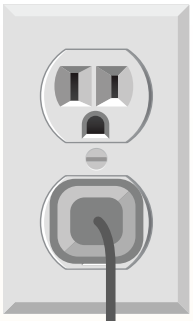


Watt's Up?
Measuring Energy

Topic: Learn how to measure energy use in the classroom.

Suggested grades 5 - 8

Materials/Resources needed:

- Hair dryer with multiple settings
- Light bulb with store packaging and labeling
- Watt meter
- Multiple classroom devices that plug into the wall
- Student worksheet
  The student worksheet may be used with classroom discussion, as a group or solo activity.

Prep time: 5 minutes

Lesson time: 30 minutes

Outcome: Students will learn how to use a watt meter to calculate energy costs of electric devices and examine ways to promote energy efficiency and energy conservation.

Purpose: Electricity is often used without consideration of costs or efficiency. After learning how to use a watt meter and how much energy is used to operate devices in the classroom, students can compare and contrast use and cost and discuss ways to save energy.

Standards:
In appendix

Vocabulary:
In appendix

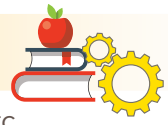
Prep

- Prepare student worksheets.

Engage

- Dramatically use a hair dryer for a minute and then ask students, How much did this cost?
- Discover how much they know about electricity, it's cost and efficiency.
- Have students point out other electric devices in the classroom list them on the board.
- Ask class, What do you think it costs to operate these devices?
- Have students come up with a definition of auditing.
- Announce to the students, We are going to perform an energy audit to find out how much energy we use in the classroom and discover how we can reduce waste and save money.

Teach



- Review various measurements: time, length, etc.
  Review the concept of miles per hour (MPH).
- Define how electricity is measured:
  Electricity is measured in units of power called watts. The amount of electricity we use in a period of time (hour) is measured in kilowatt-hours (kWh).
  Define: 1 kWh is 1,000 watts used for one hour.
- Demonstrate light bulb packaging and pass it around for inspection.
- If you use a 100 watt light bulb for 10 hours, have you used 1,000 watt hours or 1 kWh?
- Ask class if all light bulbs are created equal. Are some light bulbs more cost efficient? Introduce the term efficiency.

Explore

- Point to the hair dryer and ask, What information is needed in order to determine the cost of using it. (time it is used, wattage of appliance and cost per kilowatt-hour used).
- Show SMUD plug-load video. (Video available at smud.org/Education).
- Write on board as a formula (watts x hours/year) / 1,000.
- Introduce the watt meter and ask a student volunteer to read the display as the hair dryer is used. Have the volunteer notice changes during various power settings. Write results on the board.
- Mention that electric devices have the wattage on the device and packaging.
- Experiment with changing the intensity of the hair dryer. Have student(s) observe the changes in the watt meter. Ask class to offer explanations as to why the numbers varied on the watt meter as the settings on the hair dryer changed.

Activity

- Hand out worksheet and work with the students to measure various electric devices using the watt meter.
- Supply the cost for electricity as $0.12/kWh on the board.
- Review the cost of using appliances on the board.
- Define plug-load as all of the devices which are plugged in and drawing power.
- Have students identify any additional electric devices in classroom.
- Write plug-load on the board above the list of electric devices.

Activity

- Have students work in groups and repeat the energy use calculations using the listed electric devices identified in the room.
- Write results on the board next to the associated devices.
- Which devices used the most electricity?
- Why? Relate the devices which produce heat or have motors to higher cost.
- Ask if there are ways to save money on electricity used in the classroom.
- Write students suggestions on how to save electricity in the classroom.

Assessment

- Students should be able to respond to these questions correctly.
- Is electricity free?
- What three pieces of information are required to determine how much electricity costs?
- What tool measures how much electricity electric equipment uses?
- How else can you learn how much electricity a device uses?
- How can one compare efficiency of devices before making a purchase?
- What are some ways you can save energy in the classroom? Reinforce terms conservation and efficiency.

Crossover

- Have students research and present findings on energy efficient appliances.
- Compare the energy use and cost between incandescent and LED light bulbs.

Accommodations and Extensions

- Have the students use sticky notes to label the electric appliances with the cost to operate.
- Complete the classroom audit worksheet as a class activity.
- For students interested in engaging in the math activity, have them create a spreadsheet which allows for automatic calculation of cost of operation of the electric devices.
- For students wanting to learn more and who would like to do energy audits at their school and take control of their local energy policies, they can form an Energy Team. Visit need.org//Files/curriculum/guides/BlueprintSchoolEnergyTeam.pdf
- Supply a copy of the home energy audit worksheet for the students to repeat the exercise with their family.
- If watt meters are not available supply a link or hand out with a list of common household electric devices and appliances.

Reference

National Energy Education Development Project – Plug Load Audit workbook
need.org/files/curriculum/guides/PlugLoads.pdf

Additional Resources

Department of Energy
https://energy.gov/science-innovation/science-education

Additional References and Digital

https://www.youtube.com/watch?v=RkgH6Ba8s9A
For copies or more information contact:

SMUD Energy Education and Technology Center
916-732-6738
etcmail@smud.org
smud.org/Education

Appendix

Standards:
Common Core Mathematics – Mathematical Practices

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Next Generation Science Standards (NGSS 4-PS3-2 Energy)

- Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat and electric currents.

Vocabulary

Electricity – A type of energy that can build up in one place or flow from one place to another. Electrical power is measured in watts, or kilo-watts (kW).

Electrical energy – Using electrical power to do work, over time. Electrical energy is measured in kilowatt-hours (kWh).

Energy audit – A survey and analysis of how a building or device uses energy.

Energy conservation – Using less energy with the same devices or equipment, typically by using them less or turning them off when not in use.

Energy efficiency – Using less energy by replacing old devices with newer equipment or technology.

Kilowatt-hour – Using one thousand watts (1 kW) of electrical power for one hour. Electric utilities bill their customers for every kWh used.

Plug load – The electrical energy used by things that are plugged into the wall.

Watt meter – A tool for measuring how much electrical power (watts) anything plugged into the wall is using.