



Lesson 1 Modification: Electricity Discovery Box

Overview

This activity uses an Electricity Discovery Box to engage students and elicit their ideas about electricity. Students randomly select items from the box and discuss how they think each relates to electricity.

Teacher Background

The adaptations of Lesson 1 focus on the Energy Discovery Box portion of the lesson. The original lesson, available at: <http://www.powersleuth.org/teacher/energy-powers/lesson1-overview> has students considering how familiar items found in the box are connected to energy. The suggested modification is to change the theme of the discovery box to an Electricity Discovery Box and include items that will stimulate students' thinking about connections to electricity use, monitoring, and conservation. In selecting items for the Electricity Discovery Box, it is strongly recommended that teachers review the items and the descriptions of the energy connections outlined in Teacher Resource 1.1 of the original Energy for Maine lesson. As the teacher resource indicates, many of the same items can be used because they have a clear connection to electricity. A list of additional or substitute items for the Electricity Discovery Box can be found at the end of this document as well as information about the electricity connections that can be made for these items.

Use this activity prior to beginning the investigation as a way to stimulate interest and preassess students' ideas about electricity. Over the course of the investigation, students will expand their knowledge of electricity and its use and learn strategies for monitoring and conserving electricity. For this reason, use an explorative approach with this activity as opposed to expecting students to generate definitive and exhaustive answers.





Key Ideas

- Energy is in some way connected to all physical objects and processes in the universe.
- People use and depend on electricity in a variety of ways, many of which are not readily apparent.

Lesson Goals

Students will:

- explore their current ideas about electricity.
- examine people's first and second-hand interactions with electricity.





Teaching The Lesson

Follow Steps 1-5 of the lesson plan for *Energy for Maine*, Lesson 1 except shift the focus from energy to electricity. As students engage in their discussions about electricity, be certain to probe for students' ideas about the relationship between energy and electricity, making the distinction, when appropriate, that electricity is a secondary source of energy.

Alternatively, some teachers have modified the items in the discovery box, but kept the approach focused more broadly on energy in steps 1-4 as written in the original lesson, choosing instead to narrow the focus on the electricity connections. In this approach, students reexamine the annotated drawings and are asked "What if I now asked you to note all of the connections these items had to electricity specifically – not energy in general? In what ways would your drawings change?" Here the distinction between energy in general and electricity can be made.

Note: In Lesson 6 of *Energy Lights Maine* students investigate how electricity is generated on a large-scale basis and are introduced to the major components of electricity production using *Power Puzzles*. Energy sources used in electricity generation are included.



Items in the Energy Discovery Box that can be used in the Electricity Discovery Box:

- coal
- subway ticket or map (select a system that runs on electricity – e.g. Boston, New York, San Francisco)
- battery (D-cell) and/or battery operated flashlight
- cell phone or other small appliance
- bottle of water
- pinwheel
- clothespin
- energy-efficient light bulb (CFL or LED)
- power strip



Additional items to add to the Electricity Discovery Box:

- **Sample electricity bill:** Sample electricity bills from three of Maine's utilities are included in these *Maine Saves Energy* materials. While students will likely readily identify connections to electricity, many students have probably never looked at an electric bill or given much thought to how people are charged for electricity use. It is important to note that examining sample electric bills is one of the first activities students will do as they begin their investigations, so give some thought to its inclusion here. See Steps 1 and 2 of the Investigation Guide for additional details and background information on electric bills.
- **Kill A Watt meter:** Kill A Watt meters are tools that measure the energy used by individual appliances. Appliances are plugged into the meter (which is plugged into a wall outlet or power strip) and most measure the Voltage (volts), Current (amperes), Power (Watts), and Kilowatt-hours (kWh). Some models are programmable and can calculate the electrical expenses incurred by a particular appliance by the day, week, month and year. Students will readily note that the meter has a plug and infer that in order to use the device it gets plugged into an electrical outlet. They may also have heard of the units written on the meter and also infer that the device measures these units somehow. Energy for Maine, Lesson 7 focuses on using these instruments to measure the amount of electricity various appliances use and contains additional background information on the units of electricity.
- **Energy Star Guide:** These bright yellow labels tell the consumer how much electricity an appliance uses and are helpful in comparing the energy use of different models as people shop for new appliances. In addition, appliances that meet the efficiency standards ratings set by the U.S. Environmental Protection Agency receive a blue Energy Star label. Energy Star guides have recently been redesigned making them easier for the consumer to read. Visit the Federal Trade Commission's website for more information on how to read an Energy Star Guide: <http://www.ftc.gov/bcp/edu/pubs/consumer/homes/rea14.shtm>. Energy Star Guides can often be downloaded from websites that sell appliances.
- **Electric Meter:** Most students will recognize an electric meter but may have limited understanding as to their role in electricity use and monitoring. Electric meters are owned by the utility company and measure the number of kilowatt hours of electricity a home, business, or school uses each month. Traditional meters are read by a utility official on a monthly basis and the number is listed on the customer's bill. Customers are charged for the

number of kilowatt hours per month they use. “Smart” meters will replace nearly all of the traditional dial meters across the state. Smart meters have digital displays, are wireless, and use a radio frequency band for two-way communication. They can be read remotely and are just one part of a system-wide upgrade of a more automated power grid system. Additional information about smart meters is found in the teacher background section of the Investigation Guide. Step 4 (optional) of the guide engages students in learning how to take readings from traditional dial meters.

- **Wires:** An item, such as a piece of wire, representative of the infrastructure required to deliver electricity to our homes can elicit student's ideas about how electricity gets from its generation point to the home. Depending on students' background experiences with circuits, they may also recognize that electricity requires a complete pathway or loop to travel.

