



Design a Cool School

Summary: Students critique the design of energy efficient, high performance schools.

Grade Level: 5–8

Subject Areas: Art, English Language Arts, Health, Science, Social Studies, Technology Education

Setting: Classroom

Time:

Preparation: 2 hours

Activity: one 50-minute period

Vocabulary: Daylighting, Geothermal system, Green energy, High performance school building, Leadership in Energy and Environmental Design (LEED®), Renewable energy system, Resource-efficient building product, Site design, Solar system, Wind system

Major Concept Areas:

- Quality of life
- Quality of the environment
- Management of energy resource use

Getting Ready:

There are many factors to consider when designing a high performance school—see **High Performance School Design Elements**.

Review the **Cool School Design Information** sheets provided. There are many new vocabulary words introduced in these information sheets. You may need to spend time discussing these terms with students. For more information related to high performance school buildings, visit the Collaborative for High Performance Schools: chps.net and the U.S. Department of Energy

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Objectives

By the end of this activity, students will be able to:

- list the different components used to design a high performance school building; and
- evaluate the qualities of a high performance school building.

Rationale

It is important for students to know that there are many decisions made in designing a building before construction begins. Some students may attend school at a high performance building, others may not. Knowing what defines a high performance building will help students understand the importance of energy conservation and energy efficiency in a building that was not designed with efficient energy use as a top priority. Using peer evaluation to critique fellow students' designs will assist in developing needed communication and accountability skills.

Materials

- Clear tape
- Scissors
- Copies of the following:
 - **Cool School Design Information**
 - **School Components**
 - **School Layout #1**
 - **School Layout #2**
 - **Questions about Your School Design**
 - **High Performance School Evaluation**

Background

It is important to understand that buildings that are designed properly can be a resource for students; improve academic performance; protect the environment; increase health, safety, and comfort; and support community values. Although students may not have a choice as to which school they attend, they can

understand what features in their school will nurture a better learning environment. If students are aware of their surroundings and identify areas that naturally encourage learning, they could improve their academic performance and feel better in general. It is also important to note that building “green” or high performance school buildings do not need to cost more than building conventional school buildings.

Many studies have indicated a correlation between student performance and the environment in which they spend their time. A 2016 report from Harvard T.H. Chan School of Public Health titled, *Schools for Health*, identifies increased academic success when schools improve factors such as indoor air quality, water quality, acoustics and exposure to dust and mold. Even factors like lighting make a difference. Students in classrooms with natural light tend to score higher on tests than students in classrooms with only artificial lighting. By simply opening shades and turning off some of the unneeded fluorescent lights in the classroom, you may see an improvement in your students' attitude and aptitude.

High Performance School Design Elements:

- **Site Design**
- **Daylighting & Windows**
- **Energy-efficient Building Shell**
- **Lighting and Electrical Systems**
- **Mechanical and Ventilation Systems**
- **Renewable Energy System**
- **Water Conservation**
- **Recycling Systems and Waste Management**
- **Transportation**
- **Resource-efficient Building Products**

Although Energy-efficient Building Shell, Lighting and Electrical Systems, and Mechanical and Ventilation Systems are very important, they will not be explored in any depth during this activity.

The school grounds are often left as an untapped resource. Solar, wind, and geothermal systems could offset a school's energy use and be used as educational resources as well. Many students have never seen a renewable energy system in action. By incorporating them into the school, students may be inspired to enter into a career in any number of the upcoming "green energy" fields.

School vegetable, flower, or prairie gardens provide students with an opportunity to get in touch with nature and often improve the performance of their school building. By planting vegetation near the building, temperatures stay lower, air conditioning runs less often, and intake air quality is improved. By diverting rainwater run-off to a garden, it often lessens the load on the city storm sewer system as well.

Adjacent school forests or wildlife habitats offer students a chance to observe, research, or simply enjoy nature. It is a lot more energy efficient to take a class a few steps from the school to "get into nature" than to get on a bus and drive many miles, using up fossil fuels along the way.

Recycling at school sets the example that we want students to follow at home. Recycling programs can empower students who want to make a difference and be part of a positive environmental movement. The more material that is diverted from landfills, being reused or recycled, the healthier our environment will be.

Schools that are connected to the community via safe walkways and paths can have a large positive environmental impact. By limiting the need for fossil fuel-based transportation, students will enjoy healthier air quality and reduced noise pollution.

Using energy efficient products can save your school money. High-efficiency products generally have a greater up-front cost, but are worth it over time. School districts spend a lot of money on energy, and

efficient appliances and systems are a must. Turning off lights and shutting down computers and other equipment when they're not in use will also save energy and reduce your school's electric bill.

Leadership in Energy and Environmental Design (LEED®) for Schools is the recognized third-party standard for high-performance schools that are healthy for students, comfortable for teachers, and cost-effective. 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.

The LEED® for Schools Rating System recognizes the unique nature of the design and construction of K-12 schools. Based on the LEED® for New Construction rating system, it addresses issues such as classroom acoustics, master planning, mold prevention and environmental site assessment. There are LEED® Standards for Existing Buildings as well. A school may wish to conform to these standards as much as possible, but they need to realize that certification requires time, documentation, and financial commitment.

Procedure

Orientation

Ask students if they have ever rearranged their bedroom. Why did they move furniture around? Was it to make it easier to get to certain items? Does it make sense to put your jacket in the back of your closet if you are going to wear it almost every day? Would it make more sense to put it on a hook by your door so you can grab it on your way out?

Designing buildings are somewhat like arranging your room to meet the needs of the building occupants. Just like you are restricted by the space of your room, architects and engineers have to work within certain guidelines to design a high performance school building. You will be

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Better Buildings Initiative:

betterbuildingsinitiative.energy.gov/accelerators/zero-energy-schools.

Meet with your school building's facilities manager to find out about the high performance elements of your school. Ask them to show you so you will have first hand knowledge to pass on to your students. Provide a copy of the **Cool School Design Information** sheets from this activity and discuss the various elements.

You can find information about green building design for schools on keepprogram.org > Curriculum & Resources > Energy & Your School > Additional Resources.

given the opportunity to design your own school using information on what makes a building more energy efficient and to critique your peers' designs as well.

Steps

1. Have students work in groups of two to four to design a school by first cutting out the **School Components** pieces and taping them to the **School Layout #1** sheet any way they wish. They do not have to use all of the components. Each group should name their school and write it on the top of the sheet.
2. After groups have completed their initial design, hand out copies of the **Cool School Design Information** sheets and have them read the information provided.
3. Now have students work in their same groups, but this time ask them to design a high performance school and incorporate what they learned from the information sheets. Hand out the **School Layout #2** sheet and the **Questions**

about Your School Design. Have students place the **School Components** on the **School Layout #2** sheet in a way that is most energy efficient. They do not have to use all of the components provided and they can add components if they wish.

- Some design elements will be incorporated into the building design by answering the **Questions about Your School Design.** (Provide instructions that are somewhat vague, encouraging students to be creative. There are no wrong answers or designs if they are justified.)
- Once students have completed their design of a high performance school, ask them to swap designs with another group. Hand out **High Performance School Evaluation** sheets and ask that each group provide feedback for the design they are evaluating. Encourage students to provide constructive criticism in a manner that is positive and friendly.
- When groups have completed their evaluations, have them return the designs and evaluations to the proper owners. Give students time to read their evaluations and make changes in their design if needed.
- Ask for volunteers to present their design to the rest of the class, explaining why they placed components where they did. Use the **Checklists of Key Design Issues** from the *Energy Design Guidelines for High Performance Schools: Cold and Humid Climates* by the U.S. Department of Energy to aid in facilitating discussion. Encourage students to ask questions of their peers.

Closure

Review the different elements in designing a high performance school building. Note design features from different groups that accurately captured the spirit of high performance school design.



Ask students what high performance features can be found in their school. What makes them high performance? Have students identify ways they could make their school a more high performance building.

Assessment

Formative

- How well did students integrate knowledge learned to design a high performance school building?
- Can students accurately name several high performance building design elements?
- Can students critique their peers' high performance school design by using the **High Performance School Evaluation**?
- Did students present their designs to the class clearly explaining the high performance attributes included?

Summative

- Are there other buildings in your community that have high performance building design elements?
- Where are they located and which high performance design elements do they possess?

Extensions

If students are interested in assessing their school further, the Wisconsin Green and Healthy Schools program has a self-paced, web-based, voluntary program that helps support and encourage schools in their quest for a healthy, safe, and environmentally-friendly learning environment. Visit ghswisconsin.org for more information.

Invite an architect or your area Energy Advisor from Focus on Energy to speak to your class about high performance school design.

Take a closer look, as a class, at the requirements for having your school LEED® certified.

Review *50 Green Strategies that Cost Less* and discuss which strategies your school could implement. Document found on keepprogram.org > Curriculum & Resources > Energy & Your School > Additional Resources.

Cool School Design Information

NOTE: There is much more involved in designing a high performance school building than what is found in the following pages. These are excerpts from the *Energy Design Guidelines for High Performance Schools: Cold and Humid Climates* produced, in part, by the U.S. Department of Energy. For more information related to high performance school buildings, visit the Collaborative for High Performance Schools: chps.net and the U.S. Department of Energy Better Buildings Initiative: betterbuildingsinitiative.energy.gov/accelerators/zero-energy-schools.

Site Design

Introduction

By orienting your school building linearly on an east-west axis, you can maximize solar access and boost the effectiveness of daylighting strategies, reducing the need for electrical lighting. If deciduous trees are incorporated in the design on the south side, you get the advantage of extra light and heat in the winter when the leaves are gone and shade in the summer when school is out and cooling load can be avoided.

Retaining ecosystems and wildlife habitat surrounding schools and incorporating them into outdoor learning activities enhances student interest in the environment.

Building Orientation

To minimize energy use, maximize your potential by siting the school correctly.

- Establish the building on an east-west axis.
- Develop a floor plan that minimizes east- and west-facing glass.
- Large, one-story designs require more energy to offset heat loss through the foundation and roof. Large building footprints also consume more scarce buildable land, especially in urban areas.

Protecting Local Ecosystems

The protection of local ecosystems is critical to an environmentally sensitive site design.

- Protect or restore ecosystems and wildlife habitats on the site.
- Protect areas for viewing natural habitat.

Renewable Energy

When evaluating site design issues, it is essential to investigate renewable systems early in the process. Solar systems need to have solar access, and wind systems require proper placement to be maximized.

- Consider installing building-integrated solar thermal systems for domestic hot water, space heating, and absorption cooling.
- Consider building-integrated photovoltaic systems for electricity production.
- Ensure that solar systems are not shaded and that they

are positioned to be visible to the students, teachers, and parents.

- Consider wind energy systems for electricity or well water.
- Consider geothermal heat pumps.

Daylighting and Windows

Introduction

Of all the high performance design features typically considered, none will have a greater impact on your school than daylighting. Not only can optimum daylighting design drastically reduce energy consumption, but it also creates healthier learning environments that may result in increased attendance and improved grades. When properly designed, windows can provide a large portion of lighting needs without undesirable heat gain or glare.

Building Orientation and Solar Access

By elongating the school design on an east-west axis, the potential for cost-effective daylighting is maximized.

- Consider daylighting strategies that primarily use south-facing glass and secondarily incorporate north-facing glass. An elongated building that has its major axis running east-west will increase the potential for capturing winter solar gain through south glass as well as reducing unwanted summer sun that more often strikes on the east and west surfaces. Exposed, eastern- and western-facing glass should be avoided wherever possible because it will cause excessive summer cooling loads.
- Verify that other exterior design elements or existing site features do not unintentionally shade windows that are designed as daylighting elements.

Renewable Energy Systems

Introduction

There is no shortage of renewable energy. Renewable energy can contribute to reduced energy costs and reduced air pollution. More importantly, the renewable energy systems that you design into your school will demonstrate to the students the technologies that will fuel the 21st century.

Over the past two decades, the cost of renewable energy systems has dropped dramatically. With improvements in analytical tools, passive solar and daylighting technologies

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can be implemented into schools with less than a two-year return on investment.

Incorporating renewable energy options into your school design helps students learn firsthand about these cost-effective and energy efficient options. Buildings that teach offer students an intriguing, interactive way to learn about relevant topics like energy and the environment.

Building Orientation and Solar Access

Employing renewable energy strategies cost effectively requires the school to be sited to maximize the locally available natural resources.

- Establish the building on an east-west axis that maximizes southern exposure for daylighting and other solar systems.
- Ensure that adjacent buildings or undesirable trees do not block the intended solar access.

Building-Integrated Approaches

- To maximize cost effectiveness and improve aesthetics, consider integrating solar thermal and photovoltaic systems into the building shell.
- Integrate solar systems into the overall design to allow the system to serve multiple purposes (e.g., a photovoltaic array that can also serve as a covered walkway).
- Eliminate the additional costs associated with a typical solar system's structure by designing the building's roof assembly to also support the solar components.

Solar Hot Water

Because of the high hot water demands associated with cafeterias, solar heating systems are often viewed as important strategies in reducing energy bills. In middle schools and high schools, with showers for gym classes and sports programs, it is even more beneficial to address this significant load.

Wind

Wind turbines convert kinetic energy in the wind into mechanical power. This mechanical power can be used directly (e.g., water pumping), or it can be converted into electricity.

Geothermal Heat Pumps

Geothermal heat pumps work differently than conventional air source heat pumps in that geothermal systems use the more moderately tempered ground as a heat source and heat sink. The result is that geothermal systems are more efficient and more comfortable.

Photovoltaics

Photovoltaic modules, which convert sunlight into electricity, have numerous school applications and can be designed as "stand-alone" applications or for utility "grid-connected" applications. Stand-alone systems address small, remotely-located loads. They tend to be more cost-effective than the conventional approach requiring extensive underground wiring. Some of the more appropriate applications include parking and walkway lighting, caution lights at street crossings, security lights, emergency telephone call boxes, and remote signage. Grid-connected systems are often used in large applications where peak load pricing is high or where first cost is an issue. Because these systems typically rely on the utility to provide power when the sun isn't shining, battery cost is eliminated and long-term maintenance is reduced greatly. This strategy is typically advantageous to both the utility and the school because peak demand will be occurring when the sun is shining.

Water Conservation

Introduction

Water rationing is becoming commonplace in thousands of communities across the country, and the price of water is escalating at unprecedented rates. You can make a considerable difference at your school in reducing community water use. By using water-conserving fixtures, implementing gray water or rainwater catchment systems, and using xeriscape practices, schools can easily reduce their municipal water consumption by 25%–75%. By saving half of the 1 million to 3 million gallons that each of the 90,000 public schools consume every year, more than 200 million gallons of treated water could be saved each day.

Water-Conserving Landscaping Strategies

The demand for water will be greatly impacted by the amount of site irrigation required. By limiting new landscaped areas and considering the type of plants and vegetation installed, water needs will be reduced.

- Minimize disruption to the existing site conditions, and retain as much existing vegetation as is practical.
- Incorporate native and drought-resistant plants and exercise xeriscape principles to minimize irrigation requirements.

Rainwater Management

Rainwater captured off the roof of your school can be harvested and stored in cisterns for non-potable use. In most rainwater catchment systems, the water runs off the roof into gutters and downspouts, which carry the water to a storage device for future use.

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- Use harvested water to irrigate vegetation on school property.
- Use a durable storage container, and locate it away from direct sunlight.

Recycling Systems and Waste Management

Introduction

Public schools across the country are producing billions of pounds of municipal solid waste each year. You can help reduce much of this waste by recycling or composting at your schools.

By creating schools in which comprehensive waste recycling can be carried out, your design team has an opportunity to instill the practice of recycling in your school's children. The most successful recycling and waste management programs are integrated into classes, with students making use of mathematical, investigative, and communication skills in implementing these programs.

Paper, Plastics, Glass, and Aluminum Recycling

Students are able and eager to participate in recycling programs. Successful recycling programs teach students recycling skills and save money through reuse of materials and disposal fees.

- Allocate space within each classroom, the main administrative areas, and the cafeteria for white and mixed paper waste.
- Provide central collection points for paper and cardboard that are convenient to custodial staff as well as collection agencies or companies.
- Place the receptacles for all recyclables where the waste is generated.
- Locate convenient bins for other materials being recycled.

Safe Disposal of Hazardous Waste

Provide a secure space within the school to temporarily store hazardous materials (e.g., batteries, fluorescent lights, medical waste) until they can be taken to a recycling center or safe disposal site.

Composting

About a third of the average school's waste stream is food and other organic materials. Composting is one environmentally friendly way of handling this waste.

- Design a conveniently located composting bin.
- Use vermicompost bins in classrooms as educational tools. The bins use worms to dramatically speed up the decomposition of food.

Transportation

Introduction

In many school districts across the country, more energy dollars are spent by the school system in transporting students to and from school than in meeting the energy needs of their school buildings.

Incorporating a network of safe walkways and bike paths that connect into the community's sidewalks and greenways can reduce local traffic congestion, minimize busing costs, and reduce air pollution. By incorporating natural gas, biodiesel, methanol, or solar electric buses into a district's existing vehicle fleet, you can help to reduce fuel costs and harmful emissions.

Connecting the School to the Community

One of the measures of success of a school is the degree to which the school is a vital part of the community. If addressed early in the site selection and design phase, a school can be planned to serve not just the students but also the entire community.

- Design the school so that the athletic fields, gymnasium, media center, and classrooms are accessible and can be shared at appropriate times with the community.
- Provide good access to public transit.
- Through good site design, link the school to the surrounding communities through safe bicycle routes, pedestrian pathways, and greenways.
- Incorporate convenient bicycle parking at the school to discourage single car traffic.

High-Efficiency and Low-Emission Vehicles

In addition to incorporating safe and traffic-reducing elements into your site design, consider the use of high-efficiency and low-emission vehicles in your fleet. Electric vehicles, hybrid electric vehicles, and vehicles using alternative fuels like ethanol and compressed natural gas are cost-effective and proven options.

Resource-Efficient Building Products

A school, like any building, is only as good as the sum of the materials and products from which it is made. To create a high performance school, your design team must choose the most appropriate materials and components and combine these components effectively through good design and construction practices.

The Life-Cycle Approach

To select environmentally preferable products, it is necessary to consider environmental impacts from all the phases in the product's life cycle. This approach is called life-cycle analysis.

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A product's life cycle can be divided into the following phases: raw material extraction, manufacturing, construction, maintenance/use, and reuse or disposal.

Phase 1: Raw Material Extraction

Building materials are all made from resources that are either mined from the earth or harvested from its surface. The most common materials are sand and stone to make concrete, clay for bricks, trees for wood products, and petroleum for plastics and other petrochemical-based products.

- Eliminate component materials from rare or endangered resources.
- Determine if there are significant ecological impacts from the process of mining or harvesting the raw materials.
- Specify that wood products must be harvested from well-managed forests.
- Determine the origin of the primary raw materials, and select options closer to the site, requiring less shipping.

Phase 2: Manufacturing

Manufacturing operations can vary considerably in their impact on the environment. The manufacturer of one product may rely on numerous out-sourcing operations at separate locations or obtain raw materials from another country. Another, less energy-intensive product may be produced in a single, well-integrated operation at one site with raw materials and components coming from nearby locations. Likewise, a particular manufacturer may use a process that relies on toxic chemicals while a competing manufacturer may incorporate environmentally friendly technologies to accomplish the same end.

- Determine if the manufacturing process results in significant toxic hazardous byproducts. Most petrochemical-based products involve some hazardous ingredients, so plastics should be used only when they offer significant performance advantages.
- Specify products that are made from recycled materials.
- Select products that are made from low-intensity energy processes.
- Select products manufactured at facilities that use renewable energy.

Phase 3: Construction

To a great degree, the energy and environmental impacts of products and materials are determined by the way they are implemented.

- Avoid products containing pollutants.
- Require the contractor to recycle construction materials.
- Require proper handling and storage of toxic materials at the job site.

- Require that the packaging of products, materials, and equipment delivered to the site be made of recyclable or reusable materials, and discourage unnecessary packaging.

Phase 4: Maintenance/Use

How easily building components can be maintained—as well as their impact on long-term energy, environmental, and health issues—is directly linked to the quality of materials, products, and installation.

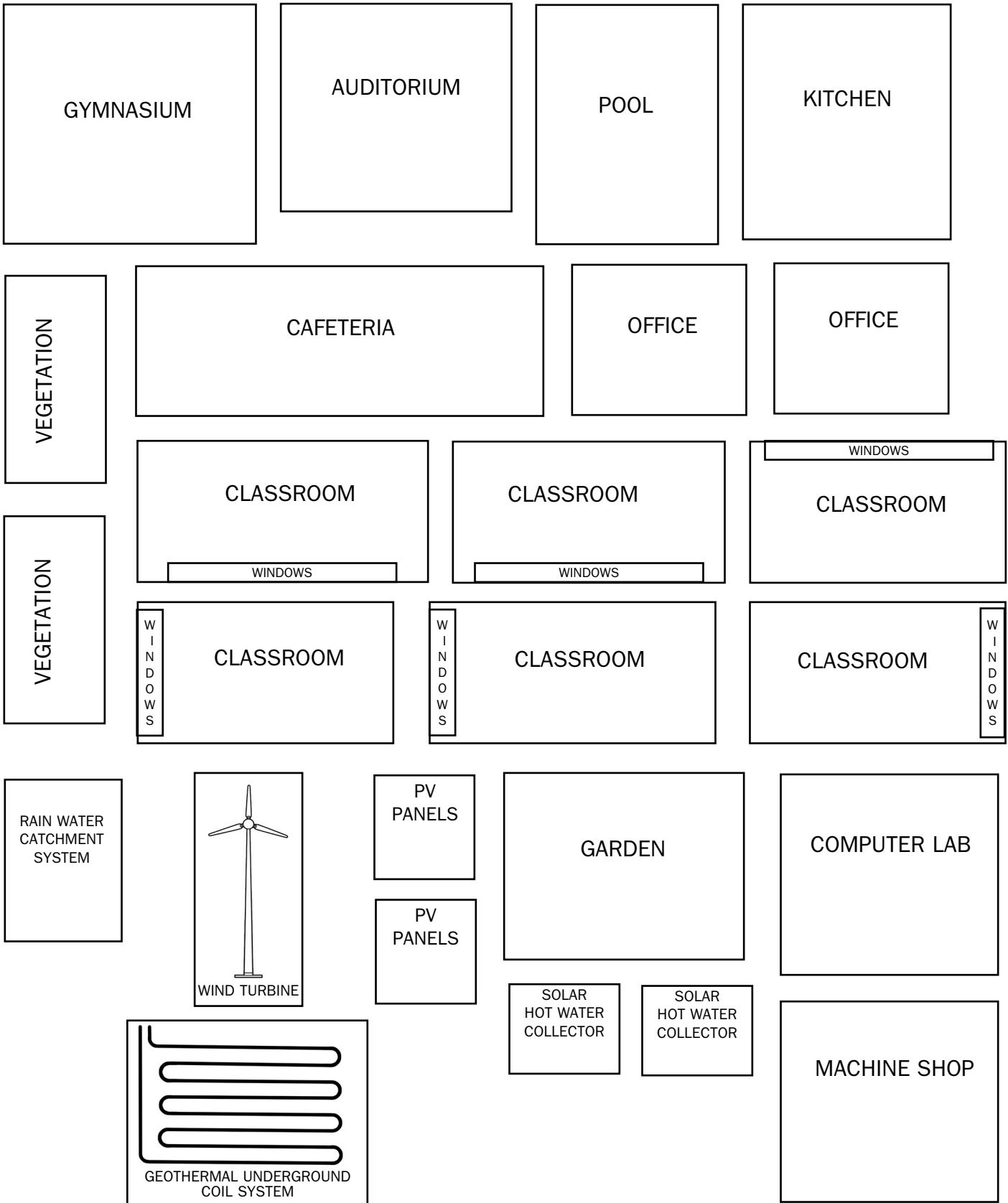
Select materials, products, and equipment for their durability and maintenance characteristics. Particular attention should be paid to selecting roofing systems, wall surfaces, flooring, and sealants—components that will be subject to high wear-and-tear or exposure to the elements.

Phase 5: Disposal or Reuse

Some surfaces in the school, such as carpets, may need to be replaced on a regular basis. The building as a whole will eventually be replaced or require a total renovation. To minimize the environmental impacts of these future activities, designers have to choose the right materials and use them wisely.

- Select materials that can be easily separated out for reuse or recycling after their useful life in the structure.
- Avoid materials that become a toxic or hazardous waste problem at the end of their useful life.

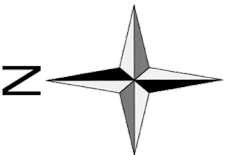
School Components



School Layout #1

PARKING LOT

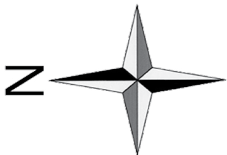
Name of School _____



School Layout #2

PARKING LOT

Name of School _____



Questions About Your School Design

* Should accompany your **School Layout #2** design

In an ideal situation, how would the high performance school you just designed incorporate the following issues?

Recycling Systems and Waste Management Plan

Briefly describe your recycling system and waste management plan.

Transportation

Briefly describe your transportation options and how they attribute to your high performance building plan.

Resource-Efficient Building Products

Briefly describe how the building products used to construct your school are resource-efficient.

High Performance School Evaluation

General

1. Name of School: _____
2. Name of Designer(s): _____
3. Were all of the School Components used? _____

Site Design

1. How is the building oriented (east-west, north-south, or other)? _____
2. Is there any vegetation or wildlife habitat incorporated into the site design? _____
3. Describe two site design features that you find desirable. _____

4. What about the site design is unclear or needs further explanation? _____

Daylighting and Windows

1. How many rooms have windows facing south? North? East? West? _____
2. Are there any structures or vegetation that may unintentionally shade the windows? _____
3. Describe two ways daylighting was successfully incorporated in this school design. _____

4. Are there any areas daylighting could be used to save energy in this building design? _____

Renewable Energy Systems

1. What are three benefits of having the systems placed where they are? _____
2. What are two things that may be a challenge with having the renewable energy systems placed where they are? _____

3. Do you have any suggestions to improve the design of the renewable energy systems? _____

Water Conservation

1. Was a rainwater catchment system incorporated into the design? _____
2. If so, what are two good reasons to have it placed where it is? _____
3. Could a rainwater catchment system be placed elsewhere to be used more efficiently? If so, describe where to place it and why. _____

Checklist of Key Issues for Site Design

Site Design

- Take advantage of your site's natural resources by:
 - orienting the building to optimize solar access and daylighting
 - using vegetation and earth formations to your advantage.
- Incorporate strategies to save water, such as the use of rainwater catchment systems and xeriscape landscaping principles.
- Retain and add site features that could become educational resources for teachers to incorporate into their instructional programs.
- Include outdoor teaching and interpretive areas.
- Provide diverse, natural environments for exploration.
- Showcase local natural features.
- Maximize the educational opportunities of the pedestrian pathways from residential areas to the school.
- Provide the school with information on environmental design features.
- Develop the site in a manner that protects the existing landscaping, ecosystems, and wildlife habitat.
- Employ energy-saving strategies, and use renewable energy to reduce air pollution.
- Create earth berms to provide sound barriers.
- Develop on-site erosion control and stormwater management strategies.
- Connect the school's walkways and bike paths directly into greenways and sidewalks surrounding residential areas.
- Design the school as a part of the community by:
 - providing easy, safe pedestrian access to surrounding communities and mass transit
 - allowing for shared recreational facilities.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
	■		□	■	□	
	■			■	□	
	■			■		■
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Checklist of Key Issues for Daylighting and Windows

Daylighting and Windows

- Account for all the financial and environmental benefits associated with daylighting, including:
 - reduced electrical lighting and cooling
 - decreased electrical service to the site
 - less mechanical system maintenance
 - fewer lamp replacements
 - peak demand and equipment reductions caused by smaller lighting and cooling loads.
- Evaluate and avoid negative impacts associated with window treatments, placement, and types, including:
 - glare and direct beam radiation entering teaching and work spaces
 - excessive radiation in warmer months
 - comfort problems and unnecessary heat loss and gain due to the lack of thermal breaks, poorly insulated windows, and the choice of solar transmission values of glazing
 - maintenance.
- Make daylighting strategies obvious to the students.
- Create deliberate connections to the outside environment so that changes in weather conditions are apparent as well as stimulating to students.
- Incorporate daylighting strategies that could be enhanced through student participation and understanding.
- Recognize the importance of daylighting as a strategy to create superior learning environments that:
 - have a positive physiological impact on the students and teachers
 - provide better quality light
 - increase the performance of students and teachers.
- Reduce building materials and cost by integrating daylighting into the overall structural design and roofing system.
- Incorporate controlled daylighting strategies.
- When climactic conditions allow, install operable windows to improve indoor air quality.
- Use daylighting and high performance windows as strategies for reducing long-term energy costs, shifting more financial resources to critical educational needs, and keeping more of your energy dollars within the community.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
– reduced electrical lighting and cooling	■			■	□	■
– decreased electrical service to the site	■			■		□
– less mechanical system maintenance	■			■		■
– fewer lamp replacements	■			■		■
– peak demand and equipment reductions caused by smaller lighting and cooling loads.	■			■		■
– glare and direct beam radiation entering teaching and work spaces	□		■		■	
– excessive radiation in warmer months	■		■		■	
– comfort problems and unnecessary heat loss and gain due to the lack of thermal breaks, poorly insulated windows, and the choice of solar transmission values of glazing	■		■		■	
– maintenance.	■					
• Make daylighting strategies obvious to the students.	□	■		□		
• Create deliberate connections to the outside environment so that changes in weather conditions are apparent as well as stimulating to students.		■		□		
• Incorporate daylighting strategies that could be enhanced through student participation and understanding.	□	■	□	□		
• Recognize the importance of daylighting as a strategy to create superior learning environments that:						
– have a positive physiological impact on the students and teachers			■		■	■
– provide better quality light			■		■	
– increase the performance of students and teachers.			■			■
• Reduce building materials and cost by integrating daylighting into the overall structural design and roofing system.				■		
• Incorporate controlled daylighting strategies.			■		■	
• When climactic conditions allow, install operable windows to improve indoor air quality.			□		■	
• Use daylighting and high performance windows as strategies for reducing long-term energy costs, shifting more financial resources to critical educational needs, and keeping more of your energy dollars within the community.	■					■

Checklist of Key Issues for Energy-Efficient Building Shell

Energy-Efficient Building Shell

- Carefully evaluate building shell issues. Many of these components are likely to go unchanged during the life of the facility.
- Consider the wide range of building systems that can improve energy consumption, reduce maintenance requirements, and improve comfort. These include:
 - light-colored exterior walls and high-reflectance roofing systems
 - radiant barriers (in addition to insulation) in the roof/ceiling assemblies
 - massive wall construction
 - optimum wall and roofing insulation
 - infiltration and weather-resistive barriers
 - light-colored interior walls and ceilings.
- Incorporate artwork and graphics in the building that will help to educate students about energy and environmental issues.
- 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.
- Consider building shell issues that directly impact comfort and health and indirectly affect the performance of students within the classroom.
- Consider the embodied energy of optional building components and implementation strategies.
- Consider the color and finish of interior surfaces in controlling glare and improving visual comfort.
- Employ energy-saving strategies that will result in more energy dollars staying within the community.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
• Carefully evaluate building shell issues. Many of these components are likely to go unchanged during the life of the facility.	■					
• Consider the wide range of building systems that can improve energy consumption, reduce maintenance requirements, and improve comfort. These include:						
– light-colored exterior walls and high-reflectance roofing systems	■			■	□	■
– radiant barriers (in addition to insulation) in the roof/ceiling assemblies	■			■	□	■
– massive wall construction	■			■	□	■
– optimum wall and roofing insulation	■			■	□	■
– infiltration and weather-resistive barriers	■			□	■	■
– light-colored interior walls and ceilings.	■			■	■	□
• Incorporate artwork and graphics in the building that will help to educate students about energy and environmental issues.		■				
• 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.		■				
• Consider building shell issues that directly impact comfort and health and indirectly affect the performance of students within the classroom.			■		■	
• Consider the embodied energy of optional building components and implementation strategies.				■		
• Consider the color and finish of interior surfaces in controlling glare and improving visual comfort.			■		■	
• Employ energy-saving strategies that will result in more energy dollars staying within the community.	■					■

Checklist of Key Issues for Lighting and Electrical Systems

Lighting and Electrical Systems

- Select high-efficiency lamps, ballasts, lenses, and lighting fixtures that address the specific task requirements.
- Specify high-efficiency appliances and equipment.
- Use long-life lamps to reduce maintenance.
- Develop the primary lighting strategy around a daylighting approach.
- Incorporate controls, occupancy sensors, and dimmable or staged lights to automatically reduce electric lighting during times of adequate daylighting.
- Provide photocell controls on exterior lights to ensure lights are not operating during the day.
- Consider light-emitting diode (LED) exit lights.
- Minimize electrical line losses by installing a high-voltage distribution system.
- Conduct a commissioning process that verifies the proper operation of equipment and systems.
- Implement a regular maintenance schedule to ensure proper operation.
- Use ASHRAE Standard 9.01-1999 to establish lighting power densities (LPDs) for each space within the school.
- Incorporate photovoltaic and solar thermal-electric systems where appropriate.
- Monitor total building energy use and renewable energy system contribution.
- Design lighting to uniformly light each space, minimize glare, and reduce overheating from light fixtures.
- Select lamps with minimal or no hazardous materials.
- Design site lighting in a manner that will minimize "light pollution" by:
 - using fixtures with cut-off angles that prevent light from going beyond the specific area to be lighted
 - optimizing the height of luminaries for pathways to improve illumination and prevent light from straying onto adjacent properties
 - limiting exterior lighting to critical areas only.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
• Select high-efficiency lamps, ballasts, lenses, and lighting fixtures that address the specific task requirements.	■		■	■	■	■
• Specify high-efficiency appliances and equipment.	■			■		■
• Use long-life lamps to reduce maintenance.	■			■		■
• Develop the primary lighting strategy around a daylighting approach.	■	□	■	■	■	■
• Incorporate controls, occupancy sensors, and dimmable or staged lights to automatically reduce electric lighting during times of adequate daylighting.	■		□	■	■	
• Provide photocell controls on exterior lights to ensure lights are not operating during the day.	■			■		■
• Consider light-emitting diode (LED) exit lights.	■			■		■
• Minimize electrical line losses by installing a high-voltage distribution system.	■			■		■
• Conduct a commissioning process that verifies the proper operation of equipment and systems.	■			■		■
• Implement a regular maintenance schedule to ensure proper operation.	■			■		■
• Use ASHRAE Standard 9.01-1999 to establish lighting power densities (LPDs) for each space within the school.	■			■		■
• Incorporate photovoltaic and solar thermal-electric systems where appropriate.	■	■		■	■	■
• Monitor total building energy use and renewable energy system contribution.	■	■	□	■		
• Design lighting to uniformly light each space, minimize glare, and reduce overheating from light fixtures.	■		■		■	■
• Select lamps with minimal or no hazardous materials.				■	■	■
• Design site lighting in a manner that will minimize "light pollution" by:						
– using fixtures with cut-off angles that prevent light from going beyond the specific area to be lighted			■		■	■
– optimizing the height of luminaries for pathways to improve illumination and prevent light from straying onto adjacent properties	□			■	■	■
– limiting exterior lighting to critical areas only.	■			■	■	■

Checklist of Key Issues for Lighting and Electrical Systems

- Select ballasts that do not contain PCBs.
- Minimize glare and eye strain by:
 - incorporating indirect lighting, particularly in computer areas
 - using lenses that shield the lamp from direct view and help disperse light more evenly
 - evaluating the location of the lighting sources in relationship to the occupants and what the occupants will be viewing
 - avoiding reflected glare commonly experienced when viewing a computer screen and seeing the light fixtures
 - minimizing situations of "transient adaptation" in which the eye cannot properly adjust when going from one space to another with drastically different light levels.
- Employ energy-efficient lighting and electrical systems that will result in more energy dollars staying within the community.
- Consider life-cycle costs to ensure that the best long-term solutions are implemented.

Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
			■	■	■
		■		■	
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■					■
■					■

Checklist of Key Issues for Mechanical and Ventilation Systems

Mechanical and Ventilation Systems

- Implement the most energy-efficient mechanical and ventilation strategies to save energy.
- Consider the initial cost of equipment, anticipated maintenance expenses, and projected operating costs when evaluating the life-cycle benefits of system options.
- Use a computer energy analysis program that simulates hourly, daily, monthly, and yearly energy consumption and effectively accounts for daylighting benefits (i.e., reduced cooling).
- Optimize the mechanical system as a complete entity to allow for the interaction of various building system components.
- Employ the most energy-efficient mechanical systems by:
 - not oversizing equipment
 - eliminating systems that first cool air and then reheat it or mix cool and hot air
 - matching the air supply to the load, without adding a reheat penalty
 - considering thermal storage systems
 - zoning air handling units so that each unit serves spaces with similar orientation and use patterns.
- Implement a strategy that energy efficiently ensures adequate outside air by incorporating economizer cycles and heat recovery systems.
- Provide safe visual access to mechanical systems to explain how they work.
- Use energy monitoring stations as teaching aids.
- Improve student and teacher performance by ensuring adequate fresh air is provided by:
 - complying with ASHRAE ventilation standards
 - incorporating pollutant sensors
 - using nighttime ventilation strategies in the cooling season to flush out air prior to morning occupancy
 - installing ductwork that has smooth internal surfaces and transitions to minimize the collection of microbial growth
 - designing ductwork and plenums to minimize the accumulation of dirt and moisture and providing access areas in key locations for inspection, maintenance, and cleaning

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
Implement the most energy-efficient mechanical and ventilation strategies to save energy.	■		□	■	■	■
Consider the initial cost of equipment, anticipated maintenance expenses, and projected operating costs when evaluating the life-cycle benefits of system options.	■			■		■
Use a computer energy analysis program that simulates hourly, daily, monthly, and yearly energy consumption and effectively accounts for daylighting benefits (i.e., reduced cooling).	■					
Optimize the mechanical system as a complete entity to allow for the interaction of various building system components.	■					
Employ the most energy-efficient mechanical systems by:						
– not oversizing equipment	■			■	□	■
– eliminating systems that first cool air and then reheat it or mix cool and hot air	■			■		■
– matching the air supply to the load, without adding a reheat penalty	■			■		■
– considering thermal storage systems	■			□		■
– zoning air handling units so that each unit serves spaces with similar orientation and use patterns.	■			■		■
Implement a strategy that energy efficiently ensures adequate outside air by incorporating economizer cycles and heat recovery systems.	■		■		■	■
Provide safe visual access to mechanical systems to explain how they work.		■	□			
Use energy monitoring stations as teaching aids.		■	□			
Improve student and teacher performance by ensuring adequate fresh air is provided by:						
– complying with ASHRAE ventilation standards	■		■		■	
– incorporating pollutant sensors	■		■		■	
– using nighttime ventilation strategies in the cooling season to flush out air prior to morning occupancy	■		■		■	
– installing ductwork that has smooth internal surfaces and transitions to minimize the collection of microbial growth	■		■		■	
– designing ductwork and plenums to minimize the accumulation of dirt and moisture and providing access areas in key locations for inspection, maintenance, and cleaning	■		■		■	

Checklist of Key Issues for Mechanical and Ventilation Systems

- locating outdoor-air intakes a safe distance from polluted and/or overheated exhaust grilles and away from parking or traffic.
- Implement mechanical and ventilation strategies that control humidity and address all physical, biological, and chemical pollutants.
- Incorporate renewable energy systems to provide for absorption cooling, space heating, hot water, and electricity.
- Address the impacts of CFCs and HCFCs when selecting refrigerants for cooling systems.
- Implement indoor air quality strategies that can provide for healthier learning environments.
- Design the mechanical and ventilation systems to maximize the comfort of the students and teachers.
- Employ energy-efficient mechanical and ventilation systems that will result in more energy dollars staying within the community.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
			■		■	
			■		■	
	■	□		■		■
	■		■	■	■	■
			■		■	
	■					■

Checklist of Key Issues for Renewable Energy Systems

Renewable Energy Systems

- Consider the wide range of renewable options, including:
 - daylighting
 - passive cooling
 - solar hot water and space heating
 - photovoltaics
 - wind.
- Consider daylighting your highest priority.
- Incorporate solar systems.
- Employ photovoltaic and wind systems as educational tools that demonstrate the opportunities for converting sunlight and wind into electricity.
- Incorporate solar hot water, and provide a view that will illustrate how sunlight can be converted into thermal energy.
- Use daylighting and passive ventilation strategies to show students the importance of working with, instead of against, nature.
- Integrate displays showing total energy use at the school and the percentage of energy being provided by renewable energy sources.
- Use renewable energy systems as stimulating, educational tools involving multiple subject areas.
- Use on-site, renewable energy systems to help make the link between saving energy and helping our environment.
- Use renewable energy systems in conjunction with battery storage to provide for emergency power.
- Use photovoltaic systems to reliably power:
 - parking and walkway lighting
 - caution lights at street crossings and remote signage
 - security lights
 - emergency telephone call boxes
 - electric charging stations.
- Employ renewable energy and energy-saving strategies that will result in more energy dollars staying within the community.
- Install renewable energy systems at schools to serve the community in times of natural disasters and utility outages.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
– daylighting	■		■	■	■	■
– passive cooling	■			■		■
– solar hot water and space heating	■			■		■
– photovoltaics	■			■		■
– wind.	■			■		■
• Consider daylighting your highest priority.	■		■	■	■	■
• Incorporate solar systems.	■			■		■
• Employ photovoltaic and wind systems as educational tools that demonstrate the opportunities for converting sunlight and wind into electricity.		■				
• Incorporate solar hot water, and provide a view that will illustrate how sunlight can be converted into thermal energy.		■				
• Use daylighting and passive ventilation strategies to show students the importance of working with, instead of against, nature.		■	□	■	■	
• Integrate displays showing total energy use at the school and the percentage of energy being provided by renewable energy sources.	□	■	■			
• Use renewable energy systems as stimulating, educational tools involving multiple subject areas.		■	■			
• Use on-site, renewable energy systems to help make the link between saving energy and helping our environment.		■	■	■		
• Use renewable energy systems in conjunction with battery storage to provide for emergency power.	□			□	■	■
• Use photovoltaic systems to reliably power:						
– parking and walkway lighting	■			■	■	■
– caution lights at street crossings and remote signage	■			□	■	■
– security lights	■			□	■	■
– emergency telephone call boxes	■			□	■	■
– electric charging stations.	■			■	■	■
• Employ renewable energy and energy-saving strategies that will result in more energy dollars staying within the community.	■					■
• Install renewable energy systems at schools to serve the community in times of natural disasters and utility outages.						■

Checklist of Key Issues for Water Conservation

Water Conservation

- Encourage the general contractor to conserve water during construction.
- Incorporate indigenous vegetation to minimize irrigation requirements.
- Install water-conserving fixtures.
- Incorporate graywater systems.
- Consider rainwater collection systems.
- Provide more localized hot water heaters, closer to the loads in the school, to avoid wasting water and energy.
- Use educational signage and graphics to help inform students and staff about the need to conserve water, and instruct them on what they can personally do to save water.
- Install monitoring devices, sight glasses in storage tanks, and energy management systems that can be used by students to monitor school usage and see the benefits of using graywater.
- Adequately insulate hot water supply piping.
- Ensure that the water is clean and lead-free.
- Implement water-conserving strategies that will reduce the need to provide water from non-sustainable aquifers and water sources not within the immediate region.
- Consider installing an on-site biological wastewater treatment system.
- Check the condition of all existing plumbing lines and fixtures for sources of potential contamination, particularly lead.
- Use only lead-free materials in the potable plumbing system to avoid lead-related impacts such as lower IQ levels, impaired hearing, reduced attention span, and poor student performance.
- Verify the condition of the potable water supply.
- Install separate plumbing lines that will allow the school to irrigate by using reclaimed water, avoiding the costs, chemicals, and energy associated with treating water to potable levels but still achieving health standards for discharging into streams.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
• Encourage the general contractor to conserve water during construction.	■			■		■
• Incorporate indigenous vegetation to minimize irrigation requirements.	■			■		■
• Install water-conserving fixtures.	■			■		■
• Incorporate graywater systems.	■			■		■
• Consider rainwater collection systems.	■			■		■
• Provide more localized hot water heaters, closer to the loads in the school, to avoid wasting water and energy.	■			■		■
• Use educational signage and graphics to help inform students and staff about the need to conserve water, and instruct them on what they can personally do to save water.	□	■	■	□		
• Install monitoring devices, sight glasses in storage tanks, and energy management systems that can be used by students to monitor school usage and see the benefits of using graywater.		■	■	□		
• Adequately insulate hot water supply piping.	■			■		■
• Ensure that the water is clean and lead-free.					■	
• Implement water-conserving strategies that will reduce the need to provide water from non-sustainable aquifers and water sources not within the immediate region.				■		■
• Consider installing an on-site biological wastewater treatment system.	■	■	□	■		■
• Check the condition of all existing plumbing lines and fixtures for sources of potential contamination, particularly lead.				□	■	
• Use only lead-free materials in the potable plumbing system to avoid lead-related impacts such as lower IQ levels, impaired hearing, reduced attention span, and poor student performance.				□	■	
• Verify the condition of the potable water supply.					■	
• Install separate plumbing lines that will allow the school to irrigate by using reclaimed water, avoiding the costs, chemicals, and energy associated with treating water to potable levels but still achieving health standards for discharging into streams.	■			■		■

Checklist of Key Issues for Recycling Systems and Waste Management

Recycling Systems and Waste Management

- Implement a comprehensive recycling strategy that involves all major recyclable waste materials in the school.
- Allocate space throughout the building for recycling receptacles to reduce waste hauling and disposal costs.
- Provide outdoor recycling bins accessible to collection agencies or companies.
- Allocate space for yard waste composting to further reduce landfill tipping costs.
- Ensure that recycling receptacles are designed and labeled so as not to be confused with trash receptacles.
- Design recycling receptacles as attractive components, well-integrated into the overall design but still obvious to the students.
- Incorporate recycling receptacles that are easily accessible to students and custodial staff and designed to be used by students.
- Develop a recycling system that allows students to monitor their waste stream and that teaches them about waste reduction.
- Require a detailed waste management plan from the contractor to minimize the disposal of recyclable or reusable construction waste.
- Monitor construction waste management throughout the construction process to minimize the landfilling, incineration, or improper disposal of recyclable materials.
- Design recycling systems that will enable the school to recycle as much daily waste as possible.
- Consider incorporating a compost center that allows food waste to be used in gardens or landscaping.
- Select recycling containers that are made of recycled materials.
- Ensure that recycling receptacles are designed and installed so as not to create a physical hazard.
- Design recycling receptacles for easy cleaning.
- Provide documentation on cleaning procedures and maintenance requirements associated with the recycling receptacles.
- Locate local companies or services that can benefit from the use of recycled materials or construction waste.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
• Implement a comprehensive recycling strategy that involves all major recyclable waste materials in the school.	■	■		■		■
• Allocate space throughout the building for recycling receptacles to reduce waste hauling and disposal costs.	■			■		■
• Provide outdoor recycling bins accessible to collection agencies or companies.	■			■		□
• Allocate space for yard waste composting to further reduce landfill tipping costs.	■			■		■
• Ensure that recycling receptacles are designed and labeled so as not to be confused with trash receptacles.	■					
• Design recycling receptacles as attractive components, well-integrated into the overall design but still obvious to the students.		■				
• Incorporate recycling receptacles that are easily accessible to students and custodial staff and designed to be used by students.	■	■		■		
• Develop a recycling system that allows students to monitor their waste stream and that teaches them about waste reduction.		■	■	□		■
• Require a detailed waste management plan from the contractor to minimize the disposal of recyclable or reusable construction waste.	■			■		■
• Monitor construction waste management throughout the construction process to minimize the landfilling, incineration, or improper disposal of recyclable materials.				■		■
• Design recycling systems that will enable the school to recycle as much daily waste as possible.	■	■		■		■
• Consider incorporating a compost center that allows food waste to be used in gardens or landscaping.		■		■		
• Select recycling containers that are made of recycled materials.	■			■		
• Ensure that recycling receptacles are designed and installed so as not to create a physical hazard.					■	
• Design recycling receptacles for easy cleaning.					■	
• Provide documentation on cleaning procedures and maintenance requirements associated with the recycling receptacles.					■	
• Locate local companies or services that can benefit from the use of recycled materials or construction waste.				■		■

Checklist of Key Issues for Transportation

Transportation

- Work with developers and local planning departments to design easy, safe pedestrian access throughout the community to the school site.
- Use high-efficiency buses and service vehicles.
- Use graphics and signage to help educate students and the community about the environmental benefits of the energy-efficient and low-emission approaches to transportation implemented by the school.
- Give high priority to the placement of bicycle racks, and use personalized nameplates for regular bikers.
- Incorporate a highly visible solar electric and/or wind-powered charging station for electric buses and service vehicles.
- Design sidewalks and bike paths throughout the community and school site to help reduce air pollution associated with busing and single car drop-offs.
- Use low-emission methanol, biodiesel, natural gas, and solar electric buses and service vehicles to reduce air pollution.
- Stress safety when designing walkways and bike paths.
- Use photovoltaic systems to reliably power:
 - parking and walkway lights
 - caution lights and street crossings
 - electric charging stations.
- Allow for handicap access.
- Encourage recreational activities by providing access to athletic facilities that can be shared with residents of the local community.
- Provide pedestrian ways to and a mass transit stop at the school site so that the school is more easily accessible to the community.
- Implement energy-efficient transportation options that keep energy dollars in the community, strengthening the local economy.
- Choose high-efficiency and low-emission vehicles as the best long-term solution to protect against future energy cost escalation.

	Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
• Work with developers and local planning departments to design easy, safe pedestrian access throughout the community to the school site.	■			■	■	■
• Use high-efficiency buses and service vehicles.	■			■		■
• Use graphics and signage to help educate students and the community about the environmental benefits of the energy-efficient and low-emission approaches to transportation implemented by the school.		■	■			
• Give high priority to the placement of bicycle racks, and use personalized nameplates for regular bikers.		■				
• Incorporate a highly visible solar electric and/or wind-powered charging station for electric buses and service vehicles.	■	■		■		■
• Design sidewalks and bike paths throughout the community and school site to help reduce air pollution associated with busing and single car drop-offs.	■			■	■	■
• Use low-emission methanol, biodiesel, natural gas, and solar electric buses and service vehicles to reduce air pollution.	■			■	■	■
• Stress safety when designing walkways and bike paths.					■	
• Use photovoltaic systems to reliably power:						
– parking and walkway lights	■			■	■	■
– caution lights and street crossings	■			□	■	■
– electric charging stations.	■			□	■	■
• Allow for handicap access.					■	■
• Encourage recreational activities by providing access to athletic facilities that can be shared with residents of the local community.						■
• Provide pedestrian ways to and a mass transit stop at the school site so that the school is more easily accessible to the community.	■					■
• Implement energy-efficient transportation options that keep energy dollars in the community, strengthening the local economy.	■					■
• Choose high-efficiency and low-emission vehicles as the best long-term solution to protect against future energy cost escalation.	■					■

Checklist of Key Issues for Resource-Efficient Building Products

Resource-Efficient Building Materials

- Use products that are energy-efficient.
- Choose fixtures and equipment that conserve water.
- Specify building systems, components, and materials with low maintenance requirements.
- Incorporate less-polluting materials, the result being a reduced requirement for mechanically induced fresh air and better energy efficiency.
- Incorporate pollutant sensors to reduce ventilation air exchange during non-occupied times.
- Design environmentally sound building components to make their purpose and function obvious to students.
- Use products and systems that save water in explicit, visible ways.
- Incorporate locally harvested or mined materials as prominent design elements.
- Avoid materials containing toxic or irritating compounds that negatively impact the indoor air quality.
- Specify products, materials, and equipment that can be maintained in an environmentally friendly way.
- Select products made from renewable energy and low-polluting processes.
- Specify products harvested from well-managed forests.
- Avoid products harvested or mined from environmentally sensitive areas.
- Select products that are made from recycled materials and/or are recyclable.
- Specify products made with a minimum of process (embodied) energy.
- Minimize the environmental impact of the building's operation by evaluating the environmental life-cycle impacts.
- Incorporate energy-efficiency and renewable energy systems.
- Use water-saving fixtures and appliances, and implement rainwater catchment and graywater systems.
- Avoid products that produce indoor air pollution.

Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
■			■		■
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Checklist of Key Issues for Resource-Efficient Building Products

- Separate polluting materials from exposed surfaces.
- Incorporate indoor planting strategies.
- Avoid equipment that requires toxic or irritating maintenance procedures.
- Provide detailed guidance on preferable maintenance procedures to minimize exposure of staff and students to toxic and irritating chemicals.
- Work with the school system to develop an indoor pollutant source assessment and control plan.
- Choose products and materials that are locally produced or made from readily available materials.
- Choose products and building procedures that maximize local labor.
- Select indigenous materials, and implement designs that enhance the connection to "place."
- Select materials that can be reused or recycled, minimizing impacts on landfills.

Reducing Operating Costs	Designing Buildings that Teach	Improving Academic Performances	Protecting Our Environment	Designing for Health, Safety, & Comfort	Supporting Community Values
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Excerpt from
Energy & Your School Activity Guide
at keepprogram.org

© 2019 Wisconsin Center for Environmental Education

The Wisconsin K-12 Energy Education Program is supported through funding from



Wisconsin K-12 Energy Education Program (KEEP)
College of Natural Resources
University of Wisconsin - Stevens Point

