6th, 7th, and 8th Grade Science

What

In this lesson, students will learn more about energy use, conservation, and efficiency by investigating electricity use in the classroom. Students will learn through experimentation and mathematical analysis that certain appliances use more energy and, therefore, cost more to power. This experience will help students brainstorm what choices they can make to reduce energy use.

How

Discussing where energy is used in the classroom will initially engage students in thinking about energy sources and uses. A light bulb demonstration using a watt meter will stimulate a discussion about “What is a watt?” and allow students to observe the difference in wattage between incandescent and compact fluorescent light bulbs. Students will then work in groups to determine the wattages of different electrical devices and their cost. Based on their findings, the class will come up with a list of choices they can make to conserve energy.

Why

While students may have a basic understanding of energy and electricity, they might not realize the costs associated with powering different electronic devices or understand how they can reduce energy use. Class discussion will prompt students to think about energy use in the classroom and why conserving energy and improving efficiency are important. The light bulb demonstration and “Watt Does It Cost to Use It?” investigation will engage students in measuring and calculating the cost of powering different classroom appliances. A final class discussion will help students identify ways that they can reduce energy use.

Objectives

• Students will discuss different ways they use energy, determine the power needs (wattage) and costs of electrical items in the classroom, and brainstorm ways to reduce energy use.

Standards

• WA State Science Standards (Grades 6 – 8)
  o EARL 2 Inquiry: Questioning & Investigating: Revise a question so that it can be investigated scientifically, and work effectively as a member of an investigative team.
  o EARL 4 Physical Science: Energy: Transfer, Transformation, and Conservation
• Next Generation Science Standards
  o Science and Engineering Practices
    ▪ Asking questions and defining problems
    ▪ Planning and carrying out investigations
    ▪ Analyzing and interpreting data
    ▪ Using mathematics and computational thinking

Materials

• 4 Watt meters
• 2 Lamps
• 1 Incandescent light bulb (800 lumens)
• 1 Compact fluorescent light bulb (800 lumens)
• Crank and temperature demonstrations (Snohomish PUD)
• Extra classroom electrical devices: 2 pencil sharpeners, 2 cell phone chargers, and a computer
• Calculators (1 per group)
• What Does It Cost to Use It? Worksheet (1 per student)
• Pre- and post-assessment handouts

Preparation
• Check that all the watt meters and light bulbs work
• Print handouts and worksheets
• Distribute pre-assessment handouts
• Show the students the video “Energy is the most important issue of our time.” from http://www.switchenergyproject.com/topics/energyissues

Plan
1. Engage and Encounter: Discussion (10 min)
   a. Introduce yourself and the topic of the day: Energy Matters.
   b. Ask the class: What are some different ways you use energy in your lives? (Write their responses on the board under 'How we use energy). Then ask: Why do you think we care about energy use, why does energy matter? (Write their responses on the board under 'Why Do We Care?') They should come up with ideas like: creates pollution, costs money, other environmental impacts.
   c. Background: Most people don’t know that the average home and classroom is responsible for more pollution than the average car. We can each play a role in reducing pollution by using less energy. Today we’re going to explore how by focusing in on one major use of energy: electricity. In the US, electricity use accounts for about 40% of our total energy use. Here are school there are many ways we use electricity. Can you name a few?
   d. Efficiency demonstration: Some devices use less energy than others, take light bulbs, for example. An old-fashioned light bulb that is used most commonly is the incandescent light bulb, invented by Thomas Edison 125 years ago. These light bulbs convert up to 90% of the electricity they consume into heat. New compact fluorescent light bulbs (CFLs) use only a third of the energy that incandescent light bulbs use and last as much as 10 times longer. CFLs create the same amount of light, but generate a lot less heat (about 70%). Which is more energy efficient, why? (Answer: CFL, it requires less electricity and produces less heat). Let’s test it using the watt meter (demonstration). Side note: Watts are the unit we use to measure energy. 1 watt = energy to lift 100 g (or 1 apple) in 1.0 seconds. More apples require more watts, or more power.
   i. Measure and record the wattage for incandescent light bulbs and CFLs on board.
2. Investigation: Watt Does It Cost to Use It? (20 min)
   a. Give students the worksheet and ask them to form groups of 2-3 students.
   b. Using the wattage you found for the incandescent light bulb, take the class through the calculations to find its cost.
   c. Explain that students are going to use the watt meter to find out how much energy or wattage is required to power three other electronic devices in the classroom, then they will use this information to calculate how much it costs to power each device.
   d. Set up a traveling station for each electronic device, and two stationary demonstration stations (i.e. crank and temperature). Pass out electronic devices and watt meters to three groups. Instruct remaining groups to start by calculating the cost of CFL light bulbs, using the information recorded on the board. When they are finished they can measure the wattage for one other device and then calculate how much it costs before moving on
to another device. Classroom helpers can select groups intermittently to participate in either the crank or temperature demonstration.

e. After 20 min, tell groups to stop their work and report to the class how much each device costs to power.

f. As a class, rank devices according to efficiency: What devices use a lot of power? What devices are used for the longest length of time? Which cost the most? Point out that total cost for the school is calculated by multiplying the power used by a single device by the number of devices of that kind in the school.

3. **Reflect and Extend: How can we reduce the amount of energy we use?** (10 min)
   
   a. Using this information, what are choices we can make as a class to reduce energy use and cost? Ideas:
      
      i. Unplug devices not in use (many appliances continue to draw energy when they are in the off position – we call these energy vampires).
      
      ii. Switch incandescent light bulbs to CFL or LED light bulbs (improve efficiency).
      
      iii. Turn-off lights and power-down computers when not needed.
      
      iv. Unplug charging devices when they reach 100% (leaving electronic devices plugged in after they charged to 100% could cost a household up to $100 a year!)
      
      v. Use a communal refrigerator in place of mini-refrigerators in each classroom.
      
      vi. Etc.

   b. Have students record their ideas in their science notebooks.

**Assessment**

- Students will record their measurements and calculations in the provided worksheet. A pre- and post-assessment will be used to determine content knowledge, conservation identity, and ownership (i.e. personal connection with and knowledge of energy issues).