chapter 1

AN INTRODUCTION TO SUSTAINABLE SCHOOLS

Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

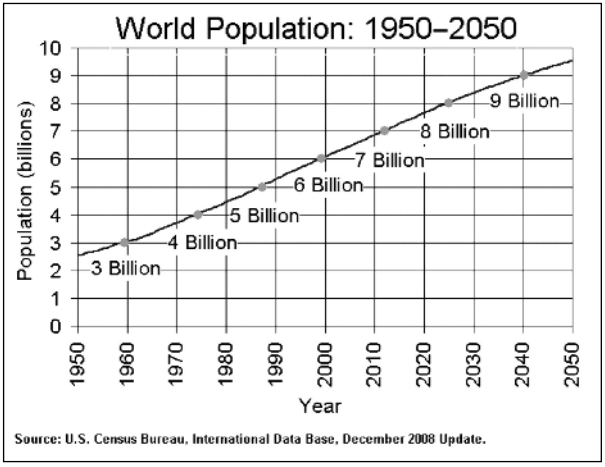
—1987 UN Brundtland Commission Report

INTRODUCTION

SUSTAINABILITY IS ABOUT TIME, the invisible dimension. Although the only sure thing about the future is that it will come, concern for the future is at the basis of concern for sustainability. The world could be in very big trouble right now—facing inundation of coastlines housing tens of millions of people, a die-off of species as large as the mass extinction that made way for mammals. Or maybe not.

But data unarguably show that humanity's activities as builders and farmers and producers and consumers have changed the world, and are changing the world at this moment. Climates are changing. Glaciers are melting. The oceans uptake one-third of the carbon dioxide produced by human activities. Their waters have become measurably more acidic. Due to the relatively small change in ocean chemistry so far, shelled creatures already produce thinner shells. The impact of their demise on the food chain is too complex to predict.

At the time of the Brundtland Commission report, world population was about 5 billion. Almost 25 years later, it is almost 7 billion. If all 7 billion live the lifestyle of Americans, the increased impact of human activities would be exponential. With 5% of the world's population, the United States already produces 25% of the world's greenhouse gas emissions.



The 2008 U.S. government world population projection shows a population of 7 billion by 2011. *Source: U.S. Census Bureau*

It is about time for sustainability. In the Brundtland Commission definition, the first requirement is meeting the needs of the present. The needs of nations to feed, house, educate, and support fulfilling lives for their growing populations are needs of the present. How can this happen without compromising the future? *Developed, technological nations must reduce, not just hold steady, their impacts on the biosphere.* While it is important to prevent irreversible harm to remaining wild and biologically rich areas such as tropical rain forests, sustainability must start in the over-consuming homes, cities, farms, and forests of temperate zone nations. This book examines how and why schools can lead the way toward sustainability in general.

NEED FOR SUSTAINABLE BUILDINGS

Constructing and operating buildings generate tremendous environmental impacts. In the United States alone, buildings account for:

- 72% of electricity consumption
- 39% of energy use
- 38% of all carbon dioxide (CO2) emissions
- 40% of raw materials use
- 30% of waste output (136 million tons annually)
- 14% of potable water consumption[1]

It is possible to reduce the impacts of buildings drastically with technology, materials, and methods available without any further research. One challenge is that this large reward can be gained only on an incremental, home-by-home, office-by-office basis. Unlike reining in big point source air and water polluters such as factories or power plants, any approach to reducing the impact from the building sector as a whole must include each individual building.

Leaking windows, lack of insulation, and obsolete systems make this building an energy hog. *Source: Gelfand Partners Architects*

New buildings comprise only a small percentage of the building stock in any given year. To substantially reduce the impact of the building sector as a whole, the efficiency of existing buildings needs to be improved. The $5 billion weatherization program adopted as part of the 2009 U.S. stimulus package is an example of the kind of program that can improve energy efficiency on a broad scale by operating at an individual building scale. New buildings with beautiful solar panels may be the face of sustainability in 2010, but the lowly caulk gun is likely to produce more gains in real energy use reduction.

BENEFITS OF SUSTAINABLE SCHOOLS

A compelling moral and educational case exists for demonstrating environmental stewardship in schools where children first learn what it is to be in the world in the society of other people. And as in any other project breaking ground today there is reason to fear that time has run out simply to do less harm. Even doing no harm is not enough. And if neither fear nor virtue motivates, there is also the business case that shows that energy efficiency and healthy environments rapidly pay back their investors.

School construction is a large market on its own, comprising approximately 5% of all construction in the United States in 2007. Sustainable practices in schools would have a measurable impact on energy and resource consumption for society as a whole.

But the benefits of sustainability are not all, or even primarily, to the outside world. A brief look at the advantages to the core mission of the school supports the value of sustainability in design, construction, and operation. Sustainable schools are better environments for learning.

Higher Student Test Scores

An analysis of over 21,000 students in Colorado, California, and Washington by the Heschong Mahone Group showed that the controlled admission of natural light through skylights and windows, "daylighting," in classrooms was strongly associated with higher student performance in reading and standardized testing. Students in the California classrooms with the best daylighting progressed 19% to 20% faster than students in the classrooms with the least.[3] Students in Colorado and Washington similarly showed 7% to 18% higher test scores at the end of the year in daylit classrooms than students in classrooms with the least daylighting.

Studies of classroom acoustics have also supported the connection between better student hearing and better student learning. Global Green, in "Healthier, Wealthier, Wiser: A National Report on Green Schools," cited a study showing students in quiet third-grade classrooms to be 0.4 years ahead of their peers in noisy classrooms in reading, and 0.2 years ahead in math.[4]

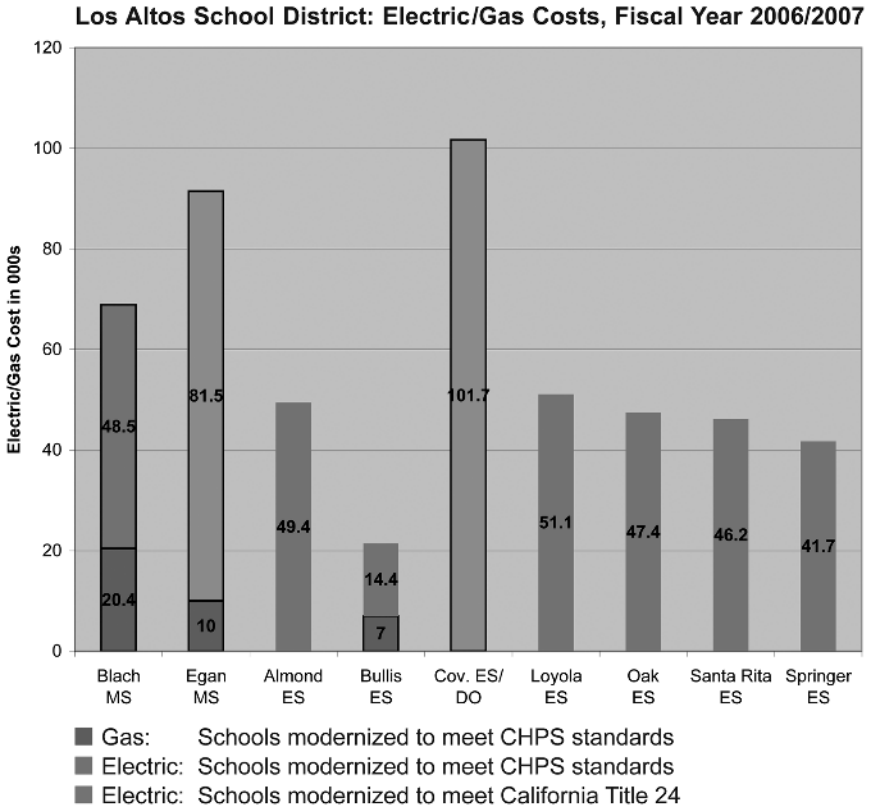
Lower Operating Costs

Energy costs schools money. It comes out of their general fund and thus directly competes with the costs

School and education construction is a major economic activity.
Education construction: The past 10 years

($ Billions)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
School Districts	$17.095	$16.039	$21.567	$26.777	$24.343	$28.638	$29.088	$22.962	$25.325	$20.283
Colleges	$7.330	$13.964	$14.703	$14.732	$16.205	$19.469	$12.186	$14.561	$11.306	$12.656
All Education	$24.425	$30.003	$36.270	$41.509	$40.548	$48.107	$41.274	$37.523	$36.631	$32.939
New Construction	$12.097	$14.431	$19.139	$20.112	$22.505	$31.596	$20.656	$21.220	$19.031	$21.942
Adds/Mods	$12.328	$15.572	$17.131	$21.397	$18.043	$16.511	$20.618	$16.303	$17.600	$10.997

Source: Courtesy *American School & University magazine*[2]



Elementary school energy savings of high-performance schools averaged $50,000 per year, while middle school savings were $23,000 per year. *Los Altos School District*

related to instruction. Saving money on heat and electricity means having more money for student supplies, teachers, and books. In the United States, school energy spending amounts to $8 billion a year, or 2% to 4% of school budgets, more than schools spend on textbooks. Improved operations and maintenance practices could save up to 20% of that in existing facilities, with major additional savings also available in design of new construction and modernization.

In addition to energy, other operating costs include water and landscape maintenance as well as maintenance of equipment and materials. Sustainable strategies lower water use with appropriate plant selection and high-efficiency irrigation; reduce the need for fertilizers and pesticides by appropriate plant selection and uses of on-site compost; and match equipment with its engineering requirements to improve efficiency.

Many of the aspects green schools address also address risks that cost schools money to insure. Benefits in worker health and safety and reduction of mold issues through appropriate waterproofing and ventilation are particularly direct and should be brought to the attention of insurers.

Increased Student Attendance

A healthier environment is reflected in fewer sick days on the part of both employees and students. The emphasis on better indoor air quality in sustainable design is a direct approach to reducing asthma and other respiratory problems in schools. Displacement

ventilation, one of the potential heating, ventilating, and air-conditioning (HVAC) strategies in sustainable schools, is directly linked to reduction of absentee rates. In Howell Township, New Jersey, absentee rates declined 60% after displacement ventilation was installed.[5] Even more limited improvements in indoor air yield measurable results; for example, changes in operations methods at Charles Young Elementary School in Washington, D.C., increased average daily attendance from 89% to 93%.[6]

Enhanced Teacher Performance and Satisfaction

Teacher retention affects both quality and operating costs of education. Gregory Kats, currently managing director of a green investment company, served as the Director of Financing for Energy Efficiency and Renewable Energy at the U.S. Department of Energy (1996-2001). In Kats' cost-benefit analysis of green design, the benefits of teacher retention alone exceed the cost of greening.

Financial Benefits of Green Schools ($/ft^2)	
Energy	$9
Emissions	$1
Water and Wastewater	$1
Increased Earnings	$49
Asthma Reduction	$3
Cold and Flu Reduction	$5
Teacher Retention	$4
Employment Impact	$2
Total	**$74**
Cost of Greening	**($3)**
Net Financial Benefits	**$71**

Green schools give positive financial returns. *Source: Courtesy Gregory Kats, Capital E*[7]

Improvements can be made in schools of all ages. *Source: Claire Takacs, © 2009*

Increased Building Life

Beyond new construction, the real challenge in changing the impact of the building sector is in making existing buildings more sustainable. Extending the service life of existing buildings contributes to sustainability, as does construction of new buildings with a goal of permanence. In addition to the choice of durable materials, systems, and assemblies, the commissioning, operations, and maintenance of sustainable buildings keep systems running efficiently. Monitoring of building system performance creates the opportunity to catch problems in filters, balancing, or controls that can shorten system life. Preventive maintenance is built into the sustainable school, along with design and monitoring features that make efficient maintenance easier to accomplish.

Lower Environmental Impact

Schools are a large sector of the building market, which itself is a large contributor to the impacts people have on the planet. But it is salutary to note the direct reduction of impact the operation of each individual green school could accomplish. According to the Kats report,[7] each year one green school could save:

- 1,200 pounds of nitrogen oxides—a principal component of smog
- 1,300 pounds of sulfur dioxide—a principal cause of acid rain
- 585,000 pounds of carbon dioxide—the principal greenhouse gas and the principal product of combustion
- 150 pounds of coarse particulate matter—a principal cause of respiratory illness and an important contributor to smog

In addition, substantial water and wastewater benefits would vary by school and locality. Because of the large physical footprint of school campuses, these benefits could be significant, along with reductions in fertilizer and pesticide use.

Changing Attitudes

Schools have an influence on their community that extends beyond the education that occurs inside the four walls of the classroom. A sustainable school will work with its community to reduce driving, change eating habits, and demonstrate energy saving behavior. These influences can be very strong. Many solar panel installers give good prices for panels they put on a school because they know that seeing the panels will bring business from parents. As students grow up in a sustainably run organization, they will carry those habits and expectations into the workplace and into their own homes as adults.

Changing the mind-set of people who have grown up with a habit of waste, the advantages of the new, and an assumption of unlimited abundance is hard work. But sustainable schools can take part in readjusting these expectations and in resetting the base expectations of the next generation so that its members are much more cognizant of their impact on the world.

Teachers in California have done wonderful work with our children in the elementary grades, instilling in them a deep respect for the environment. By the time the kids reach us, they have really bought into the conservation ethic, intellectually and emotionally. The junior high years for many students mark the start of a phase of intense questioning of parental and societal values. Children at this age develop an exquisite sensitivity to any suggestion of hypocrisy or inauthenticity on the part of their elders. The inclusion of serious energy-conserving technologies at Blach makes a powerful statement to our youth that our commitment to environmentalism comes not only from our hearts, but also from our wallets.

—Arthur Harris, Principal, Georgina Blach Intermediate School[8]

Bacich School in Kentfield, California, generates 100% of its electricity from roof-mounted photovoltaic panels.[9] *Source: Reproduced courtesy Mill Valley Herald*[10]

ELEMENTS OF SUSTAINABLE SCHOOLS

Community-Based Planning

Schools are entrusted with the care of the children of a community. It is an enormous responsibility. The school has a special status in the community. It forms the basis of the social life of the children, friendships that teach children how to have friendships, and often extends a web of connectivity into the whole family. Schools cannot be successful without the support of the families, friends, and neighbors who make up the school community.

The decision to create a sustainable school, whether by modernization or by new construction, is one that helps define the school community. The planning and design process for the school defines both the holistic approach and the sustainable features that are incorporated in it. Those choices reflect the values and priorities of the school community. Community participation in the process, at the site level and at the governing level of school boards or boards of trustees, is vital in engaging the passion, imagination, and commitment of the school community.

Just as the students will one day graduate with an understanding of sustainability nurtured by their experience in the school, the members of the community who are involved in building a sustainable school "graduate" from that process with knowledge and skills that they carry to their own homes and businesses. Involvement in design workshops, working groups, community outreach, or the legacy of sustainable operations offers scope for a range of individual commitments. A school is an ideal place to plant an idea that is meant to propagate throughout a community.

Community-based planning is the first step in creating the sustainable school. Through the policies and priorities that are developed, a program can be defined for the school. Especially when looking at the breadth

Workshop-style events involving the design team, community members, and even children can be fertile occasions for sustainable ideas. *Source: Sharon Danks*

and multivalent interpretations of sustainability, it is vital for the community to define its priorities for itself. Whether it is preservation of habitat, energy efficiency, or indoor air quality, the top concerns of the community need to be identified.

LEED and CHPS

For many organizations, achieving a certain level of performance as measured by a scorecard system such as LEED (Leadership in Energy and Environmental Design) or CHPS (Collaborative for High Performance Schools) satisfies their need to define sustainability. Cities, states, and school and university systems target a level, such as LEED Silver. The checklist systems include various categories of green design and define targets, documentation, and verification. In 2009, the U.S. Green Building Council (USGBC) finalized a specific LEED for Schools product that acknowledges the important ways in which schools differ from other building types.

LEED for Schools is a modification of the well-known LEED system, now such a standard in green design that product manufacturers include in their marketing literature how many LEED points their product can help achieve. Companies making products such as steel lockers that may always have been high-recycled-content steel are now putting that information on the front page of their brochures.

By their nature, scorecards reward features, or narrowly defined performance parameters. CHPS, originating in California, has created another sustainability checklist, along with an array of excellent best practice manuals and resources for planning sustainable schools.

Initially created by a committee with funding from California utilities, CHPS gave high importance to energy efficiency but also took an education-based look at other categories, based in part on the LEED system. The successful refinement of its criteria in California led to their adoption as an acceptable standard of sustainability for federal high-performance school funding. Other CHPS programs have included further regional refinements in nine states and various cities, including New York.

LEED and CHPS scorecards are the main vehicles for tracking sustainability goals. *Note: LEED and related logo is a trademark owned by the U.S. Green Building Council and is used by permission. CHPS is a registered trademark of the Collaborative for High Performance Schools.*

The International Code Council is developing a green building standard to be consistent with international building codes. The building code in California includes a voluntary green section. It is subject to review but if adopted in full in 2010 would require building performance roughly equal to LEED Silver. Already the building code in California requires energy and water conservation that meets LEED prerequisites.

Working through the categories of the CHPS or LEED checklist can help define the goals a school should meet, focusing on site, energy, materials, indoor air quality, water, construction, operations, and innovation. Most goals can be met at various levels. That way a design team can match goals to the situation.

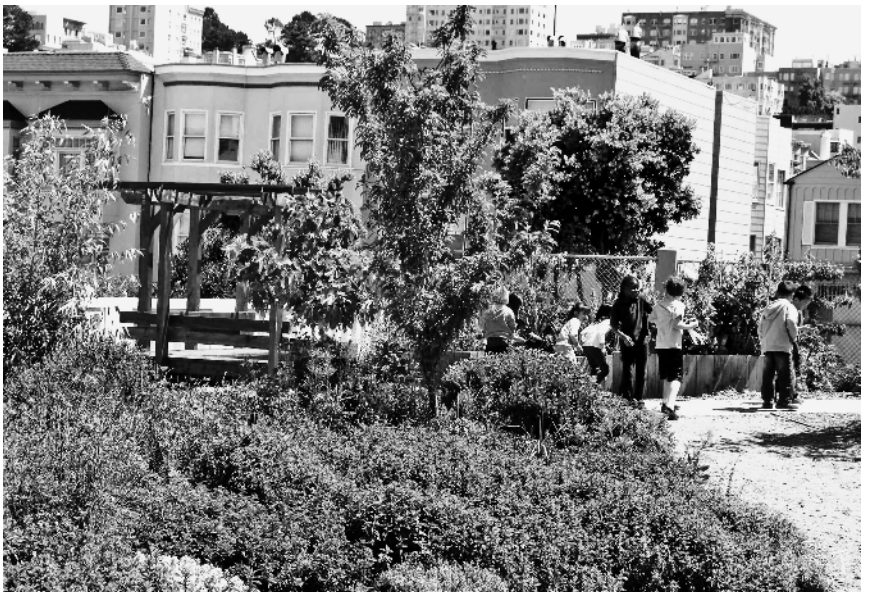
Integrated Design

Integrated design is the most essential strategy in the sustainable design approach. But if it was hard to agree on a checklist, and indeed it was hard enough that USGBC in 2009 has nine separate LEED checklists, it is almost impossible to define a single holistic measure of building sustainability. And without measuring it, how can one know what has been achieved?

One solution is to separate the design process and approach, which must be synergistic, from the measurements of performance, which can be as simple as reading the utility bill before and after. Program goals, sustainability approaches, site and community needs and opportunities, and the resources available for the project all converge in the solution. A single decision, such as raising a part of the roof for a new clerestory, can be part of structural needs (new plywood, new framing), daylighting improvements, ventilation improvements, and a new appearance. Such an integrated solution cannot be separated easily into different budget items—the sustainable improvement does not increase the cost of the structural and appearance change. Using this kind of approach can mean that sustainable design is achieved at limited or no additional cost.

New light monitors added during a modernization at Almond School emphasize doors, bring in daylight, ventilate, and introduce better scale and rhythm along the building face. *Source: Gelfand Partners Architects*

Before modernization, Almond School classrooms needed seismic upgrading, reinforcement of daylighting, and better use of outdoor space. *Source: Gelfand Partners Architects*



Naturalistic plantings enrich the playground at Sherman School. *Source: Miller Company Landscape Architects. Photo Jeffrey Miller*

The Sustainable Building Industry Council, with a history of working with the federal government, created a useful resource in developing integrated design strategies. The *Whole Building Design Guide* offers a wealth of online information to help teams think through integrated design approaches.[11] It helps to demystify the need for design strategies to do several things at once.

School as Campus

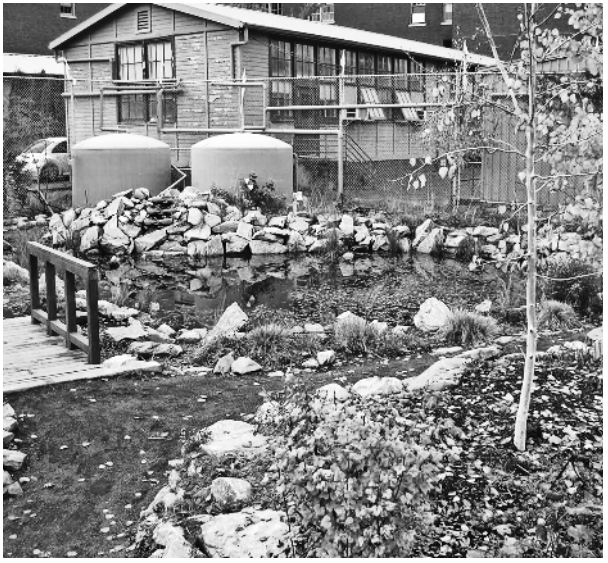
Schools differ from other building types in the frequency with which they are not just buildings but campuses composed of multiple buildings and a variety of site uses. This large footprint increases the need to look at the site impacts in terms of water and habitat as well as transportation impacts. The sustainable school can attempt to have a low impact, but it can also go further, using its open space to extend or connect areas of surrounding native habitat.

Building design on campuses takes into account the orientation to the sun and wind, not just of the individual building but of the spaces between the buildings. Buildings and planting can shade each other; planting can moderate building exposures to the setting sun or deciduous tree planting can shade classrooms in the summer but allow heat gain in the winter. Buildings can be used to screen outdoor areas from direct wind or unwanted sun or can be sited to avoid shading areas where full sun is desired. By integrating buildings with each other and the site design, a varied campus can still honor the differences between easily controlled north and south sun and more difficult east and west exposures.

Environmental Curriculum

The whole campus also contributes to supporting an environmental curriculum. Depending on the grade level, environmental learning can range from small children touching the leaves of lambs' ears and learning about the various textures in the natural world, to experimental farms at the primary and secondary level, to learning about ecological connections and

◀Children assist in planting and caring for their garden. *Source: Miller Company Landscape Architects. Photo Jeffrey Miller*



▼The rain garden at DaVinci Arts Middle School helps kids see how water moves through its cycle.[12] *Source: Portland Public Schools, 2004*

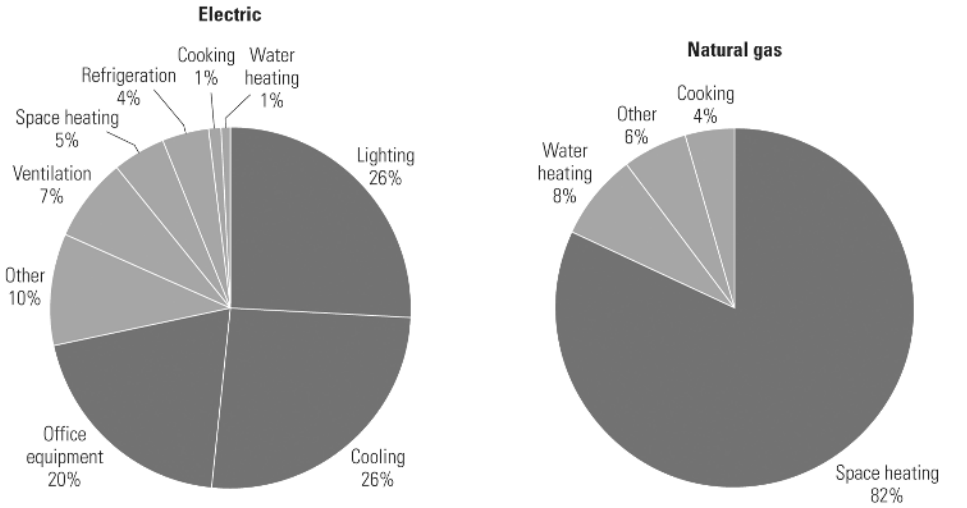
consequences in natural systems. The relationship of buildings to grounds is also a wordless lesson in the relation of our works to the works of nature and to the potential for partnership that always exists.

Flexibility for Multiple Uses

Many schools are the largest community facilities in their area. They represent large investments of money, space, and energy. The sustainable approach is to employ those facilities for many more uses than the school, cutting down on the need to build more facilities or cause more sprawl. Involving joint-use partners can also improve the quality of the facility further than either partner could have afforded separately.

Water Efficiency

The sustainable school reduces or eliminates potable water use for irrigation and cuts use of potable water in the buildings. The huge quantities of potable water going down toilet and urinal drains can be reduced by using gray water or roof water or waterless urinals. Making visible the collection of rainwater and its ultimate use to water gardens, for example, can be part of the sustainable curriculum.



Courtesy: E SOURCE; from Commercial Building Energy Consumption Survey, 1999 data

Large energy uses are larger opportunities for savings. *Source: Used with permission, ©1999 E Source Companies LLC*

Energy Efficiency

Twenty to 30% of a building's life cycle energy use occurs during construction. Modernization of existing buildings and design of new buildings for longevity make immediate energy savings. Energy efficiency in building operations attacks the other 70% to 80%.

Energy efficiency is more than saving money on utility bills. Energy use is the factor most directly tied to greenhouse gases, climate change, and the school's carbon footprint. To cut these major impacts, school managers must first understand where the energy uses are. Lighting and cooling are more than half the average electricity consumption, with office equipment providing another major load. Air conditioning, for schools that are not in use in the summer, is an area that must be examined with an eye toward using more natural ventilation systems or more efficient strategies, such as displacement.

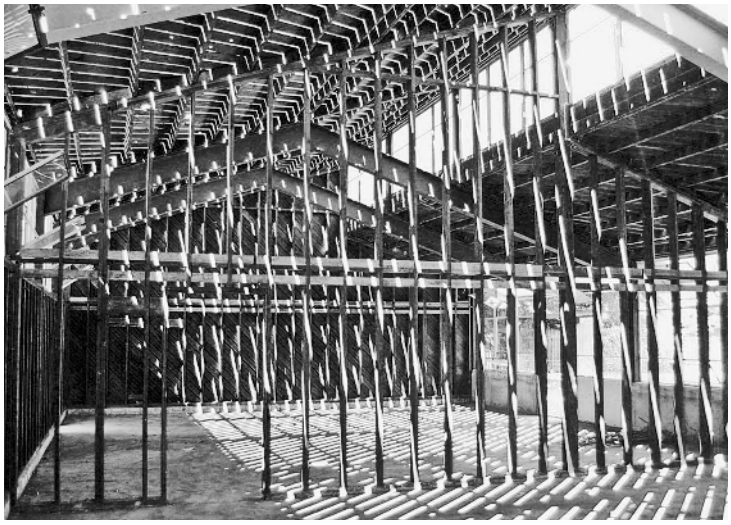
In schools without air conditioning, lighting by itself is more than half the electric load. And schools have primarily daytime use. Good daylighting coupled with a daylight compensation electric light control system can cut electric use by 40% to 60%. Further, student test scores will rise.

Office equipment, including computers, is a major draw on power even when it is not in use. Replacing office equipment such as copiers with machines that power down and turning off computers, televisions, and other electric equipment when not in use saves another large bite of the power pie.

The other major energy load is space heating. Heating systems have greatly increased in their efficiency. Many choices are available from better package units, to more exotic systems such as geo-exchange heat pumps. Making the right choice is part of the integrated building design process.

Resource Efficiency

As in energy efficiency, the first place to look for gains in resource efficiency is in existing buildings. Even if a building must be stripped to its foundation and structure, 20% of the building is still there.

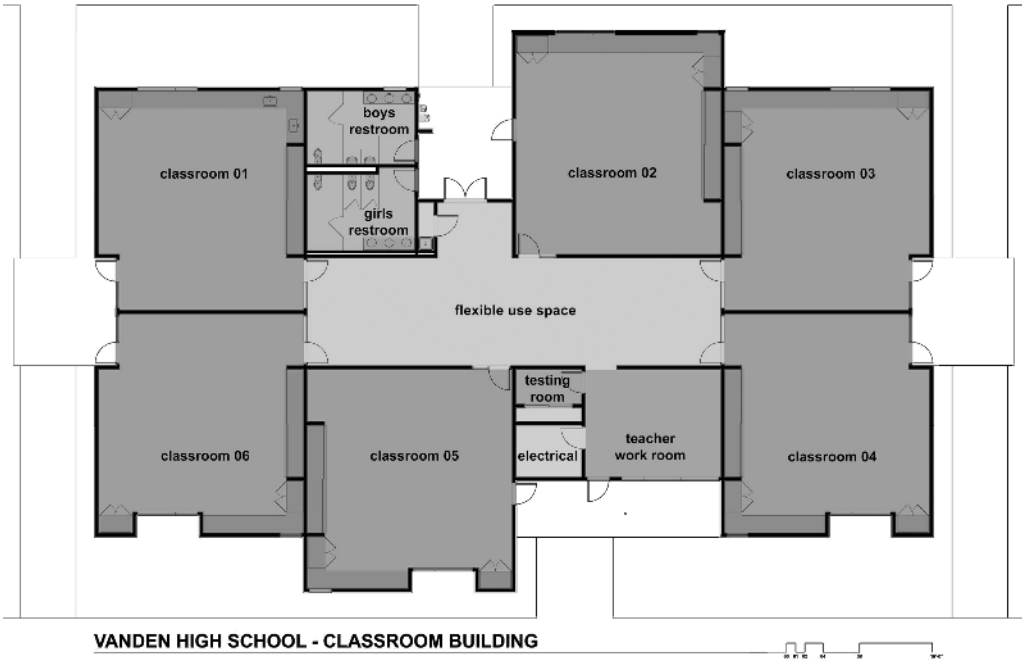


◀Foundation, structure, roof and wall sheathing, and windows remain for reuse. *Source: Gelfand Partners Architects*

▼The San Francisco Friends School is housed in an adaptive reuse of the historic original Levi Strauss factory. *Source: Gelfand Partners Architects*

Buildings that are reused do not go to landfills. In looking at existing buildings that did not start as schools, however, caution is required. Schools need wide hallways and column and wall spacings that allow larger spaces, such as classrooms. Classrooms should have access to daylighting. School entries need convenient access for students arriving in large numbers all at once. Most schools need to be adjacent or close to sport and recreation areas.

In addition to adaptive reuse, good use of the facilities also limits resource use. Small is better. Driven more by budget than sustainability, many high



The teacher workroom allows teachers who teach six periods of students' seven-period day to have prep space without tying up an entire classroom. *Source: Gelfand Partners Architects*

schools are unable to give teachers exclusive use of a classroom. If classrooms are used during the entire school day, then teachers need prep areas. Part of the sustainable school is working with the site to develop appropriate staff support spaces while encouraging full utilization of the facility in order to build less floor area.

High-recycled-content materials are part of the picture, too. As the industry adapts to changing economics and to the market created by LEED, these materials are more readily available. Contractors may choose to recycle asphalt on site, for example, or to contract with haulers that will do it off site for another project.

High-Performance Learning Spaces

The chief hallmark of the sustainable school is the quality of its classrooms and other learning spaces. Integrated design and energy efficiency contribute to sustainability and contribute to an improved learning environment. With the heavy use of power in cooling and lighting, the incentives are strong to develop good daylighting and ventilation. These strategies will contribute to high performance in learning—the core mission of the school.

Daylighting

Good daylighting admits light but not heat or glare. The sky opposite the sun—north in the northern hemisphere—is an ideal source of cool, diffuse light. When evenly spread over the walls and ceiling of a room, it provides calm, appealing light. Sun from other angles is handled with various design techniques. The electric lighting is either separately switched or automatically controlled to go off or dim when not needed. Accompanied by views, daylighting is the single most effective combination of energy saving and classroom improvement the design can accomplish.

Excellent daylighting and automated window controls make this Vanden High School classroom energy efficient as well as comfortable. *Source: Mark Luthringer*

The Blach library was built between two existing buildings and admits daylight over one of the roofs.
Source: Mark Luthringer

Improved Air Quality

> US EPA studies of human exposure to air pollutants [indoors] may be two to five times—and occasionally more than 100 times—higher than outdoor levels.
>
> —*Environmental Protection Agency*[13]

Indoor air quality is tied to the materials in the room, maintenance procedures, and ventilation. An integrated approach to specifying low volatile organic and nontoxic compounds, no added formaldehyde, and appropriate airing or flushing procedures before occupancy can turn over a building with good air quality from the beginning. Maintaining it depends on appropriate maintenance for materials such as carpet, which cannot be left wet, and in the choice and use of appropriate cleaning supplies.

But the other major influence is ventilation. New approaches such as heat or energy recovery ventilation can bring 90% to 100% outside air into the space continuously, flushing out pollutants, contaminants, and germs, without losing energy efficiency.

Indoor air quality in portable classrooms is so suspect that the California Department of Education has issued specific advisories of mitigation measures districts can adopt. *Source: Gelfand Partners Architects*

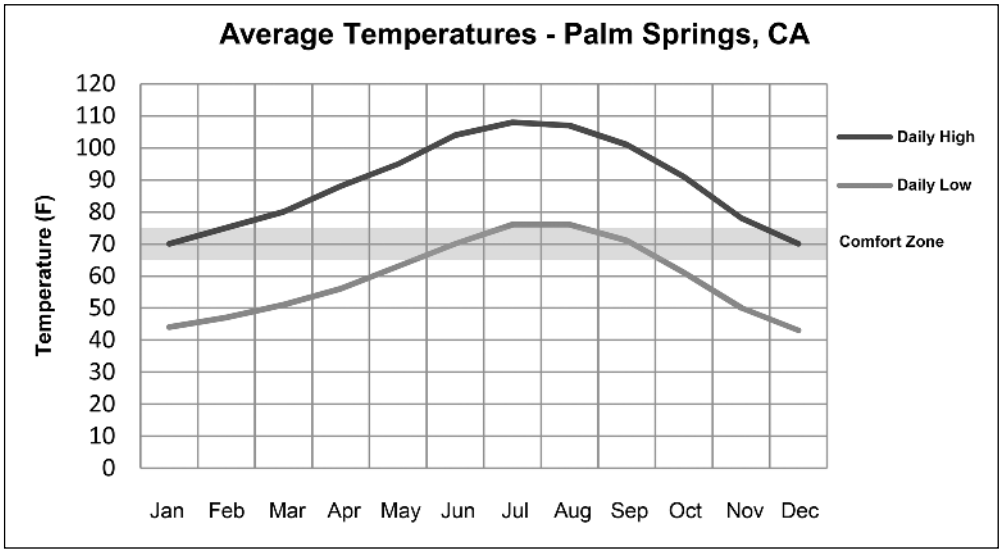
Thermal Comfort

One of the limitations of sustainability Version 1 in the 1970s was that it seemed to depend on discomfort and a lot of attention. If building inhabitants could accept discomfort, they would save a lot of energy—just expand that comfort range (with a sweater) before turning on the heat. In contrast to the unsustainable oversized mechanical systems that ran with no intervention, they could manually lower insulating blinds at night and turn on fans to blow heat down and then switch them to suck air out and then do all that again. Sustainability Version 2 right-sizes mechanical systems and depends on smart controls to maintain comfort with very little user input. The automatic system can be responsible for many more adjustments than a basic thermostat and can maintain higher levels of comfort than many conventional systems.

For many schools, though, the choice of whether to air-condition or not still may depend on tolerance for discomfort. If heating is best accomplished through a radiant system, air conditioning imposes either a different system or a redundant one. In climates where non–air-conditioned spaces with good ventilation are uncomfortable for several hours a day during 10 days in the year, is that acceptable? Even in Palm Springs, in the desert of California, many hours of every average day of the school year are at exactly the right temperature outside as inside. With a highly efficient ventilation system, the hourly need for additional cooling is greatly reduced and in some climates eliminated.

Improved Acoustics

The CHPS criteria include acoustics because of its vital role in creating a high-performance learning environment. In the terms of the Brundtland Commission sustainability definition, good acoustics is part of meeting the needs of the present. A classroom where children can hear the teacher and each other is very important.



Even in Palm Springs, California, the daily low is always below or within the comfort zone, demonstrating that round-the-clock cooling should never be necessary. *Source: Gelfand Partners Architects*

In an integrated approach to design, acoustic performance is part of the envelope, the HVAC system, the finishes in the room, and the choice of natural ventilation system. The HVAC system must be designed so that noise does not drown out the teacher or the children when it kicks on. The room must cut reverberation times, which interfere with the intelligibility of speech, by installation of sufficient absorptive surfaces, typically the ceiling and the walls if there is no carpet or just the ceiling and the carpet. And ventilation must come in through acoustic louvers or windows that open onto quiet areas. If the school is near a noisy highway or railroad, the walls and even closed windows probably will need improvement to cut environmental noise.

Commissioning

Commissioning is an integrated strategy that helps define the expected performance of building systems, measures their performance after construction, and takes an interdisciplinary approach to troubleshooting problems. CHPS and LEED both require basic commissioning and give extra points for enhanced commissioning.

Commissioning is a good idea in any building program. The initial step of assuring that the building user has chosen an expected performance (e.g., light level or temperature comfort range) is invaluable in solving postoccupancy issues. The interdisciplinary approach of commissioning coordinates sophisticated control and HVAC systems so that their interactive performance meets design goals before the various contractors leave the job. It is not good enough to have the HVAC balancing check out and the system fail. Commissioning works so well that retro-commissioning—going back to existing buildings and systems on a regular basis—is also recommended.

PUTTING IT ALL TOGETHER

Sustainability is no luxury. It is an approach whose time has come. The building sector of the economy is responsible for a large percentage of energy and resource use, dispersed across millions of projects. But the only way to reduce the impact of the sector is to design and run each project in a sustainable way.

Any system designed into a project is useful only if it is maintained and operated as intended. Schools are a unique operating environment. They are busy, chronically underfunded, and house often rambunctious children. Systems, materials, and assemblies need to be designed to work in that environment. The people responsible for running the buildings are invaluable resources in keeping the design real. When they have participated in the design, they are also better prepared to manage the buildings.

Schools that tie sustainability and education into a way of inhabiting the campus support both the running of the facility and the educational activities. As buildings and landscapes that are found in every community, schools constitute a piece of the building sector that is uniquely suited to provide leadership in sustainability.

- Schools are a major construction activity.
- Schools can model long-term changes in attitudes.
- Schools are used by entire communities.
- Sustainable design makes better schools.

NOTES

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