



Home and School Energy Audits

Grade Level: 4-8

Length: 90 Minutes, divided into 2 class periods

www.pwsrcac.org/lessons

NGSS Standards

3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Crosscutting Concepts

Scale, Proportion, & Quantity In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

Related Resources

Worksheets My Home Electricity Footprint; My School Electricity Footprint; School Energy Audit

Websites

- <https://www.energy.gov/energysaver/estimating-appliance-and-home-electronic-energy-use>
- <https://akenergysmart.org/>

Overview

There are many opportunities to conserve energy at home and school.

Objectives

- Students will understand how daily routines can use significant amounts of energy and have important environmental and economic effects.
- Students will analyze data to identify ways to conserve energy in the home and school.

Materials

- “My Home Electricity Footprint” Worksheet
- “My School Electricity Footprint” Worksheet
- “School Energy Audit” Worksheet
- Pencil
- Sticks or Old Pencils
- Tape
- Scratch Paper
- Computers with Internet Access (optional)
- Clipboards
- Thermometers
- Watt meters
- Paper
- Envelopes
- Stamps

Notes

Background

An energy audit is an excellent way for students to learn about the multitude of ways we use energy in our daily lives. Beyond an academic experience, conserving energy helps students, families, and schools to save money and promotes a healthier environment by cutting down on the amount of oil and natural gas that have to be drilled, transported, and burned for heat and electricity.

Preparation

1. Make copies of the “My Home Electricity Footprint” worksheet and “My School Electricity Footprint” worksheet included here sourced from <https://akenergysmart.org/>
2. Also makes copies of the School Energy Audit Supplement worksheet provided in this curriculum.
3. Watt meters can usually be checked out from the local library or an energy cooperative or company. Bring one or more for students to use if possible. If you cannot access a watt meter, help students to access an appliance energy usage estimator, such as this one: <https://www.energy.gov/energysaver/estimating-appliance-and-home-electronic-energy-use>

Introducing the Lesson

Ask students where energy comes from. Brainstorm a list of ways we use energy in our homes and schools. Have students prioritize their top three energy needs. What energy uses are important to them, and which ones are less important?

Activity

1. Introduce the My Home Electricity Footprint worksheets and review them with students.
2. In addition to the worksheet, they will also be looking for drafts within their home. Students set up a draft-o-meter by taping a 2-inch-long, ½ inch wide piece of paper so it hangs vertical off a small stick or pencil. Practice using the draft-o-meter in the classroom and identify an area with a draft (indicated by the paper being blown into a horizontal or diagonal position). Send students home to complete the worksheet and use the draft-o-meter near

doors and windows in their home. Have them make a list of drafty areas.

3. The next day in school, review the worksheet. Without “naming names” use a scatterplot to graph the scores of the class in watts or number of appliances and lights. Have each student identify an area in which their home scored poorly and think of a way to change that score. What areas were the draftiest? How can that be changed?
4. Next, perform a school energy audit. Divide students into teams and provide them with the My Classroom Electricity Footprint and school energy audit supplement worksheets. Have students look for thermostats and energy star appliances in each room. (Note: The whole school heating/cooling system may be controlled by one central thermostat). Check to see whether lights, appliances, and electronics are off when not in use. Students should record the temperature and use the draft-o-meter in each room. Use the wattmeter to measure the energy draw of frequently used electronics and appliances.
5. Have each student team analyze their data to identify an area of energy waste and present to the class. Discuss the different areas of energy waste.

>>Homeschool Tip: If you are working with homeschool students, have them develop and present solutions based on their home or a favorite public building. Determine a group of decisionmakers and experts that can participate in the discussion about the solutions.

6. If possible, invite the school principal, a janitor, or another decision-maker about school energy use into the classroom to share three criteria/constraints for energy conservation or efficiency projects that would be feasible to implement at the school. If you are unable to have someone come in to present with the class, talk with them beforehand to identify three criteria/constraints. These criteria and constraints might include one or more of the following:
 - Conserves energy
 - Increases energy efficiency
 - Saves the school money within one year
 - Doesn't require any initial investment of money
 - Saves the school money over the lifetime of the appliance
 - Doesn't require any additional staff time to install, operate, and maintain
 - Can be implemented and maintained by students

- Only requires ____ extra hours per month of staff time to install, operate, and maintain
 - Doesn't require any new equipment, only new behaviors
 - Has additional benefits to student/teacher health, learning, etc.
7. Have each group work together to develop a way to minimize energy waste that fits these criteria and prepare a presentation for their classmates. The presentation should directly address the criteria/constraints they've been given as well as an explanation of why they believe this is a worthy project.
 8. Invite the school principal, janitor, or other energy-related decision makers to the classroom and have students present their solutions. After the presentations, ask all students and adults in the room to quickly respond in writing to the following prompts:
 - Which solution do you think is the best option based on (criteria #1) _____? Why do you think that?
 - Which solution do you think is the best option based on (criteria #2) _____? Why do you think that?
 - Which solution do you think is the best option based on (criteria #3) _____? Why do you think that?
 - Which solution do you think is the best option based on all of the criteria? Why?
 9. Then facilitate a discussion about some of the strengths and challenges of the solutions, seeking consensus on one (or more) solutions that the class can work to refine and implement.

Wrap-up

Now that students have addressed energy waste in the school, ask them to make a switch in their home. Have each student write a letter to themselves with a promise to make at least one simple, inexpensive change to conserve energy in their home or other part of their life. Students should fold the letters, place them in self-addressed envelopes, and give them to the teachers. Mail the letters two weeks later to students to remind them of their promise.

Assessment

Review worksheets for completeness. Evaluate student collaboration, cooperation, and consideration of their peers' ideas throughout the process of designing and presenting a solution to minimize energy waste. Listen during discussion for arguments based on evidence from their own life and science ideas. Students who successfully meet the performance expectation will work together throughout the course of

the project and demonstrate that they have generated and compared multiple solutions to the problem based on how well each is likely to meet the criteria and constraints of the problem.



Name _____

My Home Electricity Footprint

Background: Think about your house and the many different ways that you use energy throughout the day. We measure electricity use in **Watts (W)**: the more watts something uses, and the longer we use it, the more energy it uses. In most places in Alaska, electricity comes from fossil fuels which cause pollution and take a long time (millions of years) to make. So using less electricity also uses less fossil fuels.

Directions:

1. Predict which things you think use the most and least amount of electricity and write it down on the next page.
2. The activity can be done in class or at home:
 - a. If you are in class, picture your home in your head and write down what items use electricity in your house.
 - b. If you are at home, walk through your house with a family member to complete the sheet as best as you can.
3. Consider what you could do to save energy at home. Are the light bulbs LEDs? Does the television get left on when not in use? Write a few words like “turn off more” in the “Energy Saving Suggestion” column for as many items as you can.
4. If possible, use an electricity monitor to find how many watts that they use. You can also use the Department of Energy’s usage estimator to look up your appliances at <https://www.energy.gov/energysaver/estimating-appliance-and-home-electronic-energy-use>
5. Add up the watts used by light bulbs and appliances/electronic devices to get a total number of watts.
6. Decide whether your hypothesis was *supported* (correct) or *rejected* (not correct) and complete the conclusion.
7. Think about ways that you can use less electricity and write down three things that you will do differently in the future to save energy.

Hypothesis: I predict that _____ will use the **most** electricity and that _____ will use the **least** electricity.

My Bedroom

Item	Number	# of Watts	Energy Saving Suggestion
Lights			
Alarm Clock			
Stereo/iPod			
Other:			

My Bathroom

Item	Number	# of Watts	Energy Saving Suggestion
Lights			
Hair dryer			
Nightlight			
Fan			
Other:			

Kitchen

Item	Number	# of Watts	Energy Saving Suggestion
Lights			
Oven			
Microwave			
Refrigerator/Freezer			

Item	Number	# of Watts	Energy Saving Suggestion
Coffeemaker			
Dishwasher			
Stove/Range Hood			
Other:			

Living Room

Item	Number	# of Watts	Energy Saving Suggestion
Lights			
Television			
DVD player			
Stereo			
Video game console			
Other:			

Other

Item	Number	# of Watts	Energy Saving Suggestion
Computer(s)			
Washing machine			
Clothes dryer			
Water heater			
Space heater (boiler, Toyo stove, electric heater, etc)			

Item	Number	# of Watts	Energy Saving Suggestion
Water pump			
Electric hot water heater			
Land line phone(s)			
Cell phone(s)			
HRV, fresh air inlet, or fan			
Other:			

Total

Total # of items that use electricity: _____ Total # of lights: _____

Total # of watts (if known): _____

Conclusion: _____ uses the **most** electricity and _____ uses the **least** electricity. My hypothesis was _____ (*supported or rejected*).

Describe 3 things that you will do to save energy at home or school:

1. _____

2. _____

3. _____



Our Classroom Electricity Footprint

Background: Think about your classroom and the many different ways that you use energy throughout the day. We measure electricity use in **Watts (W)**: the more watts something uses, and the longer we use it, the more energy it uses. In most places in Alaska, electricity comes from fossil fuels which cause pollution and take a long time (millions of years) to make. So using less electricity also uses less fossil fuels.

Directions:

1. Predict which things you think use the most and least amount of electricity and write it down on the next page.
2. Count how many light bulbs are in the classroom and with your class calculate how many watts that uses.
3. In small groups or as a class, walk around the classroom and list the different electronic devices or appliances that are in the classroom.
4. If possible, use an electricity monitor to find how many watts that they use. You can also use the Department of Energy's usage estimator to look up your appliances at <https://www.energy.gov/energysaver/estimating-appliance-and-home-electronic-energy-use>
5. Add up the watts used by light bulbs and appliances/ electronic devices to get a total number of watts.
6. Decide whether your hypothesis was *supported* (correct) or *rejected* (not correct) and complete the conclusion.
7. In small groups or as a class, discuss ways to reduce the amount of electricity that is consumed in your classroom. Think about ways that you can use less electricity and write down three things that you will do differently in the future to save energy.

Name(s): _____

Our Classroom Electricity Footprint

Hypothesis: I predict that _____ will use the **most** electricity and that _____ will use the **least** electricity.

of light bulbs: _____ x Watts of each: _____ = Total watts: _____

Appliances/Electronic Devices

1) _____ Watts: _____.

2) _____ Watts: _____.

3) _____ Watts: _____.

4) _____ Watts: _____.

5) _____ Watts: _____.

6) _____ Watts: _____.

7) _____ Watts: _____.

8) _____ Watts: _____.

9) _____ Watts: _____.

10) _____ Watts: _____.

Total (including lights): _____.

Conclusion: _____ uses the **most** electricity and _____ uses the **least** electricity. My hypothesis was _____ (*supported or rejected*). In our community, we use _____ to generate electricity.

Describe 3 things that you will do to save energy at home or school:

1. _____

2. _____

3. _____

Why is it important to use less energy?

School Energy Audit

Room: _____

Thermostat Set To: _____ Actual Room Temperature: _____

of EnergyStar Appliances: _____ # of Appliances not EnergyStar: _____

of Unused Appliances Off: _____ # of Unused Appliances Left On: _____

of Lights Turned Off: _____ # of Lights Left On: _____

of Compact Fluorescent Bulbs: _____ # of Non-CFL Bulbs in Room: _____

Drafty areas:

Other notes:

Your Energy Efficiency Rating for Room (circle one):

Awful

Bad

Okay

Good

Excellent

Room: _____

Thermostat Set To: _____ Actual Room Temperature: _____

of EnergyStar Appliances: _____ # of Appliances not EnergyStar: _____

of Unused Appliances Off: _____ # of Unused Appliances Left On: _____

of Lights Turned Off: _____ # of Lights Left On: _____

of Compact Fluorescent Bulbs: _____ # of Non-CFL Bulbs in Room: _____

Drafty areas:

Other notes:

Your Energy Efficiency Rating for Room (circle one):

Awful

Bad

Okay

Good

Excellent

Room: _____

Thermostat Set To: _____ Actual Room Temperature: _____

of EnergyStar Appliances: _____ # of Appliances not EnergyStar: _____

of Unused Appliances Off: _____ # of Unused Appliances Left On: _____

of Lights Turned Off: _____ # of Lights Left On: _____

of Compact Fluorescent Bulbs: _____ # of Non-CFL Bulbs in Room: _____

Drafty areas:

Other notes:

Your Energy Efficiency Rating for Room (circle one):

Awful

Bad

Okay

Good

Excellent

Room: _____

Thermostat Set To: _____ Actual Room Temperature: _____

of EnergyStar Appliances: _____ # of Appliances not EnergyStar: _____

of Unused Appliances Off: _____ # of Unused Appliances Left On: _____

of Lights Turned Off: _____ # of Lights Left On: _____

of Compact Fluorescent Bulbs: _____ # of Non-CFL Bulbs in Room: _____

Drafty areas:

Other notes:

Your Energy Efficiency Rating for Room (circle one):

Awful

Bad

Okay

Good

Excellent