Change Who Changes the Lightbulb: Building an Efficiency Ethic at School

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ABSTRACT

In the Green Schools program, teams of students, teachers, custodians and administrators plan and implement a school energy efficiency program that combines instruction, changes in operations and behavior, and involvement of the whole school. Educating kids and saving energy are the program's twin goals, but participating schools reported that in addition, they were functioning better as communities. Before, teachers and custodians, if not adversaries, operated in separate spheres. As team members, however, they interacted and began to share responsibility for building energy use. This paper suggests that involving only one element of the school population—say, just administrators or just teachers—in energy efficiency will not be as effective or sustainable as a more comprehensive approach. The "learned group experience" of Green Schools results in fundamental organizational change. Significant and measurable energy conserving behaviors do occur, but in the long run, lasting change in relationships among school personnel may be even more important.

Introduction

Custodians and K-12 facilities and operations managers have all the technical knowledge required for making schools more energy efficient, but their best efforts can be undermined by thoughtless and uninformed actions of those who use the building daily--students, teachers and staff. Best efforts also can be undermined by the preconception that the core business of schools—educating young people—has no link to educational facilities.

In a sense, the Alliance to Save Energy's Green Schools program is the commissioning process for school energy efficiency programs because it attends to the way that existing expertise and existing requirements are used together to support the twin goals of more efficient school buildings and improved education. For example: Manitou Park Elementary School in Tacoma, Washington was about two years old with all the latest energy management systems firmly in place. Although school officials did not expect to save any energy as a result of the Green Schools program, Manitou Park saved five percent of its energy usage the first year. The savings was primarily the result of a motivated and informed custodian, who did things like disable the magnetic door stops on the outside doors and change the timing for outdoor lighting in the parking lot.

The Green Schools program was not conceived initially as a program that might improve the ways schools function internally. At the Alliance to Save Energy, we were interested in saving money for schools while at the same time improving the relevance and effectiveness of educational offerings for the students. While Green Schools from the start has been successful in both those areas, it was the unsolicited feedback about school functioning that made us wonder what--quite unintentionally--we were doing right.

"My facilities staff were viewed as invisible broom pushers," said Rick Monaco, former Director of Facilities and Transportation at Baldwinsville (NY) School District.

"Now, they are treated with respect and even considered leaders in Baldwinsville's campaign to avoid energy waste."

Teachers for their part, report that the Green Schools team format, which incorporates facilities staff, administration, teachers, and kids, forced them to examine other points of view, take on the role of "learners," and participate in their own "education." In the Green Schools program, students are jointly responsible (with custodial staff) for creating energy savings. Through the program, they see those actions translated into real dollars. For example, in Philadelphia, the student members of Prince Hall Elementary school's Energy Club launched a peer education campaign and a turn-out-the-lights program. As the school year progressed, the Energy Club members noticed that when students would come in from recess, the outside door would remain open. (This was not a double door vestibule.) The Energy Club devised a plan to share the job of monitoring the door during each recess period. These and other efforts at the school yielded energy savings four times greater than previously realized.

In some schools, students are part of the team that decides how savings should be spent. With behavior and operational savings averaging more than $8700 per year per Green School, that starts to add up to real money that can be invested in anything from field trips to energy efficient landscaping to scholarships. (Table 1 shows comparative savings among Green Schools pilot sites.)

Marketing efficiency strategies to one element of a school population fails to account for the synergistic effect of having cross-functional teams take ownership of the program. It has been our experience that teaching energy conservation behavior in schools can be done most effectively by fostering a learning culture, where it is recognized that expertise in energy management does not reside solely in one area (traditionally the facilities staff and the environmental science teacher.) Rather, the entire community is engaged in discovery of what makes their building work more efficiently. This team effort, in turn, also helps make the school itself work better as a community.

As an example, in a recent building walk-through in a vocational-technical high school in New York, students spotted areas of infiltration and pointed them out to the lead custodian. He marveled, "I walk these halls every day and am so used to seeing certain problems that I never really noticed what the students showed me." During another building walk-through in Philadelphia, an administrator remarked that she had "no idea of the challenges our building engineers face every day."

Each of the two Green Schools' goals—saving money for schools and improving the relevance and effectiveness of educational offerings for the students—reinforces the other. Using the building as a learning lab to solve problems in the real world strengthens students' learning, and energy savings increase when all the building users work as a team to identify and reduce energy waste.

Core Principles

The core principles of the Green Schools program are:

- The program is comprehensive and long-term, including energy savings from retrofits, behavior and operational changes. It focuses on energy but may include recycling, water

efficiency, and low-toxic landscape and cleaning materials. It always ties energy efficiency to schools' core business: educating students.

- A percentage of the dollar savings from energy efficient no-cost behavior and operations changes are returned directly to the individual schools that achieved the savings. The remainder goes to the general district facilities budget.
- The program is implemented at the school level by teams of teachers, custodians, administrators, and students, and includes three strands: instruction, energy efficient behavior, and involvement of the whole school and community.
- Local leadership is identified early, trained, and encouraged to take complete authority for running the program by the end of the 2- or 3-year start up period.

Key Elements

How does the design of a comprehensive schools program contribute to development of a shared mission? We suggest that these are key elements:

1) Team approach: Green Schools is planned and implemented by cross functional teams that give equal voice and appropriate responsibility to a spectrum of staff.
2) Planning approach: Green Schools is based on team planning, not on learning to teach or take action according to a "cookie cutter" set of materials.
3) Professional development for teachers and for facilities staff.
4) Performance feedback: Providing concrete feedback to school teams by returning a portion of behavior and operations savings to them.
5) Power of the increment: Demonstrating the power of individual action.
6) Creating links between schools and communities.

1. Team Approach

Green Schools initial planning teams are made up of teachers, custodians, and administrators. Meeting as a group, they start the process by reviewing overall school goals for the year, such as literacy, character education, or building a sense of community within the school. In many instances, these are the first education discussions of which custodians ever have been part. And vice versa: sometimes the Green Schools process is the first time teachers have a chance to discover what custodians do and how complex the systems are with which custodians work. With the overall goal in mind, and with training from the Alliance staff, teams plan to integrate energy efficiency into instruction in concert with plans for changes in behavior and operations, always focusing on those areas where the energy saving activities support already-existing school goals and state standards.

One of the very first activities in a Green Schools training is a discovery learning and team-building exercise. Before the walk-through audit, team members are asked to list all their burning questions about energy. These questions represent a wide range of experience and sophistication. After a quick sorting of the questions, the group uses its collective intelligence to answer the questions it can. They find that facilities personnel have a wealth of information. The group brainstorms to see where expertise may be found locally to help answer some of the unresolved technical questions. For example, in Iroquois, the facilities

manager of the local state university provided expertise for teachers, custodians, and students. The team determines its own needs for further knowledge. If more technical input is seen as necessary, a local college or utility may be invited to join. District and state curriculum experts can participate by helping to link Green Schools instructional materials to state learning standards.

In team meetings during the year, kids, parents, support staff and other community members can be added to the Green Schools team. In Baldwinsville, the Green Schools team included the President of the PTA, and in Iroquois, the Green Schools team formed a liaison with the local Chamber of Commerce. The idea is to give everyone a part in developing and carrying out a systematic approach to instilling energy conserving behavior.

In the Green Schools program, education and facilities are equally important, no matter how much easier it would be to house the program solely in one area or the other. If instruction and facilities were split apart, Green Schools easily could become just another classroom energy education program or just another turn-off-the-lights program.

2. Planning Approach

Green Schools is based on planning, rather than presenting a simple step-by-step code of conduct for saving energy in schools. We use this approach for several reasons:

1) It allows the program to be adapted to fit the specific priorities, needs, and standards of each school district;
2) It strengthens the current emphasis in professional development on thematic planning and integrated instruction by giving teachers an opportunity to apply and refine their planning skills; and
3) It creates shared local ownership of a complex, systemic intervention.

Green Schools teams actually develop their statement of ways to use Green Schools to meet school priorities. Teams create a calendar of the school year to coordinate activities and instruction among team members. Team members commit to specific responsibilities each month of the school year among the three strands of intervention: instruction, behavior, and involvement (school and community.) This planning approach helps insure that team members will follow through. They can see immediately how a program in school energy efficiency is relevant to their own driving issues to engage students in meaningful, relevant, real-world learning and to present subject matter in the classroom in context rather than in isolation.

Finally, for Green Schools—or any program—to influence the routine behavior of a school over time, it has to address many issues. It must be a systemic intervention, addressing the financial, physical, and personnel needs of schools as well as schools' core mission of educating children. It must endure for more than two or three years which requires the program to create enthusiasm. The program creates enthusiasm by helping team members meet the requirements of their jobs and develop a sense of their power to impact the amount of energy used at school. When the program belongs to the school, it is more able to become part of the fabric of learning and living in a school.

The planning approach takes considerable additional time and effort by school personnel, both teaching and support staff. But, the investment in "thinking through the process" fits with leading thought in education reform.

Unlike many other programs, where a pre-printed checklist is used during the building walk-through, Green Schools has a form with only three areas for team notes:

- Opportunities for Savings
- Related Behaviors
- Links to Instruction

Without the structured "help" of a checklist, participants in the walk-through have to *really* look and think about what they are seeing. As mentioned before, it is not uncommon for custodians with 20 years' experience to see something new in their building as the team progresses. The form's focus on creating a link among the status of the building, individual behaviors to improve energy efficiency, and areas of instruction that become available through analysis and action, keeps the three levels of the program developing together in teams' minds.

As students learn to understand how their school uses energy, they participate in inquiry-based learning and develop skills that they can readily apply in the real world. For example, one group discussed doors and heat loss: Does someone in the group think these outside doors allow a lot of heat loss? How would we test that idea? What measurements would we take? How could we evaluate alternative door materials? Is the problem really the door itself or the way the door fits in the jamb?

3. Professional Development

Teachers and custodians together attend Green Schools training, which is generally held the summer prior to the start of a program. Small stipends are offered to offset the additional planning time. Initially, the Alliance to Save Energy started by offering stipends only to teachers, but we quickly learned that custodians needed equal recognition to combat the "broom pusher" image and give them equal stature as team members. Teachers start by mapping out the essential areas that will be covered in each of their classes. Next, they find the energy "link" to that subject and the curriculum material that supports it. (We have huge resource manuals.) For example, a third-grade teacher who did a unit on butterflies and the stages of transformation in their growth cycle used the idea of transformations as a springboard to energy, efficiency, and environment.

Custodians in Green Schools also are offered professional development. One training mechanism is a peer match, where the facilities manager of an experienced Green Schools school district will spend the day assisting staff at a school that is just starting the program. Larry Bishop, facilities manager at Iroquois School District, convinced custodians at Broome-Tioga that working with groups of kids was the way to get excitement rolling about energy management opportunities in the school. Broome-Tioga BOCES (Board of Cooperative Educational Services) provides training and special programs to 16 school districts in central New York State.

Green Schools also now offers a Building Operator Training Program (BOTP) developed by Destination Conservation of Alberta. The BOTP program has five modules: Lighting, HVAC, Computers and other Electrical, Water, and Waste. These discrete training packages focus on specific operational and maintenance actions and can be practiced at school and used later to educate parents and other community members. In Broome-Tioga, which has an active vocational-technical program, the training will be incorporated into

standards of instruction for the various trades and also will be used to ultimately train custodians of the school districts that feed into the BOCES.

4. Performance Feedback

In Green Schools programs, school districts agree to establish a baseline for each participating school, leave it undisturbed for three years, and return each year a substantial portion of savings back to the schools (generally 50 percent or more) to be used for educational purposes.

Schools are provided software for tracking their utility bills so that they can see more quickly how their energy saving efforts are doing. By dating and recording actions, then reading utility meters and estimating savings, students can look back and draw conclusions about "cause and effect" relationships. In schools with demand metering, students can experiment with timing their efficiency activities to impact peak load periods directly--and can then see the impact of their actions in the next month's billing.

Each month (or at intervals determined by the team), the team reviews its progress and adjusts its plans.

5. Power of the Increment

Ted Flanigan, consultant and musician, speaks of "the power of the increment" –or the power of individual action to make collective change. Each of the parties in a Green Schools project adds strength to the whole. It becomes almost immediately evident that an energy saving program involving one "environment club" or one classroom, will not influence energy use in a whole school building. Yet, by involving wider and wider circles--eventually getting most of the school involved—significant results are produced.

The power of the increment is also demonstrated well in schools because the simplest of actions, such as turning off lights or computer monitors, multiplied over dozens of classrooms day after day, will result in measurable, substantial savings. It is hard for children, who often feel powerless, to see the impact they have on the environment—but they do make the connection through programs like Green Schools. Energy efficiency is a key strategy for pollution reduction. Kids can make the leap from very concrete efficiency actions—keeping outside doors closed—to the very abstract—translating energy saved into amount of greenhouse gas reduced. To help them with the latter, we refer them to EPA's online pollution calculator, but the more important connection is that day-by-day action does add up to long-term environmental benefit.

6. Creating Links between School and Community

One of the more exciting recent trends in the evolution of the Green Schools program is the opening of Green Schools to their immediate communities. One of the key concepts in education reform is a renewed interest in hands-on, real world learning. At Broome Tioga, students and classroom instructors with backgrounds as diverse as horticulture and special education participated with the custodians in the BOTP training. During the training, a "lifeline" expert was "on call" to answer questions that prove controversial. For the lighting module, this was the education director at the Lighting Research Lab at Renssalaer

Polytechnical Institute. For the HVAC training module, the lifeline expert was from DOE's National Renewable Energy Laboratory in Golden, CO.

The students had to combine what they learned in the operations-oriented BOTP, with what they discover for themselves using the "Mad-Air" building science model supplied by the Green Schools program. This dynamic and interactive model (manufactured and sold by Watts Right) demonstrates the various pressure effects that may occur in a building due to forced air HVAC systems and combustion systems. To test their newly acquired knowledge in the real world, the students accompanied a local contractor to conduct a blower door test on the area's first Energy Star home.

Taking concrete efficiency actions within the school, and then applying this learning on the job is exactly what this BOCES expects from its Green Schools program.

In Baldwinsville, students in an advanced Problems in Government class researched the history of the local electric utility's role and activities in the community. Students interviewed company employees, shadowed a variety of positions in the company, and wrote a final paper about the company's record as a citizen of the community. Several students obtained summer internships through the experience.

At Iroquois School District, a team of high school students received training in STEM (Savings Through Energy Management), a 5-day intensive student energy auditing training. Rather than see their skills languish, the students developed a plan to audit the elementary schools in their district and communicate the opportunities for efficiency to the building users, helping to expand the Green Schools effort in their district.

Conclusions

As noted before, the effectiveness of Green Schools is partially based on the project's tie to the core business of schools and its congruence with the driving issues of education reform. Teachers apply Green Schools activities to encourage real-world applications of academic content, problem-solving, and critical thinking.

In Green Schools, learners become educators. The project reaches into the community as students and teachers take what they have learned and apply it in other places--whether it's Baldwinsville, NY high school students teaching elementary students or Seattle, WA elementary students auditing a neighborhood church.

The Green Schools experience is confirmed by research of the State Education and Environment Roundtable funded by the Pew Charitable Trusts. The study showed that in 40 schools which used environment as a context for learning (such as an energy efficiency project in the school), student achievement was significantly greater. In addition, the research found that community impact and involvement was greater in areas where schools used environment as an integrating concept for learning. This finding confirms our experience that school energy efficiency programs can reach out into the community.

The Green Schools program strengthens existing efficiency initiatives and supports any movement within a school district to become a more high performance organization. Team building, custodial and teacher professional development, building user behavior—these do relate to energy efficiency hardware, retrofits and energy use. And, they help improve the quality of education. The Green Schools Project, in effect, helps schools become better team players.

ELECTRICITY SAVINGS AVERAGES (PER SCHOOL PER YEAR)

Baldwinsville:

SCHOOL	kWh	Dollars	Percentage
Baker HS	170,159	$ 6,806.50	6.5%
Durgee JHS	-7,077	$ (566.00)	-2.0%
Elden Elementary	16,206	$ 1,296.50	6.5%
McNamara Elementary	37,137	$ 2,970.50	13.7%
Palmer Elementary	-5,280	$ (422.00)	-1.7%
Ray Middle School	220,500	$17,640.00	18.1%
Reynolds Elementary	1,872	$ 150.00	0.6%
VanBuren Elementary	-11,523	$ (922.00)	-5.9%

Iroquois:

SCHOOL	kWh	$$$$$$$	%%%
Elma Primary	41,220	$ 4,323.50	16.0%
Iroquois Intermediate	53,203	$ 6,083.00	15.4%
Iroquois Middle School	134,573	$15,053.00	20.7%
Iroquois High School	189,353	$21,815.50	15.0%
Marilla Primary	-2,735	$ (342.00)	-2.0%
Wales Primary	42,693	$ 336.00	1.8%

Philadelphia:*

SCHOOL	kWh	$$$$$$$	%%%
Martin Luther King HS	637,254	$ 70,736.00	10.7%
Prince Hall Elementary	85,732	$ 11,146.00	11.4%

*Philadelphia school savings are based on .5 year's worth of data, and were multiplied by two to estimate a full year's worth of results.

Seattle: (W/O RETROFIT INCLUDED)

SCHOOL	kWh	Dollars	Percent
B.F. Day Elementary	106,138	$ 4,500.00	13.3%
Roosevelt High School	35,530	$ 1,031.00	2.7%
South Shore MS	151,514	$ 4,227.00	6.6%

ELECTRICITY SAVINGS AVERAGE per school/year (w/o Seattle retrofits): **$8,729.55**

Table 1: Comparative Savings among Green Schools Pilot Sites