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HIGH PERFORMANCE SCHOOL BUILDINGS:

Energy-Smart Schools That Make a Difference

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Over seventy percent of U.S. schools still in use today were built before 1960, according to the General Accounting Office. In the next decade, school districts around the nation will have to replace or renovate over six thousand of these buildings, and the school's administrators will aim to construct the best possible learning environments while using limited budgets. At this EESI Congressional briefing, co-hosted by the Sustainable Buildings Industry Council, a panel of experts discussed the concept of a "whole building design" as a way to attain a high performance school building. With an integrated design, a school's various components work together as a whole system to produce an efficient and well-operating building. Another key aspect to creating a high performance building is implementing an energy management program to monitor and reduce energy use wherever possible. In recent years, many legislators, architects, engineers and school officials have begun to embrace this holistic approach to building design and function. Not only will it lower a school building's overall energy costs and environmental

"The high-performance schools concept is a win for the environment, it's a win for saving money and resources, and it's a win for student performance."

- Congressman Mark Udall

impact, initial studies indicate that high performance school buildings also improve student performance.

WHAT IS A WHOLE BUILDING DESIGN?

A high performance school building creates a healthier and productive atmosphere for both students and teachers through a combination of energy-conserving design features, energy efficient equipment, and the use of renewable energy technologies. First, utilizing natural light to the fullest extent possible reduces the amount of energy used for lighting in a school. Some studies also suggest that students score higher on standardized tests in classrooms with more daylight. In addition, spacious, daylit hallways and well-planned acoustics within the classrooms bolster student attentiveness and create a superior learning environment.

Second, installing proper ventilation systems will ensure high indoor air quality, which is a crucial component of any building design. Jim Zavesky, Ohio school specialist for the Trane Company, cautioned

PANELISTS

Representative Mark Udall (D-CO)
Co-chair, House Renewable Energy and Energy Efficiency Caucus

Gary Bailey
AIA, Principal, Innovative Design

Roy Michaelson
Energy Management Specialist, Howard County Public Schools

Jim Zavesky
Ohio School Specialist, The Trane Company

Deane Evans
FAIA, Director, Center for Architecture and Building Science Research, New Jersey Institute of Technology



against building a school with “too tight an envelope.” In one recent case, mold grew in the ducts of a newly-built school, causing teachers and students to get sick. This not only drew attention away from the school’s main purpose of education, it resulted in an expensive lawsuit against the school district. By choosing high-quality heating ventilation and air conditioning (HVAC) systems and by learning proper installation and maintenance practices, other schools can prevent this unpleasant and costly situation.

Third, proponents of holistically-designed schools envision the building as a teaching tool in itself. For example, by leaving ceiling beams exposed, students become more aware of their surroundings and of the high performance building components. At Walker Elementary School in McKinney, Texas, many such unique design methods encourage students to constantly ask questions.

Finally, using recycled and reusable materials and employing renewable energy and energy efficiency technologies make the school a more sustainable building and reduce its impact on the environment. Gary Bailey, principal of Innovative Design, summed up the ideology behind a whole building design when he stated, “We’re not just designing boxes to house kids anymore... Every school should represent the values of our country and our communities.”

Case Study: Roy Lee Walker Elementary School McKinney, Texas

This Dallas-Fort Worth area elementary school, completed by Gary Bailey’s firm Innovative Design, epitomizes the whole building design approach. There are many windows and daylighting features to make the most of the sunlight. Energy efficient HVAC systems condition and circulate fresh outside air throughout the school. Together, these features require less energy to be used for lighting and air conditioning, which generates less pollution. In the ceilings, beams are exposed in order to display the building’s components, and the carpeting is made with recycled and reusable materials. The wide, naturally-lit hallways are lined with computers: every bit of space is used for learning! Outside, indigenous wildflowers grow and cisterns collect rainwater, which is reused for irrigation on the campus. These aspects of a whole building design provide teachers with hands-on lesson material, allowing the children the opportunity to think about the footprint that humans leave and actually see how their school is minimizing that impact. Overall, both teachers and kids find the school a fun and productive learning environment.

WHAT ARE THE BENEFITS OF A HIGH PERFORMANCE SCHOOL BUILDING?

According to Deane Evans, director of the Center for Architecture and Building Science Research at the New Jersey Institute of Technology, a holistically-designed school building has further positive effects. With proper HVAC systems providing healthy air flow in a school, students stay home sick less often. In addition, the environment engages students in the learning process, and they enjoy school more. For these reasons, daily average attendance at high-performance schools increase, while teachers encounter fewer behavioral problems. Additionally, teachers enjoy working at the schools and even flock to get jobs there, allowing the schools to hire and retain the best teachers.

One of the most significant benefits of a high performance school building is its lower operational costs. Many administrators, upon initial investigation, become concerned about the increased cost of building and maintaining a high performance school. However, when deciding how much to invest in the construction of a new school, they should consider the building’s full life-cycle costs. Even though the price of construction for a high performance school might be greater than for a conventional school, the lower long-term maintenance costs balance it out. In fact, the payback from energy conserving measures can actually make it a cheaper building than conventionally designed schools.

Zavesky emphasized the importance of taking into account the total lifetime cost of a school when

making decisions, and especially when purchasing HVAC equipment. He cited an extensive Ohio study, which looked at the “total cost of ownership and verified that a high performance HVAC system does pay for itself.” The dollar savings that a Red Wing, Minnesota high school achieved by building within high performance standards represent a prime example of how choosing quality equipment can, quite literally, pay off. The developers integrated a high quality indoor air regulation system with other features to optimize the overall functioning of the building’s features. After implementing energy efficiency measures, such as designing roof and duct structure for minimal heat loss, they were able to install smaller boilers and chillers than they would have done ordinarily. For taking these steps, the school gained first-cost savings of \$900,000, which included a \$200,000 utility rebate. Additionally, through the installation and use of more efficient products, the school saved \$120,000 in operational costs.

ACHIEVING HIGH PERFORMANCE CHARACTERISTICS IN EXISTING SCHOOLS

Not every school district needs to build a brand new school in the near-term. By applying whole building design techniques to existing buildings during renovation and by implementing proper energy management programs, existing schools can realize significant energy savings too. Roy Michaelson, energy management specialist for the Howard County Public School District in Maryland, described the successful energy-saving plan adopted by his school district. During the 1997-1998 school year, individual schools volunteered to implement energy-saving strategies and track their energy use. At the end of the year, the district would split the energy savings with the schools, who would receive a direct rebate check. Before this initiative began, energy usage and school district spending on energy increased proportionately with increased student enrollment. Since the pilot project was implemented in 1996, the student population has increased by 23 percent and 11 new school buildings were added, but the district has only seen a 12.6 percent increase in energy use.

The Howard County Public School District achieved these remarkable cost savings by taking a number of different steps. First of all, they hired a new “Energy Management Controls Technician” to oversee HVAC maintenance, and trained the facilities’ staff to be able to operate the HVAC equipment at its full efficiency potential. Next, during renovations and when making equipment purchases, they paid close attention to selecting the most energy-efficient products, using Energy Star approved equipment whenever possible. In addition, they conducted regular energy audits and actively participated in the Metropolitan Council Electricity Energy Procurement Program. Monitoring the demand on the electricity systems and reducing it whenever possible through conservation measures is another method that Howard County Schools have used to dramatically reduce their energy consumption. Finally, the school district is currently running a pilot program to find out whether on-site power generation will be an option for supplying more consistent and high-quality electricity to the school facilities. All of these innovative techniques for lowering energy costs have made Howard County an excellent example for other school districts to follow. They have shown that school districts have many options for making their existing buildings and systems more environmentally sound and cost-effective to run.

LEGISLATIVE INITIATIVES OF THE 107TH CONGRESS

Even with the best resources available and most motivated planners, some school districts simply do not have quite enough capital to implement whole building designs in their schools and need further financial and technical assistance. Congressman Mark Udall (D-CO), a long-time champion of high performance school buildings and clean energy technologies, was the first Member of Congress to introduce legislation on this issue in the 106th Congress and reintroduced the bill in the 107th: the High-Performance Schools Act of 2001 (H.R. 1129). This legislation would set up a program within the Department of Energy whose specific directive would be to grant money to state energy offices and school districts for high-performance school construction. Senator Hillary Clinton (D-NY) introduced a similar Healthy and High-Performance Schools Act of 2001 (S. 968), which passed as part of President Bush’s education law on January 8, 2002. This initiative would establish a high performance schools program within the Department of Education to provide schools with the financial opportunity to institute energy-saving design measures in their renovations and new buildings, although no author-

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ization of funds was made in the law. There is also high performance school building legislative language in both the House and Senate energy bills.

All of these legislative proposals will set the stage for enormous energy savings and healthier schools in the United States. Congressman Udall summed up the issue when he declared, "The high performance schools concept is a win for the environment, it's a win for saving money and resources, and it's a win for student performance."



Additional Resources

- Sustainable Buildings Industry Council: www.sbicouncil.org
- The U.S. Department of Energy: www.eren.doe.gov/energysmartschools/
- The U.S. Environmental Protection Agency's Energy Star Program: <http://www.epa.gov/building/schools/>
- National Clearinghouse for Educational Facilities: <http://www.edfacilities.org>
- Consortium for Energy Efficiency (CEE): <http://www.cee1.org/com/bldgs/schools.php3>

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