

**Age Level:**

Third grade and up

**Subjects:**

Science  
Math  
Social Studies  
Language Arts

**Time:**

60 minutes for each part

120 minutes total

**Materials:**

- Sheets of 8 1/2 x 11 white paper
- Number 10 pencils
- Computer with Internet access

**Learning Objective:**

- To introduce students to the concepts of green building and sustainable design

**Design Professional and Teacher:**

The initial activity in this lesson is followed by two that utilize activities located on websites and will require Internet access. In conjunction with the activities printed in this lesson, they will offer students a broader scope of the impact of “green” building as well as living sustainably in their communities and in our world.

**Rationale:**

When a building is carefully designed to positively utilize the natural environment, there is less negative impact on natural resources and therefore a healthier place is created for people and other living things. This lesson guides students through a discussion and suggested activities on the impact of buildings and their influence on our work, learning, home, social and natural environments.

**Part One:****Overview of “green” design concepts:**

Suggested dialogue . . .

*“Architecture that considers impact on the environment is sometimes called “green” or “sustainable.” This approach to design and construction positively uses the natural environment so there is less negative impact on natural resources, and it makes the finished building a healthier place for people and other living things to live, work, learn and play.*

*“Sustainable buildings are “healthy buildings” with better air quality and lighting. They are energy efficient, use natural resources wisely, and are operated in an environmentally friendly manner.*

*“Designing buildings that naturally maximize light, heat and other natural resources is not a new thought. Before the invention of electricity, it was necessary for architects and builders to create structures that would automatically use natural resources to keep people warm or cool and let in light.*

*“Historically, people also had to be aware of how much water was available to live on in their natural environment. Electricity now allows us to store and transport water and make water clean to drink. We cannot live without water. Architects who value sustainability think about minimizing water usage when they design a building in order to preserve water as a precious resource. Although the relative importance of water usage varies from region to region, an awareness and concern about adequate water supply is becoming more and more important worldwide.*

*“Sustainable building practices also incorporate what is called “rehabilitation.” This involves reusing a building that has outlived its original function. Sometimes architects and builders reuse the entire structure, and sometimes the building’s materials are recycled. For example, it costs less money and energy to reuse a window than it does to make a new one. Reusing a building or its materials also uses less money and energy by not having to tear it down, haul it away, make new materials and transport them.”*



**Ask students some questions to initiate discussion such as:**

1. What do you think our world would be like if we ran out of fossil fuels, like oil or gasoline?
2. What would life be like if we couldn't heat our buildings with oil, electricity or natural gas?
3. How many ways can you think of that you rely on electricity? (Remind students of things like hot water, refrigerators, traffic lights, microwaves, computers, etc.)
4. Can you think of ways this electricity could be generated without using non-renewable resources?
5. List all of the ways that we use water. If we were required to restrict our water usage year-round, which of the ways that you use water would be most important to you?
6. Can you imagine a toilet with 2 buttons instead of one? Why would you want 2 options instead of one? Can you think of better ways to use water than our culture does currently? How about using rain water?
7. How do you think people lived without electricity 150 years ago? What kinds of things did they live without that we take for granted?

**Vocabulary:**

Below are important vocabulary words for students to understand as you begin to talk about sustainability. After going over the vocabulary words with students, hand out the "Green Building Definitions" matching activity.

**Building Reuse/Adaptation:** Buildings are kept and reused by using the original walls and/or other parts from existing buildings as an alternative to demolishing the building and starting over.

**Daylighting:** A method of lighting the inside of buildings with natural light (like sun-light through windows) so that less artificial light (like from lightbulbs) is needed.

**Eco-Roof:** A light-weight, green living roof of plants and soil that doesn't need a watering system, fertilizer or pesticides.

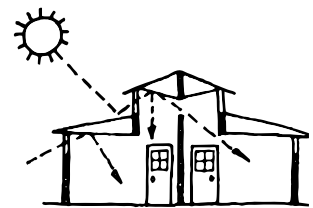
**Energy Efficiency:** The ability to do something without wasting energy. Examples of being energy efficient are to turn out the lights when you leave a room or to turn off the water while you are brushing your teeth.

**Environmentally Preferable:** Products or services that don't effect human health and the environment as much as other products or services that serve the same purpose.

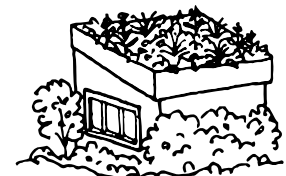
**Fossil Fuel:** Fuel, such as coal, oil and natural gas, produced by the breakdown of ancient (fossilized) plants and animals. It is a source of non-renewable energy.

**Green Building:** A building that is more sustainable than typical buildings and results in structures that are environmentally responsible and healthy places to live, work, learn and play.

**Indoor Air Quality:** The quality of air in an indoor space.



DAYLIGHTING



ECO-ROOF



**Integrated Design:** A building with systems that work together for the most efficient building. Efficiency relies on daylighting, heating & cooling, plumbing and electrical systems, etc.

**Natural Ventilation:** The building design uses wind or warm air to supply air to the inside of a building.

**Offgas:** The emitting of fumes into the air. There are numerous building materials that have chemicals in them which offgas, when exposed to air, high temperatures, moisture and/or ozone levels.

**Rainwater Harvesting:** The rain that falls on a roof or other surface and is directed by gutters to a storage tank. That water is then used for irrigation, toilet flushing and other uses; it is not used for drinking, cooking or bathing.

**Recycling:** Products or other materials are recovered for use in the creation of new products.

**Renewable energy:** Energy sources such as wind and solar power that can keep producing indefinitely without being used up as with fossil fuels.

**Sick Building Syndrome:** The term “sick building syndrome” is used when people become ill in a building (headache, dizziness, allergies due to mold) and the source of their sickness is caused by contaminants in the building (when a building is not “sick,” it is a “healthy” building).

**Solar Power:** Heat from the sun is used to heat and power things in a building like a house, office or school.

**Volatile Organic Compounds (VOC's):** VOC's are the chemicals that evaporate into indoor air at room temperature (offgassing). Examples of materials that may contain VOC's can include: paints, glues, and carpeting. VOC's include Chlorofluorocarbons, Hydrochlorofluorocarbon, Methane.

**Water Efficiency:** The ability to do something without wasting water. An example of water efficiency is rainwater harvesting.

**Wind Power:** Wind power systems (like windmills) convert the energy of the wind into electricity.

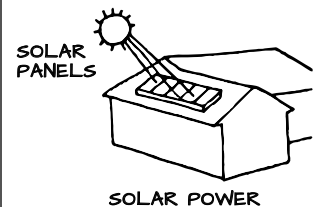
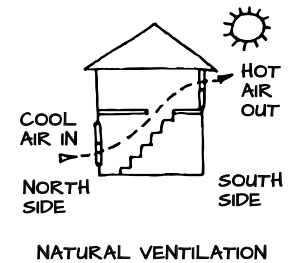
## Part Two:

### How Green is my School?

Have students, either individually or in groups, complete the “How Green is My School?” questionnaire. Help them gain as much access as possible to staff and faculty in the building they might need to ask questions of. After the questionnaires are completed, have students discuss findings and, if possible, create an action plan for the future.

### Suggestion for further exploration:

Have students use the questions and scoring from “How Green is my School?” to analyze “How Green is my House?” at their home. Then have students discuss what could change in their household and households in general to have less impact on the environment.





## Supplemental Lessons:

### How BIG is my Footprint?

“Environmental Footprint”: This is a survey to illustrate how our individual living patterns and material usage have environmental impacts. Use the following web sites for official surveys.

[www.footprintcalculator.org](http://www.footprintcalculator.org)

<https://www.earthday.org/action/>

### Planning a ‘Green’ Community

- Brainstorm what goals a green community might have (dialogue might include water usage, land use, food production, transportation and housing)
- Brainstorm what a green community might look like
- Discuss what would be different from your current community
- Create a master plan and assign specific uses to each student. Have them develop a green building that will support and improve the overall community (based on previously introduced concepts)

<https://www.nbm.org/wp-content/uploads/2016/02/CBDERP.pdf>

[www.greeneducationfoundation.org/institute/lesson-clearinghouse/531-How-Green-is-Your-Community.html](http://www.greeneducationfoundation.org/institute/lesson-clearinghouse/531-How-Green-is-Your-Community.html)

<https://education.minecraft.net/en-us/worlds/sustainability-city>

### Additional Resources

- Teaching and Learning for a Sustainable Future

This is a multi-track resource that includes technical background for sustainable concepts with associated activities.

[www.unesco.org/education/tlsf/](http://www.unesco.org/education/tlsf/)

- Environmental Learning Activities

A free resource focused on environmental learning activities for a number of classroom subjects and lenses.

<https://www.neefusa.org/what-we-do/k-12-education/environmental-education-activities>

### Closure:

Summarize the basic concepts of sustainable building, such as energy efficiency, environmental friendliness and wise use of natural resources. Talk about some of the overall findings from the activities completed and discuss how students might change their own individual living habits based on what they learned.

**HOW GREEN IS MY SCHOOL?****4.19***What is Green Building and Sustainable Design?*

NAME

DATE

School Name:

\_\_\_\_\_

Student Name(s):

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Directions: For each question answered “yes” award your school 10 points. For questions answered “sometimes,” award a portion of the points. For questions answered “no” award your school zero points.

1. Do staff and students turn off lights in your school when they are not required?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

2. Are computers and monitors either turned OFF or put to SLEEP mode when not in use?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

3. Are computer printers, scanners, photocopiers and other electronic equipment turned OFF when not in use?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

4. Are windows and curtains closed at the end of the school day?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

5. Are air vents on walls or windowsills kept free of obstructions?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

6. Are outside doors not kept open longer than is necessary?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

7. Are mechanical equipment and water faucets checked regularly and problems reported immediately?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

8. In addition to recycling, does your school also coordinate energy conservation efforts?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

9. Does your school encourage use of both sides of the paper?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

10. Does your school use a sibling list when sending printed information home to parents?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

11. Does your school use other means of communication to minimize the use of paper?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

12. Does your school promote waste free lunches: reusable containers, a share basket for unwanted items?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

13. Does your school have a recycle bin for each category of recyclables in every room?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

**HOW GREEN IS MY SCHOOL?****4.20***What is Green Building and Sustainable Design?*

NAME \_\_\_\_\_

DATE \_\_\_\_\_

14. Are all classrooms accessible to natural daylight (for instance, do they have outside windows)?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

15. Do ventilation systems get regular inspections and are air filters replaced as needed?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

16. Does school have submeters installed to monitor water efficiency and identify leaks?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

17. Are teachers and students encouraged to report water leaks to maintenance staff?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

18. Is mulch used around plants outside to retain moisture?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

19. Are sprinklers and hoses directed at grassy areas and not pavement?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

20. Does landscaping consist primarily of hardy, native plants adapted to the local climate and rainfall?

YES    SOMETIMES    NO   **Points:** \_\_\_\_\_

TOTAL Points: \_\_\_\_\_

(200 points possible)

Questionnaire adapted from "Green Schools Checklist: Environmental Actions for Schools to Consider" by the Office of Pollution Prevention

**GREEN BUILDING DEFINITIONS**

*What is Green Building and Sustainable Design?*

NAME	DATE
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Match the word to the definition by drawing a line between the word and the correct definition:

Heat from the sun is used to heat and power things in a building like a house, office or school.
A system in a building's design that uses wind or warm air to supply air to the inside of a building.
A method of lighting a building inside with natural light (sunlight) instead of artificial (light bulbs).
Buildings are recycled by using the original walls and/or other parts from existing buildings.
Collecting and saving used materials for remaking something useful again.
Power systems that convert the energy of wind into electricity.
Rain that falls on a roof and is used for irrigation and grey water uses.
A sustainable building that is environmentally responsible and healthy to live, play & work in.
Building materials that have chemicals in them which emit fumes.
Volatile Organic Compounds: Chemicals that contain carbon molecules and evaporate from material surfaces. Examples: carpet, paint, glues.

Wind Power
Offgas
Green Building
Rainwater Harvesting
VOC's
Solar Power
Daylighting
Natural Ventilation
Building Reuse
Recycling

**GREEN BUILDING DEFINITIONS - TEACHER KEY****4.22***What is Green Building and Sustainable Design?*

Heat from the sun is used to heat and power things in a building like a house, office or school.	Solar Power
A system in the building's design that uses wind or warm air to supply air to the inside of a building.	Natural Ventilation
A method of lighting the inside of buildings with natural light (like sunlight through windows) so that less artificial light (like from light bulbs) is needed.	Daylighting
Buildings are recycled by using the original walls and/or other parts from existing buildings.	Building Reuse
Collecting and saving used materials for remaking something useful again.	Recycling
Power systems that convert the energy of wind into electricity.	Wind Power
Rain that falls on a roof and is used for irrigation and grey water uses.	Rainwater Harvesting
A building that is more sustainable and results in structures that are environmentally responsible and healthy places to live, work, learn and play.	Green Building
Building materials that have chemicals in them which emit fumes.	Offgas
Volatile Organic Compounds. Chemicals that contain carbon molecules and evaporate from material surfaces. Examples: carpet, paint, glues.	VOC's