



Lesson 6 Modification: Maine's Energy Picture

Overview

Students analyze the way they personally use energy and investigate energy use on a much larger scale (in Maine and nationally) through examination of data. Students discuss and make predictions about the amount of energy used by each sector. They create a visual representation of their predictions which they then compare to the actual percentage of energy used by each sector. Students begin to discover how reliant all sectors (residential, commercial, industrial, transportation) are on electricity and fossil fuels as energy sources.

Teacher Background

This lesson is an adaptation of Energy for Maine, Lesson 6 and sets electricity use into the large context of energy use. Refer to the original version, available at: <http://www.powersleuth.org/teacher/energy-powers/lesson6-overview> for Teacher Background information relevant to the focus of this lesson. Teachers could further abbreviate this lesson by focusing only on select individual steps of this modified plan. Lesson 6 has information about advance lesson Preparation and Materials. State and national learning goals are identified in this guide's Investigation Guide and Supplementary Activity Matrix.



Key Ideas

- Data about energy use is divided into different categories known as sectors and include transportation, residential, industrial, and commercial.
- Different sectors use energy and electricity in different ways.
- The amount of energy people in the United States and in Maine use continues to increase.
- Data is collected to answer a question and can be used to make informed decisions.

Lesson Goals

Students will:

- become familiar with the various ways energy, including electricity, is used by different sectors.
- analyze and determine energy use trends for themselves, for Maine, and the nation.
- recognize that data is collected to answer a question.
- begin to consider the cumulative effects of the energy decisions they make daily.





Teaching The Lesson

Engage

1 Examination and discussion of students' energy snapshots.

snapshots. Working in small groups of 4, students share their snapshots. If students were given the option of documenting their energy use with digital photographs, show students a slideshow of the assembled images. Once snapshots have been shared, discuss the following:

- *What do our snapshots tell us about the way we use energy?* Students will likely notice that their day to day activities frequently involve electricity.
- *How do you think the way humans use energy has changed over time? For example, if this were 1950, what might be different about the energy snapshots? What do you think would be the same?* Students will likely recognize that energy use has increased, especially our dependence on electricity.
- *If this were 1900, what do you think our energy snapshots would include? If it were 2050? What do you think accounts for these differences?* Students should recognize that the way energy is used has changed and is due to a number of factors including increased population and increased sophistication in the types and availability of devices that have been engineered to utilize energy in many different ways.
- *What don't our snapshots tell us about our energy use that we might like to know?* Answers will vary but draw students' attention to what the snapshots can and can't tell us about in terms of their personal/specific instances and collective energy use. For example, snapshots tell us that we do use electricity but it doesn't tell us about the amount of electricity we use – the actual number of kilowatt hours. Samples represent a few examples of "typical" use but due to a relatively small sample size, we couldn't say we've used more, less, or about the same amount of energy as in the past. The snapshots don't help us identify the devices that use large amounts of electricity or those that use electricity for a long period of time.



- (Optional) *Would you consider these snapshots "data?"* Throughout the investigation, students examine, collect, and analyze different types of data. Consider using this opportunity to clarify what data is. The *Connected Math Project* developed by Michigan State University describes data in this way: Data is values such as counts, ratings, measurements, or opinions that are gathered to answer questions. Data can be categorical (data that are words or categories) or numerical (data that are numbers). Our snapshots would be an example of categorical data (show how electricity is being used). Our snapshot data was collected to answer a particular question; it answers how we (students) use energy.

Explain to students that in the next few lessons they will be collecting, and analyzing different types of data and one of the first key steps in working with data is to recognize its nature. Remind students that we'll regularly ask: *Why was the data collected? What question was the data trying to answer? How was the data collected, what can it tell us, and what are its limitations?*

Explore

-  **2 Consider changes in energy use over time.** Have students view, either individually or as a class using an LCD projector, the Palmer Putnam podcast. The podcast can be accessed from the *PowerSleuth* website (www.powersleuth.org). Click on *Energy for Maine*, Teacher Zone, Lesson 6.

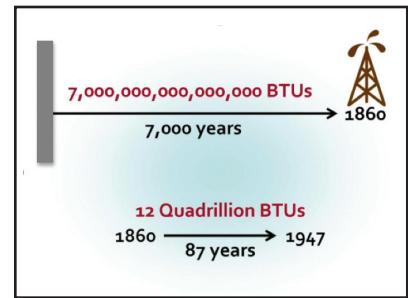
Note: *Keep in mind the Palmer Putnam story and the examination energy use in different sectors addresses overall energy use– not just electrical. This broad view of energy consumption serves multiple purposes and examination of the "big picture" data allows students to 1) situate electricity use with the scope of overall energy use and 2) to begin students' involvement with looking at different types of data. In the Palmer Putnam slides, data is displayed using few details. However, trends in energy use are clearly shown including a notably dramatic spike increase of energy use after the discovery of petroleum. As students begin to examine energy use in different sectors (see Step 3), they first are asked to create a display showing their prediction of energy use by each sector and then examine a pie graph showing use for each of the different sectors for Maine.*

Set the context for viewing the podcast by asking students to focus on the following as they listen:

- *What question does Palmer's data answer?*

After students watch the podcast engage in a discussion of the following:

- *What question does Palmer's data answer?* Palmer's data answers the question of: "How much energy (in British thermal units) have humans used throughout history?"
- *How has the amount of energy people use changed throughout time? What accounts for these changes?* Students should recognize that energy use worldwide has dramatically changed with the discovery and use of petroleum in the 1860s.
- *What do you think the data will show about people's energy use in future years?*
- *How is our snapshot data related to Palmer's findings? Do you think your snapshots are representative of how people in Maine, across the United States and the world use energy? What are some other ways energy is used by people in our society?* The aim of this line of questioning is twofold; initially, to get students to recognize the dramatic and overwhelming increase in energy use in recent years and second, to help students recognize people's use of energy (in all sectors) is heavily reliant on petroleum and nonrenewable energy sources. Asking students about how their snapshot relates to Palmer's findings guides them to thinking about what role their own energy use plays in the larger energy-use picture. Students have most likely recognized people's reliance on electricity but probably have not considered the entire energy story – tracing electricity back to its source when they plug something in or flip a switch.



3 Introduce different sectors of energy use.

Provide each student with Maine's Energy Picture handout (optional). Introduce students to different categories, known as sectors, of energy use: transportation, residential, industrial, and commercial. List the different sectors on the board and briefly describe each category. Students may have limited knowledge of how energy is used by other sectors such as business, industry, and transportation. Differentiate between "commercial," (referring to businesses- those engaged in buying and selling goods and services), and "industrial," (referring to occupations that involve manufacture or production of a product). Provide local examples of commercial, industrial, and transportation to help students understand the dif-

ferences. Students may wonder how schools are categorized (commercial). Give students a few minutes first to brainstorm, with a partner, all the ways they think each sector uses energy and make a list in their scientists' notebooks.

After students have completed their lists, discuss some of the items they included. Give each pair 100 counters (pennies or beans), a piece of chart paper, and markers. Explain that they will be using their 100 counters to predict the percentage of energy they think each sector uses. Explain that each counter represents 1% of the total energy used by the different groups (sectors). Students should think about what percentage of total energy they think each sector uses and create a visual on chart paper showing the percentages for each sector in Maine. Students may create a pie chart, bar graph, or come up with some other way of representing their predictions. Alternatively students may make a representation without using counters.

Monitor students as they work. Talk with students about the reasons behind their predictions. Visit each pair and make note of the trends in students' displays. After a few minutes, call the class together to share the similarities and differences in the percentages displayed in their predictions.



4 Examine Maine energy consumption data.

Distribute a copy of Maine Energy Consumption data (available in *Energy For Maine*, Lesson 6) to students and/or share the information by displaying an overhead or digital slide of this information. Discuss with students how the actual data compares with their predictions. Discuss with students what might account for (any) differences.

Revisit the types of questions posed to students as they examined their snapshots, but instead, ask about the data for Maine:

- *What does the Maine Energy Consumption data tell us about the way energy is used in our state?* Help students generate a list of statements that the data supports.
- *What doesn't the Maine Energy Consumption data tell us about the way energy is used in our state?* Help students generate a list of specific questions they have that this data doesn't answer. Save this list, as these could be questions for further study.
- *What additional questions do you have about Maine's energy use?* It may be necessary to provide students with an example question or two to get them started. For example: *How does Maine's energy use compare to other states? Do we use more or less energy than other states? How does Maine's energy use relate to Maine's electricity use?*

5

Read Energy Consumption article. Distribute a copy of “Energy Consumption” reading and from Energy for Maine, Student Handout 6.1: Advance Organizer for Energy Consumption Article to each student. Explain to students that this reading describes more specifically what each sector uses energy for and the energy sources most commonly used to fuel various tasks.

Encourage students to mark the article by underlining, circling, or highlighting parts of the article that pertain to the focus areas. Give students time to read the article silently or read the information together as a class.

Alternatively, use a jigsaw reading strategy with the article. Divide the class into “home groups” of three. One person in the trio reads the Residential and Commercial section (point out that these two categories are grouped together in the reading), another person in the home group reads the Industrial section, and the last person is assigned the Transportation section. All students in the class assigned to read the Residential and Commercial section (or Industrial, or Transportation respectively) gather to read and discuss their section in preparation for sharing their “expert” knowledge about their section with the home group. Experts return to their home group and take turns sharing a summary of their findings with the other members of their home group.



6

Summarize learnings and bring lesson to a close.

Clarify any remaining questions students have about the Energy Consumption article. Explain that in upcoming lessons they will be using a variety of tools to investigate energy use, specifically electricity use in homes. Remind students of what their own Energy Snapshots showed: each of us interacts frequently with electricity, and therefore, we have a direct impact and influence on how electrical energy is used in our homes.

Note: According to the Department of Energy, 21% of the energy people use in the U.S. is for the home; in Maine about $\frac{1}{4}$ of the energy used is residential (23%). While it is a bit tricky to pinpoint exactly how much of this home energy use is electrical, nationally 47% of home energy use is for heating the house, and another 17% of home energy use is for hot water for washing and bathing. Lighting, appliances, and refrigeration take 29% of home energy use, with the remaining 6% used for cooling the home.

Consider closing the lesson by asking students to generate some preliminary questions about their home’s electricity use, such as what (factors) they think affects how much electricity a particular

home uses? Ask students to brainstorm all the electronic devices they can think of that would impact use and other factors such as size of home, season (for lighting and heating), number of windows, age of home, etc.

References:

In addition to those resources listed in *Energy for Maine*, Lesson 6:
Michigan State University. (2009). *Connected Mathematics 2: Variables and Patterns*. New York, NY: Pearson Education.

