

## Smart Schools Mean Healthy Students

California's Collaborative for High Performance Schools project (CHPS), implemented in 2002, is just one of the many energy conservative and design conscious programs making its way through our nation's schools.

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"This is a unique period in California history. The state, already educating 1 out of every 8 students in America, has seen historical enrollment rates four times higher than national averages. Hundreds of schools a year are being built to house over 125,000 new students moving into the system and to expand capacity for class-size reduction programs. The current infrastructure is aging and over 30% of existing facilities need a major renovation. At the same time, California schools are spending nearly \$750 million on energy, more than the combined cost of supplies and books, in a time of rising concern over energy supplies and tight school budgets.

These figures illustrate an enormous opportunity for our state's school districts to build the next generation of schools: facilities that improve the learning environment while saving energy, resources, and money.

High performance schools achieve these goals by using a whole building, integrated design strategy that incorporates the best of today's ideas and technologies. From the beginning of the design process, each of the building elements (windows, walls, building materials, air-conditioning, landscaping, etc.) is considered part of an integrated system of interacting components. Choices in one area often affect other building systems; integrated design leverages these interactions to maximize the overall building performance.

The Collaborative for High Performance Schools (CHPS, often referred to as "chips") aims to increase the energy efficiency of public schools in California by marketing information, service, and incentive programs directly at school districts and designers. The Collaborative's 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.

The Board Members in the collaborative came together to fill a void in the public school market: to create a cohesive set of programs and information that districts and designers could use and reference to promote the construction and modernization of high performance school facilities.

The result of this approach is facilities that address the major issues facing schools today, including student and teacher health, student performance, and tight operating budgets.

**Student and Teacher Health.** One-fifth of California's population spends their day inside a school facility. Published and anecdotal reports are exposing the poor indoor air quality in some of the state's school facilities, and the potentially serious effects it can have on student health and absenteeism. Poor indoor air quality can trigger asthma attacks, spread disease, expose occupants to toxic substances, and cause drowsiness, headaches and dizziness. High performance schools mitigate poor indoor air quality by using materials that do not off-gas hazardous chemicals, including properly designed ventilation and air conditioning systems, and focusing on preventative maintenance.

**Student Performance.** Numerous studies have confirmed the relationship between a school's physical conditions - including its indoor air and lighting quality - and improved attendance and test scores. High performance schools apply this knowledge by providing:

- Natural Daylight. Naturally lit rooms have been proven to boost student productivity and improve visual acuity. A study called 'Daylighting in Schools' sponsored by Pacific Gas & Electric examined student performance data from three elementary school districts - one each in California, Washington and Colorado. The three districts have different curricula and teaching styles, different school building designs and very different climates. In spite of these differences, the results of the studies showed consistently positive and highly significant effects on student performance from daylight.
- Superior indoor air quality.
- Visual Comfort.
- Better designed lighting systems put the correct amount of light where it is needed.
- Thermal Comfort. Well designed ventilation and cooling systems create environments that are not too hot, cold or humid.
- Acoustic Comfort. Noisy air conditioners are eliminated so that students and teachers can hear each other.

**Impact on operating costs.** High performance design saves money on both sides of the ledger by reducing operating costs and increasing school funding. School districts can save 30 to 40 percent on annual utility costs for new schools and 20 to 30 percent on renovated schools by applying high performance design and sustainability concepts. The potential for savings is greater in new schools because it is possible to "design out" inefficiencies from the outset. For example, the US Department of Energy's Rebuild America K-12 Schools Program estimates that school energy costs are approximately \$100 per student year, depending on region and climate conditions. Adding in the costs of water, wastewater processing and trash raises the cost to approximately \$125 per student per year. High performance, sustainable design solutions can yield savings of up to \$50 per student per year. In addition, high performance schools are healthy, and can bring more money into the school by lowering student absenteeism. With current revenue limit rates of \$4,300 to \$5,200 per student directly dependent on Average Daily Attendance (ADA), even small increases in attendance can significantly affect funding.

**Impact on the environment.** High performance school buildings improve the indoor environment by providing cleaner air, better acoustics and natural light. They also improve the global environment by reducing greenhouse gas emissions. By using renewable energy in schools - such as solar power and daylighting - and by reducing energy consumption through efficient design, school districts can reduce the use of fossil fuel sources to heat, cool and light school buildings.

### **Where Do You Start?**

The knowledge and technical resources to build high performance schools already exist. Your district can build sustainable schools just by demanding them. You will need to plan early, know what to ask for, and verify that the design firms you hire have the required knowledge and skills.

Organized this year, CHPS helps facilitate and inspire this change. The goals of CHPS are to:

- Increase the performance of California students with better-designed and healthier facilities.
- Raise the level of awareness in California districts to the impact and advantages of high performance school design.
- Provide the design professional better tools to facilitate effective design.
- Increase the energy and resource efficiency of California schools.
- Reduce peak electric loads.

Each Board Member has existing programs to promote high performance buildings, but some are not tailored specifically for schools and apply to all building types. Additionally, some of the programs overlap, complement, or duplicate the offerings of other Board Members. The goal of CHPS is to provide better coordination between existing programs; to identify gaps between existing programs that may motivate the development and implementation of new programs; and to improve the flow of information about programs, tools, and documents to the target audience of architects, engineers, school district officials, politicians, and anyone else interested in creating high performance schools.

### **What is a 'High Performance School?'**

'High Performance School' refers to the physical facility. Good teachers and motivated students can overcome inadequate facilities and perform at a high level almost anywhere, but a well-designed facility can truly enhance performance and make education a more enjoyable and rewarding experience. The following features define a high performance school.

A high performance school is **healthy**. High indoor environmental quality is essential. The significant amount of time that students and teachers spend inside schools during the course of their educational career, combined with children's increased susceptibility to indoor pollutants underlines the importance of healthy schools.

A high performance school is **thermally, visually, and acoustically comfortable**. Comfort includes thermal comfort, visual comfort and acoustic comfort. Thermal comfort means that teachers, students and administrators should neither be hot or cold as they teach and learn. Visual comfort means that quality lighting makes visual tasks, such as reading and following classroom presentations, easier. The lighting for each room is 'designed,' not simply specified. Daylight and electric light are integrated, and glare is eliminated. Visual comfort also means providing a connection to the out-of-doors and visual stimulation through the use of eye level windows. Acoustic comfort means teachers and students can hear one another. Loud ventilation systems are eliminated, and the schools minimizes outdoor and indoor noise from reaching the classroom.

A high performance school is **energy efficient**. Energy efficient schools save money while conserving non-renewable energy resources and reducing atmospheric emissions. A high performance heating/ventilating/air conditioning (HVAC) system uses high efficiency equipment; is "right sized" for the estimated demands of the facility; and includes controls that boost system performance. The school's lighting system: uses high efficiency lamps and ballasts; optimizes the number of light fixtures in each room; incorporates controls that ensure peak system performance; and successfully integrates electric lighting and daylighting strategies. The walls, floors, roofs and windows of the school are as energy efficient as cost effectively possible. The building shell integrates and optimizes: insulation levels, glazing, shading, thermal mass, air leakage and light-colored exterior surfaces.

A high performance school is **material efficient**. To the maximum extent possible the school incorporates materials and products that are durable, non-toxic, derived from sustainable yield processes, high in recycled content and easily recycled themselves.

A high performance school is **water efficient**. Water scarcity is a major problem in much of California. High performance schools are designed to use water efficiently, saving money while reducing the depletion of aquifers and river systems. The school uses as little off-site water as possible to meet its needs, controls and reduces water run-off from its site, consumes fresh water as efficiently as possible, and recovers and reuses graywater to the extent feasible.

A high performance school is **easy to maintain and operate**. Building systems are simple and easy to use. Teachers have control over the temperature and lighting in their classrooms, and are trained how to most effectively use them.

A high performance school is **commissioned**. The school operates the way it was designed to and meets the needs of the owner. This is made possible by implementing a formal commissioning process - a form of 'systems check' for the facility. The process tests, verifies and fine tunes the performance of key building systems so that they perform at the highest levels of efficiency.

A high performance school has an **environmentally responsive site**. To the extent possible, the school's site: conserves existing natural areas and restores damaged ones; minimizes stormwater runoff and controls erosion; and enhances the school building's high performance features.

A high performance school is **a building that teaches**. By incorporating important concepts such as energy, water, and material efficiency, schools can become tools to illustrate a wide spectrum of scientific, mathematic, and social issues. Mechanical and lighting equipment and controls can be used to illustrate lessons on energy use and conservation, and daylighting systems can help students understand the daily and yearly movements of the sun.

A high performance school is **safe and secure**. Students and teachers feel safe anywhere in the building or on the grounds. A secure environment is created primarily by design: opportunities for natural surveillance are optimized; a sense of territoriality is reinforced; and access is controlled. Security technology is used to enhance, rather than substitute for, the design features. High performance does not compromise safety.

A high performance school is a **community resource**. The most successful schools have a high level of parent and community involvement. This involvement can be enhanced if schools are designed to be used for neighborhood meetings and other community functions.

A high performance school is **stimulating architecture**. High performance schools should invoke a sense of pride and be considered a genuine asset for the community.

A high performance school is **adaptable to changing needs**. High performance schools need to be able to embrace new technologies and respond to demographic and social changes.

Creating a school with these characteristics is not difficult, but it does require 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. At the end of the process the entire facility will be optimized in terms of long term performance. The result will be a finished school that is an enduring asset to its community; one that enhances teaching and learning, reduces operating costs, and protects the environment."

To learn more about the High Performance Schools project, please visit the CHPS website at [www.chps.net](http://www.chps.net) or the Ohio Department of Development website at [www.odod.state.oh.us/cdd/oe/e\\_l\\_doe\\_energysmart\\_schools.htm](http://www.odod.state.oh.us/cdd/oe/e_l_doe_energysmart_schools.htm).