



Lesson 9: Bright Schools

Energy Knowledge in Action!

Overview

In this culminating lesson, students examine electric lighting used in their schools and determine if there are methods that can reduce the amount of energy being used for their schools' lighting.

Teacher Background

Schools spend more money on energy than on textbooks, computers, and other school supplies. Lighting accounts for approximately 15% of the total energy bill of educational institutions nationwide. (Source: US Department of Energy's Office of Energy Efficiency and Renewable Energy, 1999.) Older buildings, particularly those constructed before 1970, have high levels of illumination and may use outdated incandescent or fluorescent light fixtures. Sometimes even more modern buildings have inefficient lighting.

The majority of lighting in most schools is from fluorescent tubes. In order to operate, a fluorescent tube needs to have a ballast. The ballast regulates the electric current passing through the gas inside the fluorescent light bulb. There are two types of ballasts, magnetic and electronic. Magnetic ballasts have lights that flicker. Electronic ballasts are more energy-efficient than those powered by magnetic ballasts, and reduce eyestrain and other negative health effects caused by some older fluorescent lighting systems. Electronic ballasts use up to 30 percent less energy than magnetic ballasts.

Electricity is used to provide artificial lighting to various school areas such as classrooms, cafeterias, corridors, offices, sports fields, and parking areas. Maximizing the use of natural light and installing more energy efficient fluorescent lighting systems can significantly reduce energy costs. Turning off unnecessary lights and proper system maintenance can also make an impact on lighting costs for the school. Even the most efficient fluorescent system is not efficient if it is used indiscriminately.

Some schools have been designed to use natural lighting effectively, particularly in common spaces such as libraries, entryways, hallways, and cafeterias. In addition to making the best use of available natural light, newly constructed schools are often equipped with devices called lighting controls that turn lights on and off or dim lights. Photocells, timers, occupancy sensors, dimmer switches and other lighting technologies help reduce unnecessary energy use. State agencies in Maine provide support





and guidance for school construction, not only to reduce the cost of energy, but also to reduce fossil fuel consumption and improve the environment in and outside schools.

Does turning off the lights when not in use or changing the type of light bulbs that are used to light schools, businesses, and homes really make a difference in reducing humans' impact on the planet? In March of 2007, in an effort to raise the awareness of the greatest contributor to global warming, coal-fired electricity, the entire city of Sydney Australia turned its lights off for one full hour. In this one-hour, 2.2 million people and over 2,100 businesses turned off their lights, reducing energy use by 10%. This is equivalent to taking 48,000 cars off the road! This bold act caught the attention of people across the planet and in 2008, 24 cities worldwide repeated this effort. (For more about this and future "Earthhour" events visit <http://www.earthhour.org/>) The message is clear: from turning off the lights when rooms are empty to replacing inefficient bulbs with more efficient versions and making the most of natural lighting whenever possible, simple changes collectively make a difference.

Students and many adults have great difficulty making sense of the complex connections between seemingly simple actions such as turning off lights when not in use and global climate change. While it is not expected that students understand all of the intricate details of this connection, it is important for students to understand that there is a connection and their efforts do make a difference. The above example of Sydney is a collective effort – students need to be convinced that single efforts make a difference.

It can be easy for students and adults alike to become overwhelmed and even discouraged with the prospects of climate change. This lesson is designed to provide opportunities of empowerment for students. Care must be taken that the message of this lesson be delivered in a way that is empowering and not frightening to students. The idea of climate change and the role electricity production and usage plays in it is very abstract and can be difficult for students to grasp. This lesson isn't meant for students to thoroughly understand those ideas and connections. They simply aren't developmentally ready either intellectually or emotionally. But they are ready to study the fact relationship electricity production and usage and the changing climate. So what are teachers and students to do? It's as simple as turning out a light. Remember this powerful quote from an insightful person as you proceed through this lesson:

Never doubt that a small group of thoughtful committed citizens can change the world. Indeed, it is the only thing that ever has.

–Margaret Mead, *anthropologist*

Note: *Even after instruction about electricity production, students may have questions that stem from misconceptions such as:*

- *Does carbon dioxide come out of the lights when they are turned on? (No it doesn't. The carbon dioxide comes from the coal, oil, natural gas power plants that create the electricity but many students think the CO₂ comes right from the bulbs themselves).*
- *Is it true that it takes more energy to turn the lights on than to leave them on? (False. This belief comes from thinking about antiquated light bulbs. This is not true of light bulbs used today.)*



Key Ideas

- By modifying habits, people can reduce the amount of energy being used for lighting.
- By taking action, students can incorporate these simple habits to save energy at school.
- These actions are cumulative, important, and have an effect on our environment.

Lesson Goals

Students will:

- conduct a survey to determine how energy is used for lighting in school.
- make recommendations for reducing the amount of energy being used for lighting in school.
- recognize that everyone can contribute to using energy more responsibly by including simple habits like turning off a light when it is not needed.



Vocabulary

survey: a method of collecting information for the purpose of analysis of a particular issue.

Preparation

- Alert the principal, teachers, staff and custodian that students will be conducting a light survey of the school as part of their energy studies.
- Become familiar with different examples of light surveys. Numerous examples of light survey can be found online. Some to review are:
XCEL Energy's School Light Survey
<http://www.energyclassroom.com/conservation.php>
Battle of the Bulbs Home Light Bulb Survey
<http://wattwatchers.org/Assets/kisp/incanvscfl.pdf>

Materials

Item	Quantity
Scientist's Notebook	1 per student
Paper for drawing diagrams of school	1 per team
Clipboards	1 per team
Master Diagram of School	1 per team
Student Handout 9.1: Recommended Light Levels	1 per student
Light meter (optional)	1 per class



Time Required: 2-4 sessions

Connection to Maine Learning Results: Parameters for Essential Instruction and Benchmarks for Science Literacy

- Some people try to reduce the amount of fuels they use in order to conserve resources, reduce pollution, or to save money. BSL 8C/E4 (3-5)
- Explain that natural resources are limited, and that reusing, recycling, and reducing materials and using renewable resources is important. MLR C3 (3-5) c



Teaching The Lesson

Engage



1 Present the scenario.

Present the following or a similar scenario to students:

The principal of our school knows that our class has been learning about how Energy Lights Maine and more specifically, how much energy is used to light our school. We have learned that lights use a lot of energy and, unfortunately, energy use in lights is not always efficient. Because we have been learning so much about energy with respect to lighting, the principal wondered if our class might have some suggestions as to how we might, as a school, reduce the amount of electricity used in our school for lighting?

Ask the class why the principal might be concerned about the school's energy use. This provides an opportunity to revisit the connection between energy use, conservation, and the environment. (See step 9 in Lesson 8.)

2 Brainstorm and share suggestions.

Allow students time to brainstorm and discuss their ideas in pairs or small groups, before facilitating a whole class discussion. It may be useful to chart their initial ideas on paper or a black/white-board.

3 Discuss developing a light survey.

During this discussion, guide students toward the idea that it may be beneficial to first determine the current amount of light use in the building. Knowing the current status of lighting in the school, including the different sources, number of lights, how many hours lights are on, etc. is valuable information because it can help determine the changes necessary and if energy is being saved in the future.

Numerous examples of light survey can be found online. Some to review are:

XCEL Energy's School Light Survey

<http://www.energyclassroom.com/conservation.php>

Battle of the Bulbs Home Light Bulb Survey

<http://wattwatchers.org/Assets/kisp/incanvscfl.pdf>



Note: Alternately, students could develop and carry out a light survey of one common room in the school, such as the library or cafeteria, or specific area or wing of the school, as practice or in lieu of conducting an entire school light survey.

4 Assist students in creating a light survey.

Create a simple, easy to follow master diagram of the school or create one as a class the day before the students conduct their survey. Label classrooms, offices, hallways, restrooms, libraries, gymnasiums, cafeterias and other common areas and non-classrooms on the master diagram. Make photocopies of the labeled diagrams. Students will initially record their data directly on these diagrams. Students should consider including the following information in the diagram:

- location surveyed (room number or name)
- number of lights
- type of lights
- number of light switches in each room and each common area as well as the number and location of each light fixture that goes with each switch.
- number of hours lights are on (copies of the school schedule may help in gathering and estimating this information. Suggest students (that they may want to) talk to the custodian to get a more accurate picture of when lights are turned on and off each day.)
- if it is a sunny day or not
- (optional) readings from light meter(s).



Explore

5 Carry out light survey.

Divide the class into small groups or teams. Pair each team with an adult volunteer and assign each team to an equal number of classrooms, common areas, and non-classrooms to survey. Give each team a clipboard with a diagram of the school attached. Guide the students through the school and conduct the survey. Record the type of lighting, number of light fixtures, and on/off switches in each area. Make note of any light fixtures that can be turned off during the course of the day. Alternatively, have teams of students schedule convenient appointment times with individual classroom teachers, perhaps visiting these teachers during a break or planning period. This approach may give students a chance to interview each classroom teacher and office employee.

Note: If you have a light meter, review its use. Also review the *Recommended Light Levels* sheet that accompanies this lesson (Lesson 9) and use the light meter to determine light levels with lights on and with lights off for each area visited and record that information.

6 Create a class chart.

After students return with their surveys, work as a class to create a class data collection chart. Each student group records the light information gathered from the school survey. Information on the class data chart should include all the information recorded on each diagram.

Reflect And Discuss



7 Bring lesson to a close.

Review and analyze data. Make recommendations. Have students review the data they collected in their survey. Ask students to respond in their notebooks to the following prompt(s):

- Write a short summary that describes what you found out about light use through your survey.
- List three things that you would recommend to the principal, classroom teacher, and students to reduce the amount of energy that is used in our school for lighting.

Discuss the findings and brainstorm ways to conserve energy. Draw up a list of recommendations to present to the school administration and the energy manager.



8 Develop and present plan to school.

Ask students to develop a plan that will encourage everyone in the school to be more aware of the issues related to energy use for lighting. Students' plans can be as simple or as elaborate as time and abilities permit. Action ideas that students might want to try include:

- Setting up an energy patrol by contacting MEEP. *The Maine Energy Education Program* (MEEP) will provide guidance in setting up a daily monitoring activity known as an *Energy Patrol*. Energy Patrols are aimed at empowering students and helping students and teachers remember to save electricity. Students simply tour the school during lunch or recess to make sure lights and computer monitors are not left on while not in use. MEEP may be contacted through their website: <http://www.meepnews.org/>

- Create “doorknob reminders” that could be placed on classroom doorknobs to remind them to turn out the lights when they are not needed.
- Create posters for the hallways throughout the school.
- Create a multimedia presentation that can be played over televisions located in common areas.
- Conduct a follow up investigation using light meters to determine if the recommended light levels could be attained by using natural or alternative lighting.
- Calculate/estimate financial savings of switching to more efficient lighting (ex: CFLs or LEDs)



Extensions

Student may:

- examine how new lighting technologies are used in schools, businesses and homes.
- read articles about or “tour” (virtual or otherwise) a school that has incorporated new lighting technologies.
- conduct a similar activity at home to see how lights are used there. Check for devices that control lights such as sensors or timers.
- talk with an energy auditor and/or weatherization specialist.
- take an online quiz about climate change http://news.bbc.co.uk/cbbcnews/hi/specials/climate_change/default.stm
- design an energy-efficient school.
- learn how to read an electric meter. MEEP and MPS are available to assist students and teachers in Maine.

Connection to Maine Agencies

MEEP (Maine Energy Education Program) has an *Energy Patrol* (4th to 8th grade) Activity focusing on the question: *Are lights left on when they are not being used?* The energy patrol tours the school and rewards the classroom that does the best job saving electricity with a week's care of a toy armadillo, an emerging symbol for climate change.

MEEP also has *Light Meter/Lighting Survey*. Students learn how to use a light meter and inventory the light levels in their school to see if any areas are over-lit. A MEEP representative will come to interested schools, free of charge, to guide this activity. The MEEP website is <http://www.meeppnews.org/classroomactivities>

For schools in Aroostook County, a Maine Public Service (MPS) representative will come to interested schools, free of charge, to guide and support concepts developed in this lesson. A description of programs is available at www.mainepublicservice.com. Click on the education section of the site. To schedule a visit contact Nancy Chandler at 207.760.2556 or nchandler@mainepublicservice.com.

Online References and Resources

Lesson modified from:

http://www.earthcarecanada.com/EarthCARE_Program/Lessons/4_light_detective.pdf

