



HIGH PERFORMANCE SCHOOLS INITIATIVE
CONNECTICUT GREEN BUILDING COUNCIL

FINAL REPORT


JANUARY 2006

ACKNOWLEDGEMENTS

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The Connecticut Green Building Council (CTGBC) was founded in 2001 to further the development and implementation of green building in Connecticut. The Connecticut Green Building Council is a non-profit 501(c3) organization that seeks to improve the quality of life in Connecticut through the promotion of intelligently designed and constructed high-performing, energy-efficient buildings. Throughout the year CTGBC holds workshops on green building topics, networking opportunities, membership meetings, educational forums, seminars on green building and periodic CT-based LEED™ training in connection with the US Green Building Council. The CTGBC also monitors activities in Connecticut related to high-performance green buildings and maintains a speaker's bureau.



We would like to thank our stakeholder group participants for bringing their ideas and energy to the project.

In alphabetical order: Ed Allen, Vice President of vanZelm Heywood & Shadford, Inc., Norm Barstow, President of the Connecticut Science Teachers Association; Dr. David Bingham, Member of the Town of Salem Planning and Zoning Commission; Bruce Bockstael, Chief Architect of the CT Dept. of Public Works; Keith Bowman, PE, Structural Engineering Manager of Dicesare-Bentley Engineers, Inc.; Leo Canty, Vice President of the American Federation of Teachers; Deborah Carling, Manager of Project Engineering of the Groton/New London Laboratories of Pfizer, Inc.; Scott Cohen, Logistics Manager of Turner Construction Company; Kevin Daly, President of the Connecticut Parent Teachers Association; Chris Doepper, Project Manager of The Whiting-Turner Contracting Company; Kate Dorsey, Green Building Point Contact for CT of Turner Construction Company; Kenny Foscue, Epidemiologist and Health Educator of the CT Dept. of Public Health, Div. of Environmental Health, CT School Indoor Environmental Resource Team; Bryan Garcia, Director of the CT Clean Energy Fund's Energy Market Initiatives; Glenn Gollenberg, Architect with the S/L/A/M Collaborative; Rick Herzer, Architect with the S/L/A/M Collaborative; Paul Holland, Principle of Green Tech; Laurel Kohl, Educational Specialist with the Institute for Sustainable Energy; Dr. David Larson, Executive Director of the Connecticut Association of Public School Superintendents; Joellen Lawson, President of the Connecticut Foundation for Environmentally Safe Schools; Maureen Mahle, Engineer with Steven Winter Associates, Inc.; Gina McCarthy, Commissioner of the Connecticut Department of Environmental Protection; Steven Murphy, Planning Specialist of CT Dept. of Public Works; Mary Pelletier, Architectural Consultant; Dr. Harvey Polansky, Superintendent, Southington Schools; Paul Popinchalk, Technical Associate with vanZelm Heywood & Shadford, Inc.; Joanne Rees, Program Director of AIA Connecticut; John Ruckes, Connecticut Office of Policy and Management; Paula Schenck, Assistant Director of the University of Connecticut Health Center; Darek Shapiro, Principle of Environmental Architecture LLC; Roger Smith, Campaign Director of Clear Water Action; Dr. Archie Swindell, Former Chair, Board of Education of Groton Public Schools; Kim Trella, Program Coordinator, State of CT Dept. of Environmental Protection; Kachina Walsh-Weaver, Legislative Analyst of the Connecticut Conference of Municipalities; David Wedge, Education Manager, State Dept. of Education, Office of School Facilities; and Steven Winter, President of Steven Winter Associates, Inc., Building System Consultants.

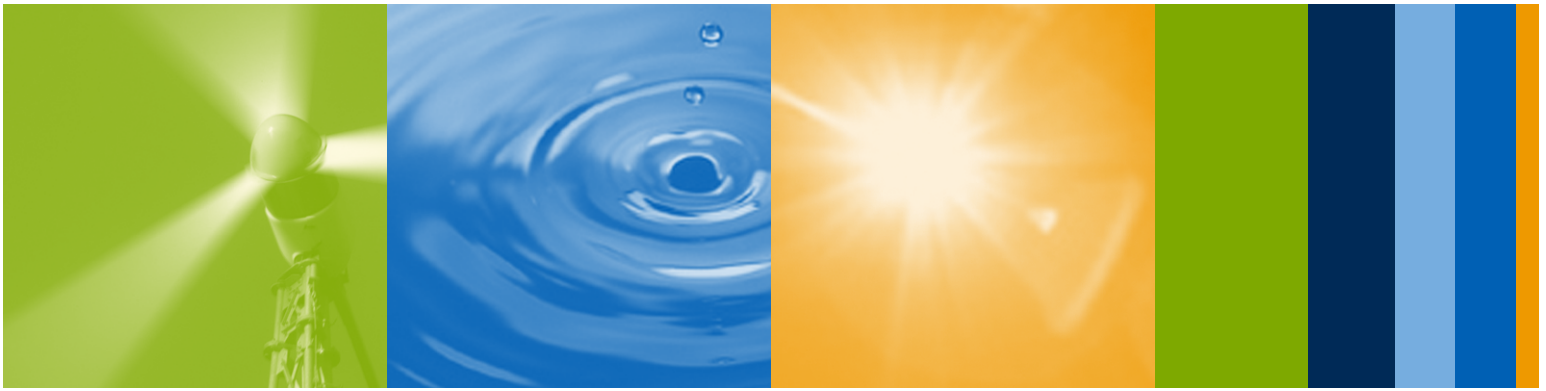


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1. Executive Summary



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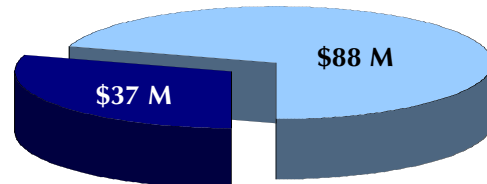
High-performance schools are built using an integrated design process that has long-term benefits for the community. Six areas are considered in the design and construction process. They are: community and site planning, renewable energy, energy efficiency, indoor environmental quality, materials, and efficient water use.

More consideration is given to siting - so that the building is oriented to optimize natural daylighting in each of the rooms. Access to daylight has been shown to improve test scores for children in math and reading.

Consideration is also given to the community's use of the school. Should the gym be large enough to host community events when classes are not in session? Do the senior citizens need a place to meet in the evenings? What is the most effective use for the school?

Energy efficiency is the largest taxpayer benefit in a high-performance school. Green schools use the highest efficiency heating, venting and air conditioning systems to minimize fuel use. Buildings can be commissioned to verify that these systems are operating properly to assure that maximum cost savings are realized. Commissioning insures that taxpayers receive the highest benefit from their investment in a new school. Over the life of a high-performance school building, annual energy savings average 20-40% as compared to schools built to the current building code.

Additional energy savings are gained by use of monitors that turn off lights in unoccupied rooms.



Energy Savings
Energy Cost for Connecticut's Public Schools is over \$125M Annually. Energy Efficiency Could Save Over \$37M Annually.

Superior indoor air quality is achieved through systems that filter air, reduce moisture and monitor air quality. Materials used in the construction of high performance schools (that contribute to a healthier indoor environment) may incorporate recycled materials. This encourages conservation of our resources. Paints and glues are used that have very low emissions and, again, improve the indoor air quality of the building.

Stormwater techniques such as rain gardens provide better management of our water resources - and allow the rainwater to naturally return to the ground water after filtering through the soil. Rain gardens also serve as good learning stations for students by illustrating the water cycle. Low-flow design bathroom fixtures also conserve water. Landscaping around a high-performance school is done using native plant species. This

reduces the need for pesticide and herbicide use and utilizes plants that thrive without watering.

All of these features work in consonance with one another to create better learning environments that operate more efficiently, provide better indoor air quality, conserve resources, and save taxpayer dollars; and the site planning and school construction is done with the benefit of the entire community in mind.

It was with this focus, and with the support of the Henry P. Kendall Foundation and the CT Clean Energy Fund, that the CTGBC launched the High Performance Schools Initiative. The first step was to convene a stakeholder process in February of 2005 that brought together representatives of key constituencies, including superintendents, educators, representatives of local governments, state officials, health and environmental advocates, and design professionals.

Through the stakeholder process, participants became knowledgeable in high-performance building standards, and examined the potential benefits that the citizens of Connecticut would receive by raising the building standards for renovating existing schools and building new schools. Through interactive workshops, the group determined that high-performance schools provide multiple co-benefits to students and their communities, including:

- Overall cost savings through lowered lifetime operating costs,
- Healthier environments for the building occupants,
- Enhanced learning atmosphere, and
- Environmental stewardship.

The group also identified what they perceived to be the major barriers to raising building standards. These include:

- General lack of understanding of high-performance schools,
- Potential conflicts with typical competitive bid and contract procedures,
- Fear of, or resistance to, changing the status quo, and
- Perception that the initial cost would be prohibitively high.

The group endorsed promoting the necessary integrated design process that leads to a high-performance, energy-efficient, healthy building for renovated and new schools. The stakeholders elected to not endorse a particular standard, but to define the essential elements that would need to be included in a standard if the facility were to be defined as a high-performance building. They also identified features that would further enhance the building and make it more energy efficient and environmentally friendly.

The process undertaken to develop the stakeholders' consensus conclusions and recommendations, and the information to support these findings are included in this report.



Photo Woodruff/Brown photography

2. Introduction



Photo WoodruffBrown photography

Each year, hundreds of millions of dollars are spent building new schools in Connecticut. They are among the most important buildings we construct as nearly one out of five people in Connecticut spends part of his or her day in a school building. Insuring that our schools are high-performing, energy-efficient, health- and productivity-promoting places to learn and work needs to be a top priority as these buildings profoundly impact our next generation.

Like all smartly designed buildings, a high-performance school offers significant benefits to both the occupants and local taxpayers. These benefits are amplified as the occupants of our schools, our children, are being shaped for the rest of their lives. In addition it is imperative that we provide for them the best indoor environmental quality feasible. The importance of protecting students from indoor pollutants was stressed in a report recently published by the U.S. Department of Education. The author of [Summary of Scientific Findings on Adverse Effects of Indoor Environments on Students' Health, Academic Performance and Attendance](#) (April 2004) states in the Executive Summary that "...the overall evidence strongly suggests that poor environments in schools, due primarily to the effects of indoor pollutants, adversely influences the health, performance and attendance of students".

To raise awareness of the benefits of high-performance schools, the CT Green Building Council (CTGBC) has embarked on a program to promote the transformation of schools in Connecticut. Launched in February 2005, the High Performance Schools Initiative is operating on four tracks that include a stakeholder process, an educational outreach effort, an inventory of all public school buildings, and monitoring of legislative action. With the conclusion of our stakeholder process, we publish this final report of what our stakeholders have identified as significant benefits of and barriers to promoting the design



and construction of high-performance schools, and their suggested actions for raising the building standards used for constructing new schools in Connecticut.

Our stakeholder process began in February when the CTGBC invited representatives of key constituencies, including superintendents, educators, representatives of local governments, state officials, health and environmental advocates, and design professionals to become part of a stakeholder process. The objective of the exercise was to identify perceived benefits and barriers, and to suggest solutions to the obstacles that deter communities from building high-performance schools in Connecticut. By facilitating the stakeholders becoming knowledgeable in high-performance building standards, it was hoped that the circle of advocates for high-performance schools would be expanded beyond the energy and design communities. The CTGBC engaged the Institute for Sustainable Energy (ISE) at Eastern Connecticut State University to facilitate and manage the stakeholder process.



3. Project Overview



The Connecticut Green Building Council (CTGBC), an organization founded in 2001 to further the development and implementation of environmentally and economically sound buildings in Connecticut, has embarked on a program that will support and leverage Connecticut's efforts to identify and assess issues relating to the design and construction of high-performing, energy-efficient, and healthy green schools. It is intended that this initiative will be a multi-year effort.

The CTGBC has developed a program that will form the foundation for educating and transforming the thinking of key influential leaders in regard to building high-performance, green schools in Connecticut. Included in Phase I are three activities:

- Facilitating a stakeholder process with a cross-functional group including representatives from education, health care, energy and environmental fields, and design professionals,
- Conducting a statewide survey of existing and planned school buildings,
- Tracking and supporting legislative actions to raise building standards for public buildings.

Our intent is to expand the CTGBC's educational activities related to high-performance green public schools based on the output of this program and to seek funding for Phase II to continue on this multi-year track. Phase II activities will include:

- Providing educational outreach statewide to municipal and state public officials and policy leaders, and
- Initiating an annual Green Buildings design contest for Connecticut college students.

A. GOALS

- Heightened state awareness of the benefits of high-performance schools leads to the support for better buildings. Goals and expected outcomes of the High Performance Schools Initiative include:
- Heightened awareness of the benefits of green schools in Connecticut, particularly among key policymakers, that may lead to the generation of public policies, executive orders, regulations, and market-based programs which support construction of high-performance green schools in Connecticut,



Senate Bill 923 - AN ACT CONCERNING COST SAVINGS THROUGH ADOPTION OF HIGH PERFORMANCE ENERGY EFFICIENT GREEN BUILDING STANDARDS.

This is a bill to require state-financed construction projects to meet or exceed the silver building rating of the Leadership in Energy and Environmental Design's rating system for new commercial construction and major renovation projects, or an equivalent standard.



Connecticut Climate Change

- Growth of statewide, local, municipal and school district support for high performance green school design, construction, and operation leading to groundswell acceptance of, and advocacy for high-performing schools, and
- Development of objective data including a list of the opportunities, challenges, and environmental, health, and economic benefits that arise from building high-performance green schools.

B. OBJECTIVES

The objectives of the High Performance Schools Initiative project include:

- Educating decision-makers, legislators, and other key constituencies about the importance of high-performance, energy-efficient, healthy, productive green schools,
- Engaging and developing statewide and local support groups comprised of influential public- and private-sector individuals who will advocate for the development of high-performance green schools,
- Developing an objective, comprehensive report that delineates and prioritizes opportunities and challenges presented by high-performance green schools,
- Compiling an inventory of all existing and planned public school facilities in Connecticut, and
- Defining a process that will facilitate the building of high-efficiency schools, including the renovation of existing structures.

In accordance with the provisions of Public Act 04252 (AAC Climate Change), the Governor's Steering Committee on Climate Change (GSC) has successfully completed development of the Connecticut Climate Change Action Plan 2005. This plan represents a major milestone in the drive to reduce greenhouse gas (GHG) emissions and achieve the regional goals set by the New England Governors/Eastern Canadian Premiers (NEG/ECP). Included in the Connecticut Climate Change Action Plan is "Recommended Action 19" Referencing high performance for schools and state funded buildings.

C. EXPLANATION OF STAKEHOLDER PROCESS

To launch Phase I of the High Performance Schools Initiative, the Connecticut Green Building Council engaged the services of the Institute for Sustainable Energy to facilitate the stakeholder process for both state and local decision-maker groups. The stakeholder construct was modeled on the successfully demonstrated process from the Connecticut Climate Change Stakeholder dialog held in 2004.

This series of statewide meetings involved a group of approximately 30 stakeholders from key constituencies. Representatives were drawn from superintendents, municipal officials, teachers, the CT Department of Education, Department of Health, and other school associations. Architects and design professionals, and officials from the CT Office of Policy and Management, Department of Public Works, and the Department of Environmental Protection, who actively support the design and construction of high-performance green buildings, were also included in the stakeholder process.



At Eastern Connecticut
State University

4. Overview of Sessions



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A. SESSION I - February 28

- Kick-off remarks by Gina McCarthy, newly appointed CT Department of Environmental Protection Commissioner, emphasized the importance of implementing the Connecticut Climate Change Action Plan and the need to initiate action, such as the Green Building Initiative, in order to protect our fragile environment.



“Connecticut is aggressively moving forward on initiatives to help reduce harmful greenhouse gas emissions. A central component of our effort is construction of green, high-performance schools. In addition to reducing greenhouse emissions and energy use, the integrated design of these schools offers multiple environmental benefits, giving Connecticut’s children a healthier, cleaner, more inspiring atmosphere in which to learn and grow.”

Gina McCarthy, DEP Commissioner

B. SESSION II - March 28

- Bill Leahy of ISE presented a summary of High-Performance School Design objectives and best practices.
- Stakeholders, grouped with their professional peers, participated in a brainstorming activity, described below, to identify the benefits of and barriers to adopting high-performance building standards for schools in Connecticut.
- Attendees were treated to a tour of the Mark Twain House and Museum, Connecticut's first LEED Certified building.



Mark Twain Museum

- The CTGBC President and High Performance Schools Initiative Project Manager, Bob Maddox, outlined the Stakeholder Process and other activities involved in the CTGBC High Performance Schools Initiative.
- Architectural designer and Green Schools advocate, Mary Pelletier, presented a PowerPoint presentation on the features and benefits of high-performance building design.

When Mark Twain built his Victorian mansion in 1874, it was the epitome of a modern home, with features such as central heating, hot and cold running water and gas lighting fixtures that were uncommon in homes of the period. One hundred and thirty years later, the new Museum Center on the grounds of Twain's restored Hartford home is a leader in its own right, becoming the first museum in the nation, and the first building of any kind in Connecticut, to attain LEED (Leadership in Energy and Environmental Design) certification from the U.S. Green Building Council.

Peer Group Brainstorming Activity:

In this exercise, the stakeholders were divided into four groups according to their backgrounds, thus:

1. Educators
2. Health and Environmental Professionals
3. Representatives of Government and Business
4. Design and Construction Community

Following a discussion identifying the typical merits of high-performance building design, each peer group was asked to brainstorm the two issues listed below, based on their past professional and community experience and their new understanding of high-performance school building design:

- ✓ Identify the most important benefits of high-performance school design
- ✓ Identify the potential barriers to adopting high-performance school design

Upon the completion of the exercise, each group was asked to identify the most critical issues in each category, and rank them in priority order. The objective was to focus on the consensus of their opinion on the benefits of and barriers to gaining widespread acceptance for improved building standards for public schools. The results of this activity can be found in Section 5.

C. PUBLIC FORUM - April 12

The CTGBC conducted an open public forum at the State Capital to provide the opportunity for interested parties that did not participate in the Stakeholder process to comment on the High Performance Schools Initiative and high-performance school building standards. Nineteen individuals attended the event. The forum began with an explanation of the



CT Capital Building

Initiative and the stakeholder process. A PowerPoint presentation on the features and benefits of high-performance schools was presented by Bill Leahy of ISE. Public comment was collected from the audience. Generally, the attendees were very supportive of the High Performance Schools Initiative and the proposed legislation to mandate high-performance design standards for state-funded construction projects.

D. SESSION III - April 25

This Stakeholder session featured presentations by representatives of four high performance (HP) building standard organizations. Each provided participants with detailed explanations of the features of, and benefits and resources provided by their organization. Featured standards programs included:

- Leadership in Energy and Environmental Design (LEED), US Green Buildings Council,
- The Collaborative for High Performance Schools(CHPS)
- Green Globes, and
- Energy Smart Schools, US DOE
- Bryan Garcia, Director of Energy Market Initiatives of the Connecticut Clean Energy Fund (CCEF), presented information on Integrating Renewable Energy in High-Performance Buildings

Design, and the programs, incentives and resources available through CCEF.

- With the assistance of David Wedge from the CT Department of Education, the group defined the current process that schools undergo while initiating school building projects, including defining education objectives and applying for state funding for new school construction in Connecticut.
- Finally, the stakeholders were asked to identify the key requirements, standards and features found in the four high-performance building standard programs represented. Following the meeting, their list, which included over 30 elements generated through the brainstorming activity, was distributed to the participants, who were asked to determine which elements should be deemed mandatory, important, desirable, or not essential when selecting a HP building standard. The results of this exercise can be found below:

Mandatory Elements:

An HP building standard program should include:

- Indoor air quality (IAQ) requirements that exceed current standards
- A building commissioning required before occupancy
- A 20% more energy-efficient standard than the prevailing building code
- An integrated design process, always
- A minimum mandatory day lighting contribution
- Operations & Maintenance manuals and training for building operators

Important Elements:

An HP building standard program should include:

- Required use of sustainable, environmentally friendly materials
- That the project to be certified to be HP by an independent 3rd party
- A life cycle analysis to be performed on the energy system options
- A requirement that the design include on-site provisions for recycling
- An accreditation process available for local design professionals
- Guidelines available for the design and construction teams
- Life-cycle analyses for material's durability
- Project planning materials available for the building committee

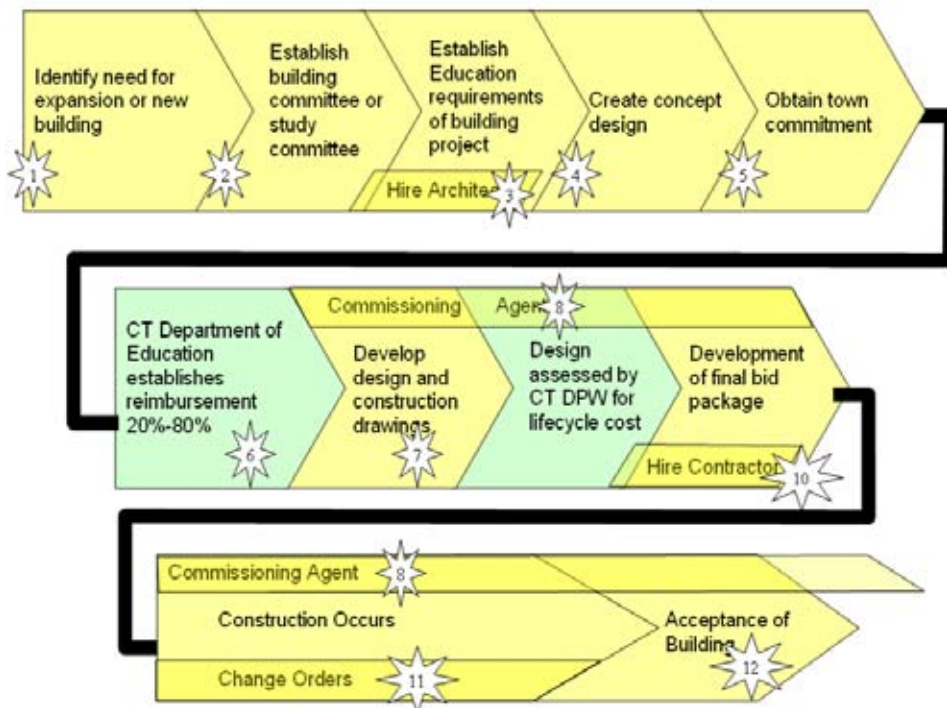
E. SESSION IV - May 23

This was the final meeting of the stakeholders group and focused on a review of the key findings of the stakeholder process including strategies for promoting the benefits and overcoming the obstacles associated with adopting high-performance building standards for schools, and defining the essential and important elements of a high performance building standards for Connecticut. Open discussions were aimed at reaching agreement on the conclusions and recommendations reached through the stakeholder process. The conclusions and recommendations can be found in Sections 6. The group also made suggestions aimed at helping CTGBC identify the next steps for advancing high-performance building standards for schools in Connecticut.

BKM Total Office hosted the meeting. Dennis J. Insogna, Vice President and General Manager addressed the group and spoke in support of Green Building Design, and conducted a tour of the facility.



PROCESS FOR DESIGN AND FUNDING OF SCHOOL CONSTRUCTION PROJECTS IN CONNECTICUT



Suggested points of interventions needed in the design and construction process to ensure High Performance Standards are followed and achieved:

1. Identify need for expansion or new building
 - Preliminary education of school board members and superintendents about HP
 - Provide checklist with sample questions to ask
2. Establish building committee or study committee
 - Workbook available to communities with basic "how to"
 - Initial charette meeting-facilitator services and checklist with sample questions to ask
3. Hire Architect - Criteria checklist with sample questions to ask
4. Create concept design
 - "How to" booklet and certification/process documents for selected HP standard
 - Second level charette meetings-facilitator services and checklist with sample questions to ask
5. Obtain town commitment - "how to" booklet suggestions for promoting HP Schools features
6. CT Department of Education establishes reimbursement 20-80%
 - Support to Dept. of Education on HP standards
7. Develop design and construction drawings
 - "How to" booklet and certification/process documents for selected HP standard
 - Continuing charette meetings and checklist with sample questions to ask
8. Commissioning Agent - Criteria checklist with sample questions to ask
9. Development of final bid package
 - Criteria checklist with sample certification/process documents for selected HP standard
10. Hire Contractor - Criteria checklist with sample questions to ask
11. Change Orders - Prior actions should significantly reduce all change orders
12. Acceptance of Building
 - Criteria checklist and certification/process documents for selected HP standard

5. Benefits/ Barriers to Green School Design



Picture courtesy of Sustainable Energy Studies at ECSU

The Stakeholders developed lists of both benefits of and barriers to adopting high-performance building standards for schools in Connecticut. Below are the composite findings of this exercise.

B E N E F I T S to the Community for Building High-Performance Schools

COST EFFECTIVENESS

Stakeholders identified cost effectiveness as the primary benefit of designing and building high-performance schools. Energy efficiency, decreased liability, building longevity and durability, and reduced maintenance costs, result in significant life cycle cost savings. The bottom line is that high-performance schools save taxpayers money.

HEALTH OF OCCUPANTS

The second most important benefit of high-performance schools concerns the health of the building users. A high-performance school is a safer, more comfortable building with exceptional indoor air quality. The result is that students and teachers are sick less often, and consequently are absent less often. Studies show that, because the building occupants feel better, attitude, performance and productivity are enhanced.



EPA's Tools for Schools
www.epa.gov/iaq/schooldesign/

ENHANCED STUDENT PERFORMANCE

The group of Education Stakeholders found it especially important that high-performance schools enhance student learning. This is accomplished through the use of natural daylighting in classrooms, which studies show assists the learning process. The building itself also acts as a learning laboratory for sustainability among students and members of the community. Studies have indicated that students in high-performance schools with significant natural lighting can learn math and reading at rates as high as 28% faster than students taught in traditional classrooms.

CONCERN FOR THE ENVIRONMENT

High-performance schools are also beneficial for the environment. This benefit is derived through energy conservation, water conservation, improved land use, and through the opportunity presented for education about sustainability by using the school as a "learning laboratory." These benefits apply not only at the local level, but also at the state, national, and global levels.

B A R R I E R S to Adopting High-Performance School Standards Statewide

LACK OF UNDERSTANDING

The stakeholders agreed that the most significant barrier to adopting HP building

standards is a deficiency of knowledge about high-performance schools. This applies to all interested parties: policy-makers, taxpayers, designers, and builders. The consensus was that these groups have misperceptions about the costs, as well as the environmental, health, and educational benefits of high-performance schools, which is due to both a lack of education on HP building and the scarcity of local examples.

CONTRACT/BID ISSUES

A second barrier involves issues with the current contracting process and local political approvals. The lack of commonly understood high performance building standards leads to specifying buildings that only meet code requirements. Building specifications and funding mechanisms for school construction need to be updated from a system that automatically accepts the lowest bid to one that takes into account lifecycle cost benefits.

FEAR OF AND RESISTANCE TO CHANGE

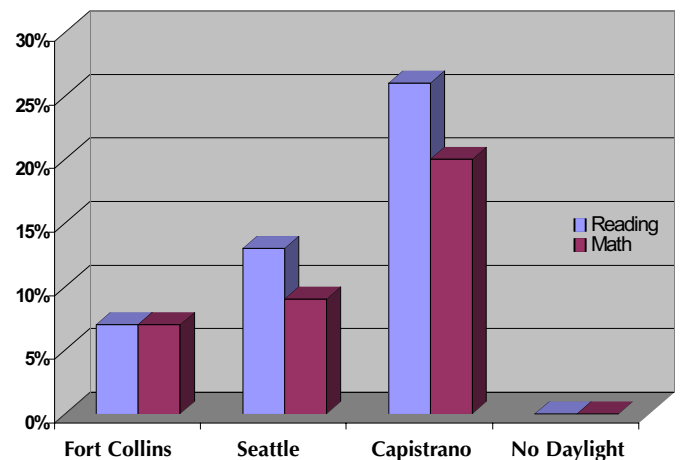
Another important barrier is skepticism and the resistance to change. This results from a lack of information on the costs and benefits of high-performance schools, lack of local examples of HP design, opposition by organizations with vested interests in maintaining the status quo, and the perception that implementing HP building standards would upset "business as usual."

HIGHER UP-FRONT COST

The final major barrier identified by the stakeholders was the potential for higher up-front costs when building high-performance schools. Commissioning, certification, special consultants, and HP building techniques all result in a more expensive building process.

These costs, however, are not prohibitively high and result in significant lifecycle savings to the community. These costs are also currently fully funded by the state within the framework of approved municipal construction compensation. Studies have shown that these costs can be minimized and even eliminated by early adoption of an integrated design process focused on high-performance building standards.

Relative Learning Rates for Capistrano, Seattle & Fort Collins School Districts
Source: Hescong Mahone Group, *Daylighting in Schools*, 1999



6. Stakeholders' Conclusion



A. OVERCOMING OBSTACLES

One of the major obstacles identified by stakeholders to building high-performance schools was the general lack of knowledge of local and state decision makers. Since all Connecticut public school construction projects are overseen by town building committees made up of volunteers, supporting their ability to adopt and reference building standards like LEED, CHPS, Green Globe or Energy Star is the most efficient way to help a school building committee integrate the benefits of high-performance schools into their town projects.

Perception of the increased cost of high-performance schools continues to be an area in which significant misconceptions exist. Because a school is a community's investment in the future, and most schools have a minimum life of over 50 years, the stakeholders agreed that the entire lifecycle cost for both energy use and product durability must be analyzed. This analysis would include the first-cost to construct the building, on-going utility costs, maintenance and repair costs, the building's effect on staff recruitment and retention and the building's effect upon student performance. As towns typically retain schools for fifty years or more, the consideration of investments using lifecycle costs would demonstrate a significant savings in a town's long-term budgeting.

Over the span of their use, high-performance schools are significantly less expensive to build

and operate than conventionally built schools. These schools offer taxpayers greater value for their tax dollars and provide a better environment for student learning. While nationwide data suggest that the first-costs of high-performance construction are between 0% and 2% more than conventional construction, high-performance buildings typically use 30% less energy than code-built buildings so the utility savings alone (electricity, heating, water and sewage) result in cost payback in 3 to 5 years.

Prudent and responsible management alone should lead school building committees, local public officials and taxpayers to demand the construction of high-performance schools, but the lack of understanding of high-performance building standards continues to overshadow the economic savings these buildings provide.

B. DO HIGH PERFORMANCE BUILDINGS COST MORE?

There is little debate over the benefits of building high performance schools. The consensus is that these facilities provide; improved classroom achievement in reading and math, healthier environment for students and teachers with reducing absenteeism, and a more cost effective building design and investment for the community. Regardless of which HP building standards Connecticut



adopts, any extra cost for a high performance facility produces fast payback through energy savings eventually offsetting any initial incremental investment. There is some disagreement however on how much additional first cost may be involved in designing and building to HP standards.

Our findings are that any additional first cost for HP facilities would occur in the design phase, which typically requires the use of an integrated approach, simulation of alternatives and building commissioning. With design typically accounting for only 10% of the total project cost, the additional requirements should raise the total project cost by no more than 2%.

Evidence from Green Building projects around the United States demonstrates a significantly lower cost of construction for LEED Silver buildings than estimated in the OFA Fiscal Note.

- National data shows a premium of only 2% on average for LEED Silver status. ¹
- The City of Seattle has reported a decrease in the cost of LEED Silver buildings to less than 1% above traditionally built buildings

as architects and others involved in the design, construction, and commissioning process become more experienced with green building techniques. ²

- A high estimate for a LEED Silver office building was only 4.2%. ³
- Another study by Matthiesen and Morris tested, “138 buildings (93 non-LEED and 45 LEED-seeking) [for] statistically significant cost premium associated with buildings designed to attain LEED rating.” They concluded, “The result was no statistically significant difference between the LEED population and the non-LEED population. In other words, green building does not necessarily cost more than traditional building.” ⁴



¹Kats, Gregory H. “Green Building Costs and Financial Benefits.” Prepared for the Massachusetts Technology Collaborative, 2003. Available at: masstech.org/RenewableEnergy/green_buildings/GreenBuildingspaper.pdf

²Kats, Gregory H. “Green Building Costs and Financial Benefits”; Syphers, G., Baum, M., Bouton, D. & Sullens, W. “Managing the Cost of Green Buildings.” Report prepared for State of California’s Sustainable Buildings Task Force, the California State and Consumer Services Agency, and the Alameda County Waste Management Authority. Available at: www.ciwmb.ca.gov/greenbuilding/Design/ManagingCost.pdf

³Steven Winter Associates, Inc. “GSA LEED Cost Study Final Report.” Prepared for the US General Services Administration, 2004. Available at: www.ccb.org/docs/GSAMAN/gsaleed.pdf

⁴Matthiesen, L. F. & Morris, P. of Davis Langdon Adamson. “Costing Green: A Comprehensive Cost Database and Budgeting Methodology.” Available at: www.dladamson.com/images/pdf_files/costinggreen.pdf



Photo Woodruff/Brown photography

Based on these findings, the benefits to the state and the communities for building to high performance, energy efficient building standards should far outweigh any preconceived first cost financial barriers.

C. RECOMMENDATIONS

The stakeholder process allowed for a wide range of ideas to be discussed with regard to the benefits of and barriers to constructing high-performance energy-efficient healthy schools.

Stakeholders agreed that the following action steps should be taken **immediately**:

1. All future new construction or gut renovation of schools buildings should utilize an **integrated design process** that is consistent with Connecticut's climate. This

process should facilitate the design and construction of school buildings that include all the essential elements of high-performance, energy-efficient design that are most appropriate to the building site.

2. Newly-constructed school buildings or major renovations should **utilize an independent third-party verifiable rating system such** as LEED or some comparable standard. At a minimum, all buildings should be designed and built to the LEED silver standard or an equivalent standard.
3. All newly-constructed buildings should be designed and built to **be at least 20% more energy efficient than current Connecticut building code** requires and should utilize properly designed solar orientation and day lighting to the greatest extent possible.
4. **Building Commissioning should be mandatory** prior to occupancy of any school that is newly built or significantly renovated, in order to insure proper design and operation of the specified equipment and systems. Particular attention should be given to achieving superior indoor air quality within the occupied spaces. Maintenance manuals and proper training of maintenance personnel should be given priority along with the establishment of periodic refresher training.
5. **An educational outreach effort should be undertaken** to convey the benefits of high-performance, energy-efficient, healthy schools. Such effort should target local decision makers, such as school administrators, boards of education and local building committees. In addition, statewide policy makers and agencies responsible for public building design, finance and oversight should be educated in the benefits of HP building design.

6. The most effective strategy for a building high performance school is to ***start early in the design and specification*** process and follow this outline:

SUMMARY GUIDELINE TO HIGH PERFORMANCE BUILDING PROJECTS:

- Get buy-in to high performance design from local school administration
- Provide training and planning support to the building committee
- Secure early decision to build to a proven high-performance building standard,
- Hire an experienced design and construction team,
- Use an integrated design process,
- Use dynamic modeling for building energy systems,
- Use life cycle analysis for building system and material selection,
- Include commissioning of both the design and completed construction,
- Provide training to the maintenance staff on proper operation of the building.



Photos: Woodruff/Brown photography

7. Resources



Photo: WoodruffBrown photography

HENRY P. KENDALL FOUNDATION



The Henry P. Kendall Foundation is a legacy of its namesake, an early twentieth-century New England entrepreneur and industrialist (1878-1959) from Walpole, MA. Kendall's wide-ranging, venturesome business instincts led to acquisitions of factories and other companies through the company that bore his name, The Kendall Company. Henry W. and John P. Kendall established the Norfolk Charitable Trust in 1957. Following the death of their father in 1959, they changed the name to the Henry P. Kendall Foundation in his honor. The Kendall Foundation began an emphasis on environmental concerns in the early 1970s by supporting land, water and wildlife conservation. Environmental advocacy and nuclear non-proliferation and arms-control activities have been the hallmark of their focus. The Foundation emphasizes the imperative of protecting nature's integrity. www.kendall.org/

The Connecticut Clean Energy Fund is engaged in a long-term effort to foster, in Connecticut, the production and use of energy from clean and renewable sources by investing in enterprises and initiatives aimed at developing a vibrant market for clean power; educating consumers about the benefits and availability of clean power; and building a base of renewable energy technologies and infrastructure. The Connecticut General Assembly created the Connecticut Clean Energy Fund in 1998 as part of legislation deregulating Connecticut's electric utility industry. The statute directed that the fund be used to foster growth, development and commercialization of renewable energy technologies and sources; stimulate Connecticut consumers' demand for renewable energy; and promote deployment of renewable energy sources that serve Connecticut's energy customers. www.ctcleanenergy.com





The Institute for Sustainable Energy (ISE) at Eastern Connecticut State University was established in 2001 to identify, develop, and implement the means for achieving a sustainable energy future. The Institute focuses on matters relating to public policy, conservation and load management, efficient and renewable distributed generation, protection of environmental resources, and the dissemination of useful information on energy alternatives and sustainability to users and providers of energy. The Institute adds an unbiased focus on practical applications and dissemination of information about how to improve the energy profile and sustainability of the region. www.sustainenergy.org

The Connecticut Green Building Council is a non-profit 501(c3) organization that seeks to improve the quality of life in Connecticut through the promotion of intelligently designed and constructed high performance energy efficient buildings. Throughout the year we hold a series of workshops on green building topics, networking opportunities, membership meetings, educational forums, seminars on green buildings and periodic CT based LEED™ training in connection with the US Green Building Council. The CTGBC also monitors activities in Connecticut related to high performance green buildings and maintains a speaker's bureau. <http://www.ctgbc.org/>



www.thegbi.org



www.energysmartschools.gov



www.chps.net



www.usgbc.org



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