE Program.
- **Site/Source Energy kBtu versus Utility Energy kWh and Therms.** Energy use baseline comparisons should be presented in kWh and therms, not just in terms of Site or Source energy (kBtu). Customers, in this case schools, do not pay their energy bills in Site/Source energy kBtu, therefore it would be more meaningful to also present *electric intensity* (annual kWh/ft^2) and *gas intensity* (therms or kBtuh/ft^2). Electric and gas intensities can also help identify sites where all meters and/or bills were <u>not</u> obtained, or the meters serve multiple facilities, such an administrative office or maintenance facility, as well as the school.

  Furthermore, converting all usage to site/source energy kBtu/ft^2 per year does not give an accurate representation because gas usage will vary considerably by HVAC system type, by region/climate, and by how well the systems are operated, whereas electric intensity should be relatively consistent across similar school building types.
- **Emphasize Relative Scores and Not Absolute Rating.** To continue to fulfill the program objective with respect to benchmarking, D&R should continue to review resulting EPR scores of facilities within a participating district *relative to each other* (i.e., compare scores for schools within a participating district) and not look at each individual score in absolute terms.

[28] California Energy Commission. *Benchmarking System for California Commercial Buildings. Plan, Timetable, and Recommendations.* CMF-400-2005-051-CMF. September 2005.

Facility Audits

Generally, the facility audits and resulting EMPs appear to be a valuable source of information for specific school sites, and will undoubtedly be useful as a starting point for the development of detailed energy management plans and for prioritizing energy-efficiency improvements. D&R went to great lengths to customize the audit and analysis results for each district and audited school. Although the EMPs might not contain enough technical information for an outsider to validate all elements of the analysis, it is apparent from the detail in the calculations and in the EMP document itself (and from the survey responses) that D&R produced a product that their customers found useful and valuable. Indeed, several of the interviewees explained that they preferred a non-technical, concise, and well-organized document to guide their decision making instead of a highly technical document in which specific recommendations could not be easily found.

Two of the in-depth interviewees, in particular, described the audit reports as being very good and useful; one noted that the report was "detailed and systematic" and exceeded their expectations. The SEE Program representative who conducted the audit was described as extremely knowledgeable. All respondents felt that the results were adequately detailed and accurately reflected the audited facility. The respondents said that the program representative reviewed the audit results in detail with them to ensure they were understood and made sense.

Additional comments and insight gleaned from the interviews are summarized below.

- The section on lighting and the executive summary were singled out as being especially good by one interviewee.
- One school district representative said that they planned to implement the audit results.
- Another respondent used the audit results to focus on upgrading portable classrooms. They found that the audit helped them compare the options and they are now better able to use payback periods as a criteria when evaluating options.
- One interviewee explained that they wanted a simple report with concise recommendations to follow that could be used as presentation materials for school board and district meetings. This individual will use the report as a reference to guide future decisions.
- One respondent rejected a suggestion to save on bright lights in the bus garage due to safety concerns.
- One respondent, who felt that they had very high electricity expenses, was considering replacing all the T-12 for T-8 lamps due to a high failure rate and poor light quality. The SEE Program helped them make that decision. However, the

respondent noted that the audit did not provide many suggestions for them and they had some additional questions.

- One respondent had very positive experience with the program, overall, primarily because they "knew absolutely nothing about energy efficiency" yet they are responsible for making sound decisions in that area. This facility manager considers the EMP to be a "good desk reference … to have at your fingertips." When discussing a recent renovation project with a lighting designer, they referenced the EMP to ensure the recommended equipment was specified. Moreover, the executive summary was particularly helpful in presenting information to the Superintendent and School Board in a way that was meaningful and non-technical.

Overall Program Experience

All interviewees felt that their district had benefited from the SEE Program. Those who devoted time to the program by participating and fully reviewing the results viewed the program and D&R very favorably. The most positive aspects of the SEE Program for one respondent were learning that their district facilities benchmark scores were fairly high and obtaining information to prioritize future projects. This respondent found that the program services fit in well with their districts needs. Another respondent had a "pleasant" program experience and appreciated the suggested "low cost/high value" improvements and simple, payback analysis. This respondent also found value in having validation for their efforts and would like all the schools in their district to become involved in the program. Another interviewee said that a particularly positive aspect of the SEE Program was that it did not require excess work on their part, and provided "a tool that can be used every day."

Despite the mostly positive feedback, comments of one respondent revealed some confusion regarding program services offered through the SEE Program. This respondent explained, "there were multiple organizations offering programs which seemed similar and there was a lack of coordination" and referred to "another group doing SEE workshops in May." They explained the need for this type of program to be implemented by one organization, as they are "flooded with people offering rebates and incentives, involving a lot of paperwork and filing. The simpler and more consistent the program, the more likely [they] would be to participate." Despite the apparent confusion, the sentiment expressed by this respondent confirms that D&R's strategy to streamline the program model and virtually eliminate the partnering organizations to offer services was prudent.

Another district decision maker who participated in the program was very satisfied with D&R and the program, though they were skeptical at the outset. Like many district facility managers, this individual felt they "should be doing something" to improve energy efficiency but did not know where to start and mistrusted organizations with the ultimate mission of

selling equipment. Through the SEE Program, this respondent was able to identify a starting point with a specific yet straightforward strategy that offered realistic solutions.

This individual explained in detail how the information and recommendations from the facility audits have been valuable and have already influenced subsequent renovation projects. Working through the SEE Program, they explained, taught them enough to know what questions to ask and the type of equipment to specify in future projects. For instance, when making a decision on the T-8 lighting color, she e-mailed the program representative and received very quick responses, which were much appreciated.

These sentiments were also reflected in the results of the District Services Evaluation Survey. Facility contacts were asked to rate the SEE Program with respect to several aspects. The results, which are very favorable, are presented in Table 3-12.

Table 3-12: Overall Rating of SEE Program by Facility Service Participants

"Please rate the SEE Program, overall, with respect to the following:"	Mean [a,b]	Std. Deviation
Level of detail presented in the Energy Management Plan	1.67	0.71
Amount of time the SEE Program representative devoted to my district	1.89	0.60
Overall quality of information provided through the SEE Program	1.67	0.87
Overall satisfaction with the program services and support	1.67	0.87

a. Ratings on a scale of 1 to 5 with a 1 equal to "Excellent," a 2 equal to "Very Good," a 3 equal to "Fair," and a 4 equal to "Poor."
b. Sample size is 9 for all items.

4

Education Services Evaluation

This section provides the results of the program effects evaluation of the education services provided by the SEE Program. Program objectives and corresponding evaluation objectives are summarized in Table 4-1 below.

Table 4-1: Evaluation Objectives for Education Component

Program Objective	Evaluation Objective
Make appropriate energy efficiency information and resources more accessible to school districts	Confirm the education services provided to each participating district
	Assess effectiveness and quality of education training workshops
Provide teachers with educational tools and resources that can be easily integrated into existing lesson plans	Assess the appropriateness of the materials promoted through the Program with respect to grade levels, content standards, and overall quality
Provide students with interactive, hands-on learning experiences that increase their knowledge of energy efficient technologies	Determine the extent to which education materials and resources were or will be implemented.

Key findings from the program effects evaluation of education services are enumerated below and discussed in more detail in the remainder of this section.

- D&R exceeded the quantitative goals associated with the education services by providing four training workshops, which were attended by at least 129 educators.
- At least 107 educators ordered and received energy-related educational materials through the SEE Program. Because some materials are available via the Internet and at no cost and materials were shared with other teachers, it is likely that some are not accounted for in this total.
- The materials and resources available through the program covered all grade levels and included a variety of lessons and activities to encourage and engage students to learn about energy and energy efficiency.
- D&R selected materials from the NEED Project, which are correlated to California Learning Standards, as the core of the educational services of the SEE Program. The materials were considered high quality and effective in teaching students

about energy, energy use, and energy efficiency. The training workshops and follow up support provided through the SEE Program contributed to the high rate of implementation of these materials by participating teachers and educators.

- The majority (83%) of teachers who received materials through the program had already implemented them in their classroom(s) and an average of 85% of each teacher's students had participated in the lessons/activities or been exposed to the materials distributed through this program.
- The SEE Program facilitated the use of the school site as a learning lab for students by providing a customized set of materials and learning activities that directly related to the technology demonstration projects. Additionally, many of the NEED materials provided to educators through the program were activity-based lessons through which students used their classroom or school to teach energy-related concepts.
- D&R took advantage of lessons learned from the SCSA/CIWMB program. Shifts in the delivery and scope of program services from the SCSA/CIWMB program were necessary and contributed to the success of this program. In particular, D&R eliminated the partnership model and provided all services to participants with its own staff, reduced the scope of services available to participants (education services, in particular). This enables the program to provide one-on-one follow-up support to educators to assist in implementing materials.
- D&R focused on identifying existing education materials and resources that were likely to be tested by the participating educators and providing follow-up assistance to help ensure the materials were successfully used in the classroom. This helped to overcome the barrier that many educators face in identifying high quality materials that are correlated to the Learning Standards and in learning how to use the materials in their classrooms successfully.

4.1 Confirmation of Education Services Participation

Through a review of program documentation, Itron determined the level of participation in the education component of the program, which is summarized in Table 4-2 and Table 4-3. Itron confirmed that educators representing 20 districts received education-related services through the program and that D&R exceeded its only quantitative goal by producing four educator training workshops through a cooperative agreement with the NEED Project.

Table 4-2: Summary of Education Services Participation

Program Activity	Program Goal	Completed
NEED Workshops	2 workshops	4 workshops

As summarized in Table 4-3, NEED materials were ordered for 107 educators through the program, representing 15 different participating districts or COEs. Five individuals

representing two districts or COEs received supplemental education materials.[29] Finally, program records indicate that 129 individuals attended at least one of the NEED training workshops.

Table 4-3: Summary of Educators who Received Education Services

Program Activity	# of Educators
Ordered NEED Education Materials [a]	107
Ordered Supplemental Education Materials [a]	5
Attended NEED Workshop	129

a. See footnote 29.

4.2 Appropriateness of Energy Education Materials

As explained in Section 1, D&R adopted a curriculum-based approach that was largely based upon NEED Project materials and training for the education component of the SEE Program. The NEED materials are correlated to California's Learning Standards and offer a comprehensive set of lessons, activities about energy (sources, production, consumption, efficiency, conservation, etc.) and how these concepts relate to the environment, the economy, and society. The NEED Project offers materials for all grade-levels, and includes an impressive selection of lessons, activities, experiments, and projects to encourage student interest and involvement. The NEED Project has a well-established professional development training program, and works with districts nationwide to develop customized energy education programs to meet their unique goals and objectives, and established learning standards. (It is important to note that the NEED training workshops conducted for the SEE Program were customized specifically for this program, in terms of the materials introduced to the attendees and the process through which teachers would order materials after receiving the training.)

The process through which educators were introduced to the NEED materials, selected materials that best fit their needs and teaching style, and received follow-up support from the SEE Program representative contributed to the overall success of this component of the program. At the onset of the program, D&R had created a policy and procedures framework that established this process. At each NEED training workshop, each educator was provided with a NEED Membership Packet that included one set of selected NEED materials, some of

[29] It is important to note that this tally represents the number of educators for which supplemental materials were *ordered and paid for* through the SEE program. Because some of the materials identified by the Program are downloadable from the Internet and/or available at no cost (to anyone) and teachers reported sharing materials with others, these figures underestimate the number of educators that received supplemental materials as a direct result of the Program.

which were added to the packet specifically for the SEE Program training. Table 4-4 provides a list of materials provided in the packet provided to each workshop attendee.

Table 4-4: Contents of NEED Membership Packet Provided to Participants

Title	Grade Level
NEED Project Materials Catalog	K-12
Blueprint for Success	K-12
Primary Flipbook	K-4
Elementary Infobook	4-6
Intermediate Infobook	6-8
Secondary Infobook	8-12
Games & Icebreakers	K-12
Energy Flows	5-12
Projects & Activities	K-12
Today in Energy	K-4
Yesterday in Energy	4-12
Energy House	4-12
Building Buddies Teacher Guide	1-3
Monitoring & Mentoring Teacher Guide	4-6
Learning & Conserving Teacher Guide	7-12
Energy Conservation Contract	4-12

At each training workshop, the teachers received the packet and learned how to implement some of the activities (starting with basic concepts in the NEED program, information about the energy management series materials kits that include data collection tools and audit procedures). The teachers could not order additional materials until the SEE Program representative met with them; they jointly developed a strategy and identified what the teacher wanted to do through the program and which materials they wanted to use in their classrooms.

All materials—NEED or those on the supplement "menu"—were ordered through the program at no cost to the teachers or district.[30] Initially D&R set a pre-determined limit as to how much to spend on each school and, while there was some flexibility, D&R generally worked within this budget to ensure funds would be available for as many teachers as possible. The program representatives also ensured that the ordered materials were being implemented with students before they continued to support the teachers. The extent of the materials that a particular teacher or school received depended on how engaged they were in the program.

[30] See Appendix H for a complete inventory of materials available through the program.

Beyond the Membership Packet, the program tracking database indicated that participating teachers ordered the following additional NEED materials:

- Infobooks (elementary and secondary – class sets),
- Monitoring and Mentoring Kit (student guides, activities, kit),
- Learning and Conserving (student guides, kits),
- Science of Energy, Primary (guide, kits, class sets),
- Science of Energy, Secondary (guide, kits, class sets),
- Building Buddies (guide, kits, class sets),
- EnergyWorks Guide,
- ElectroWorks Guide,
- Mission Possible: Energy Trade-offs,
- Energy Flows,
- Great Energy Rock Performances, and
- Energy in the Balance.

Additional supplemental materials ordered through the program include:

- Is Efficiency Our Best Resource? (Teacher Guide and student booklets),
- Watt Watchers and Energy Council Program Manual and Activity Pak,
- Flex Your Power Energy Challenge Teacher's Guide and Student Handouts, and
- Iscience HOBO kit and Data Loggers.

Results of the Education Services Evaluation Survey indicate that the SEE Program provided access to materials considered to be useful and interesting and were, in fact, used in the classrooms by the majority of teachers after receiving them. (As assessment of the likelihood that teachers will implement the energy education materials with their students is presented below in Section 4.4.)

Survey respondents rated the education materials, overall, with respect to several aspects that are thought to contribute to longer term adoption into lesson plans and a school's or district's adopted curriculum. As presented in Table 4-5, the materials used by the educators rated quite well—between "excellent" and "very good" in all respects.

Table 4-5: Average Rating of Education Materials

"Please rate the materials you received through the program with respect to the following:"	Mean rating [a,b]	Std. Deviation
Ability to hold students' attention	1.6	0.50
Ease of incorporating the materials/activities into my lesson plans	1.9	0.55
Appropriateness for the grade level(s)	1.9	0.59
Ability to increase student *awareness* of energy use and/or energy efficiency	1.4	0.59
Ability to increase student *knowledge* of energy use and/or energy efficiency	1.4	0.49
Support provided by SEE program representative to use these materials successfully	1.5	0.51

a. Ratings on a scale of 1 to 4 with 1 equals "Excellent," a 2 equals "Very Good," a 3 equals "Fair," and a 4 equals "Poor."
b. Sample size is 20 for all items, except the sample size for the last item is 18.

4.3 Effectiveness and Quality of NEED Training Workshops

Given that the NEED Project has a well-established professional development training program, it is not surprising the workshops developed for the SEE Program were well attended and received favorable ratings by attendees via the workshop evaluations. Overall, workshop attendees felt the NEED Project presenters did a "great job" and provided an interesting and interactive learning environment for the attendees. Many attendees noted the importance of materials being correlated to the California Learning Standards.

More than three-fourths of the workshop attendees felt that the workshop activities *strongly* encouraged them to learn more about energy, and most of the remaining felt *some* encouragement to do the same.

Eighty percent of the attendees believed that it was "very likely" that they would use energy activities and materials in their classroom during that school year. Moreover, most (94%) of the attendees felt that, based on what they had learned at the workshop, they would be able to deliver the activities to their students comfortably. Nearly 91% of all attendees indicated that they would definitely recommend the workshop to other teachers.

The favorable reviews were also revealed in the results of the Education Services Evaluation Survey. Over 90% of the survey respondents had attended one of the four NEED workshops offered through the program. When asked for their opinion regarding the usefulness of the workshop, 82% of the attendees found the workshops "very useful," or "useful." and 16% "somewhat useful."

4.4 Likelihood of Implementation of Education Materials

There are numerous factors that contribute to educators being willing and able to implement new learning materials, activities, and projects in their classrooms. Some of these factors are institutional, such as the Learning Standards, and the district/school/department's established curriculum. Changing the institutional framework in which educators teach students is very difficult and can involve several months or even years. Educators, though, do have varying degrees of flexibility within this institutional framework to choose the materials and activities and develop their own unique lesson plans. The goal of the SEE Program was to introduce educators to quality materials, provide materials and training at no cost, and provide follow up support to increase the likelihood the educators would use materials with their students.

Results of the Education Services Evaluation Survey revealed that, at least in the short run, educators who received materials through the program were likely to use them in their classrooms; in fact, a large percentage of the program participants had already used the materials when they provided input for this evaluation.

Close to 56% of the survey respondents had ordered NEED Project materials or other supplemental materials through the SEE Program. The majority of teachers, 83%, had already used them with their students. An average of 85% of the students taught by each surveyed educator was involved in these lessons or activities. The number of students involved in the lessons or activities using these materials ranged from 19 to 230, with an average of 78 students per teacher.

Survey results indicate that once a teacher implemented the education materials with their students, they were very likely to use them again. Of the survey respondents who had already used the materials, 100% indicated that they were "very likely" or "likely" to use the materials again in the upcoming school year. Moreover, two-thirds of the educators indicated that they shared the materials they received with other teachers at their school.

These results are significant given that the majority of participants were not at all familiar with NEED prior to participating in the program.[31] The fact that nearly all educators claim to have already used the materials or will use the materials in the upcoming year is a testament to the quality and value educators place on these materials as appropriate for their particular classrooms and correlation to California's Learning Standards.

[31] More than 88% of the participants said that they were "not at all familiar" with the NEED project before they participated in the SEE program and 10% said that they were "slightly familiar" with the NEED project and had heard of it or knew someone who used the materials or attended training. Only 2% of the respondents indicated that they were "very familiar" with the NEED project before participating in the SEE Program.

Seventy-five percent of those who had not yet used any of the materials received through the program said that they had not yet had the time to implement a lesson plan or activity. One respondent cited having already covered the topics already in the current school year, and that the materials would be implemented in the next year.

4.4.1 Follow-up Support Provided to Educators

Identifying appropriate quality materials correlated to California's content standards and providing those resources to educators at no cost overcomes a significant barrier to educating students about energy use and energy efficiency. One element of the education component of the SEE Program that contributed to its success is the follow-up support provided to educators to ensure successful use of the materials in their classrooms. While the NEED Project has a well-established professional development training program, it lacks the ground support to keep teachers engaged in the program and implement the materials. Keeping teachers motivated is particularly challenging since most teachers are likely to attend the training during the summer with greater risk of losing motivation and forgetting what they learned by the beginning of the next school year.

D&R's model, therefore, incorporated materials developed through a reputable well-established organization, scheduled customized shorter and more frequent training workshops, and provided the additional on-the-ground support that is not offered through the NEED organization.

SEE Program representatives provided the following support to participating educators:

- Conducted one-on-one meetings with teachers (after a training workshop) to review the NEED materials to determine those that would be most appropriate for each teacher,
- Provided follow-up support with each teacher after they received materials they requested to confirm receipt, answer questions, and provide guidance on how to develop lessons and activities,
- Identified supplemental materials and resources for teacher who had used the core NEED materials and wanted to fold in other activities, and
- Developed a customized set of materials that corresponded to each demonstration project (described in the following subsection).

Results from both the Education Services Evaluation Survey and the in-depth interviews with participants revealed the value of this support, which ultimately contributed to the high implementation rate. One comment provided by a survey respondent echoed this sentiment:

> *The support was the most valuable resource. The Coordinators are fantastic to work with, and they will be missed. … Thank you to all of them. Working with*

> *NEED opened up an entire new venue of science for me in my classroom. … I am inspired to say the least!*

In the professional development training provided through the NEED Project, teachers received the Membership Packet of materials and some familiarity with how the core kits work. Typically, a kit includes background information on the subject area, a teacher guide, equipment, transparencies, and instructions. Kits that are needed to fully implement the NEED materials are expensive (approximately $400), and the teachers may not feel that confident with what they learned in the training to justify purchasing a kit. The SEE Program purchased kits for those who requested them, thereby eliminating the "first cost" barrier. Once teachers have a core kit, the marginal cost of purchasing the additional student guides is low (around $35); the kit can be used repeatedly. SEE Program staff explained that the key for SEE Program success was encouraging the teachers to use the kit once through the follow-up support described above. Generally, the kits were well received and teachers wanted to use them again. The problem with the NEED training outside of the SEE Program is that teachers are less likely to purchase the kits on their own, and thus are less likely to use the NEED Project materials.

4.4.2 Encouraging Use of the School Facility as a "Learning Lab"

As stated above, one core objective of the education component of the SEE Program was to provide students with interactive, hands-on learning experiences to increase their knowledge of energy efficient technologies. Accomplishment of this objective is evidenced by the SEE Program's success in providing the materials and guidance to participating educators to use their own school facilities as learning labs. Many of the NEED Project materials, particularly the Energy Management series, use the school site to teach various energy-related concepts. For example, students learn how to read meters, conduct surveys of the school building and examine sources of energy consumption, and gather, record, monitor, and analyze energy usage with the use of data loggers and meters.

One of the SEE Program's most difficult objectives to fulfill was the integration of the technology demonstration projects into learning activities—the use of an actual retrofit project in their own school as a learning lab. According to program staff, the difficulty is attributable to the fact that facility management decision makers (at the district or even school level) rarely interact with educators, thus such opportunities for integrating improvement projects into learning activities are not recognized. Moreover, a process through which educators and facility staff can communicate, much less *collaborate*, is unlikely to have been established. Secondly, the timing of a retrofit project would need to coincide with the planned and appropriate lessons in the classroom. Thirdly, retrofit projects in schools, particularly those that would disrupt a classroom, are often undertaken when students are out on summer break or other times when students are not in the school.

Because of these barriers, developing educational opportunities with actual equipment installations is difficult.

One of the goals of the SEE Program was to overcome such obstacles and provide the framework and support needed for both facility staff and educators to develop a successful demonstration projects that benefit both of these areas. Through in-depth interviews with facility participants and program staff and a review of demonstration project documentation, Itron was able to confirm and describe that the three technology demonstration projects installed through the SEE Program were successfully integrated into educational opportunities. Summaries of the education activities for each project are provided below.

Demonstration Project #1: Lighting Retrofit. As described in Section 3, this project upgraded the lighting of the school's multi-use room adjacent hallway. A team of three teachers worked with SEE representatives to implement the educational component of the demonstration project. The teachers were provided educational resources and NEED project materials to enable them to teach their students about energy and work with the students on classroom activities. The teachers also used data recorded from the data loggers installed at the site to create graphic presentations to illustrate to their students the difference in energy use due to the upgraded lighting fixtures. The students created displays to showcase their awareness of energy efficiency and conservation that were exhibited at an open house attended by parents and families. The students also gave away compact fluorescent lamps (CFLs) and "Energy Saver" booklets that had been donated by NEED and the U.S. Department of Energy (DOE).

Itron found this demonstration project and the educational activities developed for it to be well documented with other pertinent participation documents in the "demonstration project binder." Included in the binder are equipment purchase and contractor installation invoices, equipment specification sheets, lumen output measurements, and before and after photographs. The educational activities are also documented in the district binder, including a copy of the teacher newsletter that highlighted the project, photographs of students performing at the open house, and a letter signed by students thanking program staff for the new lighting in their school.

Demonstration Project #2: HVAC and Lighting System Upgrade. The demonstration project at this school upgraded the HVAC and lighting systems in the school's existing computer lab. Students were introduced to the demonstration project by SEE Program staff, who explained the lighting retrofit and the high efficiency HVAC equipment. Program staff also installed data loggers to record light level, relative humidity, and temperature in the room prior to the project installation to allow for pre- and post- installation comparisons. As a compliment to the vocational emphasis at this school, students were

provided a binder to develop an energy education portfolio that included energy information, newsletters, and other materials, including information about careers in the energy industry.

This demonstration project and the educational activities developed for it are also well documented with other pertinent participation documents in the "district binder." Included in the binder are equipment purchase and contractor installation invoices, and equipment specification sheets. The educational activities are also documented in the district binder, including copies of all materials provided in the student portfolios.

Demonstration Project #3: Lighting Retrofit. This demonstration project, also described in Section 3, involved a lighting retrofit in a conference room of a COE district administration building. Not having students housed in this site made it a challenge to incorporate direct, hands-on student education related to this particular demonstration project. SEE Program staff explained that they did provide some education materials and resources that were loosely related to this demonstration project to a teacher at a special needs school associated with this COE. For example, program staff recorded before and after light lumens data that were provided to a teacher at the school. NEED Project materials and a mobile energy lab (discussed below) were also provided to that school, but the retrofit project, itself, was not used as a learning lab, per se.[32]

The objective of the using the school site as a learning lab was not tied exclusively to the demonstration projects or limited to the NEED Project materials. Many of the materials selected for the supplemental menu involved hands-on activities, such as energy patrols. Additional resources provided through the program are the Mobile Energy Labs developed under the previous SCSA/CIWMB SEE Program and provided to D&R in November 2004. The labs included a CD, a teacher's guide and a student activities handbook to educate teachers how to use the mobile energy lab as an effective tool, and hands-on activity to educate students on energy use and energy efficiency. The labs focus on core concepts that are integral to the California Science Standards and are designed for the sixth through ninth grade levels. One unit focuses on lighting, one on heating and cooling, and one on controls.

The SEE team provided information about the energy labs to COEs and districts that may be interested in using the labs on site at their schools. D&R provided the mobile lab to a COE that agreed to participate late in the program. Unfortunately, D&R shortly thereafter learned that the left-over funds from the SCSA/CIWMB program would not be transferred to extend services for the 2004-05 program they could not provide follow-up support to the COE or its districts, as originally intended.

[32] The educational activities associated with Demonstration Project #3 described here are taken directly from communication with Program staff and were not documented in the demonstration project binder, as was the case with the other two demonstrations.

4.5 Process Evaluation of Education Services

The objective of the process evaluation of the SEE Program is to assess the program's overall operational efficiency and the quality of services provided to participating districts. With respect to the education component of the program, Itron's objective was to determine if the process through which SEE Program representatives worked with educators was professional and successful. Most of the insight provided here was gleaned from the in-depth interviews with SEE Program staff and participating teachers.

When learning about the program and during initial discussions with SEE Program staff, the respondents felt that D&R provided adequate and accurate information about the program, answered all of their questions, fully described the program services, and completely described the participation requirements and responsibilities. They all understood who their SEE Program contacts were and how to contact them. One individual was surprised to learn how much the program paid for, and another mentioned that the SEE representative was great about checking in and they had never experienced that in their eight years of teaching. Universally, the interviewees felt that the program representatives were sensitive to their needs as educators and they felt the representatives thoroughly understood how the education sector operates.

The interviewees learned about the SEE Program and the NEED workshop through a variety of sources that included e-mail, other teachers, and their school principals. Interviewees said their SEE Program representative contacted them anywhere from once a week to once a month, and all knew that they could contact their representative any time. The SEE Program representatives typically contacted the teachers via e-mail to let them know about upcoming workshops or that they would be in the area and could be available to meet. The teachers thought the contact level was about right and that the meetings were efficient.

Universally, the respondents indicated that the SEE Program provided a good variety of materials and activities. The teachers felt that they could easily integrate the materials into their curriculum. They all received what they ordered, when they expected them via personal delivery, and felt the materials met their expectations in terms of scope, quality, California Learning Standards, and their own personal standards.

All in-depth interview respondents had used the materials they received through the program. They believed that the students learned from them and enjoyed their experience with the materials, and would use them again. They particularly liked the "hands-on nature" of the materials and felt that their students have benefited from them. The teachers felt that the amount of time they had to invest in preparing and teaching the materials was worthwhile given all their other goals, and the time they invested in preparing the lessons was about what they expected. One teacher stated "you could not be displeased with these materials."

All interviewees felt that their expectations from the SEE Program had been met. They expected that the SEE Program materials would reinforce topics covered in class, expand their science knowledge, and provide a way to learn more about energy, energy conservation, and energy production.

All respondents were very positive about their participation in the SEE Program, and when asked explicitly about negative aspects, there were no comments. Participants liked the updated information and hands on activities. They further commented that the interest from the students was "phenomenal." They appreciated the support provided by SEE Program staff and all knew whom to call if they needed anything. All believed that their districts benefited from this program. One teacher, in particular, obtained school board support to set up a lab that will become a new science building.

All respondents were very pleased with the variety of materials and were hard-pressed to voice possible improvements. One suggestion offered was to update the materials as often as possible and to tie the materials to current events, social events, and elements that cause social change. With respect to the NEED training, the only comments made were to offer training sessions in more locations. Another suggestion was to continue the SEE Program and to expand it to reach more students.

The favorable review of the program was also reflected in the Education Service Evaluation Survey results. Respondents to the survey were asked to rate various aspects of the SEE program , overall, on a scale of 1 to 4 with 1 representing "excellent" and 4 representing "poor." Again, the program rated highly, between "Excellent" and "Very Good" in all respects. As shown in Table 4-6, teachers rated the program highly, particularly with respect to the variety of materials offered through the program and the variety of materials that were correlated to the state's Learning Standards.

Table 4-6: Average Overall Rating of SEE Program by Education Service Participants

"Please rate the SEE Program with respect to the following aspects:"	Mean Rating [a, b]	Standard Deviation
"Variety of available materials for the grade levels you teach"	1.74	0.63
"Variety of available materials that are correlated to California standards"	1.88	0.63
"Overall quality of materials available through the program"	1.55	0.59
"Overall satisfaction with the program services and support"	1.57	0.63

a. Ratings on a scale of 1 to 4 with 1 representing "excellent" and 4 representing a rating of "poor."
b. Sample size is 42 for all items.

5

Program Tracking and Documentation

Tracking and documentation of any project contributes significantly to the overall operational efficiency of the project by providing the project management and implementation team with accurate information on project status and achievement of state goals. Accurate and up-to-date tracking enables the project team to allocate resources efficiently and effectively and prevents duplication effort.

With respect to the SEE Program evaluation, Itron relied heavily on program tracking data and documentation as a means of confirming participation and summarizing services provided through the program.

Table 5-1 summarizes the program tracking and documentation provided to Itron in support of this evaluation. Observations regarding these items are provided below:

- Overall Itron found the SEE Program tracking and documentation to be comprehensive and accurate. Itron spot checked data in the tracking database with other documentation and found only a few discrepancies that were minimal.
- The tracking database, a multi-tabbed Excel workbook that included characteristics of participating districts and schools and tracked the program services provided, was easy for Itron to decipher and locate information about each district, school, (and even) teachers and the services provided to each. However, the database was somewhat "clumsy" and does not easily allow for quick "management reporting" capabilities. (For example, it took some effort to determine the number of districts and schools represented by workshop participants.) A higher level of sophistication, though, is secondary in importance to accuracy, and the data contained within this workbook appears to be fairly accurate.
- While program tracking and documentation appeared to be organized and comprehensive, some tracking components and documents overlapped, indicating some duplication of effort. This inefficiency could have been reduced with a slightly more sophisticated tracking database. For example, a great deal of the information recorded in the District Docket (a Microsoft Word format) is also found in the tracking database. A more sophisticated tracking database with better summarizing capabilities would have eliminated the need for the District Docket all together. Some of this duplication appears to be a residual result of the fact that

program tracking and documentation evolved through the implementation period and D&R refined documents over time. Additionally, some errors and inconsistencies were found between documents, although these were minor. A more efficient centralized tracking database could circumvent duplication of information and eliminate potential for error.

- Documentation of some services was missing for some districts and it took some effort for Itron to determine if it was missing or *not applicable* because the district did not receive that particular service. (For example, some districts did not participate in the education component of the program, and some districts that benchmarked did not have a facility audited.) In nearly all cases, Itron could reconcile missing documentation, but a more efficient tracking system would have made it easier to discern participation of each district.
- Program tracking indicated accurate accounting of the education materials that were ordered and delivered for each request.
- Program tracking indicated an accurate accounting of the facility services (benchmarking, audits, and demonstration projects) provided to each district.

Table 5-1: SEE Program Tracking and Documentation Summary

Item	Description/Contents
Tracking Database	A multi-tabbed Excel workbook that logs district participation status for the various program services, includes the following: *Participation Status* – Indicates program services received by each district, dates for completing milestones *Schools Database* - District and school level data from the CA Department of Education, provides background statistics on all schools and districts in California *Audited Schools* - Contains the list of audited schools and key information about the audits (County, District, School, date of audit, report delivery information). *Benchmarked Schools* - Contains the list of schools that were benchmarked, the benchmarking scores, total energy use in kBtu and total floor area. *District Recruitment* - Lists district participation by month, and key district characteristics (enrollment, HTR indicator, etc.) *Teacher Workshops* - Attendees at NEED workshops (May and November 2005) *Santa Clara County Office of Education Workshops* - Attendees at NEED workshops held in Santa Clara COE (January and February 2006) *Facility Workshops* - Attendees at Facility training workshop in May 2005, and program information workshop in Oct 2004. *Teams* - Designates program implementation team assigned to each district. D*emonstration Project Status* - Tabs for each demonstration project providing status of each milestone toward project completion. *Educational Services* - Lists all education materials ordered for each participating educator, also includes costs. *NEED Materials Kits for Santa Clara County Office of Education* - Lists all educators for which NEED Science of Energy and Energy Management Kits were ordered through the Program. (SCCOE was the formal program participant).

Table 5-1 (cont'd.): SEE Program Tracking and Documentation Summary

Item	Description/Contents
District Binders	A separate binder for each district, includes all key documents and deliverables for each participating district, including the District Docket, all signed forms (IPA, CIRF, etc.), copies of significant correspondence, benchmark information and Statement of Energy Performance, audit information and results (EMP), summary of education materials ordered by and provided to the district, and the District Participation Plan (DPP). District binders also include all background information on the district, copies of presentations, and any other documentation relevant to the district.
District Dockets	A separate document for each district that summarizes key data and information (contact information, address), specifies implementation team/program representative(s) assigned to provide services to the district, procedures/documents checklist, summary of facility services (date, activity, notes), summary of education services (date, activity, notes)
Initial Participation Agreement (IPA)	Describes program mission, program objectives, and program team responsibilities. By signing this document, the district agrees to support program team to facilitate the development and implementation of DPP, and agrees not to receive duplicative services from other PGC funded program at the same time.
District Participation Plan (DPP)	Originally intended to be a planning tool to develop and summarize services to be provided to each district. In use, the DPP documented program participation and the specifies program services that were provided to each district at the close of the program.
Educational Services Implementation Plan (ESI)	Specifies educational materials and services to be provided for each district; specifies key district contacts and assigned SEE program representative, Summary of action items, target date of completion, and notes on status.
Demonstration Project Agreement	Document establishing a mutual agreement between D&R and the host district regarding the installation of a technology demonstration project and the responsibilities of each party. Agreement specifies estimated funding amounts and financial responsibilities of each party, and sets forth a preliminary schedule for the specification and installation of the project.
Customer Information Release Form (CIRF)	Signed by a participating district, the CIRF provided permission to D&R to access district consumption data from PG&E to conduct energy use benchmarking.
Participation Questionnaire (PQ)	Short survey designed to collect primary facility characteristics current facility management practices, energy management strategies the district is pursuing, and planning related to future modernization and renovation projects. (Only a few districts completed a PQ).
Correspondence	Implementation introduction letter, emails, faxes, and letters, also includes newspaper articles, and background information pertaining to the school district.
Benchmarking of District Facilities	Includes Facility Summary Report (print out of tabs from Portfolio Manager space use summary, energy performance comparison to "industry average", and environmental impact), Portfolio Manager Statement of Energy Performance, meter billing history, and other information/notes pertinent to energy use benchmarking for each site at the district
Energy Management Plan (EMP)	Report provided to each district that summarizes benchmarking and facility audit results and recommendations for energy efficiency improvements. This document is a key deliverable provided to districts as a result of participation in the program.
Audit Calculation Spreadsheets	Spreadsheet calculation tools used to develop energy and demand cost savings estimates, and cost analyses that are summarized in the EMPs. Separate spreadsheet was developed for each audit that was conducted.

Table 5-1 (cont'd.): SEE Program Tracking and Documentation Summary

Item	Description/Contents
Facility Training Workshop Binders	Separate binder for each workshop that includes workshop flyers, agenda, copies of all presentations, attendee list, planning documents, and workshop evaluation forms.
NEED Training Workshop Binders	Binder for each workshop that includes attendee list, planning documents, and workshop evaluation forms.
Demonstration Project Binders	Binder for each project that includes all pertinent information regarding a demonstration project, including the Demonstration Project Agreement, equipment purchase and installation invoices/quotes, equipment spec sheets, project installation diagrams (such as lighting designs and wiring charts), and copies of all significant correspondence between parties. Binder also includes copies of educational materials used in conjunction with the project, and copies of all publicity relating to the completed project.

6

Conclusions

6.1 Achievement of Program Goals

Table 6-1 and Table 6-2 summarize program achievements of goals in the SEE PIP. As shown in Table 6-1, D&R obtained signed IPAs from 26 districts and COEs. Additionally, D&R has exceeded the goals for all program services, including facility and educator training workshops, facility audits, benchmarking, and demonstration projects.

Table 6-1: Achievement of Quantitative Goals

Program Service	Goal	Completed
Participating districts	20 districts	26 districts/COEs
Benchmark building energy use	56 buildings	89 buildings
Level I (Basic) Audits	32 buildings	43 buildings
Level II (Advanced) Audits	9 buildings	12 buildings
Demonstration projects	2 projects	3 projects
Facility staff training	2 workshops	3 workshops
Teacher training	2 workshops	4 workshops

Achievement of qualitative goals is summarized in Table 6-2. Overall, Itron has determined that D&R achieved the goals of increasing knowledge and awareness of energy efficiency among program participants. Many program participants indicated the program services were valuable and that they would use the information and education materials in the future to develop more energy efficient modernization projects and to educate students about energy use. This evaluation occurred within a relatively short time (months) after program services were provided and therefore does not reflect program effects in the longer term. In particular, this evaluation did not assess the extent to which the information presented through the SEE Program is retained and assimilated into district standard practices.

Table 6-2: Achievement of Qualitative Goals

Program Component	Goal	Completed
Education Services	Increase student knowledge of energy use and energy-efficient best practices	The majority (83%) of teachers surveyed had already implemented educational materials in the classroom. On average, 85% of their students were involved in the lessons.
	Make appropriate energy efficiency information and resources more accessible to school districts in PG&E's service territory through marketing and outreach.	Through training workshops and marketing the program through County Offices of Education, D&R targeted districts in many counties in the PG&E service area, particularly those considered "hard to reach," geographically.
	Provide teachers with educational tools and resources that can be easily integrated into existing lesson plans.	The NEED Project curriculum includes a variety of materials and activities for all grade-levels. The professional development training and one-on-one follow-up support provided through the SEE Program helped the participating educators implement the materials.
	Provide students with interactive, hands-on learning experiences that increase their knowledge of energy-efficient technologies.	The educational materials ordered by participating educators included data collection, audits, energy patrols, and other activities that use the classroom or building as a "learning lab." In addition, SEE Program representatives assembled education materials relevant to the technology demonstration projects for participating teachers at the host schools.
Facility Improvement Services	Increase facility staff understanding of and receptiveness to energy-efficient technologies and practices.	Facility energy management training workshops and energy use benchmarking helped participating facility managers learn about energy efficient technologies and about the energy performance of schools within their districts. Many facility managers learned the facilities were less energy efficient than they had thought. All facility services provided through the program were considered valuable by the participants.
	Identify and prioritize energy management strategies and cost-effective energy efficiency improvements.	Energy use benchmarking helped participants identify school sites in their districts that were in most need of improvements. Facility audits and the Energy Management Plans prepared for each audited site provided specific recommendations for energy efficiency improvements. Life-cycle cost analysis was also provided to illustrate the financial benefits of recommendations. All surveyed participants considered the Energy Management Plan a useful reference for planning future projects.

6.2 Observations on Program Implementation and the Program Model

One of the goals of this evaluation was to assess the operational efficiency of the program model (how effectively D&R is recruiting districts and providing facility and educational resources to participants). D&R has exceeded the participation goal of 20 districts, which

reflects a successful marketing, and outreach strategy that was comprehensive in terms of materials and methods. The fact that D&R's marketing and recruiting strategy was targeted in terms of geography indicates that economies were likely achieved by serving participants that were in close proximity to each other.[33] Recognizing the difficulties in reaching decision-makers at individual districts, D&R successfully leveraged COEs as a conduit for distributing program information, earning credibility in the market, and establishing participation with many districts.

There are many obstacles unique to the K-12 education sector that make promoting energy efficiency and energy education particularly difficult. With respect to education, understanding the Learning Standards to which students and therefore teachers and schools are held accountable is extremely important; anything that does not contribute to student performance relative to those standards is unlikely to be implemented. The school calendar, testing schedules, and established district curricula are all obstacles around which the program implementer must navigate to be successful. Survey and interview results of this evaluation indicate that D&R has recognized these limitations and developed a program implementation plan that successfully worked within these constraints.

There are many institutional barriers and practices that have slowed adoption of energy efficient equipment and design in school facilities. The availability of public school modernization funding, district specification and design standards, and even the availability of adequately trained facility staff are examples of some of these barriers. While some of these barriers are unlikely to be mitigated by any energy efficiency program, the SEE Program provided facility decision makers with valuable information and tools to help them develop more energy efficient renovation projects when opportunities arise.

In addition to the institutional barriers that are unique to the K-12 education sector, D&R needed to overcome the rather negative perception of the SEE Program that was generated during the SCSA/CIWMB's term. Discussions with the D&R implementation team revealed that some participants of the SCSA/CIWMB program declined to continue participating because of inadequate service or confusion associated with the earlier program. Some districts did agree to continue participating despite any negative experiences with the earlier program, none of which expressed dissatisfaction with D&R or the services provided by through the 2004-06 SEE Program.

D&R also appears to have been successful in providing facility services (benchmarking and audits) to program participants that were valuable and professionally sound. Interviews with

[33] The work conducted for this report did not investigate the nonparticipant population (districts or individuals, such as educators within districts). Reasons why districts choose not to participate in the program might reveal a program design weakness.

participating districts reveal that D&R program staff was professional, responsive, and easy to contact. Additionally, the evaluations for the facility training workshop held in the spring of 2005 received very high ratings with respect to effectiveness and the quality and usefulness of information provided.

With respect to education, the program appears to have provided a valuable service to educators seeking to identify and implement new learning materials for their students. The program not only provided quality materials correlated to California's Learning Standards at no cost, but provided training and one-on-one follow-up support to ensure successful use of the materials in the classroom. None of the surveyed or interviewed participants had any negative feedback and all indicated they received the materials they ordered through the program.

While secondary to the quality of program services and information provided to the program participants, the program tracking system and documentation process was found to be somewhat duplicative and inefficient. The information stored in the program tracking database was consistent with other forms of program documentation, however, and Itron was able to confirm participation levels and the services provided to participants. A slightly more sophisticated tracking database that prevents duplication of entries – in the database itself and with other documents produced that summarize participation – will significantly reduce this inefficiency. This weakness was identified only through Itron's "audit" of the program tracking spreadsheet and participation documents, and did not appear to impact the quality or timeliness of services provided to the participants.

Appendix A

Facility Services Evaluation Survey Development and Administration

A.1 Survey Objectives and Design

The objectives of the Facility Services Evaluation survey were to determine whether facility staff is more likely to implement or recommend implementing energy efficiency measures after participating in an audit. The survey also allowed participants who were mostly the primary contacts at the districts or County Offices of Education to provide their opinions about the Facility Improvement information, services, and training that they received through the SEE program.

A.2 Survey Administration

The target sample for this survey was a census of districts that received facility-related services through the program. D&R provided a database of 32 facility related contacts at participating districts that Itron used as a sample frame for this survey. Five of these were removed from the frame because they were targeted to the in-depth interview effort as part of this evaluation. Thus, the frame and sample target was 27 individuals.

Itron and D&R determined that the facility contacts working with the program were most likely to respond to an Internet-based survey, rather than a telephone or mail survey. The Internet-survey was activated on June 13, 2006. Respondents were invited to complete the survey via an email sent in the second week of June 2006 to all contacts in the final sample frame. Follow-up reminder emails were sent to all non-respondents, and a hard copy letter was mailed on July 20, 2006. The survey was closed on July 18, 2006.

A.3 Response Rate and Summary of Respondents

Twelve evaluation surveys were completed, resulting a response rate of 44%. One-third of the surveyed participants were Managers or Directors of Maintenance and Operations, 25% were Facilities Managers or Directors. The facilities of the respondents' districts that were audited through the program included seven high school sites, eight middle school sites, 16 elementary school sites, and six sites designated as other school district buildings.

A.4 Survey Instrument

Copies of the Internet survey and the recruiting email and letter and the are provided below.

Itron

Knowledge to Shape Your Future

School Energy Efficiency Program Evaluation Survey

Because you are the primary contact of a district or County Office of Education that received facility improvement information or services or training through the School Energy Efficiency (SEE) Program your input into the independent evaluation of this program is very important.

The survey should take approximately 10 minutes to complete. Although not required, it might be helpful to have the Energy Management Plan and other information from the Program with you as you take this survey.

All responses to this survey and any contact information provided will remain confidential. Thank you in advance for your time.

1. **Please select the title that best represents your current position.**
   - ○ Facilities Manager or Director
   - ○ Manager or Director of Maintenance and Operations
   - ○ Superintendent or Principal
   - ○ Business or Financial Manager
   - ○ Facilities Planner
   - ○ Energy Manager
   - ○ Other. Please specify:

2. **Please indicate the number of sites of <u>each type</u> that were audited and/or benchmarked through the SEE program:**
   - ☐ High School(s)
   - ☐ Middle School(s)
   - ☐ Elementary School(s)
   - ☐ Other district building(s)
   - ☐ None. ***Please skip to Question 17***

3. **What were the primary considerations for selecting this/these particular site(s)?**

4. **Did you receive an Energy Management Plan that summarized the results of the audit(s)?**
   - ○ No ***please skip to Question 10***
   - ○ Yes

5. **Does the "Facility Description" section of the Energy Management Plan accurately describe the site(s), with respect to general site characteristics (sqft, building types, enrollment) and existing equipment (such as type of lighting fixtures, HVAC equipment, etc.)?**

- ○ No
- ○ Yes

6. **Rate the usefulness of the Energy Management Plan with respect to the following:**

	Very Useful	Useful	Somewhat Useful	Not Very Useful
Identifying cost-effective energy efficiency improvements	○	○	○	○
Identifying incentives and loans for energy efficiency improvements	○	○	○	○
Understanding the energy use of the school site(s)	○	○	○	○
Prioritizing renovation/retrofit projects	○	○	○	○
Economically justifying energy efficiency improvement projects to other decision makers	○	○	○	○
Indentifying low-cost energy efficient "best practices"	○	○	○	○

7. **Considering the existing equipment and energy use pattern of the facility (or facilities) that were audited, how reasonable are the recommendations for reducing energy usage that are outlined in the Energy Management Plan?**

- ○ Very reasonable, all of the recommendations were appropriate.
- ○ Reasonable, most of the recommendations were appropriate.
- ○ Somewhat reasonable, only some of the recommendations were appropriate.
- ○ Not at all reasonable, the recommendations were not very appropriate.

8. **Within the next year, how likely will your district be able to implement one or more of the energy conservation recommendations presented in the Energy Management Plan(s)?**

- ○ Very likely
- ○ Likely
- ○ Somewhat unlikely
- ○ Not at all likely

9. **If you answered "Somewhat likely" or "Not at all likely" to Question 8, please explain why you do not expect to implement any recommendations.**

10. **Did the SEE Program benchmark the energy use for one or more of the audited sites?**

- ○ No *please skip to Question 17*
- ○ Yes

11. **The benchmarked energy use per square foot (kBtu/Sq.Ft) result was...**

- ○ About what I expected
- ○ Higher than what I expected
- ○ Lower than what I expected
- ○ I did not know what to expect

12. How useful to you is the kBtu/sqft for school sites in your district?

- ○ Very useful
- ○ Useful
- ○ Somewhat useful
- ○ Not at all useful

13. How useful to you is the Performance Rating for school sites in your district?

- ○ Very useful
- ○ Useful
- ○ Somewhat useful
- ○ Not at all useful

14. If you answered "Somewhat useful" or "Not at all useful" to Question 12 or Question 13, why do you feel the rating(s) is(are) not very useful?

15. How often do you plan to update your district's Energy Star Portfolio Manager account to re-benchmark energy use of the site(s)?

- ○ Monthly
- ○ Every few months
- ○ One or two times a year
- ○ Never

16. If you answered "Never" to Question 15, please explain why you do not expect to re-benchmark.

17. Did you attend one or more training workshops offered through the SEE program?

- ○ Yes
- ○ No *please skip to Question 19*

18. Which training workshop did you attend?

- ○ Fresno County Office of Education, May 12, 2005
- ○ Finelight, October 27, 2005
- ○ Do not remember

19. Did the SEE program provide your district with any support other than facility audits or benchmarking?

- ○ No
- ○ Yes. Please describe:

20. Please rate the SEE program, overall, with respect to the following:

	Excellent	Very Good	Fair	Poor
Level of detail presented in the Energy Management Plan	○	○	○	○
Amount of time the SEE Program reprentative devoted to my district	○	○	○	○
Overall quality of information provided through the SEE Program	○	○	○	○
Overall satisfaction with the program services and support	○	○	○	○

Please provide any additional comments about your experience with the SEE program below.

Your responses to this survey are greatly appreciated. Thank you for your participation and have a great summer!

If you wish to receive information on additional program services and/or information on energy efficiency opportunities for school facilities, please provide your contact information below (optional).

Name:

District:

School (if applicable):

Phone:

Email:

What type of information/services are you interested in?

Your responses to this survey will remain confidential. Any contact information you provide will only be used to provide you with additional information on energy efficiency resources for school facilities.

Submit Clear Form

Any questions regarding this survey can be directed to:

Jennifer Holmes
Itron, Inc.
831.457.9822
jennifer.holmes@itron.com

Dear <<Contact First Name>>:

During the past year, <<Site Name>> participated in the School Energy Efficiency (SEE) Program and received information and training on improving the energy efficiency of one or more facilities. Itron, an evaluation firm, was contracted to conduct an independent evaluation of this program to ensure the program met your expectations and provided quality information, services, and training. Your opinions about the information, services, and training you received through the SEE program are extremely important.

I am contacting you to ask that you take just a few moments out of your busy schedule to complete a SEE Program evaluation survey. The survey is conveniently available over the Internet and will only take about 10 minutes for you to complete. Just click on this link or enter www.itron.com/SEEfacility in the address bar of your internet browser and you will be directed to the survey.

If you have any questions about this survey, you may contact your SEE program representative or the evaluation manager, Jennifer Holmes at 831-457-9822 or jennifer.holmes@itron.com.

Thank you for your time,

Jennifer Holmes
Evaluation Manager
Itron, Inc.

July 20, 2006

<<Contact First Name>> <<Contact Last Name>>
<<Site Name>>
<<Street Address>>
<<City, State, Zip>>

Dear <<Contact First Name>>:

During the past year, <<Site Name>> participated in the School Energy Efficiency (SEE) Program and received information and training on improving the energy efficiency of one or more facilities. Itron Inc., an evaluation firm, was contracted to conduct an independent evaluation of this program to ensure the program met your expectations and provided quality information, services, and training. Your opinions about the information, services, and training you received through the SEE program are extremely important. This evaluation is required by the California Public Utilities Commission, the state agency with regulatory oversight over the funding that was allocated for the SEE Program.

I am contacting you to ask that you take just a few moments out of your busy schedule to complete a SEE Program evaluation survey. The survey is conveniently available over the Internet and will only take about 10 minutes for you to complete. Just enter www.itron.com/SEEfacility in the address bar of your internet browser and you will be directed to the survey.

If you have any questions about this survey, you may contact me, the evaluation manager, at 831-457-9822 or jennifer.holmes@itron.com. You may also contact your SEE program representative.

Sincerely,

Jennifer Holmes
Evaluation Manager
Itron Inc.

Appendix B

Education Services Evaluation Survey Development and Administration

B.1 Survey Objectives and Design

The overall objectives of this evaluation survey were to answer to the following questions:

- Did teachers receive useful educational tools?
- Did the tools and resources provided by the program increase students' knowledge of energy use and energy-efficient best practices?
- Did the workshops provide teachers with educational tools and resources that could be easily integrated into lesson plans?
- Did the workshops successfully increase educator efficiency awareness?

B.2 Survey Administration

Itron and D&R jointly determined that educators were most likely to respond to an Internet survey, since they are not likely to be accessible by phone during business hours and a mail survey would likely be tossed by school administrative staff and not ever be delivered. The Education Services Evaluation survey was conducted over the Internet in May 2006 to The survey allowed participating districts and educators to state their opinions regarding the effectiveness of the program and to rate the educational material and training they received.

The target sample for this survey was a census of educators who received SEE Program services (attended a workshop or ordered educational materials). D&R provided Itron with a sample frame of 86 educators for this effort, all of which were targeted for this survey. The survey was open to the participants on May 8 through June 13, 2006. Itron sent an initial e-mail, then a follow-up hard copy letter inviting them to complete the survey. A final reminder email was delivered on June 8 to anyone who had not yet completed the survey. As an incentive, each of the participants who completed the survey was entered in a random drawing to receive a gift card worth $75 from GW School Supply.

B.3 Summary of Respondents

The final response rate was 50%, or 43 completed surveys. The educators represented 21 school districts and included those who mainly taught kindergarten and middle school. Only eight educators who completed the surveys taught high school. More than half of the participants taught general subjects, while most of the others taught science, (mainly integrated science or biology). The number of students taught by each educator varied between 16 and 450, with a mean of 85 students per respondent.

Seventy-four percent of the respondents indicated that they had attended one of the two workshops conducted in January and February 2006 at the Santa Clara County Office of Education, 21% attended the November 2005 workshop at Kern County Museum in Bakersfield, and 5% said that they had attended the workshop held at UC Merced Center, Bakersfield in May 2005.

B.4 Recruiting Materials and Survey Instrument

Copies of the survey and recruiting letter and email are provided below.

Itron

Knowledge to Shape Your Future

School Energy Efficiency Program Evaluation Survey

Because you were an educator who received educational materials or training through the School Energy Efficiency Program, your input into the independent evaluation of this program is very important.

The survey should take approximately 10 minutes to complete. All responses to this survey and any contact information provided will remain confidential.

Thank you in advance for your time.

1. **What grade level(s) do you teach?** ***(select all that apply)***
   - ☐ Kindergarten/Elementary
   - ☐ Middle School
   - ☐ High School

2. **What subject(s) do you teach?** ***(select all that apply)***
   - ☐ General subjects
   - ☐ Science. Please specify the field(s) of science you teach:
   - ☐ Other. Please specify:

3. **How many total students are in your class(es) this year?**
   _____ students.

4. **Did you order any NEED Project materials or other supplemental materials through the SEE program?**
   - ○ No ***please skip to Question 13***
   - ○ Yes

5. **Please indicate the type of materials you received** ***(select all that apply)***
   - ☐ NEED Project Materials
   - ☐ Energy Patrol - How to Instructions
   - ☐ School Energy Audit / Survey - How to Instructions
   - ☐ Energy at Home with Classroom Activities
   - ☐ Classroom Resources - videos, posters, CD's
   - ☐ Special Project Resources
   - ☐ List of Website Resources

☐ Hobo Dataloggers - Hobo Henry and CD of classroom activities

☐ Other. Please specify:

6. **Have you used any of the materials you received through the program with your students?**

◯ Yes. ***Please continue to Question 7***

◯ No

6a. What are the primary reasons you have not used any of the materials yet? ***(select all that apply)***

☐ I did not receive what I ordered

☐ The quality of the materials was less than what I expected

☐ I did not have the time to implement a lesson plan or activity, *but plan to before the end of the school year*

☐ I did not have the time to implement a lesson plan or activity, *and will not likely do so this year*

☐ Did not receive the support I needed to implement a lesson plan or activity

☐ The materials did not fit well into my lesson plans

☐ The materials were not correlated to California's content standards

☐ Other. Please explain:

If you answered Question 6a, please skip to Question 13

7. **Please rate the materials you received through the program with respect to the following:**

	Excellent	Very Good	Fair	Poor
Ability to hold students' attention	◯	◯	◯	◯
Ease of incorporating the materials/activities into my lesson plans	◯	◯	◯	◯
Appropriateness for the grade level(s)	◯	◯	◯	◯
Support provided by SEE program representative to use these materials successfully	◯	◯	◯	◯
Ability to increase student *awareness* of energy use and/or energy efficiency	◯	◯	◯	◯
Ability to increase student *knowledge* of energy use and/or energy efficiency	◯	◯	◯	◯

8. **About how many students were involved in the lesson(s) and/or activity?**

_____ students.

9. **How likely are you to use the materials you received through the SEE program in your classroom(s) next year?**

◯ Very likely

◯ Likely

◯ Somewhat unlikely

◯ Very unlikely

10. **Approximately how many in-class hours did you allocate to using the materials you received through the program?**

- ◯ 1-4 hours
- ◯ 5-9 hours
- ◯ 10-14 hours
- ◯ 15 hours or greater

11. **Approximately how many hours for preparation did you devote to learning about the materials you received through the program and developing the activities/lesson plans?**
    - ◯ 1-4 hours
    - ◯ 5-9 hours
    - ◯ 10-14 hours
    - ◯ 15 hours or greater

12. **Did you share any of the materials with other teachers at your school?**
    - ◯ Yes
    - ◯ No

13. **Did you attend one of the NEED workshops offered through the program?**
    - ◯ Yes
    - ◯ No. ***Please skip to Question 16***

14. **At which location to you attend the training?**
    - ◯ UC Merced Center, Bakersfield, May 19, 2005
    - ◯ Kern County Museum, Bakersfield, November 16, 2005
    - ◯ Santa Clara County Office of Education, January 26, 2006
    - ◯ Santa Clara County Office of Education, February 15, 2006

15. **Please rate how useful the workshop has been for you in implementing lessons or activities that increase your students' knowledge of energy use and energy efficiency.**
    - ◯ Very useful
    - ◯ Useful
    - ◯ Somewhat useful
    - ◯ Not at all useful

16. **Please rate the SEE program with respect to the following aspects:**

	Excellent	Very Good	Fair	Poor
Variety of available materials for the grade levels you teach	◯	◯	◯	◯
Variety of available materials that are correlated to California standards	◯	◯	◯	◯
Overall quality of materials available through the program	◯	◯	◯	◯
Overall satisfaction with the program services and support	◯	◯	◯	◯

17. **How likely are you to incorporate energy efficiency or energy use topics into your lesson plans next year?**
    - ◯ Very likely

- ◯ Likely
- ◯ Somewhat unlikely
- ◯ Very unlikely

18. **How familiar were you with the NEED Project before you participated in the SEE program?**

- ◯ Very familiar
(Used NEED materials, attended training or was a NEED member prior to receiving assistance through the SEE program)
- ◯ Familiar
(Seen NEED materials, researched the NEED Project website or ordered a NEED catalog prior to the SEE program)
- ◯ Slightly familiar
(Heard of the NEED Project, know someone who used the materials or attended training)
- ◯ Not at all familiar

Other Comments?

Thank you for your participation! If you want to be entered into the drawing to win a $75 gift card for GW School Supply, pleas provide the following contact information:

Name:

District:

School:

Email:

Phone:

Mailing Address:

City:

Zip:

Submit Clear Form

This information will not be used for any other purpose other than to notify the winner of the drawing.

The winner of the GW School Supply gift card will be randomly selected and will be notified no later than June 30, 2006.

Any questions regarding this survey or the gift card drawing can be directed to:

Jennifer Holmes
Itron, Inc.
831.457.9822

Dear <<Contact First Name>>:

During the 2005/06 school year, you received educational materials and/or training through the School Energy Efficiency program. As you approach the end of the year, the SEE program is wrapping up services to participating districts and educators. One of the important aspects of this final phase of the program is evaluation, to ensure the program met your expectations and provided quality educational materials, training, and services. Your opinions about the materials and training you received through the program are extremely important.

The survey is conveniently available over the Internet and will only take about 10 minutes for you to complete. Just click on this link or enter **www.itron.com/SEEteachers** in the address bar of your internet browser and you will be directed to the survey.

Your responses to this survey are important, and we hope you will find time to complete the survey before leaving your classrooms for the summer break.

To express our appreciation, you will be entered into a drawing for $75 gift card from GW School Supply (www.gwschool.com) after you complete the survey.

If you have any questions about this survey, you may contact your SEE program representative or the evaluation manager, Jennifer Holmes at 831-457-9822 or jennifer.holmes@itron.com.

Best regards,

Jennifer Holmes
Evaluation Manager
Itron, Inc.

June 8, 2006

<<Contact First Name>> <<Contact Last Name>>
<<Site Name>>
<<Street Address>>
<<City, State, Zip>>

Dear <<Contact First Name>>:

During the 2005/06 school year, you received educational materials and/or training through the School Energy Efficiency program. As you approach the end of the year, the SEE program is wrapping up services to participating districts and educators. One of the important aspects of this final phase of the program is evaluation, to ensure the program met your expectations and provided quality educational materials, training, and services. Your opinions about the materials and training you received through the program are extremely important.

The survey is conveniently available over the Internet and will only take about 10 minutes for you to complete. Just enter www.itron.com/SEEteachers in the address bar of your internet browser and you will be directed to the survey.

Your responses to this survey are very important, and we hope you will find time to complete the survey before leaving your classrooms for the summer break.

To express our appreciation, you will be entered into a drawing for $75 gift card from GW School Supply (www.gwschool.com) after you complete the survey.

If you have any questions about this survey, you may contact your SEE program representative or the evaluation manager, Jennifer Holmes at 831-457-9822 or jennifer.holmes@itron.com.

Sincerely,

Jennifer Holmes
Evaluation Manager
Itron Inc.

Appendix C

Program Participant In-Depth Interview Development and Administration

C.1 Interview Objectives and Design

Interviews were conducted with participants involved with different aspects of the program to obtain feedback regarding the administration of the program and the effectiveness and usefulness of the resources and services provided to districts.

C.2 Interview Administration

Itron's priorities were to interview representatives of districts that had completed or received the most facility-related services, as well as teachers who had received and were using educational material provided through the SEE program. This was done under the assumption that these individuals would have the most history in working with D&R and could provide the "richest" feedback on the quality of resources and services received through the program. (Thus, the interview sample is not considered random or representative of all participating districts.) Districts that participated in the SCSA/CIWMB program were also assigned a higher priority in the sample, though none were available to be interviewed.

Table C-1: Participant In-depth Interview Sample Frames and Response Rates

	Facility Service Participants	Education Service Participants
Total contacts in sample frame	32	12
Number of individuals contacted for interview	11	6
Number of completed interviews	6	5
Response rate	54.5%	83.3%

All in-depth interviews were conducted via telephone in August and October 2005 and June 2006.

C.3 Summary of Interview Respondents

Facility Managers/Decision Makers. Itron completed in-depth interviews with facility contacts representing six districts participating in the SEE program. The completed interview sample includes a Facilities Manager, an Associate Director of Facilities, two Directors of Maintenance Operations and Transportation, and a Superintendent/Principal. Districts represented by the interviewees include one unified school district, two elementary districts, a high school district, and a County Office of Education. The interviewees have been involved with the program for periods of six months to one year and had indicated they learned about the program through a variety of sources, including flyers, mailers, email, or through a direct contact by a SEE program representative.

Educators. To support this evaluation, Itron conducted five in depth interviews with participating teachers representing four school districts participating in the SEE program. Itron's priorities were to interview teachers who had received and were using the program materials, under the assumption that these individuals would have the most experience and could provide richer feedback on the quality of the services and materials provided by the SEE Program. The interview sample, therefore, is not intended to represent a random sample nor is it representative of all the participating districts.

The interviewees represent a range of school types (an elementary school, an education center, an intermediate school, and a high school), grade levels (fourth through the twelfth grade), and subject areas. The number of students taught by each teacher ranged from 19 to 200, with two teachers teaching 19 students each, one teaching 30 students, one 130, and one 200. All teachers interviewed had ordered, received, and were currently using education materials. All but one attended the NEED training workshop.

C.4 Interview Guide

A copy of the in-depth interview guide is provided below.

District Participant In-depth Interview Guide

Introduction

Hello, my name is _____. I work for an evaluation firm called Itron, who has been hired as the independent evaluator of D&R's School Energy Efficiency Program. We are currently in the process of speaking with people who are or have been involved in the program to gain an understanding of how well the program is working.

Do you have about 15 to 20 minutes to discuss the SEE program with me?

YES → Confirm contact's role in the SEE program and that respondent is most appropriate person and schedule interview time/date.
Clarify that respondent's comments will remain confidential and will be compiled with responses of other respondents.

NO → Reiterate importance and value of their insight, and ask to schedule an interview at a more convenient time.

Respondent Background and Relationship to Program

First I'd like to ask you a few questions about your district and your role in working with the SEE program.

1. What is your job title and primary responsibilities at your district?

2. How long have you held these responsibilities (at this district or other employer)

3. How long have you been involved with the SEE program?
   [If response is > than 2 years confirm that the district was a participant with the 02/03 program administered by the CIWMB/SCSA. If so, ask how the D&R program compares to the CIWMB/SCSA program in terms of services.]

4. About how much time/what percentage of your time do you spend on SEE program?

5. About how often are you contacted by your SEE program representative?
   Please describe the nature of these contacts and what has been accomplished.

6. How did your district learn about the SEE program, and why did you, personally decide to participate?

Who made the final decision at the district level to participate?

7. When learning about the program and during initial discussions with SEE program staff, do you feel you received adequate and accurate information about the program?
   Were all of your questions answered?
   Were program services described completely?
   Were participation requirements and responsibilities explained?
   Did you understand who your SEE program contact was and how to reach them?

8. What program services is your district receiving through the SEE program?
   How were these services chosen? (If not, why are they different?)

9. What were[are] your expectations for the SEE program?
   Have these expectations been met?

Now I'd like to ask you some questions about specific services your district is receiving/has received through the SEE program.

<u>If respondent is education contact:</u>

10. What curriculum, materials, and/or training did you receive through the SEE program?
    How were these provided to you?
    Are these the materials you were expecting?
    Do they meet your expectations in terms of scope and quality?
    Are they correlated California Learning Standards?

11. Have you used them yet?
    If yes, please describe how.
    Will you continue to use them?
    If no, why not?

12. Do you feel your students learned from them?
13. Do you have any suggestions or recommendations for improving the materials or process by which they were provided to you?
14. Have you attended a training workshop sponsored by the program?
    What was your impression about the quality and usefulness of the workshop?

<u>If respondent is facility contact:</u>

15. Are you benchmarking any of your facilities through the SEE Program?
    Are you benchmarking all buildings or just some?
    If some, why not all?

16. How did you choose the buildings you're benchmarking?

17. How have you used the benchmarking results?

18. How likely do you think you will continue to update the energy use and continue using your ENERGY STAR Portfolio Manager account?

19. Did the benchmarking results meet your expectations?

20. Has a facility audit been completed for some of your district facilities?

21. Was the SEE program representative who conducted the audit professional, intelligent, etc?

22. Did they review audit results and recommendations with you?

23. Do you feel the information summarized in the audit report and the recommendations for energy efficiency improvements make sense and are reasonable?

24. Is the audit report or "Energy Management Plan" useful to you?
    Why/Why not?

25. How will you use the audit results?

Overall Program Experience

Finally, I'd like to get your overall opinions of the SEE program.

26. What aspects of the SEE program were particularly positive for you?

27. What aspects have been particularly negative for you?

28. Do you feel your district has benefited from the program?

29. Do you have any suggestions for improving the program?

Appendix D

Program Staff In-Depth Interview Development and Administration

D.1 Interview Objectives and Design

The goal of the in-depth interviews with program staff was to gain a complete understanding of the program model and delivery, obtain information on operational efficiencies of the SEE program, and determine how well program implementation processes corresponded to the implementation plan and program logic. Data obtained through this survey helped to answer the following questions:

- How effectively did D&R market and recruit districts into the SEE program?
- How effectively did D&R manage overall program implementation among its implementation team?
- How effectively did D&R manage and track progress of services provided to participating districts?
- What future improvements can/should be made in the next program cycle?
- How did the SEE program structure differ from the 2002-03 program implemented by the SCSA/CIWMB?

D.2 Interview Administration

Two formal in-depth interviews with program staff were conducted (via telephone) as part of the final program evaluation. (In addition, several informal discussions with program staff were conducted to support the mid-term progress memorandum.) Itron's target sample for this effort was at least one in-depth interview with a program staff member for the facility services and one for the education services. The response rate for this effort was 100%.

D.3 Interview Guide

A copy of the in-depth interview guide is provided below.

SEE Program Staff In-depth Interview Guide

Introduction

Hello, my name is _____, and I'm on the evaluation team for the School Energy Efficiency Program. We are currently in the process of speaking with people who are or have been involved in the program to gain an understanding of how well the program is working.

Your insight and experience with the program would be very valuable. Do you have about 20 to 30 minutes to discuss the SEE program with me?

YES → Confirm role in the SEE program and that respondent is most appropriate person and schedule interview time/date.
Clarify that respondent's comments will remain confidential and will be compiled with responses of other respondents.

NO → Reiterate importance and value of their insight, and ask to schedule an interview at a more convenient time.

Respondent Background and Relationship to Program

First, I'd like to ask you a few brief questions about your background and expertise as it relates to the SEE program.

1. What is your primary responsibilities on the program team? How long have you held that responsibility?

2. How long have you been personally involved in the SEE program?

3. What are your primary responsibilities with the SEE program?

4. How often and for what reasons do you interact directly with participating districts?

5. About how many individuals are on the program implementation team?
   Probe: Do you feel program implementation staffing is adequate?

SEE Program Model and Implementation

Now I'd like to ask you about how the SEE program works.

1. Please take a few moments and describe to me how the program was developed and how it evolved into its current state.

2. Describe how districts learn about the SEE program and how the program is marketed to districts.
   Probes:
   What is the process by which districts are contacted and receive program services?
   How are districts selected to participate in the program?
   Who on the implementation team makes the final decision of which districts will participate?
   Would you characterize participating districts in any particular way? (Is the SEE program attracting a particular type of district, either geographically, financially, etc.?)
   Why do you feel districts participate in the SEE program?

3. How do you determine which services each participating district will receive?
   Probes:
   Who makes this determination?

4. How do you track progress of services provided to each participating district?

5. Have there been any changes in structure of the program or delivery of services?
   Probes:
   What facilitated these changes?
   Do you feel that these were positive or negative changes?

6. What do you feel are the strengths and weaknesses of the current SEE program model?

7. Overall, how do you feel the implementation of the SEE program is going?
   Probes:
   What aspects of the SEE program do you feel have gone particularly well? Why?
   What aspects of the SEE program do you feel have not gone particularly well? Why?

Comparison to the SCSA/CIWMB Program

8. Finally, are you familiar with the SEE program administered by the State and Consumer Services Agency and the Integrated Waste Management Board in the 2002-03 program term?

   If yes,

   Did you have a role in that program? Please describe your role.

   Please discuss the similarities and differences between this current program and the CIWMB/SCSA program.

Appendix E

Facility Workshop Evaluation Survey Development and Administration

E.1 Summary of Facility Training Workshops

The objective of the facility training workshops was to educate district facility personnel and decision makers on cost-effective energy efficiency technologies and energy management strategies, and how to finance energy efficient improvement projects. Through the course of program implementation, D&R conducted three program facility training workshops.

Twenty-five participants attended three workshops conducted between May 2005 and June 2006. Attendees were presented with information and ideas relating to lighting, HVAC and controls that would enable them to consider such technologies when developing renovation/modernization projects, and to lower costs of operation and maintenance of their facilities and equipment.

Facility Management Workshop, May 2005

The first facility workshop was hosted by the Fresno County Office of Education in May 2005. D&R invited district facility maintenance staff and business managers from school districts in California's Central Valley region. Both participating and nonparticipating districts were invited to attend the workshop. This workshop provided attendees with information about technologically and economically feasible ways to optimize building performance and prioritizing future building improvement projects. The attendees received information on PG&E's incentive programs as well as the resources available through the California Energy Commission.

Integrated System Classroom Lighting, December 2006

The second workshop was held in Union City in December 2005 and was hosted by FineLite Inc. This workshop mainly dealt with effective lighting in schools and at other premises as a means to saving energy and educated attendees about the financial benefits of energy efficiency. Information was also provided to participants about state and local resources, available incentives, and other energy management issues.

Fresno County Office of Education Demonstration Project, June 2006

The third workshop was hosted by the Fresno County Office of Education in June 2006. The objective of this workshop was to showcase the demonstration project at Site 7-C as a means of demonstrating the benefits of the energy efficiency technologies installed as part of the project. In particular, the workshop presented general energy efficiency concepts (i.e., the benefits of an energy management plan, lighting, energy economics, project analysis); and overview of energy concepts and technologies, with emphasis on lighting; SEE program services. A lighting demonstration was also provided.

E.2 Workshop Evaluation Survey Objectives

The objectives of the facility training workshop evaluations were to determine if the workshops increased understanding of and receptiveness to energy-efficient technologies and practices, assess the quality and appropriateness of information presented, and to determine how likely facility staff and other decision makers would recommend implementing energy efficiency improvements.

The Workshop Evaluation Survey allowed the attendees to rate the effectiveness of the information provided in the workshop regarding resources and strategies for reducing energy use. Attendees also provided information about their plans to pursue energy efficiency improvements in the future.

E.3 Evaluation Survey Administration

Workshop evaluations were to be distributed by SEE Program staff during or immediately after each workshop. Copies of all completed evaluations were collected by Program staff and provided to Itron.

Table E-1 summarizes attendance, the number of districts represented at each workshop, and the number of completed evaluation surveys. As shown, 11 out of the 14 attendees completed an evaluation of the first workshop. Unfortunately, workshop evaluations were not distributed at either of the remaining workshops.

Table E-1: Facility Workshop Attendance and Evaluation Response Rate

Workshop Location and Date	# of Attendees	# Districts Represented	Completed Evaluations
Fresno County Office of Education, May 2005	14	13	11
FineLite, Inc. December 2005	4	2	n/a
Fresno County Office of Education, June 2006	7	6	n/a

Low attendance at the FineLite workshop in December 2005 is attributed to the time of year it was scheduled.

E.4 Summary of Respondents

In total, 14 individuals representing 13 school districts across Fresno, Kern, Kings, and Madera counties were in attendance at the first workshop. All workshop attendees were asked to complete a workshop evaluation, developed by Itron and distributed during the workshop by SEE program staff. Eleven attendees submitted completed evaluation surveys. These attendees were District Facility Managers (27%) and Maintenance, Operations, and Technology Directors (55%). The audience also included an Environmental Manager and an Energy Manager. Nearly 74% of the attendees represented districts currently participating in the SEE program. The remaining 26% represented non-participants but indicated they were planning to participate in the SEE program. Over half (55%) of the attendees represented districts which currently have an energy management plan.

Energy Efficiency for Schools

Building a Better Tomorrow Today Through Knowledge and Action
Fresno County Office of Education
Thursday May 12, 2005

The sponsors of this professional development opportunity are very interested in knowing your opinion of this workshop. Please take a few moments to let us know if the objectives for conducting this workshop and your expectations have been met.

Section 1: Circle a number for each item below to <u>indicate how effective each of the presentations and subject areas were in meeting the workshop objectives and your expectations</u>. Provide additional comments about each presentation in the space provided.

	Highly Effective		Effective		Not Effective
SEE Program Summary COMMENTS:	5	4	3	2	1
Lighting technologies and opportunities COMMENTS:	5	4	3	2	1
HVAC technologies and opportunities COMMENTS:	5	4	3	2	1
Controls and controls strategies COMMENTS:	5	4	3	2	1
Building the financial case for energy efficiency COMMENTS:	5	4	3	2	1
PG&E Incentive Programs COMMENTS:	5	4	3	2	1
California Energy Commission's Bright Schools COMMENTS:	5	4	3	2	1

Section 2: Circle a number for each item below to indicate <u>how relevant the workshop subjects were to you and how likely you will pursue energy efficiency improvements in your district.</u>

	Very Relevant				Not At All Relevant
How Relevant were these subjects to you and your district?	5	4	3	2	1

	Very Likely				Not At All Likely
How likely will you pursue reducing your district's energy use as a result of the information presented in this workshop?	5	4	3	2	1

If you answered a 4 or 5, please describe possible projects or other actions you will pursue:

If you answered a 1 or 2, please explain obstacles in reducing your district's energy use.

Section 3. Circle a number for each item below to <u>indicate how effective the information presented during this workshop was in providing you with the following:</u>

	Highly Effective		Effective		Not Effective
Understanding the value of an energy management plan	5	4	3	2	1
Awareness of energy efficient technologies.	5	4	3	2	1
Understanding of how to identify and implement energy efficient renovation/modernization projects.	5	4	3	2	1
Understanding of energy efficient building operation and maintenance "best practices."	5	4	3	2	1
Understanding of energy efficient building operation and maintenance "best practices."	5	4	3	2	1
Understanding of the financial value of energy efficiency	5	4	3	2	1
Where to find support and resources	5	4	3	2	1

Section 4: Tell us about yourself and your district.

1. What district do you represent? _____

2. What is your title and scope of your responsibilities? (*Check one.*)
   - ☐ District Facility Manager
   - ☐ District Business Manager
   - ☐ Maintenance, Operations & Transportation Director
   - ☐ Superintendent/Assistant Superintendent
   - ☐ School Board Member
   - ☐ Other:_____

3. Is your district participating or planning to participate in the School Energy Efficiency Program?
   - ☐ Yes, currently participating
   - ☐ Not participating, but planning to participate
   - ☐ Not participating
   - ☐ Don't know

4. Does your district currently have an energy management plan?
   - ☐ Yes
   - ☐ No
   - ☐ Don't know

Section 5. Please provide any additional comments or suggestions for future workshops. <u>Your input is very valuable to help us plan future opportunities of the School Energy Efficiency Program.</u>

Thank You

Appendix F

NEED Workshop Evaluation Survey Development and Administration

F.1 Summary of NEED Training Workshops

The first NEED Project Workshop was held at the University of California (Merced – Bakersfield) Bakersfield, California in May 2005, a second at the Kern County Museum in November 2005, and two more at the Santa Clara County Office of Education in January and February 2006. The workshops were open to SEE Program school districts' curriculum staff and school-site teachers who were enrolled as program participants, as well as educators in non-participating districts. Workshop flyers were distributed district-wide via email, fax and school internal mailing systems with the help of County Office of Education staff. Workshop invitations were sent to both participating and non-participating districts.

F.2 Evaluation Survey Objectives and Design

The overall objectives of the workshop evaluation survey were answer to the following questions:

- Did the workshops provide teachers with educational tools and resources that could be easily integrated into lesson plans?
- Did the workshops successfully increase educator efficiency awareness of available resources?

The NEED project has a well-established training program and accompanying program evaluation process. To not burden workshop attendees with two evaluation questionnaires, Itron opted to utilize the already-developed NEED workshop evaluation, which has been widely used by the NEED organization to evaluate its professional development training programs. Itron felt the survey questions addressed research objectives and did not request any revisions, except to add space for the respondent to indicate their district.

F.3 Survey Administration

Workshop evaluation questionnaires were distributed to all attendees by the NEED coordinator who moderated each workshop during or after each workshop. The NEED

coordinator provided copies of all completed evaluations to D&R, which in turn, provided copies to Itron. Table F-1 summarizes the number of evaluation forms received for each workshop.

Table F-1: NEED Workshop Completed Evaluations

Workshop Location and Date	# of Completed Evaluations
UC Merced-Bakersfield, May 2005	16
Kern County Museum, November 2005	20
Santa Clara COE, January 2006	45
Santa Clara COE, February 2006	37
Total	118

A total of 129 educators attended the four workshops, out of which 118 completed an evaluation (a response rate of 91.5%). The respondents mainly taught grades 10, 11 and 12, followed closely by the grade levels 7 through 9. Eight educators taught the Kindergarten level and 41 taught grade levels 1 through 3, while 48 taught grade levels 4 through 6. The surveyed educators taught a variety of subjects including resource education, elementary school topics, life science, earth science, mathematics, history, language, biology, advanced placement environmental science, and physics. The number of students taught by each educator ranged from 15 to 200, averaging 77 students per educator. Thirty-three of the respondent had attended a NEED program prior to the workshop.

F.4 Survey Instrument

A copy of the NEED workshop evaluation survey is provide below.

NEED WORKSHOP EVALUATION

Today's Date: _____
Location: _____

Please answer the following questions about today's workshop. Your feedback is very important to NEED. We will use the information to improve and plan future workshops. *Thank you in advance for taking the time to help!*

1. What grade do you teach? _____ 2. What subject(s) do you teach? _____

3. How many students do you teach? _____ 4. Have you attended a NEED program before today? ___ Yes ___No

---

OVERALL EVALUATION

5a. Overall, how satisfied are you with the workshop? Think about all aspects, including staff, materials, content, pace, facility, etc. Please circle the number on the rating scale below to indicate your level of satisfaction.

Very Dissatisfied						**Very Satisfied**
1	2	3	4	5	6	7

5b. What could we have done to get a higher rating?

PERFORMANCE

6a. Please rate the workshop on the following items:

	Poor						**Excellent**
1- The pre-workshop communication……..	1	2	3	4	5	6	7
2- The facilitation skills of presenter(s)……..	1	2	3	4	5	6	7
3- The presenter(s) knowledge of the subject……	1	2	3	4	5	6	7
4- The organization of the workshop…….……	1	2	3	4	5	6	7

6b. What could we have done to improve our performance? Please explain below.

7a.Which workshop activities did you enjoy the most?

7b.Which activities are the most appropriate for your subject and age level?

7c. What could we have done to improve the workshop activities? Please explain below and specify which activity you are referring to.

YOUR OPINIONS

8. Did the workshop activities encourage you to learn more about energy? ___Yes, a lot ___Yes, some ___No, not really

9. How likely is it that you'll use the energy activities and materials in your classroom during the school year?

___ Very likely ___ Likely ___ Not Very Likely ___ Don't Know

10. Based on what you learned at the workshop will you be able to comfortably deliver the activities to your students?

___ Yes, Definitely ___ Yes, Think So ___ Yes, Somewhat ___ No, Not Really

11a. Would you recommend the workshop to other teachers? ___Yes, definitely ___Probably ___Probably Not

11b. Why? Please explain your answer:

12. How many students do you expect to reach this school year using NEED activities and materials? _____

13. How did you find out about the workshop? Why did you choose to attend?

14. Please provide any additional comments or suggestions below.

THANK YOU SO MUCH FOR COMPLETING THE EVALUATION!

Appendix G

Educator Baseline Practices Survey Development and Administration

G.1 Survey Objectives and Design

The goal of the Educator Baseline Survey was to obtain information on educator baseline practices with respect to energy, energy efficiency, and energy conservation education prior to participating in the SEE program. This survey was intended to help to answer the following questions:

- Have participating educators received training on energy related educational materials/activities before participating in the SEE program?
- Have participating educators used any energy related educational materials/activities before participating in the SEE program?
- How relevant do educators feel energy efficiency and energy conservation is to their own teaching plan, to their school, their district, and to students?

G.2 Survey Administration

D&R program representatives obtained answers to these questions through their information gathering process when they began working with educators in each participating district. The Educator Baseline Survey was completed with each participating educator and the completed surveys were returned to Itron.

G.3 Summary of Respondents

Throughout the course of program implementation, 101 educators completed the baseline practices survey. The participating educators mainly teach grades 10, 11 and 12, followed by the grade levels 7 through 9, with 6 educators for the Kindergarten level and 30 for the grade levels 1 through 3. The number of students taught by each educator ranged from 4 to 680, averaging 71 students per educator. The surveyed educators taught a variety of subjects including general/elementary subjects, resource education, life science, earth science, biology, advanced placement environmental science, geography, and physics.

G.4 Summary Baseline Practices

Nearly 60 percent of the educators who completed the Baseline Education Practices Survey indicated that they had included lessons or classroom activities related to energy use, energy efficiency, or energy conservation into their teaching plans in the last two years. These efforts include classroom discussions on energy use, conservation and sources of energy, general classroom science lessons, school assemblies, environmental science units, science fairs, Earth Day events, field trips, science kits, and environmental science symposiums.[1]

Thirty percent of the survey respondents indicated that their district or department had formally integrated lessons, teaching materials, or activities relating to energy use, energy efficiency or energy conservation into their formal curriculum through the environmental science unit, as specified in California Learning Standards.

Forty-four percent of the educators indicated that they were sponsored or encouraged by their department/school/district to attend educator training that has included energy-related materials and/or resources, one-third of which received professional development/credential credit. Forty percent of the surveyed educators had, in fact, attended such training.

The surveyed educators anticipated benefiting from the SEE program by the following:

- Enabling them to teach students how to conserve and efficiently use energy and then extend the teaching to parents through home connections,
- Incorporating energy into the curriculum,
- Encouraging science exploration
- Developing a family science night,
- Keeping up to date on all the latest energy information and activities to support energy education,
- Beginning an energy survey and starting an energy patrol at school,
- Boost science skills and knowledge
- Helping to teach the standards,
- Increasing the available materials and tools,
- More effectively instructing students about energy and to make energy more relevant to their lives

[1] It is important to note that many of the teachers in participating districts are, in fact, science teachers that would naturally incorporate energy related topics in their lesson plans. Thus, the fact that the majority already include lessons and activities relating to energy can mislead one to believe that such teachers are already doing what the program offers and thus, are not good candidates to participate in the program.

- Enabling the district to save money and ensure that students become interested in saving money and the planet.
- Incorporating relevant, current and state-standards focused science education into writing activities.

Schools Energy Efficiency Program
Educator Baseline Practices Survey

1. What district and school do you represent?
   District _____
   School _____

2. What grade level do you teach? (Circle all that apply)

   K 1 2 3 4 5 6 7 8 9 10 11 12

3. What subject(s) do you teach?

   _____

4. How many students are there in your class(es)? _____students

5. Have you included lessons or classroom activities related to energy use, energy efficiency, or energy conservation into your teaching plans in the past two years?
   (Specifically referring to lessons that cover energy use/efficiency/conservation in the classroom, at school, at home, and in society. Probe if educator has incorporated these subjects into school-wide activities, events, or school-sponsored club activities such as Earth Day events, science fairs, school assemblies, etc.)

   ☐ No
   ☐ Yes *Please describe:*

   _____
   _____
   _____

6. Has your district (or department) formally integrated any lessons, teaching materials, or activities relating to energy use, energy efficiency, or energy conservation into its formal curriculum? *(Notes for Q5 also applicable for this question.)*
   ☐ No
   ☐ Do not know
   ☐ Yes *Please describe:*

   _____
   _____
   _____

7. Has your department/school/district sponsored or encouraged you to attend educator training that has included energy-related materials and/or resources? *(These materials would be designed to teach students about energy use, conservation, or efficiency at home, school, and in society.)*

   ☐ No *(Skip to Q8)*
   ☐ Yes

   a. Did educators who received that training receive professional development/credential credit?
      ☐ No
      ☐ Do not know
      ☐ Yes
   b. Did you attend the training?
      ☐ No *Why not?* _____
      ☐ Yes

8. What are the primary sources you currently use (or have used in the past two years) to find new teaching materials, lesson plans, and classroom activities?
   ☐ Internet
   ☐ Educational organizations
   ☐ Non-educational organizations that develop educational materials
   ☐ Peers (educators either in my school/district or other school/district)
   ☐ Department
   ☐ Education conferences
   ☐ Other *Please describe.* _____

9. How do you anticipate benefiting from the School Energy Efficiency Program?

   _____
   _____
   _____
   _____
   _____
   _____

Appendix H

Educational Materials Available Through the SEE Program

Educational Materials

The SEE Education Team has chosen the National Energy Education Development (NEED) Project as its primary source for educational materials. NEED Project materials provide a comprehensive curriculum for grades K-12 correlated to the California Learning Standards in Science, Social Studies and English.

Teachers participating in the SEE Program Educational Component will have an opportunity to design their own approach to implementing an energy education program at their school site. Teachers who are interested in materials that can be integrated into the curriculum and enhance their current learning objectives should consider the NEED Project Materials a viable resource. Educational materials can be used in a classroom setting, in a club environment, in an after school program, or as a school-wide project.

Teachers will be encouraged to start off their energy education track with a background resource. NEED Energy Infobooks are provided in primary, elementary, intermediate and secondary reading levels. These booklets provide resource information on the sources of energy, electricity, efficiency and consumption. The infobooks are used in the classroom as a resource for many other NEED activities. The companion workbooks, NEED Energy Infobook Activities are filled with activities that reinforce the general energy information and facts about energy sources.

The SEE Education Team also developed a list of Supplemental Program activities that can be used in coordination with the NEED Project materials or as stand alone projects. The time commitment for the teacher and students will vary between activity; from minimal (coloring pages and storybooks) to extensive (setting up an energy patrol or conducting a school site audit).

FULL DISCLOSURE STATEMENT

California consumers are not obligated to purchase any full fee service or other service not funded by this program. This program is funded by California utility ratepayers under the auspices of the California Public Utilities Commission (CPUC).

Los consumidores en California no estan obligados a comprar servicios completos o adicionales que no esten cubiertos bajo este programa. Este programa esta financiado por los usuarios de servicios públicos en California bajo la jurisdiccion de la Comisión de Servicios Públicos de California (CPUC).

D&R International in partnership with the National Energy Education Development (NEED) organization will provide educational materials to teachers and students who participate in the School Energy Efficiency (SEE) Program to educate them about energy, energy efficiency and conservation, and energy choices and challenges. The NEED Project materials for grades k-12 are correlated to the California Learning Standards for Science, Social Studies and English.

Professional development workshops, using the NEED Project materials to further teacher's knowledge on energy education, will be held in the Southern Central Valley and Greater Bay Area regions during the first quarter of 2005.

Founded in 1980, the mission of the National Energy Education Development (NEED) Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs

Title: **ENERGY INFOBOOKS**
Grade level: K-12
Time: Reference resources

Overview:
The *Energy Infobooks* are provided in primary, elementary, intermediate and secondary reading levels. These booklets provide resource information on the sources of energy, electricity, efficiency and consumption. The infobooks are used in the classroom as a resource for many of the NEED activities.

Materials Provided:
Teacher Guide, Student Worksheets.

Title: **ENERGY INFOBOOKS ACTIVITIES**
Grade level: K-12
Time: 30-45 minutes per activity

Overview:
These companion workbooks to the Energy Infobooks are filled with activities that reinforce the general energy information and facts about energy sources.

Materials Provided:
Teacher Guide, Student Worksheets.

Title: **PRIMARY SCIENCE OF ENERGY**
Grade level: K-4
Time: 2-6 weeks depending on time allocation

Overview:
Backgrounders and hands-on experiments explore the fundamental concepts of energy. Students explore the science of motion, heat, sound and light with a series of simple activities. Students learn to make observations, measure, record results, compare and contrast, categorize, make predictions, analyze and graph results, and draw conclusions.

Materials Provided:
Teacher Guide, Student Guides, Primary Science of Energy Kit.

Title: **ELEMENTARY AND SECONDARY SCIENCE OF ENERGY**
Grade level: 4-12
Time: Five class periods

Overview:
Hands-on experiments explore the different forms of energy and how energy is transformed from one form to another. Groups of students master six stations, and then teach others about the energy transformations at their station.

Materials Provided:
Teacher Guide, Student Guides, Elementary or Secondary Science of Energy Kit.

Title: **BUILDING BUDDIES**
Grade level: Grades 1-3
Time: 5 class periods, ongoing

Overview:
Building Buddies introduces primary students to energy sources, energy consumption at home and at school, and energy efficiency and conservation through a series of hands-on activities that encourages students to identify ways that energy is consumed and implement on-going behaviors to conserve energy – includes: home audit, school audit and energy patrol.

Materials Provided:
Teacher Guide, Student Guides, Building Buddies Kit

Title: **MONITORING AND MENTORING**
Grade level: Grades 4-6
Time: 5 class periods, ongoing

Overview:
This program introduces students to methods of measuring energy usage, determining costs, and quantifying environmental effects through a series of hands-on activities that include reading meters, EnergyGuide labels ad electric nameplates. Students conduct surveys of the school building and school energy consumption –Students are encouraged to buddy with primary students to learn by teaching others.

Materials Provided:
Teacher Guide, Student Guides, Monitoring and Mentoring Kit.

Title: **LEARNING AND CONSERVING**
Grade level: Grades 7-12
Time: 5 class periods, option of extension activities

Overview:
Students learn about energy consumption and conservation by reading utility meters and utility bills, comparing EnergyGuide labels, and exploring electric nameplates. Students conduct comprehensive surveys of the school building and school energy consumption – Students develop a comprehensive energy management plan for the school.

Materials Provided:
Teacher Guide, Student Guides, Learning and Conserving Kit.

Title: **ENERGY CONSERVATION CONTRACT**
Grade level: Grades 4-12
Time: 2-3 Class Periods over a one month period, plus homework

Overview:
Students ask their families to sign contracts in which they agree to save energy at home and on the road for a one month period, then calculate the energy savings. This activity serves to educate students and their families about energy conservation and efficiency at home and encourage them to use energy-saving behaviors and technologies.

Materials Provided:
Teacher Guide, Student Worksheets, Conservation Contract Forms

Title: **TODAY IN ENERGY**
Grade level: Grades K-4
Time: 30-45 minutes

Overview:
Designed to help primary student become aware of the ways they use energy every day. It introduces students to the concepts of choice, trade-offs and cost. Students are given a limited amount of money (in energy bucks) for a day of activities. Students use math and critical thinking skills to plan their day so that they can pay for their choices and still have fun.

Materials Provided:
Teacher Guide and Student Worksheets.

Title: **ENERGY HOUSE**
Grade level: Grades 4-8
Time: 2 hours

Overview:
Students insulate a cardboard house with a variety of insulating materials that they must purchase with energy bucks, leaning about energy conservation, energy savings, and diminishing returns.

Materials Provided:
Teacher Guide and Student Worksheets.

Title: **YESTERDAY IN ENERGY**
Grade level: Grades 4-12
Time: 4-6 class periods, plus homework

Overview:
Allows students to travel back in time to conduct interviews and do research to learn and make exhibits about energy use in the good old days.

Materials Provided:
Teacher Guide and Student Worksheets.

Title: **ENERGY GAMES AND ICEBREAKERS**
Grade level: Grades 4-12
Time: 10-20 minutes

Overview:
Offers entertaining activities to introduce energy, efficiency and conservation to students as well as reinforce information that has already been presented.

Materials Provided:
Teacher Guide and Student Worksheets.

Supplemental Energy Education Activities

A broad range of activities are offered through the program that can be used independently as stand-alone projects or in conjunction with the NEED Project materials. These activities can be implemented in the classroom or used in after-school programs or as club projects. Furthermore, several of the resources offered support school-wide projects or events that will engage the school community. Materials are offered across the K-12 grade levels and represent a range of activities that can be conducted during one class period to more extensive efforts that take place over an extended period of time. Included in the offerings are:

- Energy Patrols,
- School Energy Audits and Surveys,
- Energy at Home with Classroom Activities
- Classroom Resources
- Special Project Resources

Summary:
Energy patrols are one of the most popular and effective energy action programs to be developed in California. While other energy-efficient measures are encouraged for longer-term savings, energy patrols are a good way to educate the school population (end-users) about energy-use as well as promote energy-saving behaviors.

Students on energy patrols can monitor classrooms to ensure that lights are turned off when rooms are vacant, which reduces school electrical costs considerably. Lighting is a good target for any school energy program because in most schools, lighting is the largest energy-user consuming from 38 percent to 54 percent of total classroom energy.

It is important to obtain support from school site administrators before any detailed plans are made to start an energy patrol. They can give guidelines under which an energy patrol can operate, suggestions for working with both staff and students, and provide access to energy-use information (utility bills) to establish baseline data. It is also critical to ask that the school site facility staff be available since as the "caretakers" of the school site they have the expertise on the school's energy features.

Once the energy plan is developed and all procedures are in place, students can monitor classrooms and other school offices to ensure that established guidelines for energy-use, i.e. lights out when the classroom is not in use, are being followed. What is most important in setting up an energy patrol program is to keep a positive attitude, even with energy-waste offenders. It is not suggested that students establish a ticket or fine system for energy waste behaviors but rather stay positive about the message by using reminder tickets that encourage better energy-use behaviors.

Extension activities could include keeping a record of the reduced energy-consumption and preparing a "Presentation Board" to show the activities of the energy patrol and the results of their efforts – this could be displayed at school events. A presentation could also be developed to give to the school board about the energy patrol and the success of the students to reduce energy consumption at their school site. Having the students make the presentation to the school board would certainly be an opportunity to gain recognition for the school's efforts from this important governing body of the school district.

Program Activity Resources:
Turn Out Those Lights! Here Comes the Energy Patrol (grades 1-6)
Watt Watchers and Energy Council Program Manual (grades 3–12)

Program Materials Coordination
To establish baselines of current energy use and help students to determine the school's energy use, refer to the School Energy Audit and School Energy Survey Activities and/or the NEED materials listed below.

NEED Building Buddies (grades 1-3)

Students learn about energy by monitoring classroom temperatures and energy usage, and taking positive actions to conserve energy.

NEED Monitoring and Mentoring (grades 4-6)

In this hands-on unit, students explore consumption and conservation using the school as a real-world laboratory. The activities in this unit have been designed so that they can be used as separate activities, although they do build on one another to provide all of the information students need to conduct school surveys and conduct on-going monitoring and data analysis.

Energy Patrols

Resource: **Turn Out Those Lights! Here Comes the Energy Patrol**
Grade range: Grades 1-6
Time / Format: moderate – extensive / PDF
Source: **California Energy Commission / DeVargas Elementary School**

Overview:
A very basic step by step guide on setting up a school energy patrol. This model was developed by an elementary school and includes Energy Patrol start-up procedures, agreements and a sample checklist.

Things to Consider:
This guide does not provide detailed information abut energy use at a school site. There is a specific reference to lighting being a good target since in most schools lighting is the largest energy user.

Resource: **Watt Watchers and Energy Council Program Manual**
Grade range: Grades 3-12
Time / Format: moderate – extensive / PDF
Source: **Environmental Protection Agency**

Overview:
The Watt Watchers Energy Patrol Program is targeted for elementary and middle school students (Grades 3-8). The Watt Watchers Start-Up Checklist is an outline of fourteen steps, starting with obtaining support from the school administration to selecting an advisor, and developing procedures - this checklist serves as a guide to setting up an energy patrol – an expanded outline of each step provides more detailed information about the process.

The Energy Council (referred to as Energy Commission) is a building audit and student mentoring program for middle and high school students (Grades 7-12). The Energy Commission program is presented with a start-up outline (page 17) of seven procedural steps and then an expanded outline. Program and Project ideas aimed at improving the energy efficiency at school are included.

As a companion to the Watt Watchers Energy Patrol Program Manual, the Watt Watchers Activity Pak contains the Watt Watcher Agreement, samples of reminder tickets and thank you notes, student name tags, general energy assumptions and calculations, lighting myths and facts and the I WANT YOU FOR WATT WATCHERS Notebook Covers. Additional resources and student activities are available on the Watt Watchers energy information website http://p2.utep.edu/watts/index.cfm

Things to Consider:
The Watt Watchers and Energy Council Program Manual serves as an operational/procedural process outline and assumes that background information on school energy-use will be provided by an advisor who also assumes responsibility for training the team. There is a suggestion to have a utility company representative or the facilities manager give the Watt Watcher team a tour of the school's energy features – this would present an excellent opportunity to connect the facilities and educational components.

SCHOOL ENERGY AUDITS / SCHOOL ENERGY SURVEYS

The most critical steps in developing a plan to reduce energy consumption are understanding how, how often and where electricity is used in a facility. Once the patterns of energy use are known, recommendations can be made for reducing that consumption. Designing an effective energy conservation program will depend on having as much information as possible

Two different methods for obtaining energy use information are school energy survey and school energy audits. The main difference between the two is the level of detail required in conducting an audit.

A School Energy Audit generally requires an investigation to determine what energy is being used, how much is being used and what is the cost of this usage. A school energy audit is designed to allow the user to find information about specific types of energy use in specified areas of the school. For instance, when performing a Classroom Lighting Audit, you would be prompted to count the number of fluorescent bulbs in the classroom and then using a formula would calculate the total cost of lighting per classroom per day. A School Energy Audit can be used to establish a baseline from which progress in increased efficiency can be measured.

A School Energy Survey generally focuses on determining energy-use through recording information from observations of energy-use and behaviors. This is also sometimes referred to as a walk through audit or a short inspection to identify obvious potential improvements. For instance, are windows and doors open when the heating or air conditioner is running? Is there enough daylight to turn off the lights and maintain the recommended light levels in the classroom?

Extension activities would include starting an energy patrol with the baseline data that is developed by either an audit or survey or prepare a report of recommendations to reduce energy use based on the information obtained from the audit or survey.

Activity Resources:

Let's Get Energized – School Audit Forms Packet (grades 3-12)
Energy Management Poster – National Energy Foundation (grades 5-10)
School Audit Video – Noodlehead (grades K-7)

Program Materials Coordination

NEED Monitoring and Mentoring (grades 4-6)

In this hands-on unit, students explore consumption and conservation using the school as a real-world laboratory. The activities in this unit have been designed so that they can be used as separate activities, although they do build on one another to provide all of the information students need to conduct school surveys and conduct on-going monitoring and data analysis.

NEED Learning and Conserving (grades 7-12)

Designed to be the classroom component of a total energy management plan for secondary schools, the activities in this unit have been designed so that they can be used as separate activities, although they do build on one another to provide all the information students need to conduct the school surveys and develop an energy management plan for the school – the culminating activity.

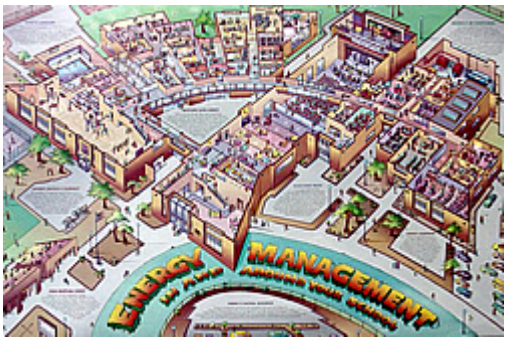
School Energy Audits / School Energy Surveys

Resource: **Let's Get Energized – School Audit Forms Packet**
Grade range: Grades 3-12
Time: Intensive – extensive / PDF
Source: **Lee County School District (Florida)**

Overview:
The audit forms provided in this packet were designed to allow the user to find information about specific types of energy-use in specified areas of the building. The audit forms are divided into three categories: Cooling and Heating, Equipment and Machines, and Lighting. "Tips for Reducing Energy Consumption" is also included.

Things to Consider:
It is suggested that responsibilities for conducting audits can be divided among personnel at the school site. That might be a worthy consideration in the lower grade levels. Another option is only a partial audit of specific areas of the school site.

Resource: **Energy Management Poster**
Grade range: Grades 5-10
Time / Format: Moderate / Poster
Source: **National Energy Foundation**



Overview:
More than mere eye appeal, the colors of this poster are symbolic. Each predominant color - brown, yellow, green, red, and blue - represents a type of energy or resource. The activities on the poster's reverse side correlate to the color coding and aid students in carrying out an energy audit of their school that leads to learning about operations and maintenance, energy conservation measures, and adaptations to renewable resources.

Resource: **School Audit Video**
Grade range: Grades K-7
Time / Format: 15 minutes run time / Video
Source: **Noodlehead Network**

Overview:
Simple Things You Can Do To Save Energy In Your School. When it comes to using energy wisely, the more that are motivated the better. In this video, Mr. Muzak "enlightens" kids about the benefits of efficient lighting while Nurse Comfort "finds a cure" for drafty windows. Sarah, the expert kid-host, shows kids oodles of low-cost and no-cost ways kids can help their schools save energy. This is a great way to discover where energy-sucking beasts lurk in your school! Included with the video is an Activity Guide that contains eight simple experiments, utilizing readily available materials, which can be done as demonstrations or small group or individual projects. Also included are student hand-outs for classroom and school energy audits, as well as ideas for influencing student behavior and school board decisions.

Energy at Home Activities are introduced in the classroom and provide extension activities for students to do with their families at home. Students are encouraged to learn about what uses energy at home and help their families save money by making better choices in using energy and to think about replacing inefficient light bulbs and electrical appliances.

Extension activities could include a contest for returned surveys or charting the estimated energy savings projected by participating households and publicize the results with energy tips in the school newspaper.

Activity Resources:

Energy Hog Challenge (grades 3-8)
Noodlehead Video Home Energy Audit (grades K -7)
Conserve in Your Room (grades 4-5)
Conserve in Your Home (grades 4-5)
Climate and Comfort (grades 8-10)
Electricity in the News (grades 5-8)
Efficiency of Electric Appliances (grades 6-9)
Is Efficiency Our Best Energy Source? (Grades 9-11)

Program Materials Coordination

NEED Building Buddies (Grades 1-3)

In Activity One, students learn about ways to save energy at home. They draw a picture of their room at home and then take a tour of their home with an adult answering a series of questions. In activity three they discuss ways to save energy at home and can do a survey of lighting and energy uses.

NEED Conservation Contract (grades 4-12)

Students discuss with their families the energy they use for everyday activities and educate them about energy saving behaviors and methods, using the Household Rating Guide.

NEED Energy House (grades 4-8)

Students learn about energy conservation and efficiency by using various materials to insulate a cardboard house.

Energy at Home with Classroom Activities

Resource: **Energy Hog Challenge**
Grade level: Grades 3-8
Time / Format: moderate – extensive / Booklet
Source: **Energy Outreach Colorado**

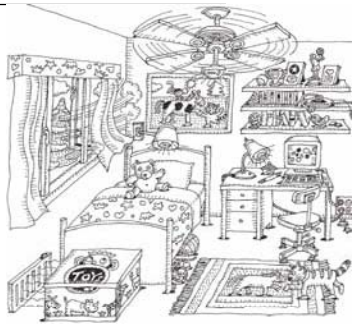
Overview:
The Energy Hog Challenge is a fun way to educate students about how they use energy in their homes and to become responsible, smart energy users. The Energy Hog Challenge focuses on saving energy at home through family-oriented activities. Teacher Guide and [class set] Student Guides provided.

Things to Consider:
Materials can be adapted for younger and older students. Character may be a little scary to some younger students. The Energy Hog Website contains five training games for students to play to earn the title of official Hog Buster! http://www.energyhog.org/

Resource: **Noodlehead Video Home Energy Audit**
Grade level: Grades K-7
Time / Format: Run time 15 minutes / Video
Source: **Noodlehead Network**

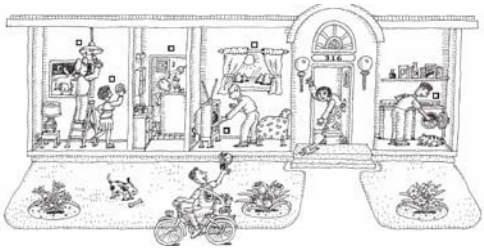
Overview:
Simple Things You Can Do To Save Energy: The Power is in Your Hands This 15-minute video follows the wacky adventures of 12-year old Sarah, as she takes viewers on a tour through an unusual home which teaches lessons about energy use and conservation. A Home Energy Test (hard copy) is included with the video that guides a room to room walk through of a house - an energy saving score can be calculated based on the number of YES boxes that are checked.

Resource: **Conserve in Your Room**
Grade level: Grades 4-5
Time / Format: minimal – moderate / PDF
Source: **Bonneville Power Administration**



Overview:
The coloring page highlights the ways that energy can be used and wasted in a bedroom. Student activity page chart lets students' list different ways to save energy. Optional take-home activity.

Resource: **Conserve in Your Home**
Grade level: Grades 4-5
Time / Format: minimal – moderate / PDF
Source: **Bonneville Power Administration**



Overview:
Take home "energy tips" sheet includes age-appropriate conservation measures students can do at home. Using the tip sheet as a teaching aid, encourage students to share energy-saving tips listed with their family.

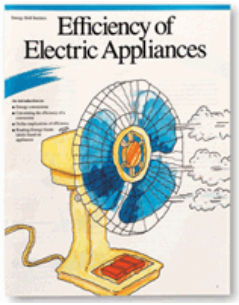
Resource: **Climate and Comfort**
Grade level: Grades 8-10
Time / Format: Minimal - two class periods and homework / booklets
Source: **Enterprise for Education**

Overview:
Tomorrow's energy customers take a hard look at America's diverse climate, learn about "heating degree days," and discuss what factors to consider in determining how much to spend when insulating their homes. They also conduct a survey of their home's construction and learn how to apply caulking and weather stripping. Teacher's guide and student booklets included.

Resource: **Electricity in the News**
Grade level: Grades 5-8
Time / Format: moderate / booklets
Source: **Enterprise for Education**

Overview:
Working in groups students write articles that tell their parents how to save energy in the home: home energy use, energy guide labels, appliances, heating and cooling homes, water heating, and lighting. Teacher guide and student booklets provided.

Resource: **Efficiency of Electric Appliances**
Grade range: Grades 6-9
Time / Format: minimal / booklets
Source: **Enterprise for Education**



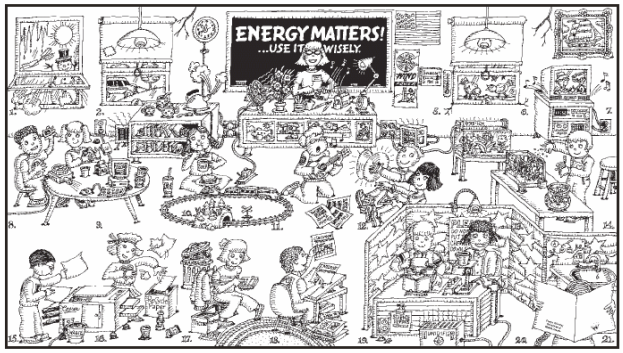
Overview:
Students become budget-conscious consumers when they study the economic impact of replacing incandescent lamps with fluorescent ones. They also learn to interpret the Energy Guide labels on appliances. Teacher guide and student booklet provided.

Resource: **Is Efficiency Our Best Energy Source?**
Grade range: Grades 9-11
Time / Format: moderate / booklets
Source: **Enterprise for Education**

Overview:
In this provocative booklet, students examine the history of energy efficiency over the past 20 years as it relates to the home (refrigerators), transportation (automobiles) and industry (electric motors). The impact of energy efficiency on lifestyle and the environment is explored.

CLASSROOM RESOURCES

Resource: **Conserve in Your Classroom Mural**
Grade range: Grade 4
Time / Format: moderate / PDF
Source: **Energy Efficiency Association of Alberta, Canada**



Overview:
This mural activity is a great way to discuss energy use and conservation in your own classroom. Each puzzle piece features several items that relate directly or indirectly to energy use. Once assembled (21 pages) this mural is 5 feet wide by 3 feet tall. Each puzzle piece is numbered for reference. There are four options in using the mural as a teaching aid. Each puzzle piece is described with energy features for students to consider.

Resource: **The SMUD Coloring Book**
Grade range: Grades K-5
Time / Format: minimal / PDF
Source: **SMUD**

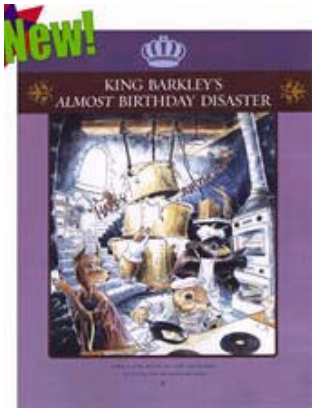

Find 4 energy savers.

Overview:
Coloring pages that encourage students to identify energy savers & wasters.

Resource: **The Tree House Team Saves the Forest**
Grade range: Grades 2-4
Time / Format: minimal / Story booklet
Source: **Enterprise for Education**

Overview:
When part of their beloved forest faces clearing because of the need to build another power plant, the "Treehouse Team," a concerned group of young animals, looks for ways to save electricity. Sure enough, they find so many different ways to save energy that the forest is spared, and everyone in town notices that their electric bills are lower, too. This engaging title builds home energy efficiency awareness in young children and challenges them with analytical questions and simple math problems.

Resource: **King Barkley's Almost Birthday Disaster**
Grade level: Grades K-3
Time / Format: Moderate / Booklets
Source: **Enterprise for Education**



Overview:
In this rhyming tale, a kingdom of animals must work together to use energy more thoughtfully, or King Barkley's birthday party will be a disaster. This booklet culminates in a sing-along that reinforces key conservation concepts. Each classroom set of booklets includes a song tape cassette with wonderful music to accompany the story and a teacher's guide.

SPECIAL PROJECT RESOURCES

Resource: **The Universal House Activity Guide**
Grade level: Grades 3-6
Time / Format: Intensive / PDF
Source: **California Energy Commission**

The UNIVERSAL HOUSE
Energy, Shelter & the California Indian

Overview:
This activity links energy awareness with traditional California Indian cultures for 3rd to 6th graders. The teacher's overview and activity pages offer the student a unique way to incorporate science, social studies, art, math and language arts as they discover the different ways native tribes constructed shelters within the natural environment.

Things to Consider:
This unit offers a unique connection tying energy awareness with resource management and California Indians. The focus is on energy efficiency and California Indians' traditional houses. This unit provides background on various tribes' shelters which provides some good multicultural content for classroom discussion. Six easy to do hands-on activities on what is energy, shelter, insulation, thermal mass, shade, and orientation are included, but student handouts to guide the process will need to be created. There are no student assessments either. The student exploration on shelters offers an opportunity for student action, but it would be nice to extend it to include a student presentation or creating a project from the research they do. This unit is not correlated to the California State Standards.

Resource: **The Earth Day Groceries Project**
Grade level: Grades K-12
Time / Format: Moderate / Website
Source: **The Earth Day Groceries Project**

Overview:
The Earth Day Groceries Project is a cost-free environmental awareness project in which students decorate paper grocery bags with environmental messages for Earth Day. This is a great way to interact with the community on Energy Efficiency and Conservation Messages. Instructions on project can be found on the website and includes a PowerPoint Presentation
http://www.earthdaybags.org

Resource: **Energy and Society Kit**
Grade level: Grades PreK-8
Time / Format: Moderate / Kit with music CD and VHS video
Source: **Project Learning Tree**

Overview:
This program kit provides formal and non-formal educators with tools and activities to help students in grades PreK-8 learn about their relationship with energy and investigate the environmental issues related to energy's role in society. It helps students develop critical thinking skills to make decisions about their personal energy use. In addition to hands-on activities, it integrates music and dance to enhance the study of energy issues. Correlations to Science Content Standards and Performing Arts Content for Music and Dance for California are provided.

Resource: **The Kids Flex Your Power Energy Challenge**
Grade level: Grades 4, 5, 6
Time / Format: Moderate / PDF
Source: **State and Consumer Services Agency**

Overview:
The Kids' Flex Your Power Energy Challenge is designed to introduce 4th, 5th, and 6th grade students to key energy conservation strategies, provide teachers with energy conservation lessons and on-line resources, and encourage parents and schools to implement energy saving action. The activity kit contains information on energy conservation; standards-based math, language arts, and social science activities; and a take-home energy audit homework assignment.

While similar activities are found elsewhere, such as the Energy Hog Challenge, this activity kit is unique in that it is available with a student take-home component in nine other languages.

Teacher Pages are available only in English. Student pages are available in English and nine other languages; Armenian, Cambodian, Chinese, Hmong, Korean, Russian, Spanish, Tagalog and Vietnamese.