

Energy Audit

GRADE LEVELS

3rd-8th; California Content Standards for 3rd - 7th

SUBJECTS

Investigation and Experimentation, Mathematics: Statistics, Data Analysis, and Probability

DURATION

Preparation: 20 minutes Activity: parts of a few class periods

SETTING

Classroom, Home

Objectives

In this lesson, students will:

1. learn what items in their homes use energy.
2. brainstorm ways to save energy.
3. practice graphing and statistically analyzing data.

Materials

Energy Audit Worksheet (1 per student)
compact fluorescent light bulb
incandescent light bulb
graph paper
lined paper
pencils

Vocabulary

- ❖ mean: the sum of all the numbers divided by the number of numbers
- ❖ median: the middle number in an ordered list of numbers
- ❖ mode: the number that occurs most often in a list of numbers
- ❖ range: the difference between the highest number and the lowest number
- ❖ lower quartile: the number that cuts off the lowest quarter of data, the median of the lower half of the numbers
- ❖ upper quartile: the number that cuts off the highest quarter of data, the median of the upper half of the numbers

Teacher Background

The United States comprises only 5% of the world's population and yet uses approximately 22% of the world's energy. About 86% of the energy consumed by the United States is derived from fossil fuels. The United States therefore uses a disproportionate amount of the world's energy and contributes a disproportionate amount to the problems associated with fossil fuel burning such as pollution and climate change.

The two main end-uses of energy in the United States are transportation and buildings. Transportation accounts for approximately 1/3 of energy use in the United States, while buildings account for approximately 1/2 of energy use. Our homes (residential buildings) are responsible for about 42% of all the energy used in buildings and about 21% of the total energy



usage in the United States. The way we use or save energy in our homes therefore has a big impact.

We use energy to heat and cool our homes, to provide electricity, to cook, to heat and pump our water, to refrigerate our food, to power our computers, and much more. Because such a large percentage of the United States energy use occurs in our homes, performing and analyzing a home energy audit can help us become more aware of some of the main ways that we use energy. Once we know all the ways that we use and sometimes waste energy in our homes, we can brainstorm ways to decrease our energy consumption and enact a plan to save energy, which will decrease pollution, decrease climate change causing carbon emissions, and decrease our energy bills.

Activity

Preparation

Prepare a letter for students' families, letting them know that their children are doing a unit on energy and will be inspecting their homes for energy use.

Introduction

- ❖ Introduce energy usage by having students list the things in their classroom that take energy.
- ❖ Hand out an Energy Audit Worksheet to each student.
- ❖ Tell students that they are going to inspect their homes for energy usage.
- ❖ Read the instructions out loud to the class and go over each of the questions, explaining how the students will answer these questions at home. Some of the questions may require asking a family member for the answer, but a lot of them simply require looking around the home.
- ❖ When you come to the compact fluorescent light bulb (CFL) question, show students the CFL. Tell them that these light bulbs are more efficient, meaning that they produce the same amount of light with less energy. Show students the incandescent bulb so that they will be able to tell the difference when conducting their audits.
- ❖ For a homework assignment, have kids fill out the Energy Audit Worksheet.

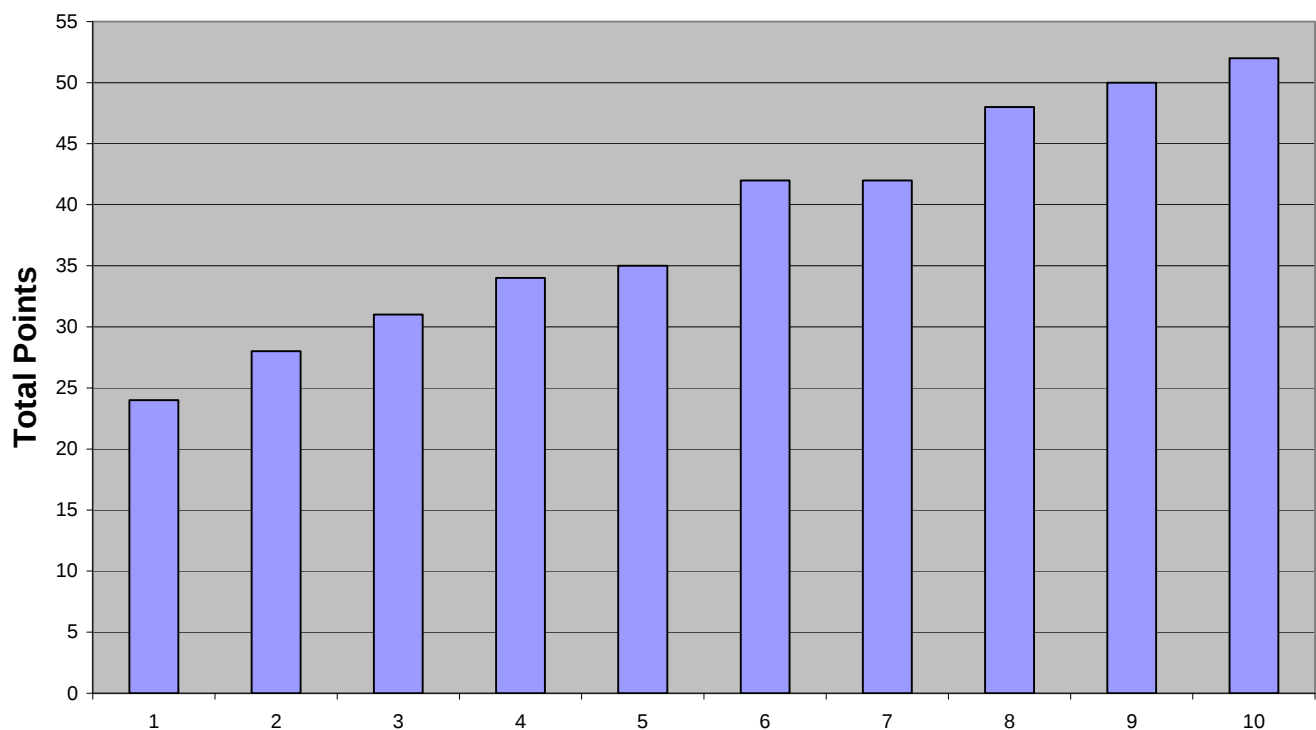
Procedure

1. Have students turn in their Energy Audit Worksheets. Tell students that they all did energy audits of their respective homes and that today the class is going to put all those separate energy audits together to graph the results and calculate a few important statistics.
2. Write the number of total points for each student (without the student names) in a random order on the board. Total point scores will range between 20 and 60.
 - ❖ Example: 24, 35, 28, 48, 52, 31, 42, 42, 34, 50
3. Tell students that these numbers are their energy audit scores, in no particular order, and that the lower numbers mean lower energy use, while the higher numbers mean higher energy use. Make sure to emphasize that the variation in the energy audit scores may be due to many different things. Some people live in apartments and some people live in houses. Some people have large families with

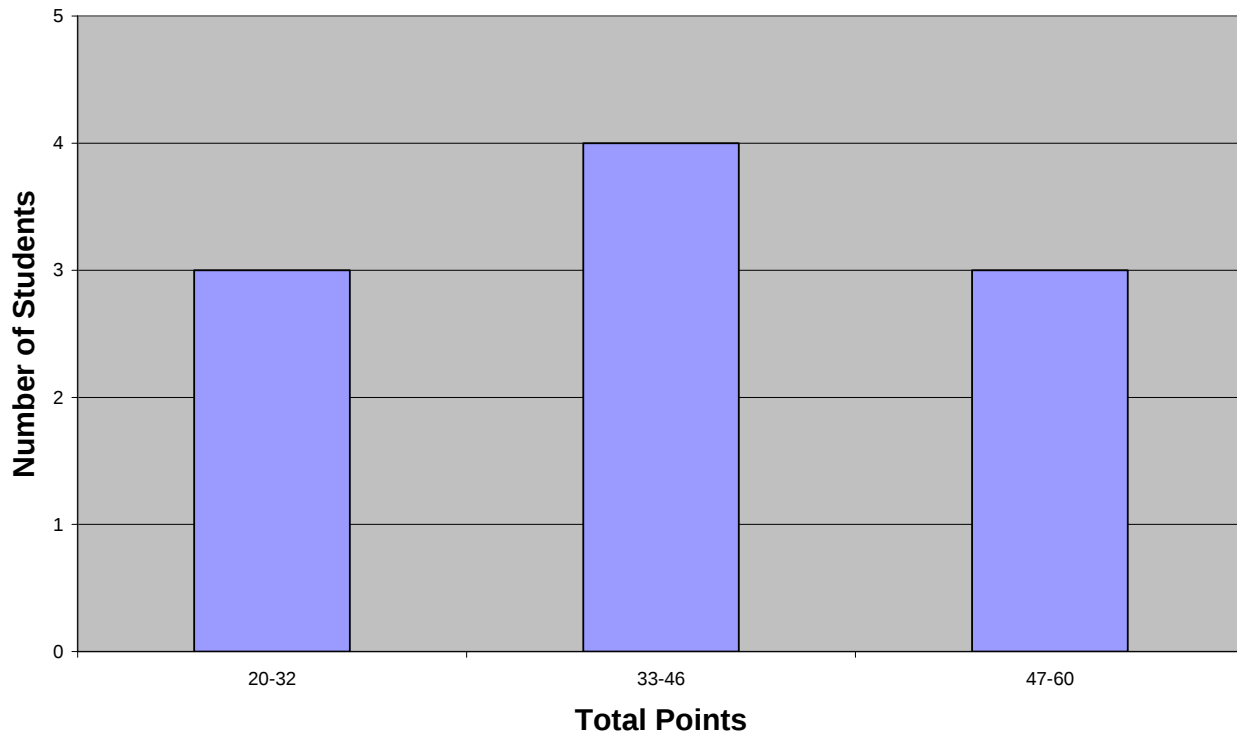
lots of people in one home and some people have small families. Some people live in older homes and some people live in newer homes. All of these factors can influence energy use, so there are lots of different reasons for the variation in numbers.

4. Give each student a piece of lined paper, a piece of graph paper, and a pencil.
5. First, have students write the numbers in order from smallest to largest on their lined paper.
 - ❖ Example: 24, 28, 31, 34, 35, 42, 42, 48, 50, 52
6. Guide students through grade-appropriate statistics.
 - ❖ Grade Five: mean, median, and mode
 - ❖ Grade Six: range, mean, median, and mode
 - ❖ Grade Seven: minimum, lower quartile, median, upper quartile, and maximum
 - ❖ For this example: mean = 38.6, median = 38.5, mode = 42, range = 28, minimum = 24, lower quartile = 31, upper quartile = 48, maximum = 52
7. Discuss what each of these statistics means with your students.
8. Model drawing x and y axes on the board. Tell students to do the same on their graph paper. Ask students what labels should go on the x and y axes.
9. Remind students that bar graphs are helpful when comparing similar data. Graph the data using a bar graph. This can be done in many ways. You can have students graph each individual number, which represents one of the students in the class or you can pool the data into data bins. For example, your data bins could be 20-31, 32-46, and 47-60. Two example graphs are below.

Energy Audit Results



Energy Audit Results



10. Explain that students' total points from the energy audit tell us how much energy they are using.
 - ❖ Students with scores between 20 and 32 are master energy savers.
 - ❖ Students with scores between 33 and 46 are on their way to big energy savings.
 - ❖ Students with scores between 47 and 50 are now equipped with energy knowledge and can soon become master energy savers.
11. Discuss with your students what the graph means. How much energy do we use? Is there a big range in our scores? Have each student write one to two sentences about what the graph tells him or her.
12. Review why it is important to reduce energy consumption. (*It reduces pollution from fossil fuels, it reduces carbon emission to the atmosphere that cause global climate change, it decreases our energy costs*)

Wrap-Up

Tell students that although some homes already use less energy than others, everyone can do a little more to help save energy and the environment. Discuss ways to reduce energy usage in home and at school with your students. Have students brainstorm for themselves and add some of the ideas listed below to flesh out the list.

- ❖ Set computer to five-minute sleep mode and turn it off when not in use.

- ❖ Unplug appliances when not in use or control with a smart power strip.
- ❖ Change from old-fashioned light bulbs to compact fluorescent light bulbs.
- ❖ Only heat or cool the rooms you need.
- ❖ Turn down water heater.
- ❖ When cooking, keep the lids on pots.
- ❖ Set your thermostat lower in winter and higher in summer and adjust your body temperature with clothes.
- ❖ Only run full loads of laundry and dishes.
- ❖ Use cold water when possible.
- ❖ Turn off water when not using it and take shorter showers.
- ❖ Air dry clothes.
- ❖ Install a low-flow shower head, which reduces hot water usage

Resources

EnergyHog.org. *No and low cost tips to save energy and money*. Retrieved April 1, 2008 from http://www.energyhog.org/pdf/No-Cost_Low-Cost_Ultimate-Checklist.pdf

Stanford University School of Earth Sciences, Earth Systems Program. Sustainable Choices Card. Retrieved on March 18, 2008 from <http://sustainablechoices.stanford.edu/>

United States Department of Energy. (2005). *A Consumer's Guide to Energy Efficiency and Renewable Energy*. Retrieved on April 2, 2008 from http://www.eere.energy.gov/consumer/your_home/energy_audits/index.cfm/mytopic=11160

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EnergyHog.org. *No and low cost tips to save energy and money*. Retrieved April 1, 2008 from http://www.energyhog.org/pdf/No-Cost_Low-Cost_Ultimate-Checklist.pdf

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Correlated California Content Standards

Grade Three

Investigation and Experimentation

- 5c. Use numerical data describing and comparing objects, events, and measurements
- 5e. Collect data in an investigation and analyze those data to develop a logical conclusion

Grade Four

Investigation and Experimentation

- 6e. Construct and interpret graphs from measurements

Mathematics: Statistics, Data Analysis, and Probability

- 1.1. Formulate survey questions; systematically collect and represent data on a number line; and coordinate graphs, tables, and charts.

Grade Five

Investigation and Experimentation

- 6g. Record data by using appropriate graphic representations (including Charts, graphs, and labeled diagrams) and make inferences based on those data

Mathematics: Statistics, Data Analysis, and Probability

- 1.1. Know the concepts of mean, median, and mode; compute and compare simple examples to show that they may differ.
- 1.2. Organize and display single-variable data in appropriate graphs and representations (e.g., histogram, circle graphs) and explain which types of graphs are appropriate for various data sets.

Grade Six

Mathematics: Statistics, Data Analysis, and Probability

- 1.1 Compute the range, mean, median, and mode of data sets.

Grade Seven

Mathematics: Statistics, Data Analysis, and Probability

- 1.3 Understand the meaning of, and be able to compute, the minimum, the lower quartile, the median, the upper quartile, and the maximum of a data set.