Photo: Innovative Design

Sustainable Schools Create better Learning Environments

The objective of this Sustainable Schools Guide is to provide you with information that will allow your school system to make informed decisions regarding energy and environmental issues that are important to your school, community, and country.

The concept of sustainable development reflects an understanding that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. A Sustainable School not only embraces the concept of sustainability but is, in itself, a teaching tool for sustainability.

"Good teachers never teach anything. What they do is create conditions under which learning takes place."

S.I. Hayakawa

By implementing the sustainable design practices included within these guidelines, you will be taking a significant step forward in creating the physical conditions in which the learning process can thrive.

Buildings That Teach Sustainability

Supporting Your Educational Mission

Historically, most schools have been designed as learning environments that primarily focused on creating functional spaces that met basic educational needs. With varying degrees of success, these schools addressed cost, function, aesthetics, and comfort. But for decades we have been missing a great opportunity -- making the schools, themselves, teaching tools -- “buildings that teach.”

With our environmental problems increasing at an alarming rate, the most effective way to demonstrate to your students what can be done to make a positive impact, is to do it yourself. By implementing green solutions into your schools, students can see first-hand how actions at a local level can make a difference.

Photo: Innovative Design

Rainwater storage tanks, roof monitors, windmill and sundial at Roy Lee Walker Elementary, McKinney, TX

The students will also know that sustainability is a value of great importance held by their parents, their school, and their community. The Sustainable Schools Guide can help change the way the next decade of schools will be built, pointing out practical ways in which our schools can become more than classrooms. The goal is to create a new type of learning experience for these students by maximizing the physical and inspirational aspects of your schools.

Insuring Success

✔ "Buildings That Teach" Should be a Priority

Many energy saving options have very good financial value. Some environmentally-sensitive products don't cost anything additional to install. There are others that are harder to rationalize financially but, from an educational standpoint, are still important to consider. Photovoltaics, for example, may still have longer return on investment but, if installed properly, they can be a very powerful educational tool. When developing your overall budget, you should establish an amount that can specifically be utilized as 3-D educational elements.

✔ Maximizing the Building as a Teaching Tool

To take full advantage of these teaching tool elements, you must involve your teachers early in the design process to better explain to the design team their current curriculum and teaching procedures and to discuss how optional sustainable features can be best incorporated to maximize the learning experience. Creative thinking by both the teachers and the designers during the schematic design and design development phases will produce exciting educational possibilities once your sustainable school is completed.

✔ Select a Qualified Design Team

The expertise required to design a school as a teaching tool on sustainability is unique. The designer has to employ energy and environmental features in a manner that is self-explanatory to the student, while still addressing typical design considerations and educational specifications. When you are qualifying firms, ask them to provide you with examples of their successes in designing green schools and implementing the concept of using the school building as a teaching tool.

I appreciate my school because of all the great features. Two of the features are the eco-pond and the sundial. We have two sundials, one is horizontal, the other vertical. My favorite feature are the rain cisterns because we are recycling the water [...]. My other favorite feature is the daylighting because we don't waste electricity.

Jessica, 4th grade, Roy Lee Walker Elementary

Walker is the most interesting school I have been to. In the eco-pond, there are many plants, all from somewhere in Texas. Also there are a windmill and rain cisterns. The windmill is not ordinary because when the blades are turning, it is pumping water to go to the hand pump. Wow, we have the coolest school!

Kelsey, 4th grade, Roy Lee Walker Elementary

Photo Courtesy: Samson Environmental Center

Samson Environmental Center
Darrow School, New Lebanon, NY

Located in a greenhouse connected to the classrooms, the Living Machine is a garden that recycles water, using tropical plants as a refuge for the microorganisms that break down nutrients and chemicals in the water.

"The system has surpassed our expectations in terms of our ability to use it in our science classes"

Lisa Riker, Director

Student's artwork,
Roy Lee Walker Elementary School, McKinney, TX

A guide to designing buildings that

Teach Sustainability

The following checklist outlines key sustainable elements that should be considered by your A&E team during the design of your school.

Photo: Innovative Design

Eco-garden, Roy Lee Walker Elementary School, McKinney, TX

Site Design

- incorporate outside teaching courtyards
- develop spaces to grow vegetables and native plants
- protect areas for viewing natural habitat
- develop interpretive nature trails through preserved wildlife habitats and ecosystems
- maximize the pedestrian pathways from residential areas to the school as educational opportunities
- consider educational benefits of retaining or planting various types of native trees and plants on the school site
- use explanatory signage for different plants and trees

Photo: Innovative Design

Four Oaks Elementary School, Four Oaks, NC

Daylighting & Windows

- make daylighting strategies obvious
- make deliberate connections to the outside environment so that changes in weather are apparent, as well as stimulating, to students
- incorporate daylighting strategies that could be enhanced through student participation and understanding
- incorporate sundials as educational tools on solar energy
- utilize prisms in focal areas to celebrate sunlight and educate students about light

Photo: Innovative Design

Floor tile compass in science classroom
Durant Road Middle School, Raleigh, NC

Energy-Efficient Building Shell

- incorporate artwork and graphics in the building which will help to educate students about sustainability
- design energy-efficient building components to make their purpose and function obvious to the students
- highlight different wall and glass treatments on each facade to emphasize the appropriateness of different design responses
- take photographs during construction to better explain the energy-efficient building systems

Photo: Southern California Edison

Monterey Hills Elementary School. Pasadena, CA

PV System at Monterey Hills Elementary School, Pasadena, CA

"I think the biggest thing is the idea that this whole building is going to have photovoltaics from one end to the other! On behalf of the students, the parents, our staff and myself, we feel honored to be a Solar School where the kids will always shine."

Joe Johnson, principal
Solar Today Jul/August 1995

Renewable Energy Systems

- consider greenhouses for growing plants
- incorporate full range of renewable energy options including passive solar, daylighting, solar hot water and space heating, solar absorption cooling, wind, and photovoltaics
- employ photovoltaic systems, wired directly to displays and equipment in science labs, helping to educate students about the concepts of solar energy and the conversion of sunlight to electricity
- use wind energy to pump well water as backup to rainwater for toilet flushing and irrigation
- integrate displays showing total energy use at the school and the percentage of energy being provided by renewable energy sources
- position renewable energy systems so that they are easily visible to the students

Photo: Mytech

Lighting sensors

Lighting and Electrical Systems

- incorporate photovoltaic lighting for parking lots, walkways, and signal and caution lights
- incorporate dimmable or staged lights to reduce artificial lighting during times of adequate daylighting
- use computers to monitor energy use and renewable system performance

Photo: Innovative Design

Heat pump and solar storage system at Roy Lee Walker Elementary School, McKinney, TX

Mechanical & Ventilation Systems

- expose parts of the mechanical systems to explain how they work

Environmentally-Sensitive Building Products and Systems

Photo: Forbo Krommenie BV

Recycled linoleum in cafeteria.

- design environmentally-sound building components and make their purpose and function obvious to the students
- install explanatory signage that helps educate students about environmental benefits of materials and products

Water Conservation

Photo: Innovative Design

Rainwater storage tank at Roy Lee Walker Elementary, McKinney, TX

- incorporate rainwater catchment strategies that are evident to the students (both coming off the roof and storing the water)

Recycling Systems & Waste Management

Photo: Innovative Design

Composting bin at East Clayton Elementary School, Clayton, NC

- design recycling systems within each classroom to encourage student participation
- develop a compost area for your garden

Transportation

Photo: Greater Peoria Mass Transit District

Ethanol powered alternative fuel bus

- provide educational signage about bicycles and other pedestrian-friendly transportation options for getting to and from school
- give high priority to placement of bicycle racks and use personalized name plates for each regular biker
- incorporate a solar electric and/or wind powered charging station for electric buses and service vehicles

Roy Lee Walker Elementary

McKinney, Texas

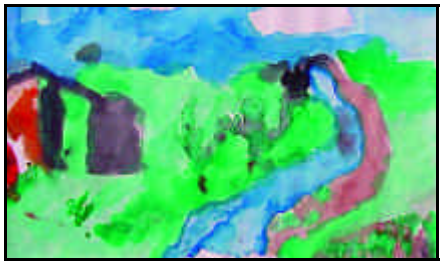
Owner:
McKinney Independent School District
#1 Duvall Street
McKinney, TX 75069
Contact:
Wyndol Fry, Executive Director of Facilities and Construction
Phone: 469-742-4132
Architect:
SHW Group, Dallas, TX
Sustainable Design Consulting:
Innovative Design, Raleigh, NC

"This is a once in a lifetime chance to have an impact, not just on McKinney, but on the whole country and the world. The real success at McKinney's Roy Lee Walker Elementary School is that the elements of sustainability are truly serving as a 3-D textbook on energy-efficiency and how to help our environment."

Wyndol Fry

Photo: Innovative Design

Photo: Innovative Design



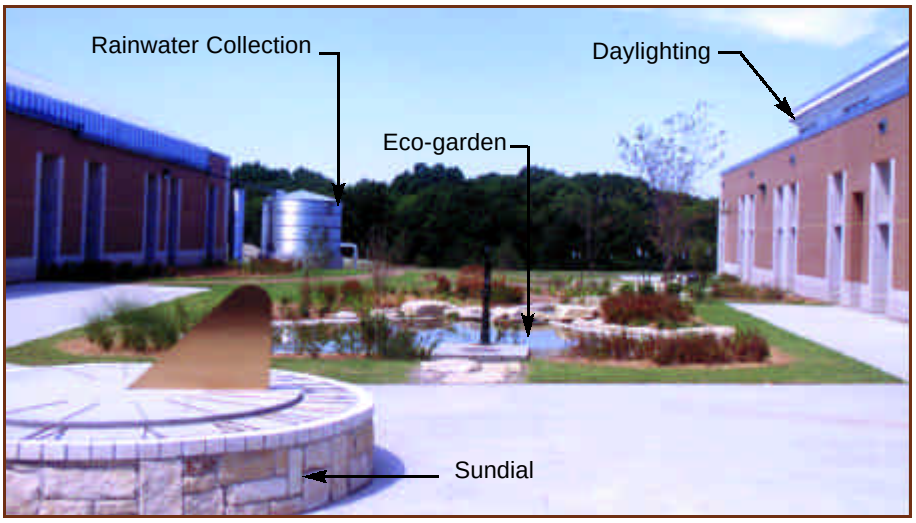


Photo: Innovative Design

The Roy Lee Walker Elementary School in McKinney, Texas, is one of the world's finest examples of sustainable school design. Because of the wide range of sustainable features included, this school not only succeeds as an energy-efficient, environmentally-sound building, but also as a powerful learning tool for eco-education as a life sized, 3-D textbook on sustainability. The numerous environmentally-friendly features integrated into the design include natural landscaping, daylit classrooms, solar domestic hot water heating, radiant barriers, energy recovery systems, recycled building materials, lighting controls, energy-efficient lighting fixtures and ballasts, a greenhouse, sundial, windmill, and eco-garden, exposed rainwater collection catchment systems and cisterns, recycling stations, and weather stations, all allowing students, parents, visitors, and teachers to experience environmentally-sustainable design as a fully functioning, three dimensional reality.

The Roy Lee Walker Elementary School was named by the American Institute of Architects as one of the country's top-ten, most environmentally-responsible buildings in 1999.

Bluffsview Elementary School

Worthington, Ohio

"What better a way to educate our students about alternative energy sources, prepare them to work as adults to conserve dwindling natural resources, and ultimately motivate them to improve the environment in which they live?"

Dr. Damon Asbury, Superintendent, Worthington Schools

Owner:
Worthington Schools
7111 Linworth Road
Columbus, Ohio 43235
Contact:
Greg Viebranz
Director of Communications
Phone: 614-883-3000

Students at Bluffsview Elementary School in Worthington, Ohio, have already been introduced to the promise of clean and renewable solar energy and technologies that convert the sun's energy into electricity. The installation of a two kiloWatt photovoltaic system on their school combined with an Internet link through American Electric Power's Datapult system lets them see how it actually works. Students can monitor the amount of power the solar panels create compared to the amount of energy the building consumes and can generate charts that provide a visual representation of the building's energy supply and demand. Kids also read special meters to see how capturing the sun's energy results in cost savings.

The $20,000 system was purchased and installed as part of a pilot project of the US Department of Energy's Million Solar Roofs Initiative.

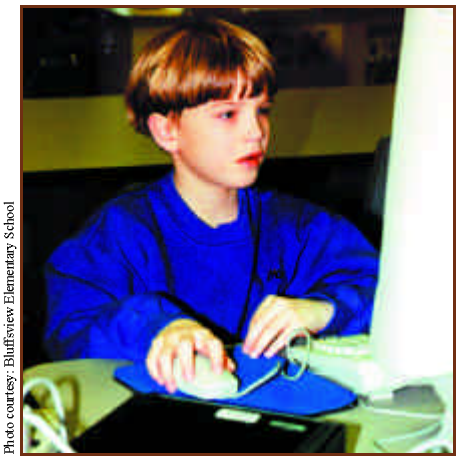


Photo courtesy: Bluffsview Elementary School

Spirit Lake Community Schools

Spirit Lake, Iowa

"Education was the first priority. We need to teach preservation of the environment, and to do that we have to model it. I'm so excited. I've never been involved in something so accepted by so many."

Harold Overmann, Superintendent,
Spirit Lake Community Schools District

Owner:
Spirit Lake Community Schools
900 20th Street
Spirit Lake, Iowa 51360
Contact:
Jim Tirevold, Facilities Manager
Phone: 712-336-2820

"The development of wind energy is one of the most popular projects in the community. Everyone loves that we are helping to reduce our dependence on fossil fuels while educating our children about the importance of resource conservation."

Jim Tirevold, Facilities Manager
Spirit Lake Community Schools District

The Spirit Lake Environmental Impact Calculator at the Spirit Lake Community School District's Wind Energy website allows students to monitor and study the environmental benefits of wind power generated at their school. Wind production may be entered into the environmental impact calculator to see the natural resources saved and emissions avoided by the wind energy produced at their school.

Photo courtesy: American Wind Energy Association

The wind turbine has been integrated into the curriculum at the Spirit Lake Community School's Wind Energy Curriculum web page. Students may choose interactive lessons from all areas of the curriculum.

For Helpful Resources and More Information

Initiatives

Alliance to Save Energy
www.ase.org/greenschools
American Electric Power's Solar Schools Project
www.aep.com/environment/solar
Energy Quest
www.energy.ca.gov/education
Energy $mart Schools
www.eren.doe.gov/energysmartschools
Maryland's Solar Schools Program Plan
www.energy.state.md.us/executiv.htm#Plan
On-Line Renewable Energy Education Module
solstice.crest.org/renewables/re-kiosk/index.shtml
Solar Energy: A Science Unit for Intermediate Grade Students
alpha.fsec.ucf.edu/ed/solar-unit
School Going Solar Program- IREC
www.schoolsgoingsolar.org
Solar Schools - Brighter Future
www.ises.org
Solar Now
www.eren.doe.gov/solarnow/solarnow.htm
SolarQuest
www.solarquest.com
Solar Schools
www.eren.doe.gov/solarschools
Training Student Organizers Program
www.cenyc.org/HTMLEE/mainee.htm
Watts on Schools
www.wattsonschools.com

Organizations

American Solar Energy Society
www.ases.org/solarguide
Center for Renewable Energy and Sustainable Technology (CREST)
solstice.crest.org
Energy Center
www.caddet-re.org
Energy Efficiency and Renewable Energy Network (DOE)
www.eren.doe.gov
Florida Solar Energy Center
www.fsec.ucf.edu
International Solar Energy Society
www.ises.org
Interstate Renewable Energy Council
www.irecusa.org
Million Solar Roofs Initiative
www.millionsolarroofs.org
National Energy Education Development (NEED)
www.need.org/need
National Network of Energy and Environmental Education Professionals
www.leeric.lsu.edu/network/network.htm
National Renewable Energy Laboratory
www.nrel.gov/ceb.html
North Carolina Solar Center
www.ncsc.ncsu.edu
Solar Energy Industries Association
www.seia.org
Solar Energy Research and Education Foundation
www.seref.org
US Department of Energy
www.doe.gov

This document has been developed by Innovative Design with technical assistance from Padia Consulting, BuildingGreen, and the Sustainable Buildings Industry Council and has been extensively reviewed by a technical review committee with broad based expertise in education, as well as energy and environmental issues.

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This document was specifically developed for school board members and school system administrators and it is part two in a six part series on how implementing energy-efficient, environmentally-sound construction practices can help you in addressing your educational mission.

The Sustainable Schools Guide includes:

- Reducing Operating Costs
- **Buildings that Teach Sustainability**
- Improving Academic Performance
- Protecting our Environment
- Improving Health, Safety & Comfort
- Supporting Community Values