

Energy Awareness:

A consumer approach

What is energy?

Why is it important?

Why should energy be conserved?



Lesson Plan for grades 4-5

**For Nov 18 ESD123/LASER Workshop,
PNWD-SA-919**

These lessons were designed to align with the *Washington State Science Learning Standards* and *Integrated Environmental and Sustainability Education Learning Standards*. These lessons also fit into the scope and sequence of the *STC Electric Circuits* Unit used at the 4th and 5th grade levels throughout the SE LASER Alliance

Workshop Overview & Schedule

- *See schedule slide in the Workshop PowerPoint file for Grades 2-3.*

Funding & Strategic Mission

- The Washington State Attorney General Office (AGO) funded Battelle to investigate ways to increase energy efficiency awareness in the K-12 student community.
- Based on guidance from several teachers and curriculum developers/organizations, we developed energy efficiency lesson plans to support the Washington State Science Learning Standards and the Washington State Integrated Environmental and Sustainability Education Learning Standards.

Overview of Student Instruction

- About 30 minutes a day for 4 days (not necessarily in a row).
- Day 1:
 - Pre/Post Energy Survey (10-15 minutes)
 - Energy Name Game (10-15 minutes)
- Day 2: “What Keeps Me Warmer?” (thermometers) (30 minutes)
- Day 3: “How Much Does It Save?” (“EZ Watt” meters) (30 minutes)
- Day 4: Home Energy Survey - homework. (5-10 minutes).
- Day 5:
 - Follow-up on the Home Energy Survey. (15 minutes)
 - Post-survey: redo the Energy Survey (15 minutes)

Teacher's Options

- Designed into two grade-groupings (2-3 and 4-5) per state curriculum standards – but teachers pick which components of this lesson plan to use in classroom.
- Download Battelle's PowerPoint slides to modify as desired. (Note our Disclaimer slide.)
http://buildingefficiency-labworks.pnl.gov/education_k-12.stm
- Ask your district, LASER, or ESD science curriculum leaders about additional training on this lesson plan, on this general subject, or about finding an energy scientist/engineer to visit your class.

Science Standards - Grades 4-5

Washington State Science Learning Standards: Note: *also addresses some standards from math, social studies, & economics*

EALR 4: Physical Science

Big Idea: Energy: Transfer, Transformation, and Conservation (PS3)

Core Content: Heat, Light, Sound, and Electricity

Time: about 60 minutes a day for 5-6 days or adaptable to class time

Washington State Integrated Environmental and Sustainability Education Learning Standards: Standard 3: Sustainability and Civic Responsibility *Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability.*

National Science Standards:

- Sun is main source of energy
- Energy comes in many forms: fossil fuels, oil & coal
 - Such fuels come from plants that grew a long time ago
- Cost effectiveness and pollution issues with energy, which sources cost more and which sources pollute
- How do we conserve energy?

State Content Standard & Performance Expectation, Grades 4-5



- Energy has many forms, such as heat, light, sound, motion, and electricity.
 - Identify different forms of energy in a system.
- Energy can be transferred from one place to another.
 - Draw and label diagrams showing several ways that energy can be transferred.
- Heat energy can be generated in many ways. Heat moves from warmer things to colder.
 - Identify several ways to generate heat energy.
 - Give examples of two ways that heat energy can move.
- Sound energy can be generated by making things vibrate.
 - Demonstrate how sound can be generated by vibrations as it moves to your ear.
- Electrical energy in circuits can be changed to other forms of energy.
 - Describe how electrical energy is transferred and converted.

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Content Standard & Performance Expectation

Energy has many forms, such as heat, light, sound, motion, and electricity.

Identify different forms of energy (e.g., heat, light, sound, motion, and electricity) in a system.

Energy can be transferred from one place to another.

Draw and label diagrams showing several ways that energy can be transferred from one place to another (e.g., sound energy passing through air, electrical energy through a wire, heat energy conducted through a frying pan, light energy through space).

Heat energy can be generated a number of ways and can move (transfer) from one place to another. Heat energy is transferred from warmer things to colder things.

Identify several ways to generate heat energy (e.g., lighting a match, rubbing hands together, or mixing different kinds of chemicals together).

Give examples of two different ways that heat energy can move from one place to another, and explain which direction the heat moves (e.g., when placing a pot on the stove, heat moves from the hot burner to the cooler pot).

Sound energy can be generated by making things vibrate.

Demonstrate how sound can be generated by vibrations, and explain how sound energy is transferred through the air from a source to an observer.

Electrical energy in circuits can be changed to other forms of energy, including light, heat, sound, and motion. Electric circuits require a complete loop through conducting materials in which an electric current can pass.



Connect wires to produce a complete circuit involving a battery and at least one other electrical component to produce observable change (e.g., light a bulb, sound a buzzer, and make a bell ring).

Repair an electric circuit by completing a closed loop.

Describe how electrical energy is transferred from one place to another, and how it is transformed from electrical energy to different kinds of energy in the circuit above.

Classroom Activities

Activity 1: Energy Survey







- Give the pre-survey on energy. Note – use this same survey at the end of the lessons to evaluate student learning.
- If you are viewing these PowerPoint slides in Battelle’s original PowerPoint file, then you can click on the following PDF file icons to open the PDF of the survey.
 - Survey:  Pre-Post_Survey.doc.pdf
 - Survey Answers:  Pre-Post_Survey Answers.doc.pdf
- If you have downloaded the files from the Battelle webpage, then use the Word .doc or Acrobat .pdf files named ‘survey’ and ‘survey answers’.

Energy Awareness (3 pages) Pre/Post Survey, Grades 4-5

Name: _____
Date: _____

1. Look at the pictures and circle the appropriate letters or letters (there may be more than one right answer) that apply:

- If it generates heat circle the word **Heat**.
- If it generates light circle the word **Light**.
- If it produces sound circle the word **Sound**.
- If it moves circle the word **Moves**.
- If it uses electricity circle the word **Electric**.
- If it doesn't do any of the above don't circle any of the letters

<p>Fan</p>  <p>Heat Light Sound Moves Electric</p>	<p>Rock</p>  <p>Heat Light Sound None Moves Electric</p>	<p>Light bulb</p>  <p>Heat Light Sound Moves Electric</p>
<p>Bell</p>  <p>Heat Light Sound Moves Electric</p>	<p>Tea candle</p>  <p>Heat Light Sound Moves Electric</p>	<p>Cell phone</p>  <p>Heat Light Sound Moves Electric</p>

The survey can also be reviewed with the class as a whole, to generate discussion about the topics, while learning what the knowledge base is in the class.

Vocabulary/Spelling List of Learning:
these are the energy related terms that accompany the lessons. Use these as desired.

appliance	battery
Celsius	electric circuit
conserve	consumer
electricity	energy
Fahrenheit	fluorescent
generates	graph
heat	incandescent
infrared	kilo
kilowatt	light
motion	sound
temperature	watt

Activity 2: Name Game

“They Call Me Mr./Miss Energy”

- Play this group game to get the students thinking about energy.
- See suggestions and flow of game in the Notes section of this slide in the PowerPoint file.
- Student “A” picks an energy name for himself and the student to the left recites that Student A’s name and then picks a energy name.
- The following slide show possible names in the slides and Notes section of the slide. The slide includes background information on some of the energy names and concepts.

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Explain the game to the entire class. The game is similar to the “telephone” game, they may have played.

- Each student will be choosing new last names. Their new last names should begin with the same letter as their first names and be energy-related—a source of energy, an energy consuming or producing device, or energy term. For example: Bob Biomass, Martha Microwave, Gina Generator, etc.
 - No relatives are allowed, in other words, there can’t be both Bob and Barbara Biomass.
 - Ask if anyone in the group is having a problem thinking of an energy last name, and have the group brainstorm several last names for them.
 - If, during the game, someone in the group has a problem remembering a person’s first or last name, members of the group can give that person a hint. For example: If the person’s name is Tim Toaster, someone in the group could say “you put your bread in it in the morning and it uses energy.” If the person’s name is Peter Petroleum, a group member could say “you make gasoline from it.”
1. Divide the students into groups of 10-12 or smaller. (the smaller groups help this to go faster, reduce the number of energy names to develop and remember) Also, it is best if the students have varying different first name letters together to minimize problems with coming up with energy names. E.g. have students with first names of A or B, etc. in each group.
 2. Each group should choose a group leader, that starts by saying, “Hi, my name is...” and then his/her first name, followed by his/her new energy last name.
 3. Then the person to the left of the leader says the first person’s first and last name, and then his/her own new energy name. The third person continues by giving the first two names, then his/her own energy name.
 4. The game continues until the final person, sitting to the right of the group leader, gives everyone’s name and then his/her own.

Activity 2: Name Game – Name List

- A. Amp – short for ampere- measures the amount of electricity moving through a wire. Amps are what give electricity its "shock". Named after physicist Andre-Marie Ampere (1775-1836). Acceleration
- B. Battery, Biodiesel, Biofuel, Biomass
- C. Conductor – A material that allows electricity to flow through easily. Most metals are good conductors of electricity. EX. That is why copper is used for electrical wiring inside your home. Coal, Carbon, Capacity, Current
- D. Diesel
- E. Energy Conservation – Using less energy. "Conserve" means to "avoid using". EX. Turning off a light. Efficiency, Electron, Energy, Ethanol, Energy of Motion
- F. Fossil Fuel – Coal, oil, and natural gas are fossil fuels. Over time, tremendous amounts of heat and pressure created by the layers of the earth turned animal and plant matter into natural gas and petroleum (oil). Fuel cell, Frequency, Force
- G. Geothermal Energy – "Geo" is Latin for "earth", and "thermal" means heat. We take the heat from the ground and use it to keep our homes, schools and other buildings warm. Gas, Generator, Geothermal.
- H. Hydroelectric power – "Hydro" is Latin for "water", hence it is made from the flow of water in a river. EX. When the river flows over the dam, the force of water spins big fan blades inside the dam. The fan blades, or turbines, turn the magnet inside the generator to create electricity. Heat, Hybrid.
- I. Insulator – A material that slows or stops the flow of electricity. EX. Special gloves and sleeves that utility workers wear are made of rubber, which is a good insulator to protect them from electric shock. Internal combustion engine
- J. Jet fuel, Joule
- K. Kilowatt - One Kilowatt equals 1,000 watts ("kilo" is Latin for "thousand"). This is how electric companies measure how much electricity your family uses at home.
- Kinetic Energy
- L. Light, Laser, Lightning.
- M. Megawatt, Mining, Motor, Motion, Momentum, methane
- N. Nova – a star that releases a tremendous burst of energy. Natural gas, nuclear power
- O. Oil
- More names in the Notes section of this slide.

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- P. Pollution, Power, Potential Energy, Power plant
- Q. (None.)
- R. Renewable Energy – Coming from environmentally-friendly resources that are naturally replaced by Mother Nature. EX. Wind, water or solar power. Reactor, Renewable, reservoir
- S. Solar panel, static electricity, steam, sunlight, specific heat
- T. Turbo – connotations of speed and great energy. Temperature, Turbine
- U. Utilities, Uranium
- V. Volt – Also referred to as voltage, is the pressure that pushes the electricity through the wires. EX. This is how electricity gets from the power plant to your house. The first electric battery was invented by Professor Alessandro Volta (1745 – 1827). Velocity.
- W. Watt – How electric use is measured or the amount of power a device consumes. Discovered by James Watt, an engineer from Scotland who lived during the 1800s.
- Waste, Wind, Windmill, Work, Wave
- X. Yottajoule
- Y. Zettajoule

Sources include:

- <http://www.alliantenergykids.com/EnergyBasics/EnergyWords/index.htm>
- <http://www.enchantedlearning.com/wordlist/energy.shtml>

Activity 3:

“What keeps me warmer?”

Materials per group (total of 2 groups):

- 3 thermometers (6 total)
- 1 small bag with denim material in it (2 total)
- 1 small bag with fleece material in it (2 total)
- 1 instant ice pack (2 total)
- 1 record sheet (2 total)

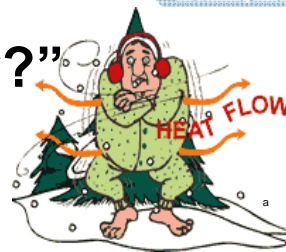


Figure 1: Bags with Insulation placed over thermometers



Figure 2: Cold pack placed over insulation and thermometers

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Note: This can also be done with a thermo probe, which needs a computer or with hand thermometers. To set up the experiment with thermometers, proceed as follows:

Teachers' discussion:

- Why do you wear gloves/mittens? ... (answer), to keep your hands warm or on other words try to keep or body heat from transferring or to the environment.
- Humans eat food and their bodies use that food (metabolize it), to create their own body heat (energy). Also, our bodies are affected by our surroundings. So when you go outside and it is cold (winter), our body heat is transferred (heat flows out of our body) to the environment. Heat always travels from a hotter area to a colder area and the bigger the difference between the hot and cold areas the faster the transfer takes place. If heat is leaving your body faster than your body cannot create heat, you will be cold. This is why you wear a warm coat in the winter (and shorts in the summer) to help adjust your body temperature...because just like "Goldilocks' porridge" your body temperature has to be just right-not too cold and not too hot.

Concept question:

Where does the earth get it's heat from or what (big yellow thing in the sky) transfers heat to the earth? Of course, the sun...it is a major example of heat flow (in nature).

Begin the Activity:

1. Separate the students into groups; about 3 students per group
2. Provide each group with 2 thermometers
3. Provide each group with 2 labeled baggies with insulating materials; can have extra materials to try if some groups get done faster, or after the activity they can try their own mittens if they have them.
4. Ask the students to decide which material that they think will keep their hands warmer?
5. Let the students feel the materials if that helps them decide
6. Ask each group to record the initial temperatures on each thermometer. Note, they should both be about the same-at room temperature.
7. Place the two thermometers on the table
8. Get an ice pack or an instant cold pack from the teacher (the teacher or delegate may want to break the cold packs for the students)
9. Place the insulating materials on top of the thermometers (just below the 30 degree F line-see figure 1)
10. Place the ice pack on top of both of the thermometers-over the bulbs (see figure 2)
11. After 3 minutes record data in the tables (shown on slide).

(a) Image provided by the Flying Turtle Company: <http://www.ftexploring.com/energy/heatflow.htm>

Activity 3 Cont'd: Record/Log Sheet

Print out for each student's recording...

Table 1: Activity

Material	Initial temperature (temperatures should be the about the same)	Final temperature

Table 2: Example Record/Log Sheet

Material	Initial temperature (temperatures should be the about the same)	Final temperature
Denim	72	52
Fleece	72	47

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1. In table 1, record the name shown on the label in the first column "material".
2. After 3 minutes, record the temperature of the two thermometers in table 1 above for the appropriate material. (Can use a timer that can be set to alarm/ring when time is up)
3. Discuss the results, and the fact that the thicker material- the fleece, was the better insulator
4. Discuss that is why gloves and blankets are made of fleece. (bring in some glove examples?)

INSTRUCTORS NOTES:

- *Do this in Celsius and Fahrenheit? Can mention that Celsius is used in science and other countries-and as can see on thermometers has a different scale, zero in Celsius is 32 in Fahrenheit. So in other countries if it is 40 degrees celsius-it is very hot...look at your thermometers.*
- *I tried it with making mittens and shoving the insulation inside the paper mitten (stapled together)- denim and fleece, and results: The instant cold pad was not as cold-after ~2 hrs...but fleece (68 deg) and denim (65) after 15 mins*
- *Can also suggest that the teacher include the book, "the mitten" written by Jan Brett and discuss why the animals that are also warm blooded (as humans) want to snuggle inside the mitten?*

Image provided by the Flying Turtle Company: <http://www.ftexploring.com/energy/heatflow.htm>

Activity 4: How Much Does It Save?



Materials:

- 2 lamps
- 1 incandescent bulb
- 1 compact fluorescent bulb
- 2 Kill-a-watt™ EZ meters
- 1 outlet plug strip
- Post it notes and ruler (not provided)

Set-up:

1. Place lamps on floor/table.
2. Screw in the incandescent (IC) bulb into a lamp.
3. Plug that lamp into one of the Kill-a-watt™ EZ meters and label that meter "IC".
4. Screw in the compact fluorescent bulb (CFL) into the other lamp.
5. Plug the lamp with the compact fluorescent bulb into the remaining Kill-a-watt™ EZ meter and label that meter "CFL"
6. Adjust height of each lamp ~8" off floor/table.

Activity 4 Cont'd :



Light meter reading and comparison

Set-up cont'd:

7. Reset the Kill-a-watt™ EZ meters
8. Turn on each bulb at the same time
9. The meters will start taking readings immediately
10. Unscrew the cap off the light meter
11. Set the light meter under the IC lamp
12. Set meter to Range "B"
14. Turn meter to on and observe reading
15. Set the light meter under the CFL lamp
16. Turn the meter on and observe reading
17. Notice that the readings are about the same (results will vary depending on height of lamps off floor and meter placement.
18. The packaging of the two bulbs can be compared (foot candles should be about the same, these lamps showed 548 and 560.)

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Before starting: Plug in the Kill A Watt™ EZ meter in the outlet. Select the menu button and scroll through until you see the "rate" in the top right corner. The rate should be displayed as "\$0.057" (5.7 cents/kilowatt-hour) based on the Benton County PUD rate as of June 2010. If this needs to be changed, refer to the instructions for how to use the device (Reference Appendix A, at end of the lesson plan). To begin a new measurement, select the "reset" button down until you see the words, "rEST" on the display, now all the accumulated measurements including KWH, elapsed time, and actual total cost in the unit should be set to zero. You can check this by scrolling through the menu again and make sure all the totals such as "elapsed time" are zeroed out. **WHEN PLUGGED IN STARTS time immediately**

1. Check that the supplied cfl bulb is in one lamp and a IC is in the other, or place one of each bulb into the lamps.
2. Plug in each lamp into the Kill A Watt™ EZ meter, and plug the Kill A Watt™EZ into an outlet.
3. You can label with a post it note which meter is the connected to the lamp with the IC bulb and which is connected to the lamp with the CFL bulb for easier identification.
4. Turn on the lamps.
5. The meters will begin taking measurements. Note that some items, such as "initial cost per hour" being displayed, may need to be left on for a short time before they are accurate.
6. Push the "menu" button until each meter reads "elapsed time", and leave on that time, until approximately one hour. These could be left to run overnight or over a weekend.
7. When you have ended the activity, push the "menu" button until you see "kwh" on the right side of the screen, (it is the unit listed after the "rate" which should be saved as a constant at \$0.057)-record the kwh off both meters-see table on next slide.
8. Push the "menu" button again, and you can record the "elapsed time" (if desired) off each meter.
9. Generate discussion as to which type of bulb is the better bulb.

Extension: Have students decide if the extra cost for the fluorescent bulbs outweighs the benefits/savings of using them versus the incandescent bulbs. Fluorescent bulbs typically cost more to buy; but boast a longer life.

Activity 4 Cont'd:

“How much does it save?”

- Record the energy (kWh) off the each IC meter and put the value in column #1
- Record the energy (kWh) off the each CFL meter and put the value in column #2
- Subtract column #1 from column #2, record in column #3
- Show savings in column #4; Multiply fixed rate ($\$0.057/\text{kWh} \times 4380 \text{ hrs/y}$)

Energy measured Lamp with IC Bulb (kWh)	Energy measured Lamp with CFL Bulb (kWh)	Energy difference (0.04-0.01, kWh)	Annual Savings (\$) ($\$0.057 * 4380$ hrs/year) if assume lamp is “on” 12 hours per day)
0.01	0.04	0.03	\$ 7.5

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NOTE: The electric EZ meter can also extrapolate costs out assuming that lamp will pull the same power and the electrical rate that was input was correct-to check the extrapolated costs:

1. Hit the “menu” button,
2. Stop at “cost”, and the cost shown should be “total” accumulated which unless you run it a long time, this will be zero.
3. Stay at ‘cost’, and hit the “up” button to toggle thru the costs offered: the first one should be, “day”,
4. Hit “up” again and the cost per “week” is shown
5. Hit “up” again and the cost per “month” is shown
6. Hit “up” again and the cost per “year” is shown

- The students may want to feel the heat the radiated heat from the bulbs to compare which gets hotter (without touching the bulbs or lamps which can get very hot)
- Discuss that energy is being lost or wasted by the bulb that is heating (radiating heat to) the surroundings. The other bulb is using less total energy and using it’s energy only on light and not heating.

Per the calculations above the savings are:

- Lamp Savings per year ($0.03\text{kWh} \times \$0.057/\text{kWh}$)= \$7.5/year
- Explain that the savings may not seem like much, but consider if you have 10 lamps on, and each is on for your lifetime-say 8 years, so $7.5 * 10 \text{ lamps} * 8 \text{ years} = \600

Activity 4 Cont'd: Record/Log Sheet

Energy measured Lamp with IC Bulb (kWh)	Energy measured Lamp with CFL Bulb (kWh)	Energy difference (kWh)	Annual Savings (\$) (\$0.057 * 4380 hrs/year) if assume lamp is "on" 12 hours per day)

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NOTE: The electric EZ meter can also extrapolate costs out assuming that lamp will pull the same power and the electrical rate that was input was correct-to check the extrapolated costs:

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5. Hit "up" again and the cost per "month" is shown
6. Hit "up" again and the cost per "year" is shown

- The students may want to feel the heat the radiated heat from the bulbs to compare which gets hotter (without touching the bulbs or lamps which can get very hot)
- Discuss that energy is being lost or wasted by the bulb that is heating (radiating heat to) the surroundings. The other bulb is using less total energy and using it's energy only on light and not heating.

Per the calculations above the savings are:

- Lamp Savings per year (0.03kWh x.\$057/kWh)= \$7.5/year
- Explain that the savings may not seem like much, but consider if you have 10 lamps on, and each is on for your lifetime-say 8 years, so $7.5 * 10 \text{ lamps} * 8 \text{ years} = \600

Activity 5: Home Energy Awareness Survey

- **Homework or in the class**

- math calculations with a calculator or by long hand
- A graph can also be made.
- See Word file “Home_Energy_Awareness_Survey.doc”

Name: _____

Home Energy Awareness Survey (“Given” kilowatts data from Benton PUD, June 2010)

	Column A	Column B	Column C	Column D
	Given: Kilowatts (1,000 watts)	Enter Hours Used per Day	Calculate Total Kilowatts Used (Col A x Col B = kW-hours)	Calculate Total Cost per Day* (Col C x \$0.06)
Incandescent Lights 60W (or 0.06 kW)	.060	Example: 10	.06 × 10 = 0.6	0.6 × \$0.06 kWh = \$0.36 (36 cents)
Fluorescent Lights 18W	.018			
Television (42” LCD)	.210			
Clock Radio	.004			



Incandescent bulb



compact Fluorescent bulb

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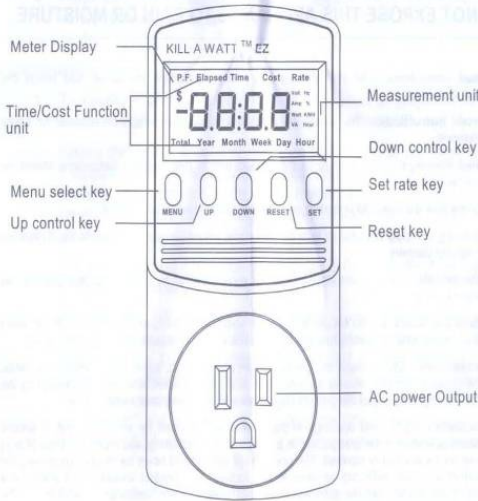
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1. Hand out the sheet above to the students
2. This is to take home and fill out based on what they find when they survey
3. Column A lists the “typical” appliances in a home, so the students should first walk around and see if they can find one in their house. If there is more than one, just fill out the form for one appliance.
4. Column B, (shaded column), is the “hours used per day” which is to be filled out by the student. For example, in the first two rows, you are looking for light bulbs. If you find a light bulb then check if it is a incandescent or a fluorescent light bulb. (you can ask your parents or refer to the pictures provided if not sure), then ask your family-if it is on all day or only a few hours of the day. If it is not in a main area, you can put “6” in column B row 1 or row 2 as appropriate, if it is in a garage, only used in the morning, put “2” in the row. Repeat this to fill out column B as best you can. Put “don’t have” if you don’t have that appliance at home.
5. Column C is a calculation, “kilowatt hours per day” found by multiplying column A * column B.
6. Column D is a calculation, “cost per day”, found by multiplying column C * \$0.06 per kilowatt hour (an estimated cost of electricity based on Benton PUD cost rate- November 2010).

Activity 1 - Retake Survey

- **Return each student's pre-survey and state the answers to each question. Ask students to mark their sheet with the correct answer.**
- **Encourage discussion and plan for how they will improve energy conservation in their lives.**
- **Each student or group of students could prepare a poster explaining their plan for being more energy aware at home/school/community**
- **present it to the class Or...**
- **start a project such as a school wide energy audit/conservation**
 - a recycling program
 - or a community awareness science project presentation.

Appendix A: Kill-a-Watt Meter Instruction sheet



Quick Start Guide:

Use these quick start instructions to get up and running in just a few minutes. Be sure to review all the operating instructions later to ensure full enjoyment of the product.

1. Connect the Kill A Watt™ EZ unit to the outlet and the appliance to the unit
2. Press and hold the RESET key on the unit until "rEST" appears.
3. Press and hold the SET rate key until "Rate" is displayed and the currently set rate flashes.
4. Press the UP and DOWN key to set your desired rate. For example, if your utility charges you 10.6 cents per KWH, set the rate until the unit displays \$0.106.
5. Press the SET key again. "SAVE" will appear briefly in the display.
6. To display the actual cost of power consumed or projected cost, press the MENU key until "Cost" is displayed in the LCD.
7. Pressing the UP and DOWN key will cycle through the cost projection periods. For example if the display indicates \$2.34 and "Month", the unit is projecting that the attached appliance will consume \$2.34 worth of electricity in one month.
8. To display the power measurements press the MENU key until "Volt" is displayed on the LCD.
9. To cycle through the various measurements press the UP and DOWN key as desired. The measurement unit currently selected will be indicated in the display.
10. To display the total consumed power in Kilowatt-Hours, press the MENU key until "KWH" is indicated in the display.
11. Review the complete operating instructions to familiarize yourself with all features.

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Washington State
Science & Sustainability
Curriculum Standards
Related to Energy and Efficiency

*Essential Academic Learning
Requirements (EALR)*

Science:

<http://www.k12.wa.us/Science/Standards.aspx>

State Standards – Sustainability

- Washington State Integrated Environmental and Sustainability Education Learning Standards, Standard 3 - Sustainability and Civic Responsibility:
 - Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability
- Battelle’s lesson plan supports sustainability by increasing students’ awareness of energy and energy efficiency.
 - Shows the effort and cost to make/use electricity.
 - Promotes thinking about turning things off, insulating (color choices), and buying energy efficient (more sustainable) products.

Resources

Battelle Resources – Grades 4-5

- Battelle's energy awareness lesson plans and supporting files: http://buildingefficiency-labworks.pnl.gov/education_k-12.stm
 - This PowerPoint file, including the Notes sections,
 - "Grade_4-5_Lesson_Plan_Current.ppt"
 - A PowerPoint file of just the key Activities slides for showing in the classroom to students.
 - "Grade_4-5_Lesson_Plan_Current_Classroom.ppt"
 - The pre and post Energy Survey, and Answer Sheet files:
 - "Pre-Post_Survey.doc" and in a pdf file also.
 - "Pre-Post_Survey_Answers.doc" and in a pdf file also.
 - The Home Energy Awareness Survey.
 - Kit inventory/purchase list for others' purchase of additional parts.
 - Teacher Feedback Form on the lesson plans
 - "Feedback_on_the_Energy_Awareness_Lesson_Plan.doc"
- **Contacts**
 - John Hail, 509-372-4799, John.Hail@pnl.gov, and
 - Theresa Koehler, 509-375-2415, Theresa.Koehler@pnl.gov

Many Resources Online ... Some:

- US Department of Energy, <http://www.loseyourexcuse.gov>
- Cool School Challenge (upper grades), <http://www.coolschoolchallenge.org>
- US Energy Information (EIA) Energy Kids, <http://www.eia.doe.gov/kids>
- Washington State OSPI grade level standards and resources, <http://standards.ospi.k12.wa.us>
- Arbor Scientific – lessons for grades 5-12 Student Lab Act. In Physics and Physical Science, http://www.arborsci.com/ArborLabs/ASLabs_Home.aspx
- The National Science Digital Library (NSDL) Literacy maps of the national standards, <http://strandmaps.nsd.org>
- Beyond Penguins and Polar Bears – energy awareness, <http://beyondpenguins.nsd.org>
- Science Net Links – Absolutely amazing site nearly limitless resources, <http://sciencenetlinks.com>
- Energy Quest – California, <http://www.energyquest.ca.gov>
- Classroom Energy K-12, <http://www.classroom-energy.org>
- National Energy Foundation for educators, <http://www.nef1.org/educators.html>

Resources, National Standards

(Thank you Kathy Fisk)


- Science Matters: Achieving Scientific Literacy, Hazen and Trefil.
- Science for All Americans, American Association for the Advancement of Science, Project 2061. Online viewing: <http://www.project2061.org/publications/sfaa/online/sfaatoc.htm?txtRef=&txtURIId=%2Ftools%2Fsfaaol%2Fsfaatoc.htm>
- Benchmarks for Science Literacy, American Association for the Advancement of Science, Project 2061. Online viewing: <http://www.project2061.org/publications/bsl/online/index.php>
- National Science Education Standards, Center for Science, Mathematics, and Engineering Education. Some online viewing: http://www.nap.edu/openbook.php?record_id=4962
- Curriculum Topic Study, National Science Foundation. www.curriculumtopicstudy.org

Videos – Energy Basics

- **Bill Nye The Science Guy on Energy – kinetic energy, then electricity generation,**
<http://www.youtube.com/watch?v=0ASLLiuejAo&feature=related>
- **Potential Energy: Wile E Coyote & Roadrunner,**
<http://www.youtube.com/watch?v=Jnj8mc04r9E&feature=related>
- **What is Energy? – Energy basics put to song,**
http://www.youtube.com/watch?v=o_5oYuDY2qM&feature=related

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<http://www.wastatelaser.org/resources/alliances/southeast.asp>
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Energy Efficiency Awareness Lesson Plan, Grades 2-3

For Nov 18 ESD123/LASER Workshop 30

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