

Energy Web Teacher Guide

Background

This activity helps students to visualize energy as a system with many items feeding into it and relying on it to function, while each use contributes to impacts locally and globally.

Objectives

- Students will be able to identify components in the climate system and describe their functions.
- Students will be able to describe the connections between each component in the climate system.

Time

- 30-40 minutes

Materials

- Ball of yarn or string
- Scissors
- Hole punch
- Cardstock
- Energy Web Hang Tags
- Energy Web Student Guide

Preparation

- Copy the energy hang tags onto cardstock for durability and laminate for reuse.
- Cut apart the hang tags and use a single hole punch to make two holes in the top corners of each.
- Lace one length of yarn or string through each hang tag and tie off, creating a necklace.
- Make copies of the Energy Web worksheet for students.

Procedure

1. Hand out the hang tag necklaces and ask students to read the backs of their cards aloud so other students in the group know the roles in the activity. Give students a chance to ask any questions they have about what is written on their cards.
2. Direct students to put on their hang tags and stand in a circle.
3. Hand the ball of yarn to one of the students. Explain that he or she should look around the circle and identify another student representing a component of the system that is related to his or her role. Some of these relationships are spelled out in the descriptions on the backs of the hang tags.
4. Holding on to the end of the yarn, the first student passes the ball of yarn to that student, explaining how that part of the system relates to him or her. That student then repeats the process, holding onto the yarn and passing the ball on.
5. Continue passing the yarn around until everyone has their hands on the yarn. While connections can be made between each component, students may have trouble seeing all of them. Because of this, it is acceptable to pass to a student a second time before the yarn has made it all the way around the circle. In the end, the students will have created a web made of yarn connecting all of them.
6. Now choose a student to give a tug on the string. Explain that this tug represents an influence (positive or negative) being exerted by that part of the system. For instance, the person wearing the 'Petroleum' tag might give a tug, and you would say, "Petroleum is produced and processed to create transportation fuels and other products. This process emits particles into the air and petroleum is a nonrenewable resource."
7. Ask students to raise their hands if they feel a pull when the string is tugged. Ask students why their component might be influenced by the original component that tugged on the string. Discuss the connections and why some students might feel stronger pulls than others.
8. Repeat this several times with different students tugging. For each tug, describe how that component is influencing the system.
9. Pass out the Energy Web worksheet. Ask students to describe how the system is dependent on all of the components. Students should be able to explain that a change in one part of the system can affect all other parts of the system.



Energy Web Cards



Energy Efficiency and Conservation

In using energy wisely we decrease CO₂ emissions from power plants and vehicles, while using less of our energy sources overall.

Atmosphere

Our atmosphere keeps us alive and warm. Gases in the atmosphere control amounts of ultraviolet radiation reaching the planet and determine the Earth's temperature, keeping us warm. Without gases in the atmosphere, it would be so cold, almost nothing could survive. However, as CO₂ levels in the atmosphere rise, greater differences in air temperature create more unstable weather patterns.

Oil and Natural Gas Prices

Oil and natural gas are our most used energy sources in the U.S. When the weather changes, or demand is high, prices go up, making our daily energy use more expensive. When demand is high, however, it can be good for our economy and jobs. When prices go down, consumers benefit from lower bills, but it sometimes can influence our economy and energy industry jobs.

Transportation Fuels

Transportation is our biggest user of energy in the U.S. Much of the fuel we use to transport goods, services, and energy comes from petroleum that is refined into gasoline, aviation fuel, diesel fuel, and more at facilities like Deer Park. Petroleum-based transportation fuels must be burned and release emissions.



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Petroleum

Petroleum is a nonrenewable fossil fuel formed hundreds of millions of years ago. We use more petroleum than any other energy source. Petroleum is turned into transportation fuels, fertilizers, plastics, medicines, and much more. Petroleum must be burned to release the energy, which emits CO₂. Shell Deer Park processes petroleum to make many products for the people in the U.S. and around the globe.

Refineries

Refineries are industrial plants that refine petroleum into useable products. We refine crude oil for fuels such as gasoline, jet fuel, and fuel oils needed for transportation. These refinery processes employ many people but release emissions into the atmosphere. Refineries work to install measures to help make the air cleaner.

Production

Oil and natural gas formed hundreds of millions of years ago and must be produced by drilling miles below the surface of the Earth or the ocean. Drilling and bringing products to the surface employs many people across the globe, but these fuels are often not ready to use right away. Petroleum or crude oil must be transported to a refinery to be separated into cleaned, useful product.

Power Plants

U.S. citizens use much of their energy for electricity. Natural gas and some petroleum products like coke are processed and transported via pipeline to generate electricity at a power plant.



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People

We need and use a lot of energy daily. Our homes, communities, and modes of transportation all use energy in various ways. We use more energy today than ever before. Much of our energy and the products we use come from fossil fuels like petroleum. The energy industry also creates many jobs.

Ports

Ports are coastal areas where goods and services are shipped, imported, or exported. About half of U.S. petroleum is imported, and some by ship. This petroleum can be refined and used in the U.S. or exported to other countries like Mexico, Canada, and China. Shipping products requires energy and produces emissions.

Carbon Capture, Utilization, and Storage

New technology allows us to store CO₂ emissions from power plants and refineries underground to be used later. This may be an effective way to limit the amount of CO₂ we put into the atmosphere. We do not know yet how effective this strategy is at storing CO₂ in the long term.



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Pipelines

Petroleum and petroleum products can be transported on land using pipelines. The extensive network of pipelines help move crude oil from its production location to refinery, and refined product to consumers.

Chemical Plants

Refineries separate petroleum into various products. These petroleum products can be chemically processed further to create synthetic products like plastics and rubber. Chemical complexes like Deer Park often employ many people, use petroleum and natural gas to operate, and do produce some emissions.

Soil and Sediments

Soil is the top layer of the Earth's surface, consisting of rock and mineral particles mixed with organic matter. We need healthy soil for growing food, filtering the water in our watersheds, and helping to absorb emissions. Developing land, farming, drilling, and other activities can cause sediment to be disturbed and depleted in some areas leading to ecological issues locally and elsewhere.



Energy Web Cards



Oceans

Oceans contain renewable and nonrenewable energy sources and other natural resources. Oceans allow us to transport goods, and energy around the globe. Oceans help keep our planet cooler by absorbing radiant energy and emissions. The ocean ecosystems can be disrupted by absorbing too much energy or emissions.

Natural Earth Events

Geological evidence tells us that the Earth's climate has changed a lot over time. Natural Earth events are factors that can contribute to climate change. Earth's position relative to the sun, volcanic eruptions, forest fires, and ocean currents are factors that can affect climate, creating more intense storms and weather events.

Economy

A growing economy demands more energy and electricity. Fossil fuels and renewables will likely be needed in larger amounts to support a growing economy that needs many products and lots of energy. Increasing energy efficiency and conservation reduces energy bills and energy consumption for families, schools, and communities.

