Can Behavioral Programs Work?
The Schools for Energy Efficiency® Approach

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ABSTRACT

Energy costs are the largest single source of avoidable spending for schools and up to one third of the energy used in a typical school building is wasted[1], so schools have the opportunity to improve operations and significantly reduce costs. With various ways to save energy from asset improvements to conservation, one approach, behavior modification, has many benefits for educational facilities.

Energy efficiency is not only important for expense reduction, but it has a positive impact on the environment, demonstrates fiscal responsibility to community taxpayers, and educates students to care about the impact of their actions. Schools for Energy Efficiency® (SEE) is a comprehensive program for K-12 schools to save energy and money by changing behavior throughout the district. To date nearly 600 school buildings have implemented SEE and so far they've achieved an average reduction of 12% and together have reduced carbon emissions by 270 million pounds of CO^2. Schools follow a systemized plan promoting efficient facility operations and behavior modification through energy awareness. The program is designed as a five year plan, with each year having a specific theme and energy saving objectives.

This paper describes the philosophy of the program, results to date, program components, case studies, and lessons learned. School districts with the desire for change can systematically reduce energy usage by increasing amounts over a number of years, primarily through changes in attitude and behavior. Maintaining the change continues to be the challenge and opportunity.

[1] U.S. Environmental Protection Agency, Energy Star Program.

Energy Use in Schools

Energy is required to keep schools operational from electricity for lighting and cooling to natural gas for building heat and domestic hot water. Schools spend more money on energy than any other expense except personnel, with the national average energy cost per student $299.43. [2] Eighty-seven percent of greenhouse gas emissions are from energy consumption, so energy used inefficiently causes unnecessary pollution and avoidable use of non-renewable resources. [3]

Faced with declining budgets, rising energy prices, and little time to devote to figuring out how to deal with this problem, schools may not realize the significant energy and money savings opportunities available through efficient use of energy. First, energy expenses are not a fixed cost, but one of the few variables a district has some control over because utility bills are based on consumption and secondly, according to the U.S. Department of Energy up to one third of the energy used in a school facility is not used efficiently.

Improving facility operational efficiency is what a behavioral based energy conservation program can accomplish and the following case study featuring the Schools for Energy Efficiency® program helps highlight the approach and results of such a program for the K-12 public school sector.

The Schools for Energy Efficiency Approach

Schools for Energy Efficiency® (SEE) was developed in 2002 by Hallberg Engineering, Inc. of White Bear Lake, Minnesota, a mechanical and electrical engineering firm with more than 25 years experience serving school districts. SEE was created in response to their school district client's need for a flexible, self-implemented plan to help manage their daily energy use and costs and develop a long-term culture of efficiency. Recently, SEE has been spun off as a separate company, Energy Efficiency Programs, Inc., for continued growth and development.

Today, nearly 600 schools in 29 K-12 districts have used the Schools for Energy Efficiency program approach to reduce their energy use and related expenses. Size of the districts varies from the smallest rural district with 2 buildings and the largest metro district with 84 facilities. Included in this range are brand new buildings with the latest energy efficiency control systems and much older infrastructure housing ailing equipment. The majority of school districts are located in Minnesota with one in Louisiana and another in the state of New Jersey.

SEE is a comprehensive program to save energy and money by changing behavior throughout the district. Energy-related expenses are reduced using a multitude of strategies for managing and measuring energy consumption in all school district facilities. The program's focus is not on equipment upgrades but rather on an integrated approach to changing the daily habits of how teachers, staff, and students influence the electricity, natural gas, oil, and water use in a school and how the operations staff (custodians, building engineers, and maintenance crew) run their buildings. The program is designed as a five-year plan, with each year having a specific theme and energy saving objectives.

[2] Agron, Joe. 2008.

[3] U.S. Department of Energy, Energy Information Administration. 2008.

Program Philosophies & Structure

Energy management is often viewed as complex because it involves cooperation between various types of staff and the knowledge to achieve a specific result. To unify the process, SEE provides a roadmap for behavioral change in operations and awareness. On the operational side, the district works toward efficient facility operations by using technical strategies that involve changing the way buildings are run as well as monitoring building energy use. For example, a no cost strategy may be to educate operations staff on ways to reduce electric demand by staggering equipment start times or the impact actions such as dusting light fixtures or calibrating thermostats has on the schools overall energy use.

On the awareness side, the focus is education and accountability for all staff and students. Through a themed series of classroom materials, activities, and coordinated communications, action is achieved for simple things like turning out lights in empty rooms and shutting off computer monitors when not in use.

To implement this approach, a specific organizational structure is used by the schools. The district's energy conservation efforts are lead by one point of contact, a district employed Energy Efficiency Coordinator (EEC). In addition, there are multiple levels of collaboration within administration and at each site.

Program Goals & Results

The Schools for Energy Efficiency® program has three main goals.

1. Reduce energy consumption & costs. The first goal is to reduce annual energy consumption by 10 percent as compared to a baseline of historic energy use. Every participating district has met this goal at least one quarter with 73 percent reaching the annual district-wide 10 percent reduction by the second year and 53 percent, marking 15 percent or more by year 3. Typically, the total energy use reduction percentage increases each year (Table 1). The average energy use reduction for all facilities currently reporting data is 12 percent.

Table 1. Actual SEE District Average Energy Use Reduction, by SEE Program Year.

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
mmbtu % (electric & natural gas, oil)	7%	12%	16%	18%	*NA

*Sufficient data not available.

Table 2. Actual SEE Program Average Energy Use Reduction per Building, per Year, by Energy Type

	Average Per Building
Overall Energy (mmbtu)	1,065
Electric (Kwh)	109,268
Heating (natural gas & oil mmbtu)	704

Table 3. SEE Program Average Cost Avoidance per Building, by SEE Program Year

Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
$7,412	$14,363	$20,249	$25,472	NA
Program Average: $14,166 per year				

Table 4. SEE Program Average Cost Avoidance per Square Foot, by SEE Program Year

Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
$0.07	$0.13	$0.18	$0.23	NA
Program Average: $0.13 per sq. ft, per year				

Table 5. SEE Program Average Cost Avoidance per Student, by SEE Program Year

Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
$12.16	$23.57	$32.25	$38.73	NA
Program Average: $22.86 per student, per year				

A school district's investment in the program is an annual participation fee for services and materials which is typically $5,000 per building per year, plus the salary for a part to full-time Energy Efficiency Coordinator costing approximately $2,000 per year per building. Both of these costs are recouped with the

energy cost avoidance savings from reduced energy use. The SEE program is not a guaranteed savings contract and no capital investments are required.

Payment for the program most often comes from the district's operating fund. Return on investment has been shown to increase with each year of participation as more components of the program are completed. On average a return of $3.08 is achieved for every dollar they spent.

Table 6. Program to Date Return per Dollar Invested in the SEE Program, by SEE Program Year

Year 1	Year 2	Year 3	Year 4	Year 5
$1.28	$3.32	$5.46	$7.92	NA

Table 7. Program to Date Environmental Impact, All Buildings, All Years

CO2	270,000,000 pounds

2. Achieve national recognition through ENERGY STAR. Secondly, SEE districts work to achieve national recognition from ENERGY STAR® for building and district-wide improvements. This determination is made through ENERGY STAR Portfolio Manager, a software tool for K-12 schools to benchmark their energy use with other schools of similar type across the nation. The SEE program has a partnership with ENERGY STAR, the national symbol of energy efficiency and a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy. As of 2008, ENERGY STAR has two types of award opportunities for the K-12 education sector.

1. *ENERGY STAR Leader*. Recognizes school district energy savings accomplishments. The U.S. EPA recognizes organizations based on documented improvement in energy performance. To be eligible for recognition as an ENERGY STAR Leader, an organization (in this case, a school district) must have energy efficiency improvements of 10, 20, or 30 percent above an organization-wide baseline or an average rating of 75 or better portfolio-wide.

2. *ENERGY STAR Label.* Recognizes top performing school facilities in the nation. The U.S. EPA offers a national energy performance rating system that scores a building's energy efficiency, on a scale of 1 to 100, relative to similar buildings across the country. The rating system accounts for the impacts of year-to-year weather variations, as well as building size, location, and several operating characteristics. Buildings rating 75 or greater may qualify for the ENERGY STAR label. Factors for consideration for this national ranking are the energy performance rating, actual annual energy intensity per square foot, and the improvement from the facility baseline period. Achieving this designation means the building ranks in the top 25% in the nation for energy efficient operations.

The SEE program has been in place within 14 of the 43 school districts across the country who have received ENERGY STAR Leader awards. Additionally, more than one fourth of the schools in the SEE program have qualified for or received ENERGY STAR Label. To date, participating districts have shown an average ENERGY STAR rank improvement of 9.26 points.

Table 8. ENERGY STAR ranking improvement for SEE buildings (ranked from 1-100 on ENERGY STAR Portfolio Manager benchmarking system).

	Energy Star Rank at Start of SEE	Current Energy Star Rank	Improvement
Baseline rating and improvement - all districts – all years in SEE	54.83	64.09	9.26
Average improvement of buildings with greater than .25 yr but less than 1 yr of results.	53.28	57.79	4.51
Average improvement of buildings with 2 - 2.75 yrs results.	72.05	78.60	6.55
Average improvement of buildings with 3 - 3.75 yrs results.	51.12	64.07	12.96
Average improvement of buildings with 4+ yrs of results.	52.93	68.28	15.34

3. Engage & educate. The third goal of the SEE program is to actively engage staff and students in the energy saving process. To date, nearly 350,000 students have been exposed to some facet of the SEE program.

In addition to students and teachers, education extends to media services and kitchen personnel through communications and meetings with district energy leaders. Building operators are educated on the best practices for energy management through the building operator strategies training, where they are taught basic energy concepts such as utility rate structures and electric demand control along with information on strategies covering all categories of energy management such as lighting, ventilation, and controls equipment operation.

Though the program is intended for school facilities, the entire community becomes involved as students bring home their energy efficient practices such as turning off the radio or television when they leave the room or turning off the faucet when brushing their teeth. Students become proud of their new knowledge and pass it along to their parents. Community education is an integral part in the success of the program as energy waste reduction after hours is important, so community members and visitors to school facilities all become aware of the goals the schools are trying to achieve. For example, welcome signs at each building remind visitors to be energy-conscious so everyone from the custodian to the teachers to the

Superintendent and the community are involved in an effort to be more efficient with their energy use. At some point in the program, all schools are highlighted in their local newspapers, websites, or televised news gaining greater support and recognition for their efforts.

Measuring energy usage reduction, although complex, is very achievable with appropriate software. Measuring success of the intangible aspects of engagement and education are less clear. Results show that energy savings are being accomplished by the activities and actions occurring in the buildings, as demonstrated in utility tracking results; however, measuring a cultural shift won't be known for years.

Program Components

The Schools for Energy Efficiency® program focuses on best practices for energy management through implementation of an organizational structure, energy saving strategies, education, and progress reporting. Together all of these practices focus on energy performance of the entire school building by aligning staff, students, community, and equipment to ensure the most energy efficient operations.

Through program guides and training, suggestions for operational and behavioral practices are provided to the districts. The program helps identify where schools use energy and where there are opportunities for improvement. The SEE program also helps facilitate the school district's partnership with the U.S. Environmental Protection Agency's ENERGY STAR® program for access to national benchmarking tools, technical resources, and awards.

At the start of each program year, participating school districts receive a new year-specific plan, training, and materials. The components outlined below encompass the program. Effective implementation and ongoing use of the plan drives change and provides strong energy savings.

Membership. Membership in the Schools for Energy Efficiencyprogram allows K-12 districts to be a part of a network of schools with a common goal of reducing energy using a district-wide team approach. Members are invited to participate in peer exchange and networking meetings with other school district energy leaders to share successes and troubleshoot challenges.

The systemized plan. An annual SEE Program Support Kit provides all the necessary tools to effectively and successfully communicate, promote, and reward energy-efficient strategies and behaviors that drive energy savings in schools. These materials are designed to support day-to-day energy saving efforts and keep district staff, teachers, and students informed and aware of the impact they have on reducing energy waste and costs. Program support kit materials include an annual guide with year-specific objectives and strategies, energy awareness campaign, communications, activities, and recognition materials.

> ***SEE program objectives and strategies*.** Specific yearly objectives focused on efficiency are coupled with operational and maintenance strategies designed to help save energy provide the basis for an energy management plan. These objectives and strategies are deployed to work on changing the way students and staff use energy in their school buildings. Low and no cost operational strategies provide sound approaches for ensuring facilities are operating in the most efficient manner possible. An example of a strategy is to set controls to heating system temperatures to a specific range and an example of an objective is for the district to establish set policies and guidelines for all HVAC operation schedules or optimum lighting foot-candle levels by area.

***SEE energy awareness campaign*.** Eye-catching graphics and action-oriented messages delivered through large posters, stickers, or classroom tip sheets encompassing each year's energy theme provide a powerful energy awareness campaign. These materials keep energy-saving goals and strategies visually top-of-mind for everyone in the district. For instance, each school's SEE program results are creatively displayed with progress posters near the main school office.

***SEE communication series*.** Effective communications are essential to the success of any program. SEE provides communication templates, including a newsletter, monthly topics, press releases and many other helpful tools. Core program information is ready to deliver with customizable templates.

SEE program activities. Through the use of interactive activities, districts increase energy efficiency awareness, student involvement, and staff participation. Each year of the program introduces a new activity to engage students or staff making saving energy fun and educational.

***SEE recognition program*.** Rewarding effort, commitment, and progress is a key motivational tactic in getting individuals to start and continue the type of cost-saving behavior that makes an energy management process a success. The SEE recognition program gives various incentive materials to spotlight individual and group efforts that are making a difference. Each year of the program has a targeted recognition program to align with the theme of the year.

SEE program training. Comprehensive SEE program implementation training is conducted for district energy leaders at the start of the program. This training consists of a detailed overview of the program philosophies, energy 101, and how to launch the program in a district from strategies to communications to understanding utility tracking. Each consecutive year also includes training to provide insight into the new years' strategies, opportunities, and awareness theme. Additionally, SEE provides training sessions to assist building operators and custodians with program strategies.

Utility tracking. Measurement of energy savings is a key component of the Schools for Energy Efficiency program. School districts track their energy savings to manage and validate their energy saving activities. Utility data is tabulated through input of monthly utility bills into utility tracking software. This internet based process collects and organizes data using software to conveniently manage and monitor energy consumption and costs for each building, which allows accurate tracking and reporting of energy savings progress. Also, the utility tracking tool offers a streamlined feature for exchanging energy and building data with the ENERGY STAR® Energy Performance Rating System.

Electricity, demand, natural gas, oil, and in some cases, water data is tracked and compared to a baseline of one to two year's utility data established for each building and normalized for weather and price fluctuations. This baseline is a historic snapshot of usage and serves as the benchmark to determine energy savings and cost avoidance for each facility. Energy savings is then calculated and reported in percentage change from the baseline year. These progress reports are typically generated on a quarterly basis and communicated to school administration, staff and students in a district. Training and support to assist data entry personnel in understanding utility bills, data analysis and validation, and SEE report generation is also provided.

Customized consulting and support. The commitment to environmental leadership and energy performance starts with the district, but is guided by the SEE Program Consultant each district is assigned. The SEE Program Consultant trains the Energy Efficiency Coordinator and key leaders in the district and works directly with them to help implement and manage all the details of the program.

With each district implementing the program in a way that best fits their culture, SEE Program Consultants provide guidance and support throughout program participation.

SEE program consulting provides resources and assistance throughout implementation and program management from technical to promotional support. SEE program support offers energy research services, comprehensive program coordination, and communications deployment. Program experts assist in development of customized program processes, reviewing program performance, barriers, and opportunities.

Case Studies

Columbia Heights school district in Minnesota is a small school district located just outside Minneapolis educating 3,000 students throughout five buildings all built in the 1960s. In their diverse population, 38 languages are represented and 62% of students qualify for free and reduced lunch programs. Saving energy has been a priority for this district as a means to reducing budget shortfalls. Despite their challenges, this district has achieved $166,739 in avoided energy expenses in 3 years and reduced energy use nearly 10%. In addition, all of their buildings are in the top 25% in the nation for efficient operations with an exceedingly high district-wide ENERGY STAR® ranking of 92 out of 100 on the U.S. Environmental Protection Agency's benchmarking system. Another district with socioeconomic challenges is St. Tammany Parish Public School district which is located just outside New Orleans, LA that was devastated by Hurricane Katrina. Reducing energy usage has been one of their methods for providing additional dollars toward educational needs of their students – in twelve months they avoided spending $1,596,589 on their energy bills.

Parallel their story with that of a growing suburban school district in Minnesota, South Washington County Schools. With 22 facilities to manage, they have reported a total of $2 million dollars in energy cost avoidance since concentrating on efficient practices starting in 2003. The district was able to put some of the cost avoidance dollars back to their classrooms for teachers, supplies, and facility upgrades to enhance our students learning environment. The energy has saved so far is equivalent to the CO_2 emissions from the energy use of 2,527 homes in a year, so the students and communities are quite amazed.

SEE has also shown that while a school may have upgraded equipment such as lighting with more efficient designs there is still further savings potential through a behavioral approach. Buffalo school district in Buffalo, MN took a comprehensive approach including both the SEE program and improvements to existing equipment to reach their energy saving goals. Through this process, they evaluated information on facilities and equipment and prioritized needs so they were able to allocate cost avoidance dollars to fund asset improvement projects such as window replacement, lighting upgrades, motion sensors in the gymnasiums, replacing rooftop units at a few schools. So far, their 9 facilities have reduced energy use by 23% in 2.5 years avoiding $942,800.

Individual schools have made an impact as well. One junior high school in St. Louis Park, MN reduced its energy use by 24% in their first year and another elementary school, Crim Primary, in Bridgewater, NJ saved 15% and avoided spending $5,259 in their first 3 months of focusing on conservation. Bridgewater-Raritan High School also avoided $40,868 by lowering their energy use 21% during the summer.

Cambridge-Isanti school district instilled healthy competition between buildings by challenging operators to reduce peak demand. To date, they have truly excelled in this objective by lowering demand by 24%.

Lessons Learned

In 2002, the SEE program was created in response to a request from a Minnesota school district superintendent for a cost effective, self-implemented energy conservation program for K-12 schools that was not focused on asset upgrades. After one year of initial development and another year of testing with four districts, SEE realized that providing too much information and too many to do lists at one time overwhelms an Energy Efficiency Coordinator and the district. Thus, the SEE program was re-written into a 5 year approach with each year introducing new strategies and concepts that build on the previous.

One of the most significant factors to the success of a behavioral program is the district's willingness and commitment to change, as well as the person hired or assigned to be responsible for the program. SEE learned early on that the person managing the implementation typically comes with great communication skills or technical skills, but usually not both. Impressive communication skills are very effective in the classroom and boardroom, but this type of person is not as confident with the building operators and building systems. The opposite is true with the technically versed skill set; however, neither person can succeed unless the district is committed to the program's goals. The program is the road map, but the people drive the car.

Utility tracking is key to measuring results and an essential part of the behavioral change momentum. Weather normalization, meter tuning, and base line adjustments are concepts and procedures integral to the software used to analyze energy savings. Educating the owners on what these topics are, as well as how they are used, is necessary to ensure believability of the data.

A multi-year approach is also necessary to accomplish sustainability of behavioral change. Students are a great audience, not just for the immediate financial improvements to district's budgets, but to a cultural shift that won't be realized for decades. So the challenge becomes maintaining the interest in energy efficiency each year. Keeping the fun alive has been carried out by changing themes or graphic appearance and introducing new topics annually, but in an age of short attention spans, this continues to be a test of creativity for any awareness program.

The program has also learned that it is sometimes difficult for a district to spend money on an energy conservation program implementer when classroom teachers are losing their jobs due to budget cuts and declining enrollment. Sometimes spending money is necessary to save money especially when the saved dollars may help keep educators in the classrooms, but it has been a challenge none the less.

Conclusion

Schools for Energy Efficiency® (SEE) is an example of an attainable and affordable way for a school district community to save energy immediately. Through the lessons learned, continued program improvement, and the 5 years of proven results from the participating districts, the program has guided schools through a three-pronged challenge all districts throughout the country face - a need to reduce spending, an obligation to operate their buildings more efficiently, and lastly a desire change the actions of current and future generations.

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