



My Electric Footprint

Target grades:

3 - 5

AK ELAM Standards:

Mathematics

5.NBT.4

AK Science GLEs:

[3] SE1.1

[3] SE2.1

[3] SE3.1

NGSS

See page 5.

Set up time:

15 minutes

Class time:

One to two class periods

Overview:

Students conduct an assessment of their electricity use from daily activities in school and at home. They then consider ways to lessen their electric footprint.

Objectives:

Students often have misconceptions about where electricity comes from. This lesson will help them understand what happens when they plug something into a wall socket. They will identify ways we use electricity in our daily lives as well as understand that different appliances and electronic devices use different amounts of electricity.

Materials:

My Home Electric Footprint student worksheet checklist

Our Classroom Electric Footprint student checklist (optional)

Kill-A-Watt meters

Background:

Electricity is a very important form of energy that we use each day. The transfer of electrons from atom to atom allows us to listen to music, light our homes and schools, and power our computers, TVs, and other electronic devices. The choices we make daily about how we use electricity—turning lights off when we leave the room and unplugging appliances when they are not in use—have a significant impact on how much electricity we consume and how much we waste.

Outside of Southeast Alaska where hydropower is widely utilized, the majority of electricity in Alaska is produced by burning fossil fuels such as natural gas, diesel and coal. Fossil fuels take millions of years to form, which means that they are limited in quantity and take a long time to replace. Being aware of how much electricity we consume and recognizing what devices use more electricity than others can help us be wiser energy consumers. It can also help us conserve our remaining fossil fuel reserves.

Although in Alaska the majority of homes are heated using natural gas or diesel, 10% of homes are heated during the winter using electricity, which is often less efficient and more expensive than other heating sources. Aside from space heating, the largest consumers of electricity in our homes are hot water heaters, lighting and appliances. Water



heaters provide hot water for showers and washing dishes. Lighting lets us stay up once the sun goes down to play games, read and spend time with our families. Although they are not significant consumers of electricity by themselves, electronic devices such as computers and iPods cumulatively require a considerable amount of electricity. Can you imagine your life without these things?

A kilowatt-hour is a unit to measure electricity consumption. A kilowatt-hour is the amount of electricity used to light ten 100 watt light bulbs for 1 hour (or one 100 watt light bulbs for 10 hours). While different appliances and electronics use different amounts of electricity, the amount of time that you use or have something turned on is also important to consider. Understanding how many kilowatt-hours appliances or electronics use is a way to track your total electricity use. A Kill-A-Watt meter will measure how much electricity a plugged-in appliance is using. This will also help determine how you can reduce electricity usage.

Ways you can reduce the amount of electricity that you use:

- Turn off the lights when you leave the room
- Unplug appliances when they are not in use or plug appliances into a power strip that you turn off
- Take shorter showers to reduce the amount of energy needed to heat water
- Encourage your family and friends to replace incandescent lights with compact florescent or LED bulbs

Vocabulary List:

electricity - a form of energy which is comprised of moving negatively-charged electrons. Electricity occurs naturally as lightning, but it can be generated through friction (static electricity) or with magnets (in a generator).

fossil fuel - an energy resource derived from organisms that lived hundreds of millions of years ago during the Carboniferous Period; fossil fuels include coal, crude oil, and natural gas.

kilowatt-hour (kWh) - a unit used to measure energy consumption. A kilowatt-hour is the amount of energy used if you use 1000 watts for one hour and is equivalent to 3.6 million joules or 3,412 BTUs.

Gear Up:

Ask students to describe what they know about electricity. Tell the students that the majority of our electricity in Alaska is produced using fossil fuels. Ask them if they know what fossil fuels are.

Ask the students to discuss different ways that they use electricity in their day-to-day lives. Make a list on the blackboard.

Look up the the cost of electricity and diesel in your community here: <https://akenergygateway.alaska.edu/> and discuss how that might be more or less than other areas of the state or country.



Activity:

This activity can be completed partially as a take-home exercise or it can all be completed in class. Distribute the *My Home Electric Footprint Checklist* to the students. As an in-class activity, students can do a mental walk through of their home, visualizing what items use electricity in each room. Go through the list with them and have them put a check next to the items they use. Please note that some of the items (i.e. lights, computers, and phones) request a number so make sure that students total up how many of these items are in each room. As a take-home activity, have the student and parent walk through the house together to fill out the checklist.

At the end of the activity, students will total up how many items they have that use electricity. They will total the number of lights, computers and phones separately. An option for this activity is to have the students use Kill-A-Watt meters to measure how many watts each appliance uses; they can then rate the appliances from “most to least” based on how much electricity they consume. If a Kill-A-Watt meter is not available, some appliances have a tag on their cord that indicates how many watts they use, or students can look at the website <https://www.energy.gov/energysaver/estimating-appliance-and-home-electronic-energy-use>.

Have the students share and compare their home electricity consumption. Ask them if they know which items consume the most energy. Use the background information and The General Electric Use Visualization website to discuss which items consume the most energy. Have students discuss the pros and cons of using energy-consuming technology—what are the positives and negatives for using such items and the impacts on health, safety, and the environment?

Finally, ask the students if they can think of ways to reduce their home electricity use. Discuss how conserving energy and using energy efficiently can have positive impacts on the environment, our health, and our wallets!

Extension:

- 1.** Conduct an energy audit of your classroom using the *Our Classroom Electric Footprint Checklist*. For older students, have them break into groups and walk around the classroom conducting an energy audit of the number of light bulbs, electric outlets, light switches and specific appliances and electric devices. For younger students, conduct this activity as a class and compile the list on the board. At the end of the activity, have the students total the numbers in each category. Ask the students if they can think of ways to reduce the amount of electricity that is consumed in the classroom.
- 2.** If available, have the students use a Kill-A-Watt meter to determine the energy use of certain appliances over a period of time. You can then multiply the amount of energy (number of kilowatt hours) by the cost per kilowatt in your area (found at <https://akenergygateway.alaska.edu/>) to determine how much it costs to run the appliances.



Additional Resources:

Michael Blue Jay

This website provides information about the amount of electricity that different household items use. For older students that have already learned about kilowatts and kilowatt-hours, this site will let them learn how many kilowatts individual household items use and let them determine how many kilowatt-hours they use a month.

<http://michaelbluejay.com/electricity/howmuch.html>

Estimating Appliance and Home Electronic Energy Use

This tool from Energy.gov is a short cut for calculating the cost of using a certain appliance and can help estimate the number of watts an appliance uses if you don't have a Kill A Watt meter. It uses an average of \$0.21 per kWh for Alaska.

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

Alaska Mathematics Standards: (For extension activity)

Number and Operations in Base Ten

5.NBT.5.

Fluently multiply multi-digit whole numbers using a standard algorithm.

Alaska Science Grade Level Expectations:

The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by:

[3] SE1.1 identifying local problems and discussing solutions.

The student demonstrates an understanding that solving problems involves different ways of thinking, perspectives, and curiosity by:

[3] SE2.1 identifying local tools and materials used in everyday life.

The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by:

[3] SE3.1 listing the positive and negative effects of a single technological development in the local community (e.g., fish trap, fish wheel, four-wheeler, computer).



Next Generation Science Standards

Standard: PS3C - Relationship Between Energy and Forces		
Performance Expectation: 4-PS3-2 - Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. (This lesson is one step toward reaching the performance expectation above.)		
Dimension	Name or NGSS code/citation	Matching student task or question taken from the lesson
Science and Engineering Practice	Planning and Carrying Out Investigations <input type="checkbox"/> Make observations to produce data to serve as the basis for evidence for an explanation of a phenomena or test a design solution. (4-PS3-2)	Students record the items (including the number of each) that use electricity in their home on the student worksheet and determine the kilowatt-hours used by each to define their energy footprint. (Alternatively use the <i>Our Classroom Electric Footprint Checklist</i> .)
Disciplinary Core Idea	PS3.B: Conservation of Energy and Energy Transfer <input type="checkbox"/> Energy can also be transferred from place to place by electrical currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2), (4-PS3-4)	Students record the items (including the number of each) that use electricity in their home on the student worksheet and determine the kilowatt-hours used by each to define their energy footprint. (Alternatively use the <i>Our Classroom Electric Footprint Checklist</i> .)
Crosscutting Concept	Energy and Matter: <input type="checkbox"/> Energy can be transferred in various ways and between objects. (4-PS3-2)	Gear-up discussion of how electricity in Alaska is produced.

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