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EDUCATIONAL FACILITY PLANNER

Volume 42 | Issue 4

HEALTHY

HIGH PERFORMANCE SCHOOLS

When the Facility Becomes the Culprit

Green Schools in the United States and Germany

Council of Educational Facility Planners International

Merle J. Kirkley, REFP

Tough Questions for the Iconic Schoolhouse

Dear Members,

After decades of tireless service, our iconic school house is being asked tough questions. School boards, parents, children, educators and policy-makers are asking:

- Are you healthy?
- Can you help us breathe normally?
- Can we see, hear and learn well inside your classrooms?
- Is there a way we can get you fixed so that we could stay in healthier surroundings?
- By the way, can we build a new, healthy school?

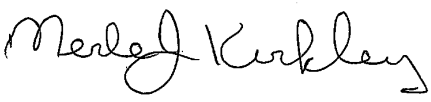
The days of living in obscurity with mold-infested schools are fading away. Communities across America are aware; and now demand better work environments for children. Featuring a new layout, this issue of the *Educational Facility Planner* focuses on healthy, high performance schools. The Planner offers viewpoints, case studies and perspectives on building and maintaining high performance facilities.

As we move forward, let me remind you that a professional association is only as good as what its membership stands for. Within our diverse group, there is nothing more inspiring, nothing more rewarding, than providing sustainable spaces for our children to enhance their learning ability.

In our quest to meet your professional development needs, I would like to personally invite you to attend our annual conference in San Diego from September 29 – October 2, 2008. Unlike our earlier conferences, this offers a new format that will make every moment you spend with us enriching and worthwhile. Stephen Heppell, (www.heppell.net) one of the foremost educational visionaries in the world is our keynote speaker this year. Content-rich pre-conference workshops, interactive seminar tracks and an exciting array of products and services will enhance your knowledge level and keep you abreast of what's happening in the field.

I look forward to seeing you in San Diego later this year.

Best Regards,



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The *EDUCATIONAL FACILITY PLANNER* is a quarterly publication of the Council of Educational Facility Planners, International and is written, produced and distributed by CEFPI Headquarters, 9180 E. Desert Cove Dr., Suite 104, Scottsdale, AZ 85260. Mailed to all members of CEFPI, the Planner is paid for annually as a part of the membership dues. Non-members may subscribe at a rate of: U.S./ Domestic, $60; Canada, $70: Foreign, $85 annually for four single issues; $15 single issue price.

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The Educational Facility Planner welcomes limited advertising in upcoming issues. Our next issue in August 2008 focuses on educational facility planning methods. To reserve space, contact Sarat Pratapchandran at sarat@cefpi.org or call 480-323-6701. Space close date is: **June 12, 2008.**

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We welcome articles, case studies and commentary offering different viewpoints and perspectives on issues of interest to our diverse membership. To access the editorial calendar, please visit:
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TALK ABOUT IT!

As you read and enjoy articles inside this issue, make it a point to talk about it with your co-workers and anyone involved in building healthy schools. Your conversations matter to us. We will soon be launching blogs featuring articles in this issue and upcoming issues of the Planner. Please e-mail us your comments about this newly redesigned *EDUCATIONAL FACILITY PLANNER* to Sarat Pratapchandran at sarat@cefpi.org. Your feedback is important to us.

Cover: West Brazos Junior High, Texas – Daylight and views flood the space of the main corridors and classrooms, which result in an improved learning environment that helps make students calmer and allows them to learn more effectively.
Photo credit: SHW Group

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Lima Senior High School Art Room
Photo Courtesy: Michael E. Hall

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Green Building Design *is* Affordable, Even for Public Schools

By Jennifer Henrikson

Test scores at the first LEED certified public school in Texas show marked improvements.

When Columbia-Brazoria Independent School District (CBISD) taxpayers approved a bond to replace their only junior high school, CBISD was in a unique position to provide a facility that would make a difference.

Given this chance to provide students with a great place to learn and teachers a great place to teach, functionality was symbiotic with the planners' conviction to do what's right for the environment.

Completed in August 2006, West Brazos Junior High School (WBJHS) is the first Leadership in Energy and Environmental Design (LEED®) certified public school in Texas, and it's an inspiration for many reasons.

The school's environment is a sanctuary of comforting daylight, along with the natural landscape surrounding the facility, which doubles as a teaching tool. Student discipline incidents are down, attendance rates have risen, test scores

are up, and teachers enjoy going to work.

The harmonic campus is a good example of how new construction can be certified sustainable without adding significant cost to the construction budget.

"We aren't a wealthy district. Most of our community's residents work in neighboring plants and refineries near Houston, and we have little commercial tax base. But we want what's best for our kids. It was our personal conviction that in today's world, that meant building in an environmentally friendly way," says CBISD Assistant Superintendent Martha Buckner. "Although our budget was already set, we challenged ourselves to follow LEED guidelines and achieve a LEED certification."

At a building construction cost of $108.54 per square foot, CBISD has proven that green schools can be built at a competitive price. The project also demonstrates what's possible when architects, owners, engineers and builders challenge traditional thinking and work collaboratively to identify sustainable solutions and materials at the earliest inception of a design.

"Much of what you read about green construction says it's prohibitively expensive. The truth is, you can make smart choices and build a sustainable building with a modest budget," Buckner says. "The reward is a clean, healthy and magnificent learning environment for your children and teachers."

Attainable & sustainable

In the 21st century, good design is sustainable design. For owners who desire or are required to verify the extent of a building's sustainability, the LEED Green Building Rating System with its integrated approach is influencing the way construction activities impact the planet and human health.

LEED principles require teams to plan thoughtfully for site development, water conservation, energy conservation, materials and indoor environmental equality. LEED recognizes successful green construction through a credit point system that reflects four levels of investment—Certified, Silver, Gold or Platinum.

CBISD's project team identified LEED credits most important for the health and comfort of students and made these the highest priority. The team also gave priority to LEED concepts that reduce operational spending so savings can be spent on student instruction. Once those areas of focus were defined, the team designed plans around its pursuit of the most economic LEED level of "Certified" rating.

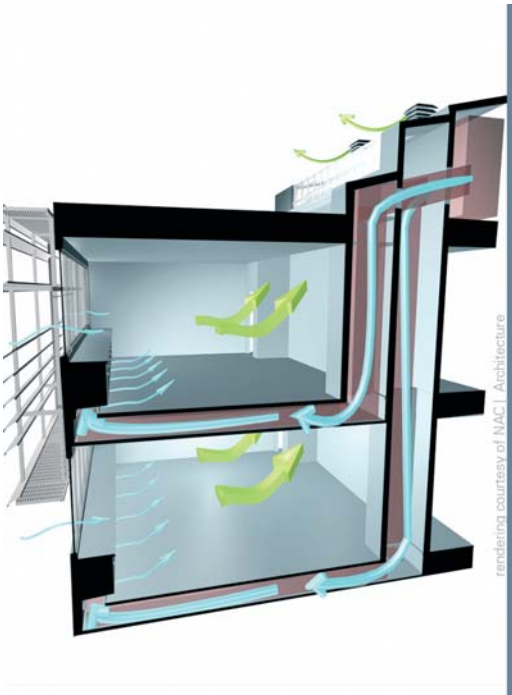
"Many LEED requirements can be achieved by simply integrating plans into the building design, which requires the total design team to work together on building strategy from the very beginning—not in silos and not after the project is designed and the plans are presented," says Tim Kilby of DBR Engineering and commissioning agent for the project.

The scores earned on WBJHS LEED Credit Checklist directly reflect priorities set by the project team. WBJHS earned the most points for maintaining a natural site, controlling water usage and ensuring indoor environmental quality. The project also earned

Tips for helping schools go GREEN

Here are strategies used in the West Brazos Junior High School project that produce excellent green results and can be incorporated into any construction project:

- West Brazos' highly reflective ENERGY STAR roofing system, combined with highly reflective pavement, reduces heat absorption in walkways and parking lots. These features reduce the heat island effect.
- The footprint of the building is designed to minimize disruption to the 53-acre natural site.
- Natural and drought-resistant plants landscape the site, reducing the need for water and eliminating the need for irrigation systems.
- Almost 18 percent of West Brazos' interior materials are made from recycled content, reducing demand on virgin materials. The WBJHS team earned extra LEED points in this category because quality recycled products are affordable and readily available on the market.
- Housekeeping uses only Green Seal, environmental friendly cleaning products to improve indoor air quality.
- Automatic sensors and low flow-faucets in the restrooms have reduced water use by 33 percent, as well as reduced impact fees charged.
- Contract documents required subcontractors to sort construction site waste into separate dumpsters. Contents were then transported to recyclers. Through this strategy, more than 55 percent of the project's construction-related waste was diverted from the landfill.
- Fifty-five percent of the construction waste was diverted from the landfill through sorting and recycling practices.
- Alternative transportation is encouraged with bicycle storage, a changing room, plug-in stations for electric vehicles and preferred parking spots for carpoolers.



rendering courtesy of NAC| Architecture

Hargis' redefined displacement ventilation for the school classroom environment provides improved IAQ through 100% outside air, energy savings, improved acoustics, efficient filtration and reduced maintenance. To see how displacement ventilation system works in comparison to mixed air systems, visit our Web site and click the link under *Projects > K12 Education.*

LEADERSHIP
through service

With the evolution of sustainable design practices in the academic environment, Hargis Engineers has supported various architects and owners in developing approaches to meet environmental and operating objectives. Through our commitment to advancing school design, Hargis has effectively ***redefined*** displacement ventilation systems to improve indoor air quality and promote energy savings in sustainable designed high performance elementary, intermediate and high schools locally. Our leadership in developing this system has gained regional and national attention as Hargis has been requested to share best practices for the betterment of K-12 design. Applying theory to practice, Hargis has served:

- 11 schools with operating or under construction displacement ventilation systems with 3 additional schools currently in design
- 4 schools featuring ground source heat pump systems in operation or under construction with 2 additional schools currently in design
- 1 school featuring natural ventilation currently in design

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extra LEED points for innovation and design.

CBISD didn't attempt to earn additional points for optimizing energy performance, and could not attempt to use green power because the school is in an electrical co-op served area.

The WBJHS project achieved 27 points, which earned a "Certified" rating of LEED for New Construction, Version 2.1.

"Some available technology and mechanical systems would have earned us more LEED points, but they didn't fit our budget or our circumstances. For example, some innovative air quality solutions make sense for some buildings, but they are expensive and wouldn't be effective in our coastal climate. Instead, we planned carefully to earn LEED points that were most important to student achievement and which we could afford," says Buckner.

Sensible strategies for this school

Numerous studies show that air quality and natural day lighting are key contributors to student success because they increase comfort, health and tranquility. Students who feel better can concentrate and learn better.

The CBISD team made day lighting a priority, choosing this strategy for significant impact. Windows direct natural lighting into more than 90 percent of the school's occupied spaces, including classrooms, the library and offices. Double-paned, Low-E-glazing windows, combined with shading devices, work together to allow ambient light to penetrate deep into the building. The building's thermal efficiency is improved through this window system, which reflects heat and filters out undesirable glare.

Improved indoor air quality was achieved through numerous strategies, including careful selection of interior materials, furnishings, and cleansers. Great attention was paid to use of low gas-emitting adhesives and sealants, paints, coatings and carpet systems.

"When I go to conferences, a lot of what I hear is that people still believe sustainable design is too costly. I know where that comes from, because 10 or 12 years ago that was the case – a recycled product was more than twice the cost of a normal product," says Fritz Hext, Facilities and Maintenance Director for CBISD. "But things are very different now, and markets are rapidly progressing every day. School officials have got to tune into this trend, open their eyes and stand up and say yes, we can accomplish what's right for the environment and what's good for our kids at no additional cost."

It's about the kids

While teachers and administrators at West Brazos Junior High do

many things to enhance learning, all agree the healthier environment of the green school has greatly contributed to student well-being and improved performance on state-mandated tests.

When comparing 2006 state-mandated testing results achieved by students at the old campus, versus results achieved in 2007, the first year at the new campus:

- Reading scores increased 5 percentage points to 96%;
- Mathematics scores increased 4 percentage points to 91%;
- Social Studies scores improved 7 percentage points to 92%;
- Attendance improved from 95.21 percent to 95.70%, currently at 96% in 2008.

School discipline records also indicate students behave better in their new environment. Incidents decreased to 1,013 in the 2006-2007 school year, compared to 1,518 in the previous year.

Measurable green results

Wherever sustainable building design is implemented, lower operating costs are enjoyed. According to the U.S. Green Building Council, green schools on average save $100,000 per year, enough to hire two new teachers, buy 200 new computers or purchase 5,000 new textbooks.

In WBJHS, water use strategies have reduced the school's water consumption by 33 percent. The team's plan included low flow plumbing fixtures, metered faucets and automatic flush control toilets.

You also won't see high-maintenance plants being watered by sprinkler systems because CBISD chose only native, drought-resistant landscaping that require no irrigation. The project's plan focused on minimizing disturbance of the pastoral site.

To achieve energy savings, the team used chilled water Variable Air Volume units with air-cooled chillers. The team also chose instantaneous at-the-source water heaters to save water heating energy.

SHW-West Brazos Junior High: Seventy percent of the building materials used were manufactured locally and native landscaping requires no irrigation.

SHW-West Brazos Junior High: Local building materials, low-E glass, sun shades and east-west siting all contribute to the school's green design.

Advocates drive green mission

It's true; you can spend a small fortune on a LEED building. There are published case study examples of U.S. schools that achieved Platinum LEED certifications costing as much as $386 per square foot.

Certainly, few school districts can afford that investment, but that doesn't mean green schools are unattainable. WBJHS is living evidence that public schools can be healthier and more environmentally friendly, debunking the myth that green schools are too expensive.

The USGBC states: "Public and private schools alike are realizing that going green is a no-brainer … if all new school construction and school renovations went green starting today, energy savings alone would total more than $20 billion over the next 10 years. By promoting the design and construction of green schools, we can make a tremendous impact on student health, test scores, teacher retention, school operational costs, and the environment."

Project Fast Facts

Owner:	Columbia-Brazoria Independent School District
Architect:	SHW Group
Engineer:	DBR Engineering, Inc.
Contractor:	Tellepsen Builders
Project Size:	91,500 square feet
Total Project Cost:	$9.931 million
Cost PSF:	$108.54 (Building only)
Completion:	May 2006

The momentum for green schools is gaining. Doing the right thing starts with individuals who care, who will voice their concerns, and who will help others understand that sustainability is the responsible way to approach building in the 21st century.

In CBISD, it started with Fritz Hext. He took his personal conviction for the environment, backed it up with solid business case research, and presented it to Martha Buckner. In going to Buckner, Hext easily recruited his champion.

"Like any initiative, you need a unifier who can promote why doing a green building is the right thing. Martha was that person for CBISD – she not only had the vision, she could describe it so that the school board, parents, administrators, everybody could see it and buy in," says Tad Lewis of Tellepsen Builders, general contractor for the CBISD project.

"Green construction can be a politically charged issue, but in reality, it's like anything else. With intelligent planning, you can spend your money where it's important to you and achieve the green school you envision." ■

Jennifer Henrikson, a LEED-accredited professional, served as the architect and project manager for Columbia-Brazoria Independent School District's West Brazos Junior High School. In practice since 1991, Henrikson has specialized in predesign services and strategic planning. Since joining SHW in 2001, she serves as the Principle-in-Charge for multiple projects in several school districts.

Henrikson is an owner in SHW Group, one of the world's leading educational design firms with a focus solely on the planning and design of learning environments from pre-K through graduate studies.

For more: www.shwgroup.com.

Green Schools in the United States and Germany

By Anja Caldwell

Trained as an architect in Germany and now working in the United States, the author takes us on a personal voyage. She tells us how she has embraced the concept of green schools in the US and later gives us insight about schools in her home country.

I am an architect raised and trained in Germany, where energy and environmental design has been mandated in building codes for longer than my two decade career in architecture.

During the past decade, I have been practicing architecture in the United States. Here, I have seen a transition from what I call undercover "green activism" to legislated "green building mandates." For me, it has been very rewarding to work directly with children and their ideas, as environmental stewardship comes naturally to most of our children.

Today, my job has transitioned from trying to convince stakeholders that green schools are the right thing to do, to consulting on how to

get this done. Needless to say, I have become a big fan of legislation and attended many legislative hearings to present the benefits I know are real, as I have seen them work in Germany.

An Interesting Year

The year 2007 was a particularly interesting year for me in three ways: First, Great Seneca Creek elementary school in Germantown, Maryland achieved a LEED Gold certification as the first LEED certified school in Maryland. This green school is a result of the Green Building Program (www.Schools2Green.org) in Montgomery County Public Schools (MCPS) in Maryland, which I manage as the LEED accredited architect on staff since 2003.

The building's opening followed a four-year process that started with a sustainable design charrette, where green building experts and schools facilities staff started to cross-pollinate for the very first time.

Back then, the architect already hired for the project was one of the most outspoken skeptics of green technologies and Leadership in Energy and Environmental Design (LEED). I recently learned that the same architect's firm has now set a goal of 100 percent LEED accredited professionals on staff. Times have changed for the better, and I hope green schools are here to stay.

Today, Montgomery County has a mandate requiring LEED Silver certification for all county funded buildings in place, and a similar mandate is being proposed for the state of Maryland. This means MCPS will have built ten more new schools to LEED's high efficiency standards by 2014, avoiding at minimum a whopping one million dollars in utility expenses per year, not counting any very likely future energy cost increases.

LEED for Schools is Released

Secondly, 2007 was also the year that LEED for Schools was released, four years after we started developing it with a team of 11 volunteers. The LEED for School core committee, comprised of national school construction experts, was elected by the USGBC membership. The committee was chaired by Bob Kobet from Sustainaissance International, one of my green schools mentors and heroes. We turned the LEED for New Construction rating system, primarily designed for office buildings, from a green mitten for school buildings, to a well fitted glove.

According to Rachel Gutter, schools sector manager for the US Green Building Council (USGBC), new school buildings are registering for a LEED-S certification at a rate of one per day, a great success.

And third, in 2007, and on a more personal level, it was also the year for in which I broke a tie: I have now practiced architecture in Germany and the United States for the same length of time, ten years on each continent, twenty altogether.

Sustainability has been my focus of choice practicing in the United States, mostly driven by the excessive waste of land, materials and energy in the construction process in the US, and elsewhere. The need to conserve is true for all buildings, but it has been particularly evident for me where there is no time or money to waste: in the construction of schools.

In this regard my German training to be frugal has been very helpful, and I see that there is a lot to learn from both sides. Starting with minor differences, like the fact that the arrow in a plan for the direction of a stair goes downstairs, not upstairs, to much bigger issues, like different budgets, schedules, cultures and contract scenarios.

Quadrupling a Loss

I could write a book about the differences, but for the purpose of this article, and to sum it up in my blunt German manner, I would say that American architects are given half the time to design a building, at half the cost, with program needs about twice the square footage of comparable building types in Europe. The common American building is further designed to last half as long, with at least twice the energy use, at half the energy cost of the same project built for example in Germany. Now what does that mean for the people, planet and profits? Let me explain:

American architects are given half the time to design a building, at half the cost, with program needs about twice the square footage of comparable building types in Europe.

When I left for the United States in 1997, my father gave me a book as a farewell present: *Faktor Vier – (Factor Four – by Ernst Ulrich von Weizsaecker and Amory and Hunter Lovins (Droemersche Verlagsanstalt, 1996, ISBN 3 7632 4551 0). Factor Four* basically refers to reducing your burden on the environment by half and at the same time doubling your profits, also referred to elsewhere as the triple bottom line. I saw this idea hit the mainstream recently on a T-shirt: "Think green, live pink" – sweet!

Faktor Vier was the prelude to the later book *Natural Capitalism* in which the authors even raised the bar to a factor ten.

Now, keep that concept in mind as I go back to my European-American architecture equation, first addressing profit. If buildings in the US are built at half the cost with twice the square footage to accommodate the same program, nothing is gained. If they last 40

years, instead of 80, at double the energy use per area, in terms of the planet I would even call that quadrupling a loss.

To address the people factor, culture and esthetics, which of course are always arguable, school buildings are indeed the center of a community and should not be mundane. Personally, I think of children as our future and how we choose to house them as they learn is a symbol of our society's values. This was particularly evident to me in a statement by one of the students of Washington, DC Sidwell Friends, the first LEED Platinum school in the US: "This building makes me feel special."

As public buildings, schools have high urban potential and I think we must spend just as much money and time on schools as we do on museums, theaters and mansions. But when it comes to American schools, I find very few projects memorable, rather they have taken on a strange hybrid architecture, neither vernacular nor works of art, certainly lacking character, sort of like vanilla pudding.

So, if the artistic and cultural value of a school building also scores a zero, how about the planet? Any building construction causes environmental damage, resource depletion and global climate change, caused by energy inefficiency. So, we are back to the quadruple loss—unless we build greener.

The fact that architects are only given half the time to design a good building is certainly not helping. Projects are rushed out of the door without the opportunity to create a well coordinated smart design. In my junior architect days I dropped lighting fixtures into a reflected ceiling plan to a pretty pattern, like needlepoint, on a ridiculous Friday deadline with no input from anyone that would know better.

A green school, no matter what it looks like, takes more design effort and is a tool that teaches environmental stewardship. This is an investment in the future of the people and the planet. Green schools increase productivity and conserves resources that helps the planet and the bottomline. A green school grants more energy independence and reduces operational savings, definitely a profit. So, the natural capitalism idea works, and a factor ten is indeed in reach for American schools, in fact for public schools with limited funds. It is our obligation to build greener—and we need more green legislation to get there.

The German School System

All children living in Germany are required to attend school between the ages of 6 and 15. They start school at primary level ("Grundschule," grades 1-4) at the age of six.

Report cards in 4th grade determine if students proceed to either one of three different types of secondary schools: "Hauptschule," which goes up to grades 9 or 10 and leads to a general high school diploma ("Hauptschulabschluss"); "Realschule," up to grade 10 and graduates with an intermediate school leaving certificate ("Realschulabschluss") and "Gymnasium," which goes up to grade 13 and leads to the senior high school leaving certificate ("Abitur"), which is also the entrance qualification for higher education.

This segregated system has received strong criticism from the United Nations and the European Union, as the very early determination of the career path puts students with special needs or children of immigrants at a disadvantage. Though it is possible to change tracks in a school career, it takes a special effort by the parents and is not common.

Some of the 11 German states have therefore adopted the system of the "Gesamtschule," a comprehensive school combining the three types of schools under one roof where students are divided into groups according to their abilities.

Sunny side of Alberti Gymnasium (high school) in Bad Friedrichshall, Germany. Striped textile shades protect the wall-to-wall classroom windows from glare and give the building a welcoming appearance. *Photo:* Anja Caldwell

German School Design

For the school designer, classrooms in new school construction in Germany have a code requirement of a minimum of 20 percent glazing related to the classrooms floor area. For this, glass energy codes mandate triple glazing to meet the high R-values. Rooms without windows and views to the outside are not allowed by code, both in schools nor office buildings. The codes prescribe a maximum sill height and all windows must be operable.

Most schools combine the multi-purpose facility and auditorium into an *aula*, a large open space adjacent to the main circulation areas. The gym, a large multi-purpose space with lots of windows, is designed to accommodate community events like concerts, dances, etc.

Land is very expensive in Germany, a country the size of Montana with more then 80 million people. School programs have multi-purpose areas and are usually without any dedicated theaters, auditoriums, television studios or additional learning spaces provided in a typical American high school today.

Most German schools provide an apartment for the building service manager in the school, called the "Hausmeister," so he or she can respond to emergencies quickly and prevent night time vandalism.

For cleanliness, preschool and kindergarten age kids have a slipper program, where they change shoes

as they enter the classroom in the morning. This not only keeps the classroom cleaner but also makes for a more residential learning environment for children and they feel more at home.

Most classes are only held in the mornings, and this has been controversial as more mothers are working and pursuing professional careers. There is a growing need for all day daycare, but that need has not been met satisfactorily to date.

No School Buses

Schools store bicycles in a dedicated room, locked during the day, but at minimum a large area that is covered and secure. At gasoline prices of nine dollars per gallon even high school students cannot afford to drive and take the bus. There are no school buses in Germany, and students share the public transportation bus system, at no charge. Classes start before eight in the morning to avoid an overlap with professional commuters.

Teachers do not stay in their classrooms; they "live" in the teacher's lounge, where they have a rather small personal desk area. This is probably not the most convenient, but saves energy and is easier to secure, as classrooms are not used as after school offices. It also improves communication, as teachers overhear conversations and keep track of colleague's activities, ideas and problems. Students stay with the same classmates through all grades, changing teachers and the classroom as they move to the next grade level.

Most schools provide a large covered outdoor area, so students can always be sent outside during recess, rain or shine. Germans believe in the benefits of fresh air, though not too long ago dedicated smoking areas for teachers and students were legal. Today, smoking is prohibited in German schools.

The vast majority of K-13 education in Germany is public and free of charge. There are few private schools, often these are boarding schools. Colleges and universities are also free.

Free-for-all education in Germany comes at the price of much higher taxes. On average, taxes and social security make up for more than one-half of a person's income, and currently, there is a 20 percent value added tax (VAT).

Stiff Competition for Architects To Get Projects

Architects for school buildings are typically hired as the winner of a design competition. Since the opening of the borders in the European Union the pool of architects has been broadened to include all European counties. Due to the surplus of architects there is little work to go around, and competitions with more than two hundred entries have become quite common.

This explains why many larger school projects have been designed by star architects like Norman Foster and Stefan Behnisch, and local architects rarely stand a chance.

Though the competition process is time and money consuming, it is a way to keep design standards at a very high level and school buildings are in fact designed as architectural icons and not as mundane. A perfect example is a school by Norman Foster in Nancy, France, or several "deconstructivist" style schools designed by Stefan Behnisch, architect of the LEED certified Genzyme building in Boston.

An Example of Innovative School Design

An outstanding example of an innovative school design is the Gesamtschule in Gelsenkirchen by the architect and university professor Peter Huebner.

The competition entry for the Gesamtschule Gelsenkirchen was a fictitious newspaper article of an environmental award given to a student, an immigrant from Turkey, who had graduated from the school that had yet to be built.

A great idea that got even better as the future students were involved in the design of their school by conducting student workshops. They built models and designed their classroom houses as homes, individual buildings with green roofs of residential scale, lining an internal street with all the common areas. The kids stay in these houses with the same male and female teacher throughout their entire time at the school, growing up as an educational family with strong social bonds. This has proven to be extremely successful in this low income neighborhood, where a lot of the students are considered at risk, mostly because of problems at home and the lack of an intact family to support them. ■

Reference: "Children make their school – Evangelische Gesamtschule Gelsenkirchen" ISBN: 3932565525, Edition Axel Menges GmbH, November 2005.

Trained in Germany and now working in the United States, Anja Caldwell is a LEED-accredited architect based in Carderock Springs, Montgomery County. Her recent projects include Maryland's first LEED certified school, Great Seneca Creek ES in Germantown, which was awarded the Gold rating from the US Green Building Council in April of 2007. Anja can be reached at anja@sustainablebydesign.com

When the FACILITY Becomes the Culprit

By Claire L. Barnett

Why should our schools be healthy places for all children? Find out what happens when we send our children to dilapidated facilities.

An Unaddressed Public Health Crisis: Poorly Maintained Facilities

America's single largest unaddressed public health crisis for children is that 32 million of the 54 million children in schools are at elevated risk for health and learning problems due *solely* to the conditions of their schools. *(Lessons Learned, 2006, national collaborative report: http://www.healthyschools.org/documents/Lessons_Learned_Rpt.pdf)*

Ten years ago, grassroots healthy schools advocates were often dismissed as fringe activists. Today, there is a robust and growing national healthy schools movement that has earned the attention of schools, parents, teachers, facility directors, architects, and policy makers at the city, state, and national levels. And there is no doubt among building and indoor environmental scientists, public health professionals, environmentalists, teachers' unions, or the array of federal and state agencies concerned with school facilities, that the poor environmental conditions of school buildings adversely impact children and all staff in profound ways.

Our children and grandchildren—yours and mine—are compelled to be in school today. Yet, every day, we see fresh reports of e-coli or lead in school drinking water; schools sinking into landfills or filling with vapors from nearby toxic sites; closures due to mold infestations; evacuations and ER trips prompted by chemical spills and fumes; inadequate cleaning; failed ventilation systems; pest problems and pesticide spraying indoors; out-of-control renovations during the school day; ancient chemicals in closets from the 1950s (and, worse, earlier); parents directed by physicians to keep their children home until the unhealthy school is cleaned up. No parent wants any of that for their child.

But we do allow those threats to occur and recur, despite the knowledge and the ability in the city, state, and federal agencies, and among school facility planners to help prevent problems through improved siting, design, construction, and operations of our children's workplaces—schools.

Healthy Schools Offer Several Benefits

School buildings must be designed and maintained in such a way that the school facility itself promotes the health and well being of children, and promotes and facilitates learning. A "Healthy and High Performance School" (codified in federal laws) can dramatically improve the health and learning of students while saving money for schools. The Healthy and High Performance School combines design features that hard science finds, helps promote children's health and achievement and attendance, as well as adult health and productivity. Other features promote resource conservation, energy efficiency, and reduced carbon emissions. All save money for education and for taxpayers and enhance communities. In fact, it now appears that 'healthy' schools save more money by reducing illness, absenteeism, and promoting higher test scores than 'green' buildings do which capture energy and water savings *(Greening America's Schools: Costs and Benefits; October 2006).*

What happens when we ignore the most vulnerable occupants? The two parent reports in the boxes below speak volumes. (*Source: Lessons Learned: A National Report – 32,000,000 children: victims of a public health crisis)*

Are Children In Your Meetings?

When a facility planner meets with school decision-makers, the most vulnerable and highest risk learners, and the most numerous building occupants, are not even at the meeting. If they were, they would tell you that children are uniquely vulnerable to environmental contaminants, many of which are found in schools.

Children proportionately breathe more air, drink more fluids, and eat more food than adults. Their developing systems are more vulnerable to environmental toxins than are fully developed adults. Toxic exposures and serious injuries during a child's developing years (0-18 years) can result in a lifetime of health problems (US EPA, CDC, ATSDR, NIEHS, AAP, APHA). They might also tell you that health standards for children's exposure to indoor environmental contaminants do not exist. Thus, to meet children's biological and developmental needs, the adults around them must think through all the aspects of how an educational facility is sited, designed, built, and maintained. For example, what are children's needs for fresh air and daylight? What are their needs for safe, outdoor play? What are the best ventilation and acoustical standards, and, were child health experts engaged in setting those professional standards? And not just for the average child. What are the relevant standards for the millions of children with asthma or with learning and behavior disorders, or those with underlying physical disorders or on daily medications that disrupt their tolerances to heat, light, noise, or deadly contaminants such as carbon monoxide.

To focus on the most common hazards to all schools- indoor air pollution, EPA has estimated that half of all schools have IAQ problems. EPA also has found that indoor pollution may be at least five times more polluted than outdoor air. School indoor air is a major contributor to causing and exacerbating asthma among adults. Asthma is also a leading occupational disease of teachers and custodians—that is, they get it on the job, at school. Asthma is also a leading cause of school absenteeism due to chronic illness. Other documented health effects from poor IAQ include: res-

New Jersey Parent

When my daughter entered fifth grade, the nightmare began. Construction was taking place and she became very asthmatic, but over the summer, she was fine. As soon as school re-convened, she got extremely ill-headaches, body rashes and sores. She got worse; her skin began peeling, she was losing hair and developed dark spots all over. After staying home, within two hours of re-entering the school, I was called to pick her up because she had completely relapsed! Once I moved her to another school, she never had a problem.

Missouri Parent

My daughter had been missing one day of school per week for 3 months because of her extreme bouts with chronic illness. She was sent home several times complaining of severe headaches..., *the doctor recommended that she stay home from school for 2 weeks to rebuild her strength. We have to be extremely cautious in managing her asthma* because she is allergic to a lot of the medications that help, so we followed the doctor's orders without hesitation. Shortly after her school absence, *I discovered that the school had reported me to Social Services for educational neglect! This was a shock because the school is well aware of her health problems as well as the doctor's order to stay out of school...*

National Summary of Data*

# of Public School Buildings	96,143
# of Students	48,590,635
# of Minority Students	19,778,912
# of Students in Special Education Programs	6,597,187
# of Employees in School System	5,447,541
% of Children withAsthma (under 18)	8.7%
% of Schools with at least one Inadequate Building Feature	57%
% of Schools with at least one Unsatisfactory Building Condition	68%
Estimated # of Students at High Risk	31,067,803

* *Lessons Learned* provides state by state data tables, news clips & reports for parents & teachers on school conditions.

piratory problems, poor concentration, rashes, headaches, gastrointestinal problems, nervous system disorders, and cancers. Nationally, there has been a dramatic rise in the number of children with learning disabilities, attention deficit hyperactivity disorder, and autism, as well as other children on daily medications for an array of chronic health conditions.

It's simple. Good parents plan on sending their well-rested, healthfully fed children to school ready to learn. Good parents and the rest of us are horrified when their children's—or any other child's--health and learning can be irreversibly damaged by hazards in the school such as bioaerosols, contaminated particulates, chemical spills or pesticide misuse, and renovation dusts and fumes.

The Healthy + Green School

Everyone wants to be green—this year. Conventional green buildings typically follow design protocols that require building owners and their designers to save energy and water, conserve land, recycle, avoid run off, and orient themselves to ease heating and cooling. They offer an array of optional design points for building elements that promote dry, quiet buildings with superior IAQ, like features that resist mold. IAQ management is too often simply a document about protecting occupant health during renovation, not a permanent requirement of the new or renovated facility.

Thus the missing element is a set of requirements, as opposed to electives, that make the buildings' health an imperative: healthy + green. In fact, a recent report from the National Research Council pointed out that, "future green school guidelines should place greater emphasis on: Building systems, their interrelationships, and overall performance; Operations & Maintenance practices over building lifetime; and Encourage systems that are durable, robust, easily installed, operated..." *(J. Spengler, NRC, Green Schools Expert Committee Chair, Dec. 2006)*

School buildings can be designed and maintained in such a way that the school facility itself promotes the health and well being of children, and promotes and facilitates learning.

Fortunately, these findings make a great deal of sense in the public health community and to parents. It is a "back to basics" approach to restore fresh air and sunshine to our nation's schools. Clean air, non-toxic building materials, daylighting and full-spectrum lighting, state of the art thermal and acoustical engineering and energy efficiency are incorporated into the holistic design and construction of a school. Demonstrated benefits include improved student performance, improved child health, attendance, teacher productivity, and substantial operational savings. Healthy and high performance schools mitigate poor indoor air quality by using materials that do not off-gas hazardous chemicals, utilize properly designed ventilation and air conditioning systems, by keeping materials and buildings dry and mold-resistant, and incorporating other features such as radon-proofing, and pest-proofing, and durable, easy to maintain floors and roofing systems.

Across the country, communities are building healthy and high performance as well as green and sustainable schools. Governors of both California and New Jersey have issued Executive Orders requiring schools to be built "green." The New York City school district, the largest school district in the US recently adopted a Green School Guide blending US GBC's LEED rating system with elements of the New York Collaborative for High Performance Schools (NY-CHPS) design guidelines. New York's new standard is linked to the City's $13.2 billion five-year capital plan for school construction. The CHPS model that began in California and is adopted by Los Angeles and 21 other large districts has now been adapted for use statewide into Washington, New York, Massachusetts, New Hampshire, and New England generally. These state and metro-based CHPS protocols are in fact impacting billions of dollars of school construction. More states and cities can and should do the same.

The National Research Council report "Green Schools: Attributes for Health and Learning" is an excellent review of the hard sciences. Among the landmark report's findings and recommendations:

- there is a robust body of evidence linking health to IAQ/Indoor Air Quality
- there is some evidence linking IAQ to productivity and learning
- there is an association between excessive moisture, dampness, molds in buildings and adverse health outcomes
- key factors in IAQ include ventilation rate and effectiveness, filter efficiency, temperature and humidity control, control of excess moisture, maintenance
- indoor pollutants and allergens are also linked to linked to respiratory and asthma symptoms
- reducing the indoor pollutant load reduces the occurrence

When a facility planner meets with school decision-makers children are not even at the meeting. If they were, they would tell you how vulnerable they are to environmental contaminants commonly found in schools.

of building-associated health symptoms
- work performance decreases with higher room temperatures
- lighting must focus on a work performance priority, then on energy savings
- control glare when encouraging daylighting
- speaking and listening are key to learning
- sufficient evidence for inverse association between excessive noise and student learning
- infection control in densely occupied spaces requires cleaning and ventilation

Summarized by Greg Kats in outlining the benefits/savings of Indoor Air Quality in schools in a series of studies conducted by Carnegie Mellon, it "identified 17 substantial studies that document the relationship between improved air quality and health. The health impacts include asthma, flu, sick building syndrome, respiratory problems, and headaches. These 17 separate studies all found positive health impacts (i.e. reduction in reported prevalence of symptoms) ranging from 13.5% up to 87% improvement, with average improvement of 41%."

A newer study funded by the National Institute for Occupational Safety and Health (NIOSH), *(Work related asthma in the educational services industry: California, Massachusetts, Michigan, and New Jersey, 1993-2000: Mazurek, et al, AJ Industrial Medicine 2007)* examined the occupational health sentinel event notification system for work-related pollutants. Researchers found that the most frequently reported agents were indoor air pollutants, molds, dusts, and cleaning products. The report cites challenges of interventions in schools as complex, diverse workplaces placing two populations at risk—adults and children. It calls for prevention of moisture, ventilation maintenance, control of air contaminants, methods to reduce exposure to cleaning product hazards, including use of third-party certified 'green' cleaning products mandated in New York State in 2005 and now Illinois.

Building design, construction, and operations of schools—typically very large, very densely occupied, and very heavily used indoor environments of 75,000–100,000 ft^2 plus associated 'portables' and bus garages, are complex systems.

How can you find out how to design and operate a healthy school?

One way to get usable information into local hands quickly and to accelerate the number of schools taking action is to encourage more states to become active. Thus, Healthy Schools Network and our National Coalition for Healthier Schools partners nationwide helped to shape and support the newly enacted High Performance Green Buildings Act of 2007 that creates a federal office and advisory committee for green buildings. Importantly it directs US EPA to give grants to qualified state agencies to build information and technical assistance systems that promote healthy school environments, to identify and help resolve environmental problems affecting children, and to create model federal school siting guidelines that take into account children's vulnerability to toxins, modes of transportation, and schools as community emergency shelters. A tall order! In 2002, the Healthy and High Performance Schools Act was also signed into No Child Left Behind, directing EPA, Education, and Energy departments to develop federal guidelines to meet specific benchmarks for school design and then develop a federal-state partnership grant program to build state information and outreach programs to assist local schools.

The Bottom Line

There is no downside to healthy and high performance school design and operations; and there are plenty of upside advantages, including improving school performance and attendance for all children. Such work improves children's health, workers' health, improves our environment, saves energy, and saves money for education. As schools across the country are built, rebuilt and renovated, we owe it to our children, their parents, their sponsoring communities and the taxpayers to assure that they are designed and built to specifications representing now proven state-of-the-art healthy and high performance architectural standards.

A healthy school is a back to basics step, and a new imperative. It is good for children, for the environment, for education, for health, and for all communities. ■

Claire L. Barnett, MBA, is the founding Executive Director of Healthy Schools Network, Inc, and the Coordinator of the National Coalition for Healthier Schools. Healthy Schools Network is a national award-winning not for profit research, information and education, and advocacy organization that seeks to ensure that every child will have an environmentally healthy school that is clean and in good repair.

Building Green for Better Education

By Paul J. Hoffman

Northland Pines High School in Wisconsin is now the highest rated LEED Gold certified public school in the country.

The Northland Pines High School (NPHS) district, that covers 474 square miles, recently opened the first LEED® (Leadership in Energy and Environmental Design) – New Construction Certified school in Wisconsin and the first and currently highest-rated Gold Certified public high school in the country.

NPHS is the highest-rated Gold Certified public high school in the country.

Why is sustainability important?

Sustainable features implemented in schools have an impact beyond the environment. For instance:

Sustainability impacts Classroom Learning: Among the vast array of demands on school administrators today, test scores and broader academic learning are always a great concern. The American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) has suggested, based on initial research, that taking steps to improve air quality might impact a person's learning performance by 10 to 20 percent.

Sustainability impacts Attitudes: According to the 2006 Cone Millennial Cause Study, a national survey released in late October of that year, a well supported case is made that *Millennials* (those born between 1979 and 2001) will be more responsive to those organizations that are environmentally sensitive. The research shows that 83 percent of *Millenials* will place greater trust in organizations that are environmentally and socially responsible.

Sustainability impacts Staff: Northland Pines High School has seen the powerful impact the facility has had in not only their students, but in their staff as well. "It's nice to be a front-runner when it comes to having an environmental school," says Northland Pines District Administrator Mike Richie. Richie goes on to share that morale has improved for both staff and students. According to a poll conducted by Mortgage Lenders Network USA, 94 percent of Americans prefer to work in a setting that is designed to be energy efficient and ecologically sound. A LEED Certified school in Maryland recently reported zero teacher turnover. While all of that cannot be attributed to the environment of the school, it is likely to have played a significant part in the equation. When potential teachers and other staff are considering their employment options, features like natural lighting and a comfortable, well-designed work environment are variables that are likely to give green schools the upper hand in successful hiring and retention.

Sustainability impacts Attendance: According to a report by the U.S. Environmental Protection Agency (EPA), the average worker spends nearly 90 percent of his/her time indoors and building-related illnesses cost organizations tens of billions of dollars every year. Improvements in air quality, lighting, and other high performance (green) features have been shown to increase productivity and reduce absenteeism. We are currently working with NPHS and other sustainable and conventional schools to estimate the impact of sustainability on teacher and student attendance rates.

The new fieldhouse has a seating capacity for 2,600 people, making it one of the largest in the state.

Sustainable Features at Northland Pines

The 250,000 square foot, two-story building incorporates a host of sustainable features that impact both the educational and overall environment in many significant ways. Below are examples of sound environmental practices that many building projects can emulate:

- **Construction Waste Management** – An impressive 83 percent of all building wastes at Northland Pines were recycled, including those from demolition of the original high school structure it replaced. Concrete, brick and mortar from the existing high school building was used in the roadbed and under parking lots.
- **Maximizing daylight** – High ceilings, strategic placement of gray Low-E windows, and photosensors on the direct/indirect lighting add daylight to classrooms (which research shows improves student performance, attendance and teacher morale) reduces power consumption while managing glare and unwanted solar heat gains.
- **Conserving water** – Water-reducing bathroom fixtures and the use of climate-appropriate plants to eliminate permanent irrigation systems create annual water savings of approximately 35%. Two large detention basins retain storm water on site, landscaping employs native species to reduce watering and maintenance.

As you consider your next renovation or construction project, consider the overall impact the choices you make right from the start will have on the education of countless students over many, many years.

- **Designing overall site** – Priority parking encourages car-pooling. Bike racks offer secure sites for cyclists to park their two-wheel transportation, and a portion of the site is protected from future development.
- **Protecting air quality** – Low- or no-VOC (volatile organic compounds) products were specified for adhesives, paints and carpeting. Additionally, carbon dioxide levels are constantly monitored.
- **Selecting local materials** – Greater than half (by cost) of the materials used were manufactured within 500 miles of the construction site. These smart choices reduce pollution and fuel consumption associated with transporting products to the site. As well, it reinforces and supports strong community relationships.

Northland Pines' 750-seat auditorium positively impacts the community.

Integration is Key from the Start

The knowledge gained and the integrated process used for design and construction services in this $28.5 million project is fully transferable to any region of the country. NHPS had a desire to strive for thoughtful environmental standards which were met at a square-foot cost well below industry averages. In fact, the school was delivered for 23% below the national median cost of $150 per square foot for high schools built in 2006.

Planners started working with the administration and school board members very early on and had the end goal in mind from their first interaction. The "end goal" of a sustainable project in this case evolved during the design process to a goal of earning Silver Certification. "It exceeded our expectations, because all along our goal was a Silver Certification," says Richie. That

High ceilings, building orientation and window selection are key components for proper natural lighting.

objective was achieved and then moved one step higher to Gold Certification, the second highest of four levels awarded by the USGBC. "Our vision was to create a building that set a positive example of responsible sustainable design and construction solutions that provided a tangible learning tool to enhance our curriculum," Richie adds.

This was all made possible because the process we developed fully integrates the disciplines of planning, design, and construction which creates a win-win situation and achieves energy efficiency at a prudent cost. *Total Project Management: Vision Taken to the Power of Green* (TPM^g) is our process that integrates cost-effective and efficient building solutions that respect the environment and enhance a building's quality and value. For example, due to effective planning and efficient scheduling before the old high school was razed, a crew of Amish workmen removed and remilled the previous wood flooring and reclaimed large laminated beams.

The school was delivered for 23 percent below the national median cost of $150 per square foot for high schools built in 2006.

Green Construction's Continued Impact

While everyone enjoys the attributes of a green facility, perhaps its highest value is in both the way it nurtures the natural environment and the positive impact it can have on the bottom line. NPHS is included in our energy modeling pool of over 4,000,000 square feet of sustainable buildings. Energy modeling is utilized early in the design process to predict energy performance for the building. After occupancy, the facility is monitored remotely to measure actual energy performance compared to expectations of the original model.

Subsequent monitoring of projects provides the opportunity to benchmark the school's performance. When NPHS opened its doors in the summer of 2006, data began to be collected. If system inefficiencies are discovered, proactive assessments and adjustments can be made. It is perfectly reasonable for schools to see annual energy savings of $40,000 - $60,000 on 100,000 square feet of space. Potential energy savings of 40 percent or more over conventional construction are available using efficiently designed mechanical and lighting systems in conjunction with higher insulation values in the walls and roof as well as high-performance windows. School administrators expect coaches and teachers to plan ahead, evaluate and make the necessary changes to impact performance. Now, we have the tools to do the same with our facilities. ■

Paul Hoffman is president of Hoffman LLC (www.hoffman.net), a Wisconsin-based planning, architecture, and construction management firm established in 1892. His firm, which worked with Northland Pines High School, began aggressively advocating sustainable design long before "green" became the new American fashion statement. To learn more about sustainable planning, design and construction, contact him at phoffman@hoffman.net.

High Performance Environment for the Future

By Matthew Porta

A private, college preparatory high school located in Highlands Ranch, Colorado incorporates green building principles.

The library frames views to the campus and the western mountains and is aggressively daylit. Recycled content carpet tile and low-VOC paints finish the space. The campus buildings beyond are constructed with local and regional materials, including the "Valor" custom brick blend.

Building Profile

Valor Christian High School is a private, college preparatory high school located in Highlands Ranch, Colorado. Valor opened its doors for its inaugural school year on September 4th, 2007 after an accelerated one-year construction process. The $55 million privately-funded, state-of-the-art campus infuses high performance and environmental responsibility—incorporating a host of green building techniques to minimize energy consumption and deliver an exceptional environment for students, faculty and staff.

Phase I included a three-story, 118,000-square-foot academic building clad in traditional brick and stone and a 62,280-square-foot athletic complex. The academic building includes 28 classrooms, eight science labs, administrative offices and a 5,000-square-foot library/ media center. Phase I also includes a 2000-seat stadium with an additional 1,000 bleachers on the visitor side, football field and track, to be completed by May 2008. At capacity, Valor will educate 1,200 students, 300 per grade.

Situation

Valor Christian High School came to fruition through the efforts of a small and dedicated board of directors who felt there was a void in Christian education at a high school level in the south metro region of Denver. The Board formed in the spring of 2005. The site for Valor was selected and purchased in January of 2006, and the design of the campus began shortly thereafter.

Valor's mission is "influence through excellence," the guiding force for the project. Early on in the design process, it was determined that a high performance building would help support and reflect Valor's mission of excellence.

The design and construction team, led by SLATERPAULL Architects and Saunders Construction, Inc., followed standards in five key areas to qualify the school for the Leadership in Energy and Environmental Design (LEED) program developed by the U.S. Green Building Council (USGBC.)

Challenges

To accommodate the school's academic schedule, the design and construction process was accelerated and completed in 21 months. Integral members of both the design and construction team were on site throughout the entire process.

The school's standard of excellence and LEED certification requirements provided a high benchmark for success.

Solutions

A variety of green building techniques were incorporated throughout the facility to qualify for the LEED certification, minimize energy consumption and deliver an exceptional learning and working environment for students, faculty and staff.

With a focus on optimizing performance and maximizing indoor air quality, energy efficient mechanical and electrical systems were installed, including a displacement ventilation system. An indoor air quality management plan was implemented during the construc-

tion phase to protect mechanical systems from construction dust and from moisture to prevent potential for mold growth. A building "flush-out" was performed prior to the facility being occupied to eliminate all toxins in the air that come from chemicals and new building materials.

Low emitting materials, such as adhesives and sealants, paints, carpet systems and composite wood systems, were specified to optimize the indoor air quality. All chemicals utilized in the school are contained indoors within closets that are ventilated and adequately separated from occupied spaces. The school has committed to using only green/low emitting cleaning chemicals and equipment.

Valor uses approximately half the amount of energy as a standard public school, saving an estimated $65,000 per year.

In addition, techniques such as daylighting were applied. One-quarter of the light fixtures in the classrooms are controlled by daylight sensors located on each exposure on the exterior of the building. If the sensors detect adequate daylight, light fixtures will not illuminate. All lighting is controlled by a centralized system where hours of operation can be set to define when and how much artificial light is allowed at any given time.

The following is a list of additional high performance facts and features:

- 77% of construction waste was diverted from landfills and into recycling programs
- 20% of materials used in the buildings are of recycled content

Tall windows and sloped ceilings bring in abundant daylight and reflect it down to the work level. A combination of radiant perimeter heating and displacement ventilation (background) work together to condition the instructional spaces. Direct-indirect lighting is controlled with occupancy sensors and day lighting controls.

- 20% of materials used in the buildings are from regional sources within 500 miles of the project site to reduce transportation costs and support the local economy
- Installation of water efficient landscaping will reduce water use in irrigation by 50%
- Synthetic turf will save an estimated 5.5 million gallons of water each year compared to a traditional bluegrass field

The classrooms are finished with rapidly-renewable linoleum floors, recycled-content carpet tile and low-VOC paints. Energy-efficient direct-indirect light fixtures with occupancy sensors and day lighting controls serve the instructional spaces.

- Bicycle storage provided for 5% of occupants with shower/changing rooms for those who bike to work/school
- Preferred parking spaces totaling 5% of total parking available for fuel efficient/low emitting vehicles
- Preferred parking spaces totaling 5% of total parking available for car pool vehicles

Results

Valor uses approximately half the amount of energy as a standard public school, saving an estimated $65,000 per year. The school is currently registered with the USGBC as the first LEED accredited private school in the state of Colorado and will become fully certified upon completion of the final paperwork. ■

Matthew Porta, AIA, is an associate with SLATERPAULL Architects in Denver, Colorado. He was the project architect for Valor Christian High School, on-site throughout the building's accelerated 12-month construction process. Matt led the training for the faculty and staff on the variety of sustainable features. He has a bachelor's degree in Architecture from Carnegie Mellon University and has worked on numerous educational facilities throughout his 11-year career. For more information, visit www.SLATERPAULL.com.

Demand Pumping Allows Optimum Control of Energy Use

Since 1992, Don Penn, PE, CGD, has been a leader in the innovation and evolution of geothermal HVAC systems. Below is a short interview on demand pumping and the use of geothermal systems in school districts. Mr. Penn is CEO of Texas-based Image Engineering Group Ltd (www.iegltd.com). He is also a recipient of the CEFPI Cornerstone Award for his involvement with the Katrina Task Force.

Could you define demand pumping on an energy efficiency perspective for a school district interested in taking this approach?

Demand pumping allows us to place the energy consumption of a Heating Ventilation Air Conditioning (HVAC) system at the point of use. The best energy management strategy is to turn energy-using systems off when they are not needed, this is what demand pumping affords.

How much average energy savings have you observed using this system?

We have designed in excess of 150 of these systems for school districts in the Dallas-Fort Worth area, and we have consistently seen energy savings in the 30 percent plus range over other type of HVAC Systems.

How many schools nationwide use this system?

As far as nationwide, the last count I saw was 600, but I really do not have a grasp on the number.

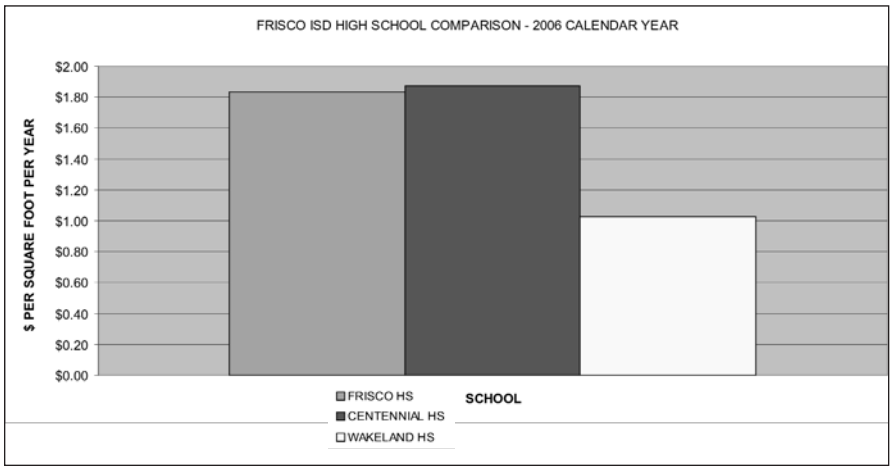
What are major hurdles that stand in the way of school districts interested in installing this facility?

The major hurdles that stand in the way of districts doing this are as follows:

a. Familiarity with the system as it is considered a "new" technology or trend.
b. Stories from the housing market of bad experiences, which goes back to someone trying something without experience or knowledge of the system.
c. Cost for school districts that budget roof top equipment can be a strain as well as a change in mind set.

Can you offer some comparative data on the benefits of using this system?

Three high schools in the Frisco ISD School District that were in use in the 2006-2007 school year are illustrated below. Frisco HS final expansion was completed in 2001. This school's initial construction began in 1997 and had multiple addition projects.



Centennial HS opened in 2004 and has a Central Plan utilizing a Thermal Storage System. Wakeland HS opened in 2006 and is the district's first geothermal high school. Since its opening, they have opened another and have three more in construction, all geothermal. These costs are from the district's gas and electric utility bills and are simply the sums of the annual expenses at each campus. An interesting note, this is the total energy costs (lights, hvac, power, etc.) if you extract the HVAC costs out of these numbers the savings are much greater. Typically the HVAC Costs are 60%+ of a campuses energy cost, based on that analysis, the HVAC Portion of the Energy Cost are as follows:

Frisco HS-Central Plant	$1.33/sq ft
Centennial HS-Central Plant/ Thermal Storage Sys	$1.46/sq ft
Wakeland HS - Geothermal	$0.62/sq ft

Why is your focus purely in the educational facilities market? Which states currently use demand pumping?

The education market works well for geothermal systems as they typically have adequate land to support a well field, the education facilities typically have a migrating population that moves around in the facility (ie: rooms are used a portion of the day, but set idle other times). As far as the states that use demand pumping, I do not know how many other facilities currently use this method. ■

Interview by Sarat Pratapchandran

LEED for Schools

By Rachel Gutter

With more than 750 additional schools in the pipeline for certification, the green school movement is national in scope.

Last April, the U.S. Green Building Council (USGBC) launched the LEED for Schools green building certification program. By addressing the uniqueness of school spaces and children's health issues, LEED for Schools provides a unique, comprehensive tool for schools that wish to build green, with measurable results.

Measurable results are key when it comes to building green. LEED certified schools use 30 – 50 percent less energy, 30% less water and fewer resources than conventional school buildings. If all new school construction and major renovations went green starting today, we would reduce harmful carbon dioxide emissions by 33.2 million metric tons and save $20 billion dollars worth of energy over the next 10 years.

The typical green school costs less than 2% more to build, and this "green premium" is paid back within the first few years of operation based on energy savings alone. Now factor in savings associated with water efficient technologies and health benefits – green schools save an average $100,000 a year in direct operating expenses, all the while creating an environment designed to enhance occupant health and increase student learning potential.

The rapid uptake of LEED by many schools and school districts speaks to the sense behind building green, high performance educational facilities. On average, a new school becomes involved with the LEED program every day – a rate that is likely to increase in the near future, due to the ever growing number of states, cities and school districts that have adopted green school standards and policies. Ohio, Connecticut, Hawaii and New Jersey have made a statewide commitment to their teachers, students and staff that all new schools will be built healthy, operated efficiently and LEED certified.

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Based on the first LEED Certification program – LEED for New Construction, LEED for Schools places an increased emphasis on aspects of the built environment that impact student health and learning; classroom acoustics, master planning, mold prevention, and environmental site assessment are among the new additions to the rating system. LEED for Schools also encourages increased daylighting, improved indoor air quality and schools that function as interactive teaching tools.

As with all LEED rating systems, LEED for Schools offers four levels of certification: Certified, Silver, Gold and Platinum. Projects utilizing the new rating system must satisfy 9 prerequisites and earn enough of the 79 optional points to meet their desired certification level.

To date, 87 schools have been LEED certified. LEED for Schools is now required for new construction and major renovations of K-12 educational facilities pursuing LEED certification and highly recommended for early education centers and college and university academic buildings. With more than 630 additional schools in the pipeline for certification, the green school movement is national in scope. There are LEED registered or certified schools in 47 states and the District of Columbia. Pennsylvania leads the way in both registered and certified schools, thanks to their popular Green School Grant Program, which awards schools up to a half million dollars for achieving a minimum LEED Silver certification.

Why would a school district choose to build a green school? Aside from being healthier, more productive learning environments for students, teachers and staff, green schools are a responsible use of taxpayer's dollars. Not only do these schools produce direct savings in water and energy costs, they save indirectly by reducing the demand on municipal infrastructure. With energy prices on the rise, building green can have a tremendous impact on operating budgets over the lifespan of our schools.

But perhaps this is the wrong question to be asking. In the words of USGBC's President, CEO & Founding Chair, Rick Fedrizzi, "When it comes to schools, the question is no longer *should we build green?* It's *why aren't we?*

So why aren't all new schools being built green? According to a 2006 survey of CEFPI members, concerns for increased first costs are by far the greatest obstacle to building more green educational facilities. Yet, given what we know about the modest up-front costs associated with going green, and given the multiple streams of anticipated savings in lifecycle costs, schools that fear they can't afford to go green are the very schools that can't afford not to go green.

For more information on green schools and LEED for Schools, visit USGBC's new Web site, www.BuildGreenSchools.org. Aside from valuable tools, resources and case studies, you can get in touch with your local Green School Advocacy Director and plug into a network of peers who are designing, building and operating green schools in your region. ■

Rachel Gutter is the Schools Sector Manager for the US Green Building Council (USGBC).

Ohio Braces for Green Schools

By Franklin Brown

A national focus on energy and environmental issues coupled with a funding stream from a legal settlement is changing the way Ohio is rebuilding schools.

Imagine saving over one billion dollars in taxpayer money over the next 40 years by reducing energy consumption in school buildings! Those are dollars that don't have to be sent to other states to purchase natural gas or electricity or other countries to buy oil. They are dollars that can stay in Ohio.

Since 1997, Ohio has been involved in several state programs focused on rebuilding the entire K-12 building portfolio, originally comprising some 3,684 buildings. To date, over 465 buildings have been built new or completely renovated representing a total investment exceeding 13.3 billion dollars. Two factors, namely the current national focus on energy and environmental issues along with a funding stream resulting from a legal settlement have changed the way we are rebuilding Ohio's schools.

Ohio reached a settlement agreement with a number of major tobacco companies wherein the state will receive annually, without an end date, a specific amount of money. The right to that money was sold to bond holders for 5.05 billion dollars, and over four billion of that is earmarked for continuing school rebuilding programs.

The Ohio legislature passed a Bill in 2007 including several provisions to cut energy consumption. The legislation required that the Ohio School Facilities Commission (OSFC) "study the USGBC's *LEED® for Schools* rating system and issue a written report to the General Assembly by October 1, 2007, comparing that system to the applicable standards set forth in the commission's most current Ohio School Design Manual."

The OSFC conducted a study working with the firms Innovative Design, Inc., Raleigh, NC and Steed Hammond Paul based in Cincinnati, OH. The study indicated that by focusing on energy savings opportunities inherent in the LEED for Schools Rating System, energy consumption could be reduced by as much as 51 percent over existing designs conforming to the Ohio School Design Manual.

The current state mandate regarding Green K-12 School Construction in Ohio comes in the form of a School Facilities Commission Resolution adopted on September 27, 2007. The Resolution requires that all Schools designed

after that date and constructed partially with state funds be designed to target LEED Gold certification and obtain no less than LEED Silver certification as defined by the US Green Building Council.

We are currently revising the Design Manual to align more closely with the LEED for Schools Rating System. When studied in detail, the benefits of the USGBC certification process are more beneficial than attempting to incorporate the strategies without certification. This has led to the State underwriting registration and certification fees with no local district share.

Every day, over a 1,000 people are working to rebuild Ohio's schools. For ten years, we have been doing with confidence what we thought was the best to design and build school buildings. Now we are asking these people to do what they do in a different, better way.

A unique accomplishment of LEED for Schools is that it enables the creation of integrated design teams. As architects, we no longer get an educational specification from the educational planner on letter paper to be converted into a floor plan to be forwarded to the electrical and mechanical engineers as a base plan for their work.

Now, we meet frequently as an integrated team, first in an eco-charrette where we determine and record our objectives and individual responsibilities for the overall design and later in design phase review meetings. From the initial meeting, the progress can be quantified and tracked through the use of building energy simulation tools comprehensive enough to be useful to all design team members, yet so intuitive that each design team member can use them.

It is very clear that the requirement for LEED for Schools Certification and the work load implicit in 4.2 billion dollars in school construction over the next three years (250 +/- buildings) is having a dramatic effect on the design community and construction materials and services supply chain in Ohio.

The OSFC is working to provide and support educational opportunities for all stakeholders in the process. Recently, a LEED for Schools Technical Review Workshop sold out its 80 seats in three weeks. Similar programs are being planned for school districts, architects, engineers, construction managers, commissioning agents and OSFC staff on an ongoing basis.

A challenge that architects in Ohio face is how to incorporate daylighting into all school designs. This strategy, more than any other, forces integration of the design team. No architect, mechanical engineer, electrical engineer, commissioning agent, civil/site engineer, construction manager or interior designer can develop a daylighting strategy on their own. If the construction manager estimates the cost of daylighting without the mechanical engineer reducing the chiller size or reducing the number of geo-thermal wells, the design will be over priced and forced to operate outside its range of optimal efficiency.

Another challenge that will inevitably arise as anyone adopts high performance standards is "how much more will it cost" or "what is the green premium?" If you isolate and estimate the added cost of one green strategy, in most cases there will be a cost premium. However, over time, this cost may be offset by lower operating expenses. On the other hand, if you incorporate many green strategies with each one interacting and supporting the others, frequently the overall cost will be less than conventional construction methods. If we look at the larger picture we can see costs that formerly were hidden. For example, if you eliminate curbs, catch basins and concrete storm water piping from a site and sheet flow storm water into bio-swales to recharge the ground water table, then we not only save the cost of those drainage structures but we relieve the cost to the public authority for off-site storm water management.

Facilitated by the LEED Online submission process, OSFC will monitor the status of each building design and construction project as it moves through the LEED for Schools certification process. Teams that show any signs of struggling with a particular credit category will be offered mentoring and coaching.

According to Rick Fedrizzi, President and CEO of the USGBC, LEED is a "market transformation tool." It is meant to change the way we think and go about designing buildings. Once we have seen the benefits of refocusing on the economic, environmental and social benefits of sustainable design and we have developed an understanding of the methods and tools to achieve it, we will be transformed and these principles will simply be how we work.

Most of what has been discussed above has to do with adult issues. These benefits pale before the educational benefits to the 1,820,000 students that will attend these schools. The benefits to the future citizens of Ohio are immeasurable. LEED for Schools is about optimizing the K-12 educational environment. It is ultimately about learning. ■

Franklin Brown, AIA, REFP, LEED AP is planning director for the Ohio School Facilities Commission (OSFC).

Why a Healthy School Matters

By David M. Hill

A school district makes the best of an open resource from the US EPA's Indoor Environments Division to improve indoor air quality. Learn how your school district can make use of this resource too.

The Blue Valley School District (BVSD) in Overland Park, Kansas used the EPA's Indoor Air Quality Tools for Schools (TfS) Program's "Change Package" to accelerate action to create a healthier and safer learning environment. Learn how your school can achieve similar results.

What is the IAQ TfS Program Change Package?

The *IAQ TfS* Program Change Package provides quick access to strategies and actions that successful school districts have followed to build effective and enduring IAQ management programs. This Change Package is one element in a suite of materials that presents the accumulated learning of more than 1,000 schools and 10 years of research into IAQ programs that deliver improved health, safety, performance, community relations, facility conditions, and more. The *Envisioning Excellence* materials provide in-depth access to the research base while the *Framework for Effective School IAQ Programs* synthesizes its most essential findings.

What Is 'The Framework' and How Can I Use It?

Years of research led to the discovery of a clear program *Framework* that underlies successful IAQ programs. The *Framework* is flexible and adaptable and any school, regardless of location, size, budget, or facility conditions, can follow it to launch and sustain an effective IAQ program. The *Framework for Effective School IAQ Programs: Six Key Drivers* presents the proven system for success and provides a common language for discussing the *Key Drivers* that lead to IAQ management program effectiveness:

- Organize for Success
- Assess Your Environments Continuously
- Plan Your Short and Long-Term Activities
- Act to Address Structural, Institutional, and Behavioral Issues
- Evaluate Your Results for Continuous Improvement
- Communicate with Everyone, All the Time

Each *Key Driver* in the Framework contributes to the success of a school IAQ management program. The *Key Drivers* are not ranked in priority order—they are all equally important. The *Framework for Effective School IAQ Programs* is a self-reinforcing system. Working to develop one *Key Driver* will contribute to and build-up another; the strategies behind the *Key Drivers* overlap and reinforce one another.

It is important to remember that a highly effective IAQ management program is a work in progress: successful school districts continuously pursue and build their programs around these Key Drivers. It is important to think about IAQ management as a marathon and not a sprint.

KEY DRIVER #1
Organize for Success

Systems Matter: Apply a systematic approach to coordinate and enhance *existing* activities and build a sustainable IAQ initiative.

BVSD used the *IAQ TfS* Program's guidance to identify which procedures, resources, and personnel to coordinate to improve our facilities management plan. By integrating disconnected pieces, we created a stronger program out of our existing parts. We used the *IAQ TfS* Program structure to tie disparate facility management activities and functions together, and to get the right people from across the district talking about environmental management issues and policies.

Process, Process, Process: Create standard operating procedures (SOPs) to ensure regular facility assessments, prevention actions, and swift problem response.

BVSD adapted existing SOPs for facility design and capital construction projects, building envelope and major mechanical replacement programs to establish new response protocols for IAQ. We also explicitly tied the new SOPs to the overarch-

ing goal of creating outstanding learning environments that promote student success. We felt it was important to demonstrate and publicize the links between our IAQ prevention and response SOPs and the educational mission of our district to help decision-makers and staff to support our activities.

Designate and Empower a Leader: Identify the person in charge of the IAQ management program and empower that person to make decisions and direct action.

BVSD chose a strong leader who is committed to IAQ management, facility health, and occupant wellness. Our IAQ coordinator has the influence necessary to pull the right policies and people together; promote the program's importance to decision-makers, staff, and teachers; and hold people accountable for progress. We chose a coordinator for our IAQ initiative whose role as Safety Manager had prepared him in many of the relevant issues (facility management, pollution prevention, etc.). He became the face of the District's IAQ program—the "go-to guy" critical to our success.

Foster IAQ champions (on your team and in the broader community) to promote your program's success.

BVSD communicated broadly about the links between the IAQ Program and student learning: Everyone knew how they could contribute to healthy school environments that lead to student success. Principals saw that the program could keep students healthy; and custodians felt pride about being the first line of IAQ defense.

KEY DRIVER #2
Assess Your Environments Continuously

Establish your facility performance baseline.

BVSD continuously conducts room checks to measure thermal comfort and CO_2 and tracks variations against baseline data. Data that we collect includes thermal conditions (average temperature, relative humidity, and CO2), and ventilation rates; particulate matter: frequency with which HVAC filters are changed; and more.

Use technology to simplify assessments, collect and manage data, and track response and prevention activities.

BVSD uses technology – including an Aircuity machine, a Forward Looking Infrared camera (FLIR), and an Environmental Management System – to comprehensively measure facility parameters during walkthroughs; and to continuously monitor filtration, air flow, CO2, temperature, and relative humidity in all facilities. Our tools help the IAQ team to limit lost instructional time by heading off potential problems.

Respond promptly to occupant concerns and demonstrate that you take concerns seriously.

The BVSD thinks of our occupants as our customers and we show them that we take IAQ issues seriously because we value their health. Our IAQ team follows up within 24 hours of receiving a complaint by talking with the complainant, describing next steps, and continuing to discuss work in progress. This culture of customer service builds trust between facilities staff and occupants and creates a joint sense of ownership for the facility. We tell complainants what we plan to do in response to their concern, share any data that we have with them, and inform them when and how concerns are resolved. Engaging occupants in our work generates trust and support.

Prevention Today Means Savings Tomorrow: Identify IAQ risk factors and opportunities for improvement and take *preventive*, not just responsive, action.

The BVSD team uses what we learn from our assessments to identify actions we can take to head off problems. We take opportunities to educate occupants and custodians, update maintenance and policies, and take precautionary action, such as sealing foundation cracks to prevent moisture intrusion. We schedule these actions proactively to save time and money and reduce risks in the future.

We prioritize custodial training for IAQ prevention. The custodial team is our eyes and ears. They are in the buildings every day and can let us know what's happening so we can prevent problems. We teach custodians to identify and report moisture leaks and mold growth and to take pictures and map leaks. The worst thing you can do is replace a stained ceiling tile with a new one. We need to see the stained ones so we can address the root cause of the problem rather than papering over it with a new tile.

KEY DRIVER #3
Plan Your Short- and Long-term Activities

Start Small to Get Big: Continuously plan your prevention and upgrade activities recognizing that you cannot do everything all at once.

BVSD launched an IAQ program by finding opportunities to improve IAQ without much new work. We 'pushed the fly wheel forward' with small wins that continually generated momentum and support for the program. We think of effective IAQ management as a marathon, not a sprint.

Put It in Writing: Include your IAQ program's goals and objectives in documents that codify SOPs.

BVSD institutionalized our program by including goals and measures for success in the district's strategic plan. The IAQ team is publicly accountable and they have senior-level support for the program because the board, superintendent, and others know the IAQ program's

focus is on significant environmental accomplishments resulting in student success. We list our IAQ program goals, plans, and responsibilities in the district's strategic plan, facility operations plans, staff training programs, operating manuals, etc. We articulate our program's goals and objectives clearly and publicly so they become true yardsticks for district performance.

KEY DRIVER #4
Act to Address Structural, Institutional and Behavioral Issues

Educate staff on IAQ risks, evidence of IAQ problems, and how to report what they find.

BVSD's IAQ team meets with principals regularly to educate them about the IAQ program, and to share a 'cheat sheet' that lists the roles, responsibilities, and contact information of facilities department staff. Most principals become active site managers. We give them the knowledge of common IAQ risks and the power to act to protect the buildings in which they spend time. In the process, we can turn them into IAQ guardians and champions.

BVSD includes leadership and stewardship messages in our education programs. We convey that facility health is a joint responsibility and that it takes a team of proactive occupants, staff, and managers to prevent problems and deliver outstanding learning environments.

Root Cause Analysis Works: Identify the underlying cause(s) of problems at the first sign of an IAQ issue and do not be satisfied with cosmetic fixes.

In BVSD, training for all lead custodians focuses on 'the root of the problem' rather than superficial solutions. Lead custodians learn to conduct regular walkthroughs, effectively report potential problems (see it, map it, report it), and train their colleagues to do the same. We ground our preventive maintenance program in root cause analysis: programs that see the biggest return on investment are those that address the sources of problems.

KEY DRIVER #5
Evaluate Your Results For Continuous Improvement

Survey Your Customers: Ask occupants for input on your program's progress and effectiveness to improve community relations *and* gather valuable data.

BVSD asks occupants to score the school's indoor environment on annual surveys and aims to receive scores of at least 4 out of 5 from 100 percent of respondents. We ask occupants for feedback on their comfort with our IAQ program, the ease of reporting concerns, perceived effectiveness of response to reports, and general satisfaction with the indoor environment.

Capture Your Return on Investment (ROI): Establish and track quantitative targets for your program wherever possible.

BVSD documented reduced operating costs associated with the IAQ management program (e.g., energy savings from HVAC upgrades) and used the proof of savings to invest money back into the environmental program. BVSD also documented a rise in test scores every year since the *IAQ TfS* Program began along with fewer per capita IAQ complaints.

KEY DRIVER #6
Communicate with Everyone, All the Time

Share Your Goals: Publicize your program's goals, plans, and expected activities.

BVSD records its IAQ goals in its strategic plan, communicates them to people across the District, and explains the rationale behind them. We communicate the connection between your IAQ activities and program goals so stakeholders know what you are doing and why it is important. "We [BVSD IAQ team and administrators] take a proactive approach to maintaining our buildings…We have to be aware that keeping a building in top shape costs money, but we know that it saves money in the long run."

Make it Meaningful to Your Audience: Communicate the link between your program's plans, activities and results and the issues that matter most to your audience.

BVSD generated support for the IAQ program by emphasizing how it would manifestly support the district's goal of "creating outstanding learning environments. The IAQ team also mailed newsletters to all households in the district, to share the message that "Each day we wait to improve IAQ, money is lost." We talk to parents about how our work safeguards their children; we tell staff and administrators how it promotes health, productivity, attendance, and performance; we share with facilities and operations and maintenance staff how their work affects student success and reduces facilities wear and tear and maintenance costs. Our patrons got the message and now support the air quality activities through bond initiatives and volunteerism.

Communicate your results to everyone in the community.

BVSD shares IAQ program progress by reporting on daily, weekly, and monthly improvements to the school board and community. We share information on our efforts and results so the community can understand the full circle of IAQ management—risk identification, action, prevention, and improvement—and see why IAQ investments and behavior/policy changes are worth supporting. "Our patrons know that things get done because we make sure to follow every issue and we communicate what we're doing, why we're doing it, and what to expect next." ■

To learn how your school district can incorporate the *Framework for Effective School IAQ Programs: Six Key Drivers* or to get additional information, contact Michele Curreri at the US EPA at 202-343-9099 or e-mail curreri.michele@epa.gov.

Author Bio

Dave Hill is the Executive Director of Facilities and Operations for the Blue Valley School District (21,000 students) located in Overland Park, Kansas. He has published articles in professional journals and presented at several local & national conferences & symposiums on school facility planning & design, site planning, population forecasting and demographics, LEED and environmental design, and indoor air quality. Dave received undergraduate and graduate degrees in Architecture and Urban Planning from Iowa State University.

Resources for EPA's Environmental Programs for Schools

EPA is a strong advocate for creating and maintaining healthy and safe school environments. For this reason, it has established several school-based programs to address a variety of environmental factors that schools encounter each day. These school-based programs raise awareness for the importance of creating and maintaining healthy and safe indoor and outdoor school environments for students and staff. Each program offers free information and guidance on how schools can address the variety of environmental factors that affect school buildings, children and staff.

Indoor Air Quality Tools for Schools Program
Indoor Air Quality Tools for Schools is a non-regulatory program that provides district-based guidance to schools about best practices, industry guidelines, and practical management actions designed to help school personnel identify, solve and, prevent indoor air quality problems.

For more information, visit www.epa.gov/iaq/schools or contact Michele Curreri at 202-343-9099.

Indoor Air Quality Design Tools for Schools
Indoor Air Quality Design Tools for Schools (IAQ DTfS) provides voluntary web-based guidance for schools on how to design healthy, high performing schools from the ground up and incorporate IAQ practices into the design, planning, building and commissioning process for new schools.

For more information, visit www.epa.gov/schools or contact Michele Curreri at 202-343-9099.

Healthy School Environments Assessment Tool (Healthy SEAT)
Healthy SEAT is a free, fully customizable software tool designed to help school districts manage voluntary self-assessment programs for all of their key environmental, safety and health issues.

For more information and to download the Healthy SEAT, visit www.epa.gov/schools or contact Bob Axelrad at 202-343-9315.

Asbestos in Schools
The presence of asbestos in high-activity public buildings such as schools presents the opportunity for inadvertent disturbance and potential for exposure. Consequently EPA created a web resource addressing asbestos in schools. This resource contains information on Asbestos Hazard Emergency Response Act (AHERA), which requires public and private non-profit primary and secondary schools to inspect their buildings for asbestos-containing building materials.

For more information, visit www.epa.gov/asbestos/asbestos_in_schools.html.

Clean School Bus USA
The Clean School Bus USA program aims to promote clean and safe school bus transportation for children in order to reduce children's exposure to diesel exhaust and the amount of air pollution created from diesel buses. Clean School Bus USA program encourages school districts to adopt policies and practices to eliminate unnecessary public school bus idling; upgrading (retrofitting) buses that will remain in the fleet with better emission-control technologies and/or fueling them with cleaner fuels and replacing the oldest buses in the fleet with new, less-polluting buses.

For more information, visit www.epa.gov/cleanschoolbus.

ENERGY STAR® for K-12 Schools
ENERGY STAR® Program for K-12 schools offers information for schools on how to incorporate building improvements that will help to reduce energy costs. EPA's ENERGY STAR® for K-12 School Districts encourages schools to prepare an energy strategy for the future; establish a comprehensive energy management program using ENERGY STAR's Guidelines for Energy Management; gather information on how to finance energy projects and receive free training and on-line tools and information and resources through the ENERGY STAR website. Schools can use these resources to improve building management practices, incorporate energy upgrades, and reduce long-term energy costs.

For more information, visit www.energystar.gov and click on the "K-12" link under "Buildings & Plants."

Integrated Pest Management in Schools
The Integrated Pest Management Program for Schools offers voluntary guidance and tips on how schools can incorporate the use of environmentally sensitive pest management techniques which utilize the lowest-impact chemical control of pests in the school environment. This will reduce the use of common toxic pesticides.

For more information, visit www.epa.gov/pesticides.ipm

Lead in Drinking Water Program for Schools
The Lead in Drinking Water Program for Schools educates schools on lead in drinking water and potential health impacts for children. EPA encourages schools to test water for lead concentration at all fixtures used for drinking and cooking.

For more information, visit www.epa.gov/safewater/lcrmr/pdfs/report_lcmr schoolssummary.pdf.

Mercury In Schools Program
The Mercury in Schools Program encourages schools to reduce the hazards of mercury exposure in schools by removing all mercury compounds and mercury-containing equipment and by discontinuing their use. They offer a variety of information and guidance for schools.

For more information, visit www.epa.gov/mercury/schools.htm.

Mold and Moisture Remediation Guidance
Moisture problems in school buildings can be caused by a variety of conditions including roof and plumbing leaks, condensation, and excessive humidity. Moisture problems in schools are also associated with the aging of school facilities, delayed maintenance or insufficient maintenance, due to budget and other constraints. When mold growth occurs in buildings, it may be followed by reports of health symptoms from some building occupants, particularly those with allergies, asthma, or respiratory problems. Mold growth can be controlled indoors by controlling moisture indoors. EPA provides guidance on training on mold remediation.

For more information, visit www.epa.gov/mold.

Schools Chemical Cleanout Campaign
The School Chemical Cleanout Campaign and Prevention Program (SC3) work to raise national awareness of the potential dangers of chemical accumulations in K-12 schools and facilitate chemical cleanout and prevention of future chemical management problems.

For more information, visit www.epa.gov/sc3 or contact Kristina Meson at 703-308-8488.

ENERGY STAR® and the LEED® Rating System

By the Southeast Rebuild Collaborative Team

Learn how you can earn LEED points by incorporating the US EPA's ENERGY STAR tools in K-12 buildings.

You've seen the ENERGY STAR logo on office equipment, light bulbs, and appliances. However, ENERGY STAR is not just for consumer products. The U.S. Environmental Protection Agency's (EPA's) ENERGY STAR program also lends its label to energy efficient new homes, commercial and industrial buildings, and K-12 structures.

K-12 school districts that seek to attain the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Certification can use ENERGY STAR tools and ratings to meet certain requirements. EPA offers a set of free online tools and resources that help you easily track energy use, associated costs, CO2 emissions, and much more.

The easy-to-use Target Finder tool helps you set aggressive, yet realistic energy use goals for your new school buildings during the design stage. It will give you a target efficiency to aim for to acquire a specific rating and tell you the rating your designed energy use will earn. This will give you the opportunity to improve your potential energy efficiency while the building is still in the design stage.

Target Finder will help with LEED for New Construction and LEED for Schools certifications. In fact, one of the prerequisites for minimum energy performance in LEED for Schools certification requires the use of Target Finder to establish an Energy Performance Rating goal.

EPA also offers Portfolio Manager, a tool that will help track your existing buildings' energy efficiency ratings and improvements. It is a comprehensive tool, designed for use after your building is operational. It requires entering basic functionality data about your school and energy use data from your monthly utility bills into an online database. Portfolio Manager will track your energy data over time to tell you the amount of energy you are using, the amount of energy and money you are saving, your reduction in CO_2 emissions, and much more. By using EPA's Portfolio Manager to regularly track your energy use, you can track cost savings and may also be able to find ways of increasing energy savings.

Portfolio Manager can also generate a Statement of Energy Performance for each building, which will tell you the building's current ENERGY STAR rating, which is a requirement for LEED for Existing Buildings. The following table shows how the ENERGY STAR rating system parallels with points earned toward LEED certification for Existing Buildings. If your building meets the criteria, Portfolio Manager will guide you through the steps of applying for the ENERGY STAR label. It will also generate the data and documentation necessary to submit for LEED certification. All this from a simple, free online tool.

ENERGY STAR Rating	LEED for Existing Buildings Points
63*	1
67	2
71	3
75	4
79	5
83	6
87	7
91	8
95	9
99	10

* Only projects registered prior to June 26, 2007 may pursue 1 point. From: LEED for Existing Buildings October 2004 – Revised for projects registered after June 26, 2007

The ENERGY STAR rating system is based on a 1-100 scale with a higher number corresponding to higher energy efficiency. EPA will compare your school to similar schools around the country to develop the rating for your building. A score of 75 or more earns your facility the ENERGY STAR label and the distinction that your school is operating more efficiently than 75% of comparable schools. For LEED Existing Buildings certification, your score can be a little lower—you start earning points at a rating of 63, but the higher your ratings go, the more LEED points you can receive (up to a maximum of 10

under the Energy and Atmosphere section).

If your rating is not as high as you wanted or imagined it would be, then do not be discouraged — simple changes can often lead to great energy efficiency improvements. The ENERGY STAR Web site offers guidance on steps you can take to make improvements and boost your energy efficiency.

As well as receiving the ENERGY STAR label, there are many ways to get involved. EPA's ENERGY STAR program is the basis for several campaigns and challenges to help garner widespread participation in energy conservation efforts:

- The ENERGY STAR Challenge is a national call-to-action encouraging America's commercial and industrial buildings to pledge to reduce their energy consumption by 10% or more. Your school or school district can sign up online for the Challenge and use Portfolio Manager to track your progress.
- Become an ENERGY STAR partner to demonstrate how much you care about the world. Your organization will be listed on the ENERGY STAR Web site for others to see. With enough participation, your organization could even be recognized for its efforts to protect the environment through energy efficiency, and become a Partner of the Year. For example, Colorado Springs School District 11 earned the Partner of the Year award in 2005 by assessing and improving more than 90% of their portfolio of 61 schools, and achieving a costs savings of over $4 million.
- ENERGY STAR Leaders are partners who demonstrate continuous energy efficiency improvements in more than just specific buildings, but organization-wide. This title distinguishes you from other organizations now more than ever, as a majority of U.S. households recognize ENERGY STAR as one of the premier symbols of energy efficiency.

If your school district is located in the Southeast you can join the Southeast Rebuild Collaborative (SRC) to begin implementing energy efficiency today. The SRC is a joint effort of the state energy offices of Alabama, Florida, Georgia, Mississippi, and South Carolina to promote energy efficiency in the Southeast. The SRC reaches out to school districts, state and local governments, colleges and universities, vendors, trade organizations, and other regional allies to help them save energy and reduce the emissions of greenhouse gases by coordinating and assisting their implementation of ENERGY STAR and LEED. For more: www.southeastrebuild.org ■

A Plaque Is Just a Plaque

By David Peterson

Do you really need a rating system for your building? Well, perhaps not. The author argues that a plaque may not be a symbol of an efficient building.

Over seventy percent of U.S. schools 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.

Schools are expensive and last a long time. Not every school district needs to build a brand new school in the near-term, but almost all districts will be faced with the task of upgrading and renovating. As school leaders begin this journey, they are exposed to the newest industry buzz words – sustainability, high performance, and greening. Developing sustainably means ensuring that our actions today do not limit our quality of life in the future. Sustainable design, also referred to as green or high-performance design, encompasses a wide array of factors.

A high performance school has been defined as one that is: Healthy and Productive, Cost Effective, Sustainable, Educationally Effective, and Community Centered. High performance school buildings are comfortable, healthy, and efficient

buildings where students and staff want to be and where they do well. According to the US EPA, Green building refers to efforts to increase building efficiency by decreasing energy, water, and materials use, and to reduce building impacts on human health and the environment. Green building relates to site selection, design, construction, operations, and maintenance — otherwise known as the building life cycle.

High performance schools integrate the best in today's design strategies and building technologies. Even better, they make a difference in the way children learn. Research has shown that better buildings produce better student performance, reduce operating costs and increase average daily attendance. Systems and materials are chosen using a life-cycle cost analysis, rather than the cheapest first-cost. During design, energy analysis tools optimize the building's performance, and after construction equipment is fine-tuned to operate correctly. Community members use the building during non-school hours; they also participate in the design process.

High performance schools pay for themselves in energy savings, waste reduction, decreased costs due to positive health effects, and increased employee and student productivity. Involving the local community in the High Performance Schools Partnership (HPSP) process enables businesses and organizations to contribute to improving schools, by reinforcing the connection between good schools, successful businesses, and strong communities.

Creating a high performance school is not difficult, but it requires an integrated, "whole building" approach to the design process. Key systems and technologies must be considered together, from the beginning of the design process, and optimized based on their combined impact on the comfort and productivity of students and teachers.

Green doesn't always have to cost more. There are many design trade-offs in any project, any of which will still meet or exceed the project's objectives. Select green options that cost less to begin with.

Why are sustainable buildings not yet being delivered as standard practice? One key factor is that many people regard sustainable buildings as an end product and not as a process. Even if a project is fully thought through, well managed and delivered, building users will then have to efficiently operate the building in order for it to function as intended. What might be regarded as a 'good design' is not necessarily sustainable. It might be made of unsustainable materials; or built for an inappropriate life cycle; or be inflexible with regard to future use; or be in the 'wrong' place.

There are several industry rating systems that promote certifications in order to show that the building is green, efficient, and high performance. It should also be noted that high performance elements can be achieved without subscribing to a rating system. Based on current budgets, it may be more important to put the money in the classroom than to pay for a plaque to be placed on the entrance wall. There are different procurement routes that authorities may consider in building or refurbishing schools.

Whatever procurement route is selected, the process requires vigilance in keeping sustainability upfront to achieve a sustainable outcome. Involving the whole team: pupils, staff, communities, design and construction teams, and financial professionals requires a commitment and attention to detail at all stages of the project. Past performance of the contractor must be examined both from a course of construction perspective and a final product. One person in the firm holding a certification can easily be outweighed by a firm that practices safe construction and focuses on efficient practices while not compromising on quality.

Green doesn't always have to cost more. There are many design trade-offs in any project, any of which will still meet or exceed the project's objectives. Select green options that cost less to begin with. There are many additional strategies that are also very good investments that can be recouped within a few years. Strategies that impact health and productivity are hard to put a dollar return on. Green strategies for educational facilities should always be considered:

- Xeriscape planting strategies cost less money upfront, and they save on water use for years to come.
- Balance cut and fill.
- Daylighting
- Cool Roofing
- Mechanical Systems
- Energy Efficient Products

When selecting the most cost-effective daylighting strategies one needs to consider the many benefits including saving energy, increasing productivity, and improving health. Daylight the spaces that are used the most and are to be air conditioned – gymnasiums, administrative areas, and classrooms in order to save on energy from illumination and cooling. Use clear, double-glazing in the glass areas that are integral to your daylighting strategy. Utilize view glass where there is a purpose – not just to balance the design.

A white single-ply roof has several advantages: it stays reflective a

long time; ninety percent of heat gain from the roof is the result of radiant gains.

When sizing the mechanical equipment, it may make more sense to actually increase other design elements (insulation levels, etc.) to help reduce the overall cooling load down to the next chiller unit size. By analyzing your seasonal and hourly loads you may be able to downsize your chiller and not significantly impact comfort.

While many of these practices should be done because we have a budget to adhere to. They should also be accomplished because it is the right thing to do. If this can be completed without the need to pay for a certification from a third party, the question of 'Why Certify?' must be asked.

According to the US Green Building Council , while LEED (Leadership in Energy and Environmental Design) Rating Systems can be useful just as tools for building professionals, there are many reasons why LEED project certification can be an asset:

- Be recognized for your commitment to environmental issues in your community, your organization (including stockholders), and your industry;
- Receive third party validation of achievement;
- Qualify for a growing array of state & local government initiatives;
- Receive marketing exposure through USGBC Web site, Greenbuild conference, case studies, and media announcements.
  (Source: Page 5 - LEED for Schools Rating System 1st Edition, Updated November 2007)

The U.S. Green Building Council created the LEED Green Building Rating System® as a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. LEED certification provides independent, third-party verification that a building project meets the highest green building and performance measures. All certified projects receive a LEED plaque, which is the nationally recognized symbol demonstrating that a building is environmentally responsible, profitable and a healthy place to live and work.

In my opinion, a plaque is just a plaque and does not necessarily stand as a national symbol of an efficient building. This is so because no matter how well a facility is built, it must be operated efficiently. Past practice does not guarantee future results.

In addition, USGBC markets to product manufacturers and service providers to join the movement so that they can sell their products.

"Product manufacturers and service providers are vital to advancing USGBC's mission of market transformation." *(Source: www.usgbc.org)* "Learn how you and your company can help advance green building, while also achieving your own environmental and economic goals." USGBC company membership sets you apart. Join USGBC to establish yourself as a leader in the green building industry, as well as enjoy:

- An online listing in our member directory;
- Access to the USGBC member logo for use on your Web site and collateral pieces;
- During construction, require the contractors to recycle materials.

In a pure sense, an organization that certifies projects may have a conflict promoting products that are sold by its members in order to obtain a certification that the organization exclusively controls. A school district may choose to implement sustainable and efficient design elements and champion green practices without paying a fee for the 'LEED plaque.' There are other organizations that promote similar practices, but do not have a certification fee.

The Collaborative for High Performance Schools' goal is to facilitate the design of high performance schools – environments that are not only energy efficient, but also healthy, comfortable, well lit, and contain the amenities needed for a quality education. There's no cost to become a CHPS school, and the program offers free training for project managers, engineers, architects, school district administrators and the general public.

Rebuild America is a growing network of community driven voluntary partnerships that foster energy efficiency and renewable energy in commercial, government and public-housing buildings. The program's goals are to: conserve energy, accelerate use of the best energy technologies, save money, reduce air pollution, lower U.S. reliance on energy imports, help revitalize aging city and town neighborhoods, and create "smart energy" jobs.

The High Performance School Partnership (HPSP) is designed to succeed by ensuring that funds already being spent are spent more effectively; better health and cost-saving benefits are possible through integrated environmental design, construction, and opera-

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tion. This approach will enable school boards to justify allocating funds toward investing in energy conservation, protecting student health, and maximizing the long-term positive impacts to our nation's schools

Sustainable design techniques applied to existing buildings during renovation and the implementation of proper energy management programs will allow existing schools to realize significant energy savings. Even though the price of construction for a high performance school might be greater than for a conventional school, the lower long-term operation and maintenance costs balance it out.

A school district can achieve high performance and sustainability without subscribing to a rating system. Our decisions should be governed by the idea that it is the right thing to do, not that there will be a plaque on the wall. ■

David Peterson is Assistant Superintendent – Operations at Scottsdale Unified School District in Arizona. He is currently renovating and replacing five comprehensive high schools at the same time on the same campus at a total cost of $217 million. He is a member of CEFPI and is the vice-president of the Arizona Association of School business Officials (AASBO).

The Collaborative for High Performance Schools (CHPS)

Tools for Building a New Generation of Green, Healthy Schools

By Charles Eley

Since its inception, the Collaborative for High performance Schools (CHPS) has come a long way. The CHPS criteria has been adapted in eight states, including Washington, New York, Massachusetts, the New England states, and CHPS' founding state, California; four of these states offer special funding for CHPS schools.

The mission of the Collaborative for High Performance Schools (CHPS) is simple – to make schools better places for learning. CHPS provides school districts and design teams with in-depth resources and technical training to facilitate the design, construction and operation of high performance schools. In turn, schools built using the CHPS Criteria and Best Practices improve student performance, increase occupant health and satisfaction, and conserve resources and funds.

At CHPS, we believe that schools are special places that deserve unique attention. Schools are built environments that require not only attention to environmental responsibility, but also occupant health, comfort, safety, and ease of use. A high performance school should also benefit the community, be adaptable to changing needs and be designed as a tool to teach occupants about the built and natural environment. CHPS provides resources and tools that help school districts and their design teams to achieve all of these goals.

CHPS Best Practices Manual

At the heart of the CHPS program is the CHPS Best Practices Manual. While the opportunity for recognition through the CHPS high performance building criteria is often what draws schools to CHPS, it is the Best Practice Manual that assists school districts in implementing high performance building techniques. The Manual is a six-volume resource, developed and written by a consensus-driven technical committee. Offered free of charge, the Manual covers topics such as high performance school planning, design, criteria, maintenance and operations, commissioning and relocatables. From acoustical design to xeriscaping, the CHPS Best Practice Manual offers guidance on planning and implementing every high performance aspect of a project.

CHPS Designed and CHPS Verified

School districts can participate in the CHPS program by utilizing one of the two recognition programs for CHPS high performance building criteria.

The first, CHPS Designed, is a free self-certification process, where the burden of reporting falls on the design team and project architect to describe the project's high performance features. CHPS also offers CHPS Verified, which combines project management tools and independent verification with an interactive scorecard, for a program that allows school districts to ensure they will realize the benefits their school was designed to deliver.

There are now over forty CHPS schools across the US, with another 300 underway. Twenty-seven school districts have committed to using the CHPS Criteria for all new construction and modernization projects. So far, the CHPS criteria has been adapted for eight states, including Washington, New York, Massachusetts, the New England states, and CHPS' founding state, California; four of these states offer special funding for CHPS schools.

In the 2006 CHPS Criteria for California, six major categories of credits are identified: site, water, energy, materials, indoor environmental quality, and policy and operations. Each of these categories contains prerequisites and credits, with eleven prerequisites in all, and 85 possible points.

Besides qualifying school districts for extra funding at the outset, high performance schools also help districts save money down the line. By keeping students healthy and productive, they can increase average daily attendance rates. High performance school features can help districts to avoid costs of worker compensation and litigation in the future. CHPS schools conserve resources, saving money on utility bills. Most CHPS schools in California estimate between 12 percent and 35 percent energy savings over California's already stringent energy efficiency standards. Without significant repair costs, a well-designed high performance school lasts longer than conventionally-built schools.

For individuals and professionals interested in bringing CHPS to their district, CHPS has developed a roadmap for implementation of the CHPS program. The process begins with identifying key stakeholders to solidify support for high performance school facilities. CHPS can serve to unify stakeholders with various priorities in the school facilities field, such as student and occupant health, environmental responsibility and fiscal efficiency. Ultimately, however, internal school district staff will be responsible for implementing CHPS, so district level buy-in is key.

Many of CHPS resources are available free to the public on the CHPS website: www.chps.net. Users can download the Best Practices Manual, view online trainings, peruse resources and learn more about CHPS' program offerings. For more: info@chps.net. ■

Charles N. Eley, FAIA, PE is is the executive director of the Collaborative for High Performance Schools (CHPS) and the technical editor of the six volume set of CHPS Best Practices Manual. He has been fundamental in creating the vision, strategy and direction of CHPS, Inc. from the ground up. Mr. Eley is also Vice President of Architectural Energy Corporation.

Schools and Climate Change

By Kristin Heinen

CHPS is developing a method of measuring and reporting emissions for schools.

Even as awareness of climate change grows, so does the depth of the problem. Schools play a part in contributing to climate change, but also present a unique opportunity to address the problem as centers of their communities. As the Collaborative for High Performance Schools (CHPS) considers revisions to its high performance building Criteria, measuring, reporting and reducing greenhouse gas emissions has become a priority for the 2009 Edition.

CHPS believes there are multiple factors that schools need to measure to understand their greenhouse gas emission contributions. School contributions to climate change can be through electricity usage, water consumption, solid waste disposal, building material manufacturing, construction and demolition, and transportation. Measuring greenhouse gas emissions from each of these sources involves reviewing energy and

water utility bills, quantifying waste leaving the school site, and trips taken to and from the school.

At the beginning of 2008, CHPS brought together school climate change stakeholders to discuss methods of addressing greenhouse gas emissions and climate change in its Criteria.

Stakeholders identified several key findings at the meeting including:

- School design and construction greenhouse gas emissions account for five to seven times the amount greenhouse gases that would be emitted by operating an average school for seven years.
- The largest single contributor to greenhouse gas emissions in schools on an ongoing basis is transportation to and from school. The major barrier to reducing the impact in this area is student safety on transportation routes to and from school.
- Life cycle impacts need to be taken into consideration in calculating climate impact because a vast majority of greenhouse gases come from indirect sources.
- Informed operations and maintenance of schools on an ongoing basis are key to ensuring high performance benefits and greenhouse gas targets are achieved.
- Occupant and staff behavior modification training, monitoring and rewards may be useful so that school occupants know how to assist in and are invested in reducing emissions.
- Federal, state and utility incentives are essential for implementation of many greenhouse gas emissions reducing measures.

Measuring greenhouse gas emissions remains one of the central challenges for implementing a system of reductions. CHPS is working closely with other stakeholders to develop a method of measuring and reporting emissions for schools in the 2009 edition of the CHPS Criteria to be released in the fall of 2008. ■

Kristin Heinen, Assistant Director of CHPS, coordinates CHPS' legislative and governance affairs as well as its six-volume Best Practices Manual on designing, constructing and operating high performance, healthy, "green", K-12 schools. Ms. Heinen has an educational background in environmental design, and environmental policy and management.

Australia Launches New Education Initiative

Australia's ruling Labor Party has launched, as part of their "Education Revolution" initiative, a new Family–School and Community Partnership Bureau to help develop better partnerships between parents, schools and their communities.

The Bureau is designed, among other things, to:

- Examine examples of good family–school partnerships and disseminate this more widely.
- Look at ways to bring disengaged and disempowered parents into positive relationships with their children's schooling.
- Provide useful resource materials to teachers and parents.
- Make parents and students feel more welcome in schools.
- Work collaboratively with each of the State's parent organisations.

The Australian Council of State School Organisations (ACSSO) which represents parent organisations in government schools across the country has welcomed this initiative.

For more:

ACSSO

www.acsso.org.au/aed080219.pdf

Contributed by:

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Student-Centered Sustainable Design™:

How Conserving Resources Can Also Boost Student Performance

By Michael E. Hall

Student-centered sustainable design™ has become a valuable approach that allows for the exploration of many avenues through which sustainable goals and strategies can be realized while also improving student performance, increasing teacher satisfaction, and keeping operating costs to a minimum

As a concept that continues to evolve and gain influence, student-centered sustainable design™ has refocused the perspective of many administrators and designers as they approach school construction projects. In particular, thoughtfully conceived connections with the natural environment have become vital, along with a corresponding consideration: how can schools be designed to create a positive impact on learning while causing a minimal impact on the environment—both initially and over the long term?

School systems should also look to another ambitious goal—one that ultimately impacts both the student and the community at large. Schools today are now being designed in such a way that students can develop a deeper respect for the environment, and a better understanding of nature at work. Accordingly, those involved in the planning and design of schools should aspire to reflect a true sense of harmony between buildings and their settings—including the land itself, the climate, and the natural resources required for facility operations.

V. Sue Cleveland High School: The new V. Sue Cleveland High School in Rio Rancho, New Mexico, features an energy-efficient façade with light shelves that shade lower window areas and transfer natural light through the upper windows into the classrooms. *(Design team of Fanning Howey and Van H. Gilbert Architects)*

School districts recognize that they must give careful consideration to the advantages and impact of building performance—in particular as a means of boosting student performance. At the same time, it is vital to keep operating costs low and address sustainability requirements that have become imperative today. Student-centered sustainable design™ has become a valuable approach that allows for the exploration of many avenues through which sustainable goals and strategies can be realized while also improving student performance, increasing teacher satisfaction, and keeping operating costs to a minimum.

Two examples may help to underscore the student-centered sustainable design™ approach. In the first example, a district is considering an on-site stormwater catchment and recycling system for a new school project. The cost is determined to be $1.5 million, bringing the project over the budget at the conceptual design phase. The district's board of education must

review the situation, and consider the appropriateness of this type of expenditure as compared to preserving the school's proposed classroom daylighting scheme. A student-centered sustainable design™ approach embraces the classroom daylighting as the most beneficial expense for students.

A second example might involve the potential inclusion of a roof monitor daylighting scheme. After the scheme is designed and priced, it is determined that rising steel prices have pushed the option beyond anticipated costs. In this case, the board of education might elect to use a scheme that accomplishes much of the same intent, but at less cost. The concept of daylighting is not abandoned, only modified to meet the budget parameters.

Improving Performance

There is ample research to support the recognized connections between learning and the built environment. Mark Schneider's landmark article, *Do School Facilities Affect Academic Outcomes?*, published in 2002 for the National Clearinghouse for Educational Facilities, describes a growing body of research that documents those facility attributes that have the most impact on academic outcomes. Schneider explores seven categories:

- Indoor air quality
- Ventilation
- Thermal comfort
- Lighting
- Acoustics
- Building age and quality
- School size/class size

Those involved in school design and construction should be diligent in monitoring the results of ongoing research and look for opportunities to incorporate the findings from studies such as these into building design while maintaining the typical school construction budget. Key priorities include the following:

Indoor Air Quality

Research clearly indicates that improved indoor air quality (IAQ) can reduce student and teacher absenteeism.

- Utilize low VOC (volatile organic compound) materials
- Provide CO2 monitoring in the classroom
- Utilize building commissioning to ensure a healthy start-up

Ventilation

Improved ventilation can minimize or reduce poor indoor air quality issues, sick building syndrome, and problems related to asthma and respiratory ailments.

- Provide operable windows
- Provide adequate mechanical ventilation for all occupied spaces
- Incorporate a displacement ventilation system

Thermal Comfort

Studies indicate that the best temperature range for learning is 68-74 degrees Fahrenheit, and that the ability to learn is adversely affected by temperatures above 74 degrees.

- Provide individual room control heating/cooling systems
- Incorporate air-conditioning, even in cold climates
- Include shading capabilities at window areas
- Incorporate a digital control system to maximize comfort levels and energy efficiency

Daylighting

There is extensive research that documents the impact that natural daylight has on student achievement and behavior. Several studies indicate that students with the most classroom daylight progress faster than those in environments receiving minimal amounts of natural light. Those findings directly support the widespread feedback of schoolchildren and teachers throughout the U.S. when asked to cite their priorities in school facility design—responses such as "sunlight," "daylight," or "lots of windows and skylights" appear at or near the top of nearly every wish list. Options include:

- Attempt a good roof monitor daylighting scheme
- If budgets won't permit a roof monitor scheme, develop a window-lit scheme that is shaded and permits light to reach far into the building
- Utilize light sensors and multilevel lighting schemes to supplement the daylight while controlling operating costs and increasing lighting efficiency

At H.G. Blake Elementary School in Medina, Ohio, sound reinforcement systems amplify a teacher's voice 10 to 12 decibels above classroom noise levels.

Acoustics

As the ability to learn depends in large part on how well the brain receives incoming signals from a teacher, acoustically appropriate learning environments are critical to learning. A properly designed acoustical environment is less stressful for teachers and students and improves student behavior and attentiveness.

- Evaluate placement of buildings, environmental systems, and components such as mechanical rooms in terms of acoustical trespassing from outside sources.

For example, carefully locating mechanical decks away from academic areas can avoid unacceptable noise transfer.
- Classroom sound reinforcement systems are inexpensive (about $1,500/room) in relation to the benefits obtained. Budget accordingly and protect this component from being omitted.
- Consider carpet in the classrooms
- Maintain the acoustical design parameters of ceiling tile and other absorptive materials in the face of value engineering suggestions to downgrade
- The latest ANSI standards for acoustics in the classroom should be considered

Physical Conditions

Studies clearly indicate that the physical condition of school facilities impacts teacher morale and effectiveness. Studies also show that there is reduced vandalism, improved relationships between students and teachers, improved motivation, and an overall enhanced learning environment as the building quality improves.

- Help communities understand the benefits of remodeling aging buildings
- Utilize low-maintenance, long-life materials and finishes
- Provide attractive, uplifting interiors
- Include exterior amenities that are user-friendly
- Provide good exterior security lighting

Small Learning Communities

Study results are also available that explore the impact of small learning communities on student performance. The goal is to connect teachers with students, and reduce isolation, violence, and an atmosphere that breeds discouragement.

- Utilize a "school-within-a-school" design to create small learning communities
- Decentralize administration spaces

Connecting to the Community

One important aspect worth considering in terms of the impact of buildings on learning is the degree to which the building can facilitate connections to the community. Many superintendents and educators have reported an increase in student motivation and a reduction in discipline problems when the community is welcomed into the facility and able to take part in a host of student programs.

Examples include facility partnerships for recreation and wellness, use of performing arts facilities, tutoring programs, distance learning, and use of school technology.

- If choosing a new site for a school, consider locations that keep students in proximity to downtown areas and central community areas, rather than remote, isolated locations
- Incorporate community rooms, with kitchens, resource areas, computers, storage, and meeting space
- Provide spaces for distance learning that are available to community members
- Zone buildings effectively so that academic spaces can be secured from public areas
- Foster creative partnerships with municipalities and community groups to share facilities and operating costs and responsibilities

Ultimately, the support of the school district in advocating student-centered sustainable design™ is paramount to its success. Many districts are framing their objectives for this approach in carefully crafted language that informs the planning and design process for each school project. For example, Dayton Public Schools in Ohio has developed the following as an important statement of the district's vision:

"Dayton Public Schools is committed to enhancing our students' ability to learn by providing environments that support teaching and learning most effectively. We believe the research supports school design practices that include:

- Integrated daylighting
- Improved indoor air quality
- Energy-efficient building systems
- Environmentally preferable building materials
- Improved classroom acoustics
- Design approaches that allow the building itself to be used as an instruction tool

We believe that these practices assist in providing superior learning environments, while reducing life cycle costs through conservation of energy, and we embrace these student-centered sustainable design™ practices as the most appropriate means to achieve our goals."

This type of clearly defined policy-level support sends the right message to both the community and the design team that student-centered sustainable design™ is not just the current trend, but a vital component of educational design criteria. By using this approach creatively and comprehensively to improve the performance of educational facilities, districts will also help improve the performance of their students and teachers. ■

Michael E. Hall is a principal and chief marketing officer with Fanning Howey, one of the nation's leading educational facility planning and design firms. He has been designing schools throughout the U.S. for more than 34 years.

Spruce Up Your Facilities for Summer

By Maureen Lally

The troubled economy in the U.S. is creating further difficulties for school administrators grappling with tighter budgets and services that cannot be cut. Spring is a good time to spruce up your facilities and save on energy costs.

Spring is generally the time of year when teachers and students are thinking about wrapping up the school year and planning for warm weather and summer vacation. However, spring is actually the perfect time for school facility managers to prepare cleaning, construction and renovation projects that will take place during the summer break when occupancy is reduced.

With increased attention being paid to green building and methods to reduce energy consumption in the U.S., a heightened awareness has developed among school administrators of the various benefits of building green. In most U.S. school districts, utilities are the second largest budget item after personnel related items, according to the Department of Energy. In the U.S., this totals more than $6 billion spent on energy by schools nationwide. Unfortunately, about 25 percent of the energy used in a typical school is wasted because of inefficient building systems and operations. This amounts to $1.5 billion annually in the U.S. – money that could be used to hire approximately 30,000 new teachers.

The troubled economy in the U.S. is creating further difficulties for school administrators grappling with tighter budgets and services that cannot be cut. Uncertainty about financial conditions or fiscal hangovers from the cooler months may cause some schools to forego capital improvement projects like installing new systems, routine spring maintenance and annual audits. However, efficient energy operations and building management is one primary method of achieving cost avoidance that schools should be looking to leverage.

Pressure to cut operational costs, yet maintain high performance school buildings, has forced school officials to closely scrutinize services and expenditures. High performance schools, with properly designed and maintained heating, ventilating and air conditioning (HVAC) and control systems, improve the learning environment while saving energy, resources and money.

Saving a small percentage on energy costs creates capital to pay for essentials like technology, teacher salaries and supplies.

Spring is the time to arrange financing plans for projects that will improve school building performance. Schools, like many American businesses, may have to do more with less this spring to either prepare to get their building systems up to par during the summer months or achieve the high-performance status modern educational facilities enjoy.

When schools defer upgrades and capital improvement projects to later years due to budget constraints, they need to make do with their current systems. There are several ways to create high performance schools by making older systems run more efficiently, saving the school capital, reducing risk of failure and maintaining the green sensibility that contributes to environmental health. Saving a small percentage on energy costs creates capital to pay for essentials like technology, teacher salaries and supplies.

Multiple Benefits of High Performance Schools

Improving student learning and creating great schools with high academic standards is of vital interest to educators and administrators in the U.S. and throughout the world. There are several factors that affect how students learn, but research has demonstrated that one important factor is the buildings themselves.

High-performance schools conserve energy, resources and money using design and construction concepts that improve a building's function. According to the Sustainable Buildings Industry Council, a school renovation that incorporates high-performance

design can net a 20 to 30 percent annual savings on utility costs.

Not only do high performance schools save money, but research has shown that they can bolster academic performance and improve the health of occupants. According to the U.S. Environmental Protection Agency (EPA), more than 53 million children and about 6 million adults, or one in five Americans, spend a portion of their day inside school buildings. A significant number of students and teachers struggle with distractions including noise, glare, mildew, lack of fresh air and hot or cold temperatures.

Children have greater susceptibility to environmental pollutants than adults because they breathe higher volumes of air relative to their body weights and their tissue and organs are actively growing. One adverse effect of poor indoor environmental conditions is asthma. The American Lung Association found that American children miss more than ten million days of school each year because of asthma exacerbated by poor indoor air quality (IAQ).

A high-performance school has these three characteristics:

A healthy and productive place for students to learn and teachers to work. Students and teachers enjoy large amounts of natural daylight, good acoustics, superior IAQ, and the safety and security of automated building systems.

Cost effective and easy to operate and maintain. High performance schools employ cost-effective design practices such as the use of energy analysis tools that optimize energy performance, a life cycle cost approach that reduces the total cost of ownership, and a commissioning process that ensures operations follow the design's intent. These practices reduce utilities costs and avoid constant servicing.

Integrate several systems for sustainable operations. These structures combine energy conservation and renewable energy strategies with highly efficient mechanical and lighting systems, environmentally responsive site planning, environmentally preferable materials and products, and water-efficient design.

Going Green This Spring to Achieve High Performance

Going green does not require all-new energy systems. Energy audits and other forms of light maintenance can deliver earth-friendly energy management to a school and its surrounding community. Instituting these improvements in schools can provide remarkable benefits, including increased attendance, healthier IAQ, reduced operating costs, reduced liability, and reduced environmental impact.

Typically, this involves servicing or renovating building systems like controls, lighting, HVAC, electrical, plumbing, flooring and ceiling. Some of this work can come in conjunction with the seasonal servicing a school might choose to do before the spring months.

Using Performance Contracting to Finance Improvements

School administrators should use the spring months to create a financing plan for summer building improvements. As long-term owners, school districts can use a life-cycle cost analysis to compare HVAC system choices. Consider the significant reductions in overall costs that can be achieved by owning and operating an energy-efficient HVAC system. In many cases, the first-cost premium for more efficient equipment will be paid back through reduced operating costs in the first year or two.

Since many school districts face increasing energy costs and aging equipment, but lack the funds to make building improvements, Performance Contracting (PC) provides an innovative option for funding energy-saving improvements in buildings. In PC, the contractor is accountable for the entire package of services (design, purchase, installation, maintenance and equipment/system performance). Furthermore, no up-front money is needed from the building owner.

During the spring, facility managers should update their summertime operation and maintenance (O&M) plans and make sure personnel are informed about the tasks and procedures.

According to the International Performance Measurement and Verification Protocol (IPMVP), which almost all performance contracting firms comply with, PC provides customers with an alternative method for financing projects. A performance contractor guarantees both operating cost savings and implementation costs and these guarantees are used to secure financing of projects. The objectives of a PC project are to determine whether savings are likely to pay for capital and financing costs for a building over an acceptable time period by performing a building assessment and identifying primary saving sources.

Performance contracts guarantee energy and operating cost savings over the life of the contract and mitigate risks that impede financing such as measurement of savings, estimated cost of improvement and longevity of savings. This ensures that solutions will be manufactured and installed correctly, achieve fastest time to project completion and generate lowest life-cycle cost. Performance contracts also deliver stable, predictable energy and operating budgets over the length of the contract.

Services that can be included under the performance contract to produce long-term cost savings include:

- Continuous engagement and oversight of operations and maintenance (O&M) practices
- Energy and utility consulting services, including systems design and application services
- New high-efficiency HVAC equipment, including boilers, rooftop units, etc.
- Upgraded classroom ventilation
- Renewable energy such as Geothermal heat pumps, solar, photovoltaic
- High-efficiency lighting
- Automated control systems to optimize heating, cooling, and lighting
- Energy efficient window replacement
- Water conservation equipment and practices
- Maintenance services over the lifetime of the project
- Commissioning of new equipment and systems or retro-commissioning of existing equipment and systems to ensure systems are performing as intended

An Ounce of Prevention Equals a Pound of Savings

Now that the heating season is behind us, the time has come to focus on prevention. During the spring, facility managers should update their summertime operation and maintenance (O&M) plans and make sure personnel are informed about the tasks and procedures. Some items for the preventative maintenance schedule as we prepare for summer include:

- Replace and maintain filters regularly
- Make sure all supply and return vents are clean and not blocked
- Ensure drain pans properly drain
- Check for piping damage and inspect condensate traps
- Clean cooling and heating coils as necessary
- Inspect plumbing and conduct any repairs immediately
- Repair roof leaks and other sources of unwanted moisture
- Repair any moisture damaged ceiling tiles
- Identify the best summertime operating settings for the HVAC system according to occupancy schedules
- To conserve energy, cool only the spaces that will be in use (If your local climate permits this practice without causing humidity control problems)

Plan for Energy Efficiency in the Summer

School administrators should plan now to make building upgrades in the summer and get financing plans in place. They should also review and document last season's energy performance of building equipment and target areas for efficiency improvements.

Programmable thermostats, web-based facility management systems, lighting sensors and carbon dioxide sensors are some examples of controls that can improve the indoor environment while saving energy.

In the American Society of Civil Engineers' latest assessment of the nation's infrastructure, U.S. schools earned a D grade. This is hardly the ideal environment in which children, our most precious commodity, should learn.

Creating a comfortable, high performance environment for U.S. students and teachers can improve their performance and make education a more enjoyable and rewarding experience. Plan to take advantage of the summer slowdown to get high grades for performance when things get back in swing in the fall. ■

Maureen Lally is the market segment leader for Trane where she works to understand the needs of Trane's education and healthcare customers and provide solutions that manage and control the indoor environment, thereby improving the performance of all who work in the building. Trane is the global leader in providing energy-efficient HVAC systems and solutions to schools and has provided services to education customers for over 50 years.

Green Schools in Australia

By Andrew Tidswell

Education departments in various states in Australia are developing higher standards of required environmental performance for schools.

Background

The 1970's oil crisis sparked an interest in energy saving measures that included consideration of the design of buildings, especially the use of passive measures to maintain comfort conditions.

In Australia, there were initiatives to develop schools that were more environmentally sensitive in their design and operation. In Adelaide we built a school that had specific passive design features including earth-bermed walls, thermal (Trombe) wall heating, only natural ventilation, no heating and cooling, and use of low maintenance materials.

While such projects never became mainstream, they did have an influence on revising standards in several Australian state education authorities. Each state in Australia has its own government education system which means that changes to standards apply to all schools in the system. In addition there is a Catholic education system and many independent schools (mostly religious based) have their own standards for the design and construction of their facilities.

Australia is a large country with a wide range of climatic conditions from the tropical north to the cold south. The major cities are on or

Belair Primary School, South Australia - an Eco-school

near the coast and do not experience snow or temperatures below 0^{0}C.

Schools generally have not been air conditioned in the past, although this has varied between states and in locations which experience particularly hot or cold conditions. In recent decades there has been increased public pressure to provide air conditioning more generally, as expectations of comfort levels have increased, and the easiest solution has been to include higher levels of mechanical intervention, which has resulted in reduced levels of good passive building design.

Current Initiatives

In recent times there has been a growing awareness of global warming and resource depletion, especially the decline in conventional energy sources, leading to a renewed interest in 'green buildings;' given that the construction and operation of buildings contributes to some 40% of total energy consumption in developed countries.

Buildings we are developing now will still be in use for fifty or more years and decisions we are making about their design, materials, energy and water consumption requirements will set a pattern for their life. We owe it to future generations of owners and occupants to provide them with the most sustainable facilities we can possibly produce now.

Education departments in various states have been steadily developing higher standards of required environmental performance for schools and encouraging designs that demonstrate industry best practice within current budget constraints: which creates its own tensions.

Green Star rating tools

The most significant impetus to the provision of 'green schools' has been the development of the Green Star – Education rating tool by the Green Building Council of Australia (GBCA). This is the latest in a suite of rating tools developed by the GBCA to guide the development of green buildings. These tools have become industry standards and are widely accepted in the market, particularly for office buildings where most new commercial office buildings in Australia are aiming for (and achieving) a 5-star rating and some even a 6-star rating.

The Green Star – Education tool has been on trial as a pilot for the last six months and is now being fine tuned as a result of feedback from test projects across the country that have used it for the design of new education facilities. The final version of the tool is expected to be released for commercial use in the next few months.

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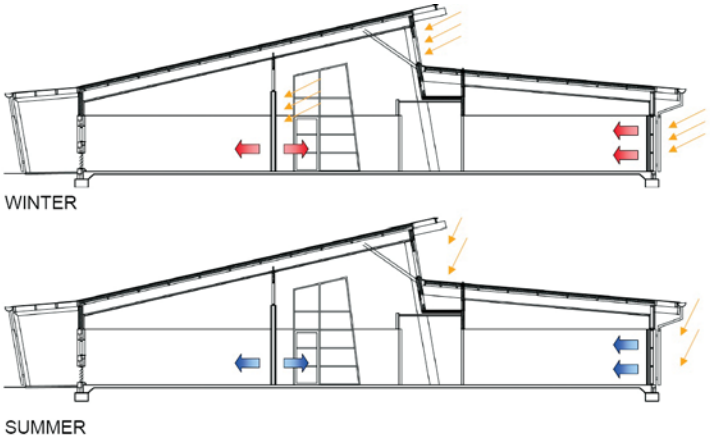

Harmony Primary School, Western Australia – cross sections

The tool can be used for primary and secondary schools, universities and other tertiary institutions, and covers the same range of categories as other building types, namely: Management, Indoor Environment Quality, Energy, Transport, Water, Materials, Land Use & Ecology and Emissions.

Buildings can be rated:
4-star *which is* Best Practice
5-star *which is* Australian Excellence
6-star *which is* World Leadership

Education authorities that see benefit in using the tool are generally aiming to achieve a minimum 5-star rating.

Unique nature of education facilities

While all good environmentally designed buildings have common benefits of reducing energy consumption (and thus greenhouse gas emissions), water consumption, resource use, and waste production as well as providing improved indoor environment quality; there are some further benefits that derive from the unique nature of education facilities including:

- improved learning outcomes for students,
- the ability to use physical facilities' as learning tools for good environmental education, and
- transferring student learning into the wider community and effecting cultural change towards a more sustainable future for all of society.

Education departments and providers in the various states are starting to develop particular projects and programs that see environmental education as being more integrated into the curriculum and that can utilise the physical facilities that exist on the site or in the school neighbourhood. Much of this impetus is coming from individual schools finding creative ways to use their physical surroundings as resources.

We owe it to future generations of owners and occupants to provide them with the most sustainable facilities we can possibly produce now.

Green School Initiatives in Australia

Some current initiatives being undertaken include:

- The Australian Sustainable Schools Initiative (AUSSI) is a

Mawson Lakes School, South Australia – award winning green school

national program from the Federal Department of the Environment, Water and Heritage which provides resources to encourage schools to integrate education for sustainability into their learning and management practices to achieve an ethos and culture of sustainability which permeates the whole community.

- In Western Australia, the Department of Education and Training has tested a number of projects in the Green Star – Education pilot study and has been working with the Sustainable Energy Development Office to develop a program to ensure that sustainable building design is linked with education programs. New schools will be required to incorporate sustainable education and community partnerships as core elements of the school's ethos.

- In Victoria, the Department of Education & Early Childhood Development is developing guidelines which set out to establish a common language and methodology to incorporate Ecologically Sustainable Development (ESD) into the design of all new schools, creating an interface with the Green Star – Education tool. They are also undertaking research to evaluate recent environmentally sensitive designs and to engage students, teachers and architects in managing space both pedagogically and environmentally and evaluating these results.

- In South Australia, the Department of Education and Children's Services has developed design guidelines that are compatible with the Green Star – Education tool but can be applied to all projects including those of a small scale and also redevelopments that would not normally use the rating tool. These also cover auditing of energy, water and resource use and waste production; their management and facility 'tune-ups' to reduce their environmental impact.

- Universities are autonomous institutions around Australia and continue to undertake significant building projects, many of which have pushed the envelope in terms of green building design. In particular the Charles Sturt University at Thurgoona has developed a whole campus of unique and overt sustainably designed facilities, long before rating tools were developed.

Challenges

We are still developing a deeper understanding of how to systemically incorporate environmental sustainability into all we do in terms of building design, learning pedagogy and their interactions, both for new buildings, but more importantly how we redevelop the vast stock of existing education buildings. We have made some important progress and the green schools agenda is now firmly on the table for all new projects in various ways in each state of Australia. ■

Andrew Tidswell is currently President of the South Australian Chapter, CEFPI Australasia Region. He has spent over 35 years designing schools, writing facility briefs and developing design policies, standards and guidelines for South Australian Government schools.

Harmony Primary School, Western Australia – new green school

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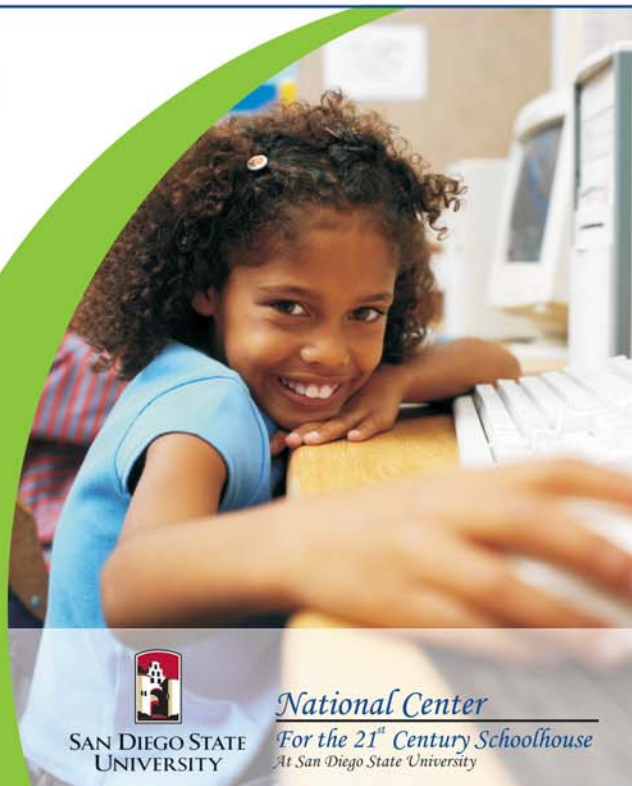

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