WOLF RIDGE℠
ENVIRONMENTAL LEARNING CENTER

ENERGY IN YOUR HOME
ADVENTURE IN LEARNING LESSON

Lesson Description
Living and working in buildings represents the largest percentage of energy consumption in the United States. In this week's video students will learn how different actions in their daily lives use energy. They will also learn how natural resource consumption affects greenhouse gas production and impacts our climate. Students will then build a solar oven to investigate energy conversion.

Guiding Question
How do we use energy in our daily lives and what are its impacts?

Concepts
1. Energy is used and produced around us all the time.
2. Our choices about energy consumption impact the environment.
3. Energy can be converted from one form to another.

Outcomes
Upon completion of this lesson the individual will be able to:
- Define energy and describe how it is used in their lives.
- Categorize their own energy consumption into essential and non-essential energy use.
- Build a solar oven, then explore and critique its effectiveness in their nature journal entry.

Minnesota Academic Standards in Appendix

Three ways to do this Energy in Your Home lesson

Recommended

The online Energy in your Home StoryMap presentation has everything you need! Click to start, then scroll through the pictures, questions, videos, and links. Do the suggested activities along the way. Follow this **Energy in Your Home StoryMap link**, or have students start from the Energy in Your Home Adventures in Learning web page on Wolf Ridge's website.

1. Read the following lesson plan for overview, activity information, and MN State Standards.
2. Share link to the lesson's StoryMap, a virtual presentation with pictures, videos, questions, and links to activities.
3. Open the link and scroll through the StoryMap presentation and watch video.
4. Within the StoryMap, there are links to PDF's containing activities.
5. Additionally, the StoryMap contains links to worksheets with two options for accessing:
   a. Link to PDF- Use this link if would like to print or respond to questions in a journal.
   b. Link as a Google Doc (with force copy) - Use this link to create a copy of the document in your Google Drive. We recommend saving the copied file as "student name – name of lesson".
6. Once complete the student can be instructed to share the file with the teacher.

If Internet access is an issue

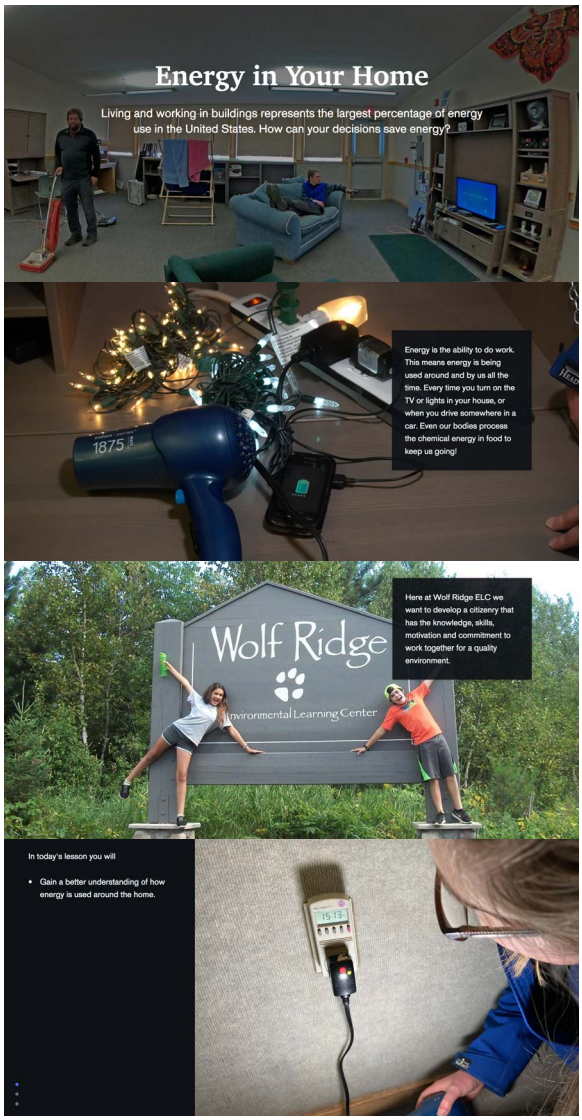
The teacher or parent reads through this lesson plan, then prints the handouts, to distribute. You are looking at the whole lesson plan right now, which includes all handouts. Here are links to individual handout pages if you prefer. Energy in your Home Story. Building a Solar Oven. Energy in your Home Journal Observations Send printed materials to students for them to complete at home.

Only have 10 minutes?

You can watch the **video** without using the accompanying educational StoryMap or student activities.

Check back for more lessons and let us know if you have feedback!

Here is an example ot the StoryMap students scroll through the screens.



Lesson Flow (for those who are NOT using the online StoryMap)

How Do We Use Energy in our Homes?
Read "Energy in Your Home" story found in the appendix.

Activity 1 - Building a Solar Oven
After collecting the necessary supplies students will build a simple solar oven.
See attached Activity: Building a Solar Oven worksheet.

Activity 2 - Collect Data and Choose a Spot
Students explore outdoors, make observations, and analyze their data to choose a spot to try their oven.
See attached Activity: Collect Data and Choose a Spot worksheet.

Activity 3 - Energy in Your Home Journal Observations
Students will make notes on their solar oven and reflect on their own energy use.
See attached Activity: Energy in your Home Journal Observations.

Extensions
Check out the average amounts of energy that common appliances use! See if you can find the appliances that use the most and least energy. Then look for appliances you use frequently to compare.
http://www.mea.coop/wp-content/uploads/2014/06/High-Bill-Packet.pdf

Appendix
Minnesota Academic Standards
4th Grade: Earth and Space Science
- 4E.4.2.1.1 Read and comprehend grade appropriate complex texts and/or other reliable media to describe that energy and fuels are derived from natural resources and their uses affect the environment.

5th Grade: Physical Science
- 5P.2.1.1.1 Analyze and interpret data to show that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 5P.3.2.2 1 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* (P: 6,CC: 5, CI: PS3, ETS1, ETS2) Examples of devices may include electric circuits that convert electrical energy into motion, light, or sound; and a passive solar heater that converts light into heat. Examples of constraints may include the materials, cost, or time to design the device.

8th Grade: Physical Science
- 8P.3.2.2.3 Design, construct, and test a device that either minimizes or maximizes thermal energy transfer.* (P: 6, CC: 5, CI: PS3, ETS1) Emphasis is on using scientific principles to design the device. Examples of devices may include an insulated box, a solar cooker, and a foam cup.

ENERGY IN YOUR HOME STORY

Welcome to the fourth episode in the Wolf Ridge Adventures in Learning series! Wolf Ridge naturalists Caroline and Robby are exploring energy and the ways you use it in your home.

Today, we are defining energy as the ability to do work. Did you know that living and working in buildings represents the largest percentage of energy use in the United States? That's a pretty big deal, so Caroline and Robby are exploring exactly where that energy is getting used in your home.

Here's Robby's "home" in the Wolf Ridge Science Center. Take a moment and see how many appliances you can see that use energy in this home. We use energy all the time in our daily lives, but we don't always think about how much we are using or if all of it is actually necessary.

Caroline shows Robby that there is a tool we can use, called a Kill-a-Watt reader, that tells us exactly how much energy an appliance is using at any given moment. A Watt is a unit of measurement for power, and it measures electricity transferred from one thing to another per second. (source:https://www.ucsusa.org/resources/how-electricity-measured)

In general, appliances that do some sort of heating or cooling - like hair dryers, refrigerators, toasters, or the air conditioning - take the most energy. Using the Kill-a-Watt reader on the Wii, Caroline shows Robby that even when appliances aren't on, they can still suck energy. This is called ghost or vampire energy, and it's super easy to avoid by unplugging appliances when you're done using them.

Caroline uses the Kill-a-Watt reader to test two different light bulbs.

Why does it matter?

We've got our brains warmed up thinking about all the energy that we use, but why should we care? There are three big reasons:

- economic (saving money)
- resource availability
- environmental impact

Economic - All of the energy that we use in our homes costs money, so when we reduce our energy use, we save money that could be put toward other things. For example, turning down the heat in your house by 6 degrees can save up to 20% of your family's heating bill.
(source: http://www.mea.coop/wp-content/uploads/2014/06/High-Bill-Packet.pdf)

Resource availability - Most of the energy that we use comes from natural resources like coal, oil, fossil fuels, natural gas, and wood. These resources are not infinite, and if we don't use them thoughtfully they may not always be available to us.

Here at Wolf Ridge we use a specialized pellet stove that burns pellets from recycled wooden pallets. We're reducing our use of resources by using recycled materials, but we still have to remember that we are using a resource that will only last if we harvest trees responsibly.

Pellet Stoves at Wolf Ridge

Wood Pellets

When we reduce the amount of energy we use, we help conserve these resources so that they will last into the future.

Environmental Impact - Gases like carbon dioxide, methane, and water vapor are naturally occuring in our atmosphere. However, with our current use of energy - in our homes, cars, airplanes, factories and more - we are increasing the amount of these gases being released into the atmosphere at levels that our earth cannot sustain. The presence of these gases in the atmosphere cause the greenhouse effect. Here's how greenhouse effect works:

1. Sunlight reaches the earth, passing through our atmosphere.
2. Some energy is reflected back into space.
3. Some energy is absorbed and re-radiated as heat.
4. Most of the heat is absorbed by greenhouse gases and reflected in all directions, warming the earth.

Some greenhouse effect is a good thing. Without it, our planet would be freezing cold like Mars. But as we produce more and more of these gases, the greenhouse effect increases and leads to rapid warming of our planet. As our earth's temperature rises, it causes things including warming oceans, rising sea levels, glaciers melting, and changing weather patterns.
(Source: https://climate.nasa.gov/causes/)

Solutions

There are small, simple changes that we can make to our behavior to reduce our energy consumption. Here are a few:

- Turn off lights and unplug appliances when not using them.
- Keep your shades open and use natural light instead of turning on lights.
- Recycle! Plastic is made from oil, coal, and gas. Cardboard and paper come from trees.
- You can also have a big impact on how your community responds to climate change. Students across Minnesota and the United States are taking action to ensure that humans and our planet have a healthy future. In the town of Grand Marais on the North Shore, students ages 9-16 spoke in front of the city council in 2017 asking the city to develop a plan for how they would reduce their energy use. As a result, the city passed a Climate Action Plan that is now being put into place.

Here is 11-year-old Olya Wright reading the plan.

(Source: https://energynews.us/2017/03/15/midwest/child-activists-score-big-climate-victory-in-small-minnesota-town/)

ACTIVITY: BUILD A SOLAR OVEN

You've learned that heating and cooling take a lot of energy - but that energy doesn't always have to come from plugging an appliance into the wall. Today, you get to try heating something with the energy of the sun.

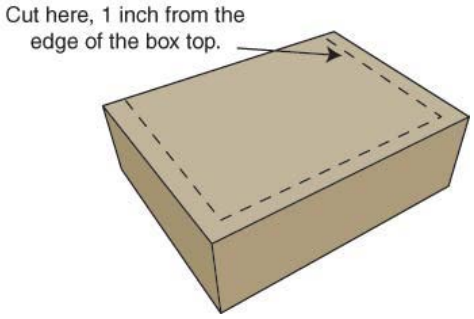
In a solar oven, energy (in this case light and heat emitted by the sun) can be focused so that the oven captures more energy than it releases. Here is photo of a solar oven that students at Wolf Ridge use in class on sunny days.

How does it work? The reflective panels catch beams of light that would otherwise go past the oven and reflect them into the oven, increasing the amount of energy the oven can capture. The clear plastic cover on the oven also allows light and heat to enter, but then traps it inside. The back of the oven is black, which also absorbs heat.

To make your oven you will need these materials:

- cardboard box with the lid attached: shoe box size or bigger
- tin foil
- tape
- box cutter or scissors (ask for adult help)
- plastic wrap
- glue stick
- stick or skewer
- thermometer (if you have one)

Step 1. Cut a three-sided flap in the top of your box using the box cutter.

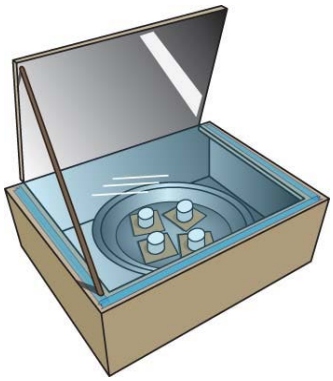


source: https://climatekids.nasa.gov/smores/

Step 2. Glue pieces of tin foil to the inside of the box on the lid-flap, sides, and bottom. Make sure the tin foil is as smooth as possible to maximize its reflectivity.

Step 3. With the lid-flap open, tape two layers of plastic wrap over the opening of your box. If you have a thermometer, place it in the bottom of your oven now. (you will need to open it later to put food inside, so don't make it impossible to untape)

Step 4. Use the stick/skewer as a kick-stand to keep the lid-flap open while your oven heats up. Your finished oven should now look like this.



source: https://climatekids.nasa.gov/smores/

Congrats! You're ready to get cooking!

Next, it's time to explore and choose a good cooking location outside.

ACTIVITY: COLLECT DATA AND CHOOSE A SPOT TO COOK!

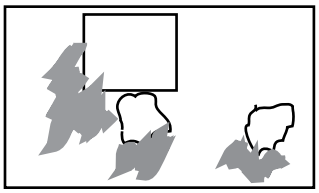
NOTE: The middle of the day when the sun is shining is a great time to do this activity

What you'll need:

- space outdoors where you can see the sun
- your oven
- ice cubes and a way to measure time
- thermometer (optional)
- pencil and this paper (or your nature journal)

1. Make an eagle's-eye view map of your outdoor space.
   Draw squares for building shapes..
   Draw puffy shapes for large trees.
   Show any areas that are shady.

   Example:



Draw your map here.

2. Locate at least two spots and label them on your map. Label "Spot 1" where it might feel chilly, and "Spot 2" where it might feel warm. If you want, add a spot 3 to test.

3. Record your observations at each spot.

OBSERVATIONS	Spot 1	Spot 2	Spot 3
What do you notice here?			
How does the air feel here?			
Does it feel different when you face different directions?			
Temperature after 20 minutes.			

4. Based on your data, which spot might be best for cooking with your solar oven? Why?

5. Run some experiments with ice cubes!

Place your oven in your different spots. At each spot, place an ice cube in your oven, then seal the cover. How many minutes does it take to melt the cube?

Spot 1_____ Spot 2_____ Spot 3_____

6. Optional. Do some more experiments! What happens if you turn your oven to face another direction? Does it make a difference if it's a cloudy or sunny day? What if you tried the same spot at noon and at supper time - would that change how fast the ice melts? What if you put some food or a glass of water inside? Would they get warm or hot?

ACTIVITY: ENERGY IN YOUR HOME JOURNALING

Create a new entry in your Nature Journal, or use this sheet to record your observations.

SOLAR OVEN JOURNALING IDEAS

Describe in a few sentences or draw a diagram to show the path energy travels from the sun, through or around your oven, and into the food or ice cube. When is the energy travelling as light, and when is it coverted to heat?

How you could build your oven differently to make it cook even hotter? Draw or describe your ideas.

ENERGY IN YOUR HOME JOURNALING IDEAS

What in the video or story about energy use in our homes surprised you?

Make a list of 10 things you do each day that use energy.

Now categorize them into things you need to do and things you want to do.

Are you surprised by anything in the list you just made?