



WASTE WATCHERS

(Adapted from PLT PreK-8 Activity #73)

TARGET GRADE: 4 - 8

OVERVIEW:

Energy seems easy to use, but obtaining it is often not easy on the environment. When we reduce the amount of energy we use, we decrease the pollution that results from producing that energy, we conserve natural resources needed to produce energy and we save money for our families and schools. In this activity, your students conduct an audit of the energy used in your classroom and/or school and explore ideas for conserving energy.

OBJECTIVES (what students will know or be able to do):

1. Students will demonstrate investigation techniques as they survey energy use in their classroom/school.
2. Students will demonstrate correct use of monitoring equipment, such as a watt meter to measure and record results.
3. Students will develop an understanding of how individual and collective student actions can affect energy usage.
4. Students will explore conservation and energy-saving strategies for school.
5. Students will be able to define key energy terms.
6. Students will identify natural resources used to produce energy.

MATERIALS:

- Classroom Energy Survey Log Worksheets
- Watt-meters, used in the appliance portion of the survey (though very informative, if watt-meters are not available students could do research on the internet to calculate the approximate energy usage of devices in the classroom. ALSO, contact Sierra Nevada Journeys as some may be available on loan.)

PREP TIME: 30 minutes

ACTIVITY TIME: 1 – 3 Class Periods over a week.

NEVADA STATE STANDARDS:

(Certain standards are better correlated with activity extensions)

Science

N.5.A.1 - Students know scientific progress is made by conducting careful investigations, recording data, and communicating the results in an accurate method. E/S

N.5.A.5 - Students know how to plan and conduct a safe and simple investigation. E/S

N.5.B.2 - Students know technologies impact society, both positively and negatively. E/S

N.5.B.3 - Students know the benefits of working with a team and sharing findings. E/L

N.8.A.3 - Students know how to draw conclusions from scientific evidence. E/S

N.8.A.5 - Students know how to use appropriate technology and laboratory procedures safely for observing, measuring, recording, and analyzing data. E/L

N.8.B.1 - Students understand that consequences of technologies can cause resource depletion and environmental degradation, but technology can also increase resource availability, mitigate environmental degradation, and make new resources economical.

L.5.C.2 - Students know organisms interact with each other and with the non-living parts of their ecosystem. E/S

L.5.C.3 - Students know changes to an environment can be beneficial or detrimental to different organisms. E/S

L.5.C.4 - Students know all organisms, including humans, can cause changes in their environments. E/S

L.8.C.3 - Students will evaluate how changes in environments can be beneficial or harmful. E/S

Math

1.3.7 - Add and subtract two- and three-digit numbers with and without regrouping. E/S

1.3.8 - Generate and solve two-step addition and subtraction problems and one-step multiplication problems based on practical situations. E/S

1.4.7 - Add and subtract multi-digit numbers. Multiply and divide multi-digit numbers by a one-digit whole number with regrouping, including monetary amounts as decimals. E/S

1.4.8 - Generate and solve addition, subtraction, multiplication, and division problems using whole numbers in practical situations. E/S

1.5.7 - Add and subtract decimals. Multiply and divide decimals by whole numbers in problems representing practical situations. E/S

1.5.8 - Generate and solve addition, subtraction, multiplication, and division problems using whole numbers and decimals in practical situations. E/S

1.6.7 - Calculate using fractions, decimals, and percents in mathematical and practical situations. E/S

4.7.9 - Make and test conjectures to explain observed mathematical relationships and to develop logical arguments to justify conclusions. I/L

4.8.9 - Represent logical relationships using conditional statements. I/L

5.6.1 - Pose questions that guide the collection of data. Organize and represent data using a variety of graphical representations including circle graphs and scatter plots. I/S

5.7.1 - Formulate questions that guide the collection of data. E/S

5.7.2 - Interpret graphical representations of data to describe patterns, trends, and data distribution. I/S

5.8.1 - Formulate questions and design a study that guides the collection of data. E/S

Language Arts

6.4.7 - Write friendly letters following an established format. I/L

6. (5 – 8).7 - Write a variety of communications in appropriate formats. I/L

Social Studies

G.8. (4-5).5 - Describe the distribution patterns of natural resources in Nevada. Describe and compare the distribution patterns and use of natural resources in the United States.

G.8. (6-8).4 - Discuss the impact of natural hazards on the use and distribution of resources.

Health/P.E.

1.5.11 - Identify programs designed to promote community health (recycle, garbage, water).

1.8.12 - Apply personal actions that contribute to the enhancement of the environment.

KEY VOCABULARY:

- “vampire” appliance- an electric appliance that consumes power while they are switched off or are in a “standby” mode. Many appliances with remote controls are “vampires”.
- Watts – the rate of electrical current flow, when one ampere is driven, or “pushed,” by

one volt.

- Kilowatt-Hours – the energy expended when 1000 watts of electrical power is used for one hour.
- Natural resources – land or raw materials, that occur naturally within environments. Many are essential for our survival, and others are used for satisfying our wants.
- Compact fluorescent bulbs – bulbs that give off light when a mixture of three phosphors are exposed to ultraviolet (UV) light from mercury atoms. Designed to replace incandescent bulbs as they give the same amount of light, use less energy, and last longer.
- Phosphors – substance that can emit light when irradiated with UV light.
- Incandescent light bulbs – bulbs that produce light by heating a filament to a high temperature. Only 5% of energy is converted to light, the remainder is wasted as heat.
- Atom – the smallest particle of an element that retains the chemical properties of that element; composed of protons, neutrons, and electrons.
- Electron – a negatively charged component of an atom; exists outside of, and surrounding, the atom's nucleus, can either be free or bound to a nucleus.

LEAD INFORMATION:

When you drive to the store, take a shower, or turn on a computer, you're using energy. Electricity is the most common form of energy we use at home and at school. It is a secondary energy source which means that we get it by converting other sources of energy, such as coal, oil, natural gas, nuclear energy, hydropower, wind power, or solar energy.

To produce electricity, power plants use one of these secondary energy sources for heating water to produce steam. Then the steam turns a series of blades on a turbine connected to a generator. As the turbine rotates, spinning bundles of copper wire in the generator create a magnetic field that causes electrons to move from atom to atom. This movement of electrons makes an electric current.

While electricity is itself a clean source of energy, the majority of electricity in the United States is generated from power plants that burn fossil fuels (coal, oil, and natural gas). These power plants emit large amounts of carbon dioxide, carbon monoxide, nitrogen oxides, sulfur dioxide, and other emissions that affect air quality.

Electricity is measured in units of power called watts. The amount of electricity we use over a period of time is measured in kilowatt-hours (kWh) or the energy of 1000 watts for one hour. For example, if you use a 40-watt light bulb for 5 hours, you have used 200 watts of power, or 0.2 kilowatt-hours.

Energy conservation means reducing unnecessary energy use and waste. Consuming less energy reduces the amount of carbon dioxide and other pollutants released into the atmosphere; and reduces the amounts of natural resources, such as coal, oil, and natural gas that may be used to produce that energy. There are many simple ways that people can conserve energy, including adjusting the heating or air conditioning thermostat to reduce energy, using compact fluorescent bulbs, caulking doors and windows to minimize drafts, lowering the temperature setting of the



water heater, and turning off lights and appliances that are not in use. (Comnes, 2009)

Activity-Specific Information for Class Energy Survey

Phantom Energy Loads:

Some appliances or electronic devices use energy even when they are turned “off.” The “off” button on these appliances may really mean “stand by” or “sleep mode.” These appliances are called “vampire” appliances, because they continue to “suck” or use energy even when powered down. Often, appliances that have remote controls are vampires; others include items that have a continuous digital display, such as a clock. Computers and printers may have phantom loads.

* To minimize phantom energy loads, consider using a power strip for multiple appliances. Turn off the power strip with a single switch. Items plugged into the strip will then truly be off.

Vending Machine Energy Misers:

The vending machine in your school may be equipped with an energy miser. This means it has passive infrared sensors that detect when the surrounding area is vacant. The device powers down the machine when there is no one nearby.

* Schools may be able to get misers from the local power company, or may request the vending machine company install a miser or replace an older machine with a newer machine that has a miser installed.

Lighting Options:

Fluorescent Lights: Consists of a glass tube coated on the inside with a fluorescent material. Mercury vapor in the tube emits ultraviolet radiation that is converted to visible light by the fluorescent material. Compact fluorescent lights (CFLs) contain an average of 4 milligrams of mercury sealed within the glass tubing. No mercury is released when the bulbs are intact or in use. EPA recommends that CFLs be recycled to prevent mercury from being released.

* The U.S. EPA suggests switching from traditional light bulbs (incandescent bulbs) to CFLs reduces energy use. ENERGY STAR qualified CFLs use up to 75% less energy (electricity) than incandescent light bulbs and last up to 10 times longer.

* Should you turn fluorescent lights off? It has been suggested that there is an initial power surge that is needed to turn on a fluorescent light. With new technology, this is only a few seconds.

The recommendation is to turn off these lights if you will be out of the room for more than a few minutes.

ACTIVITY:

1. Ask the students to brainstorm a list of ways they use energy in a typical week. Discuss: *Which uses involve the most energy? Which uses involve electricity? Where does electricity come from? Why is it a problem if we waste electricity?* Help students understand the relationship between electricity generation (and other energy uses), air pollution, cost of energy consumption, and use of natural resources.
2. Pass out copies of the “Classroom Energy Survey” student pages. Determine whether you want students working alone or in groups to complete the survey. There are four parts of the survey available for your use: A-Appliance, B-Lighting, C-Temperature, and D-Cost.

Depending on the number of watt meters available and time, you may want to have students work in groups on the different areas, rotate among the areas of investigation so all complete each area or you may elect to have students work on only one area.

3. Instruct the students on how to use a watt meter:
 - 1-Plug the watt meter into the electrical outlet. (Remind students of safety precautions when working with electrical appliances and outlets.)
 - 2-Plug the appliance being tested into the watt meter. Wait for the read-out to stabilize. If it jumps from one number to the next, have students record the highest number registered over a 20 second period.
 - 3-Record the number of watts registered on the worksheet.
 - 4-Have students test at least one vampire appliance. (If each group tests a different appliance, you can share findings and calculate the total number of watts of possible savings if the vampire items are turned off.)
4. Have students complete the survey.

When finished with the survey, bring the class together as a group. Discuss their findings. Collect data from the vampire items and calculate the possible all-class savings of watts and money. Brainstorm ways they might help conserve energy at school and at home. Create a class “action plan” to begin conserving energy. (Consider having the students set goals for conserving. Monitor class progress over time.)

REVIEW QUESTIONS:

1. From doing your investigation, discuss below the ways you discovered energy was being wasted.
2. What recommendations can you make to save energy in your classroom? Discuss these recommendations below.
3. How can you help stop energy from being wasted? Take Action! Discuss below at least three ways you are going to help save energy in your classroom.

EVALUATION:

- Have the students construct an “exit ticket” which they must turn in to the instructor at the end of the lesson, writing 3 things they learned by doing the energy survey of their classroom.
- Write a “news article” informing fellow classmates of ways that they can save energy.
- Have students create an action plan with energy saving strategies for their home.

CONSTRUCTED RESPONSE:

- After completing our classroom energy audit, consider how energy might be wasted in your home. Describe things you might do at home to save energy.

CROSS-CURRICULAR EXTENSION:

- Create a public service announcement (PSA) for their school on why it is important to save energy, and what students can do to help the school save energy. This can take the form of a written brochure, informative poster, skit, or even a video.
- Research ways that energy usage is changing. What are some of the world's latest technologies that are available for people to use that help them save energy in their homes, school, and offices. Follow up with a research paper, and/or presentation on their findings.
- Graph the group's findings for energy use, cost, and possible savings for each appliance tested.

GIFTED AND TALENTED:

- Write an influential letter to a person of authority (school/district administration, local/national elected officials) recommending ways to change their energy use practices (including new technology that could be implemented) in order to conserve energy at your school, or in your community as a whole. Be sure to include why this is important. *Why is saving energy at your school, and in your home, important to your community?*
- Give presentations to other classes at your school on ways they can help the school save energy. Obtain a copy of your school's energy bill each month, so you can track consumption. Graph energy usage over a period of time to determine if your recommendations helped your school to save energy. Present your findings to your classmates, teachers, and/or administrators.

DIFFERENTIATION:

- Students can work in groups so they can collaborate on ideas, and can delegate varied responsibilities.
- Certain calculation requirements can be done as a whole class so instructors can guide students through more difficult mathematical portions of the activity.
- The activity can be done as a whole, or in smaller portions, with the instructor eliminating or adding any portion they deem as too advanced, or too simple. Please see Cross-Curricular Extensions, and the Gifted and Talented portions of this activity to enhance the challenge of the lesson.

RESOURCES:

- <http://www.plt.org>
- <http://michaelbluejay.com/electricity/howmuch.html>
- American Forest Foundation, Project Learning Tree, PreK – 8 Environmental Education Activity Guide, GreenSchools Guide