

All about E

How do we produce electricity and what is the cost?

How much electricity do we use? What is our contribution to pollution?

How does our energy use affect the climate? What can we do to reduce energy consumption?

Objective

Students will learn about the different ways electricity is created and the environmental cost. They will understand the difference between sustainable and unsustainable resources. They will reflect on the amount of energy they use and think of ways to reduce it overall.

Preparation

This lesson is an overview of how energy consumption is related to climate change. Students will watch videos and do research to help them understand:

1. How energy is made: <https://www.youtube.com/watch?v=20Vb6hLQSG>
2. How energy consumption causes climate change (The Greenhouse Gas Effect): https://www.youtube.com/watch?v=yU3GwJu_yNA
3. Their personal contribution (EPA Power Profiler): <https://www.epa.gov/energy/power-profiler#/>
4. Ideas to reduce that contribution (Nerd Wallet Energy Saving): <https://www.nerdwallet.com/blog/finance/how-to-save-money-on-your-electric-bill/>

Make sure you've watched each video and completed your own energy use assessment. Have these videos ready as well as the student work sheets (and monthly school energy usage if necessary).

Delivery

Have students answer the first three questions before any videos and share their answers in small groups or with the class.

VIDEO 1 - play and allow students to answer questions. Depending on the age students may get caught up on drawing the thermal power plant model. You can reference the Electric Generator Explained or pass out this info sheet. The goal is students understand that most of the energy we create is from burning things to heat water and create steam (and currently these things are fossil fuels).

VIDEO 2 - play and allow time to answer questions and discuss. All but the last question are straight forward: plants capture Carbon in the cells that make up their body. This **carbon sequestration** is important in fighting global warming and is foundational knowledge for upcoming lessons.

Extension: EPA Power Profiler - This extension can be done as homework or in class but students will need information about their household monthly energy consumption. You could also get the average usage of your school for the students to use for this extension.

Debrief

How does taking shorter showers fight climate change?

Why would we want to use a limited resource, like fossil fuels, to power our cities and homes?

What renewable resource do you think could be used at your school or in your community?



Theme

Human Impact & Climate Change

Age

6-12th; 3rd-5th with direct guidance

Duration

45-60 mins

Materials

Student Packet, Extension Packet, Electric Generator Explained, Links provided, monthly energy consumption stats

Standards

NGSS: MS-ESS3-5; MS-ESS3-4
EP&C's: P2.CA-C; P3.CC; P4.CA

Vocab

Energy: ability to do work

Renewable: unlimited resource, or able to be replenished

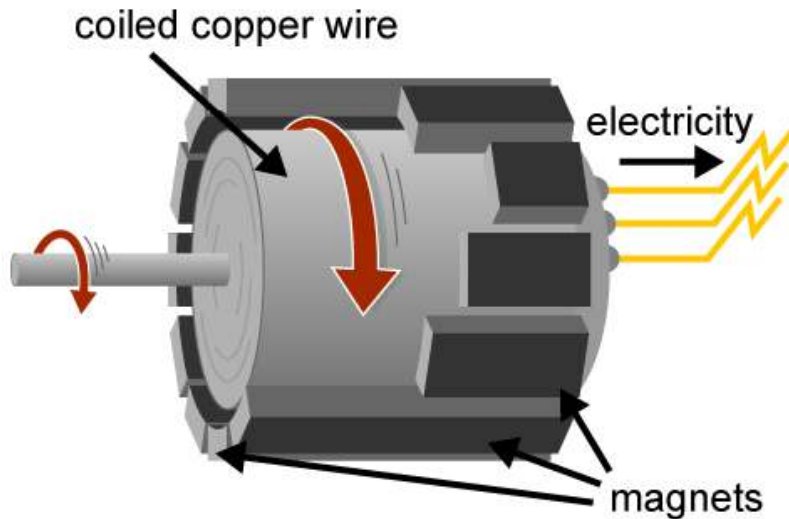
Non-renewable: Limited resource that will eventually run out

Deforestation: The clearing of trees on a large scale

Desertification: Change in climate changes ecosystems to deserts

Electricity Generator Explained:

Magnets surround the coiled copper wire and spin around. Remember the spinning is mechanical energy – this can be caused by steam pushed through turbines (thermal power plants) or a hamster running on a wheel. The magnets spin around a copper wire moving electrons allowing them to be captured.



Electric generator

Energy comes in many forms: light, heat, mechanical, and chemical. We create electrical energy by converting from other types. We then use electric energy and convert it to other types to perform tasks. Most of the electricity we generate is made from the conversion of **mechanical energy** to **electric energy**.

Fossil Fuels – burning coal, petroleum or natural gas to boil water and create steam. Under pressure, the steam is used to spin turbines connected to an electrical generator.

Nuclear Energy – Splitting uranium atoms (nuclear fission) creates heat. That heat turn water to steam and the steam spins turbines connected to an electric generator.

Renewable Energy – Mechanical -> Electrical

Biomass – Burning plant material to spin turbines connected to electric generators

Wind – Using the wind to spin turbines connected to electric generators

Hydraulic – Water moving turbines as it flows from a high place to a low place

Geothermal – Using the heat of the Earth to create steam to spin turbines

Tidal – Using the power of tidal flow to move a turbine, much like wind power but underwater

Renewable Energy – Light -> Electrical

Solar panels convert **electromagnetic energy (light)** into **electrical energy**.

Solar – The sun excites atoms and those atoms release electrons. Those electrons are captured

How much energy do you consume, and what emissions occur as a result?

1. Follow the link. You'll first notice a colorful chart on the right side of the page. What is this chart showing?

2. Time to zoom in on your own eGRID subregion. Locate your region on the gray map of the U.S. – or enter your zip code into the power profiler. Compare and contrast your subregion fuel mix to the national fuel mix. Write three sentences describing similarities and differences.

3. Now let's see how your household energy consumption and pollution emission compares to the average in your subregion and the national average. Scroll down the page to **Estimate Your Emissions**.

You're going to have to do a little research and get some information from parents/guardians. Go to the website of your local gas and electric company to see what your average usage was for this month. Enter the monthly average into the kilowatt hours bar (kWh).

How does your household compare to the average usage in your subregion? How does it compare to the national average? How many acres of forest would it take to offset your Carbon emissions?

How can you reduce your emissions and fight against global warming?

1. Read the Nerd Wallet article provided and/or follow the [EPA's Energy and the Environment site](#) link (this can be found in the Annual Results paragraph from pg. 3 of this lesson).

What are three things that **you** can do, today, that can reduce your energy use, emissions, and help fight global warming?

I.

II.

III.

All About **E**

Answer these questions before the first video:

How is electricity generated? _____

What is the difference between renewable and non-renewable sources of energy? Give an example of each.

How many hours of electricity do I use in a day? _____ month? _____ year? _____

Video 1 - Energy 101: Electricity Generation:

1. What's the difference between fossil fuels and wind as sources of energy?

2. Draw a rough sketch of how energy is created at a thermal power plant.

3. What's the difference between using coal versus biofuel to heat water at a thermal power plant?

Video 2 - Explaining the Greenhouse Gas Effect:

1. Keeping with the metaphor of a “green house” what is Earth’s equivalent of the glass on a green house that traps heat? Draw a small diagram and label it.

2. What are two examples of green house gasses?

3. What are the three main reasons greenhouse gasses increase?
 - I.

 - II.

 - III.

4. What do plants on land and in the water do to keep greenhouse gasses from increasing?
(This important ecosystem service is called **carbon sequestration**)