We3 Bridging Document: Xcel Energy Electricity and Energy Conservation

Grade 6

Abstract

Students compare two types of light bulbs to find out which is more efficient, by exploring how much heat they produce..

Connection to State Science Standards (Grade 6)

Strand I – Physical Science
Sub-Strand C – Energy Transformations
Standard – The student will understand that energy exists in many forms and can be transferred in many ways.
Benchmark
4. The student will recognize the relationship between light and heat.

Activity

Compare Two Types of Light Bulbs is found on the Xcel Energy Foundation website at www.energyclassroom.com/pdfs/EC_CO_EX_BulbCompare.pdf

Follow-up activity: Light Bulb Cost Comparison
http://www.energyclassroom.com/pdfs/EC_CO_AC_LightBulbCost.pdf

To view additional background information and activities, go to the general page on *Conservation: How does saving energy help you and the environment?*
http://www.energyclassroom.com/conservation.php

Students' prior knowledge or alternate conceptions about key concepts/ideas and implications for teachers/advisors

Misconceptions about electricity
http://homepage.mac.com/vtalsma/syllabi/2943/handouts/misconcept.html#electric

Materials

- Incandescent light bulb
- Compact fluorescent light bulb that produces equivalent light. See light equivalency chart in the activity description.*
- Two remote wire thermometers (These thermometers, used for cooking, are more sensitive.) If you only have one thermometer, just run the experiment twice, making sure the thermometer has a chance to cool to room temperature in between the two trials.
- Ruler
- Notebook to record results

* Incandescent bulbs produce 15 lumens per watt and fluorescent bulbs produce about 50 to 100 lumens per watt. See Key Concepts section for information on lumens and watts.

Key concepts/ideas

- A watt is a measure of energy use.
- As a side effect of energy use, the higher the wattage, the greater the heat produced.
- Light bulbs are classified according to how many watts, or how much electricity, they use.
- Standard incandescent light bulbs waste 90% of their energy producing heat instead of light.
- Lumens are the standard measure of light produced by a bulb. (Standard 100-watt bulbs produce about 1,600 lumens.)
- A compact fluorescent light bulb uses less electricity to produce a given amount of light. So, a lower wattage compact fluorescent light bulb will produce the same amount of light as an equivalent, higher wattage incandescent light bulb.
- Compact fluorescent light bulbs use about 75% less energy and last 10 times longer than standard incandescent bulbs.

Connection to Minnesota Environmental Literacy Scope and Sequence Benchmarks

- Social and natural systems are made of parts. (preK–2)
- Social and natural systems may not continue to function if some of their parts are missing. (preK–2)
- When the parts of social and natural systems are put together, they can do things they couldn't do by themselves. (preK–2)
- In social and natural systems that consist of many parts, the parts usually influence one another. (3-5)
- Social and natural systems may not function as well if parts are missing, damaged, mismatched, or misconnected. (3-5)
- Social and natural systems can include processes as well as things. (6-8)
- The output from a social or natural system can become the input to other parts of social and natural systems. (6-8)
- Social and natural systems are connected to each other and to other larger or smaller systems. (6-8)

For the full Minnesota Environmental Literacy Scope and Sequence, see www.seek.state.mn.us/eemn_c.cfm

Connection to State of Minnesota Environmental Education Goals

To view Minnesota State Statute § 115A.073, "Environmental education goals and plans," go to www.seek.state.mn.us/eemn_g.cfm and scroll down to Statute § 115.073. It is the second statute listed on this page

Instruction tips

This activity can be the culmination of a lesson related to the state standard on forms of energy and energy transformation. Information is available in the Background Knowledge for Teachers section on next page.

Teachers may choose to focus on:

- What is energy and what is electricity.
- The forms energy takes—light, heat, sound, motion, and chemical energy.
- How energy is transferred.
- How electricity is generated at power plants.
- How energy moves from a power plant to the classroom.
- Culminate with the Compare Two Light Bulbs activity outlined in this document.

Background knowledge for teachers

Xcel Energy Foundation, "How We Use Energy" information sheet, www.energyclassroom.com/conservation.php

Energy Quest

This is an environmental education website produced by the California Energy Commission. Includes the *Energy Story* in simple, easily digestible chapters. In addition to the chapters linked below, there are chapters on each type of energy (fossil fuels, solar, wind, etc.) as well as other energy-related information.

- Introduction, http://energyquest.ca.gov/story/index.html Scroll down the page to see links to all of the chapters.
- Chapter 2: What is Electricity?, http://energyquest.ca.gov/story/chapter02.html This section includes information on energy forms and transfer directly related to the science standard listed in the Connection to Science Standards section on previous page of this document.
- Chapter 6: Generators, Turbines, and Power Plants (How Energy is Generated in a Power Plant) http://energyquest.ca.gov/story/chapter06.html
- Chapter 7: Energy Transmission System http://energyquest.ca.gov/story/chapter07.html
- Chapter 19: Saving Energy and Energy Conservation http://energyquest.ca.gov/story/chapter19.html

Related K-12 outreach resources

- Xcel Energy Foundation, *Conservation: How does saving energy help you and the environment?* www.energyclassroom.com/conservation.php
- School Light Survey, www.energyclassroom.com/file_download.php?filename=EC_CO_AC_SchoolSurvey.pdf
- Create Conservation Ads, www.energyclassroom.com/file_download.php?filename=EC_CO_AC_ConAdvertise.pdf
- *Estimating: How Much Electrical Energy Do We Use?* and *How Do You Read an Electrical Meter?* www.uni.edu/earth/EECP/elem/mod1_ma.html
- Energy Conservation Score, www.energyclassroom.com/pdfs/EC_CO_WK_ConScore.pdf

Other sites

- Maine Energy Education, www.efficiencymaine.com/education_programs_mee.htm
- U.S. Department of Energy Lesson Plans, http://apps1.eere.energy.gov/education/lessonplans

Assessment options

1. Have students make a prediction and write it down before conducting the activity. Students compare the results with their predictions. In small groups, students create 5-minute presentations on the results of the experiment, describing why it turned out the way it did.
2. Students draw a visual representation of the results of the activity, showing each light bulb, the amount of heat produced, and an explanation of the difference between the two bulbs.
3. Given that the incandescent light bulb used a lot of its energy to produce heat, calculate how long it would take for the equivalent compact fluorescent bulb to use that same amount of energy.
4. Use the questions at the end of the activity.

We save—Ideas for action

1. Do the School Light Survey activity (See Related K-12 Outreach Activities section on page 1) to determine how much energy is being used by light bulbs in different parts of the school.
2. Students can also find out how much the school pays for its energy use. They can calculate how much the school would save if incandescent bulbs were replaced with compact fluorescent bulbs and bring this information to the principal to consider potential cost savings for the school.
3. Students can consider other ways that energy could be saved on lighting and do an education campaign in the school to change student and teacher behaviors.