

From Resources to Energy: the Origins of Energy

Lesson plan for grades 6-8

Length of lesson: 90 minutes

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SOURCES AND RESOURCES:

- Fossil Fuels
<http://energy.gov/science-innovation/energy-sources/fossil>
- Renewable resources
<http://www.epa.gov/statelocalclimate/state/topics/renewable.html>
- Wind farms in desert
<http://www.desertskywind.com/faqs.htm>
- Hoover dam energy production
http://www.enviro-news.com/article/hoover_dam_nevada.html
- Fracking
<http://www.epa.gov/hydraulicfracture/>
- Coal from swamps
<http://www.ucmp.berkeley.edu/carboniferous/carboniferous.php>
- Oil from limestone
<http://www.limestoneoil.com/geology011.html>

POTENTIAL CONCEPTS TEKS ADDRESSED THROUGH THIS LESSON:

§126.14c (Creativity and Innovation: 1C,1D, Critical Thinking & Decision Making: 4A, 4E),
Grades 6, 7, 8

§112.18b (Scientific Investigation and Reasoning: 4A, Matter & Energy: 7A,7B) Grades 6,7,8

PERFORMANCE OBJECTIVES:

Students will be able to:

- Understand the origins and uses of different energy sources
- Describe how energy comes in many forms and can be transformed from one form to another
- Consider the ethical/social issues surrounding Earth's natural energy resources while looking at the advantages and disadvantages of their long-term use

MATERIALS (per group of four):

- [Energy strips](#)
- [Energy cards](#)
- Generic poster sheets
- Markers
- Glue
- Energy source worksheets for groups: [Coal](#) [Gas](#) [Oil](#) [Water](#) [Wind](#)
- [Energy source pros and cons table](#)
- Pen, pencil

CONCEPTS:

Our world depends on different sources of energy to supply electricity, fuel, and heat needed to live day to day. The ratio of which we use these energy sources is important to think about, as each source comes with environmental and sustainability issues. To introduce this unit, students will work with identifying different sources of energy by thinking in patterns, then by working with specific energy sources, and then with all the sources together. Once a list of possible sources is compiled and explained, ethical and social issues can be discussed.

Vocabulary:

Cap rock – a layer of hard, impervious rock overlying and often sealing in a deposit of oil, gas, or coal

Carbon dioxide – a heat trapping gas present in the atmosphere formed when energy sources containing carbon are burned

Coal – a fossil fuel burned as an energy source consisting of plant matter found in underground deposits

Emission – the production and discharge of something

Fracking – hydraulic fracturing of non-permeable rocks in order to obtain oil or gas deposits

Generator - a machine for converting mechanical energy into electricity

Kinetic energy - energy that a body possesses by virtue of being in motion

Oil – a fossil fuel burned as an energy source derived from petroleum that stays as a liquid and is drilled for underground

Shale - soft, finely stratified sedimentary rock that formed from consolidated mud or clay and can be split easily into fragile slabs

Turbine - a machine for producing continuous power in which a wheel or rotor, typically fitted with vanes, is made to revolve by a fast-moving flow of water, steam, gas, air, or other fluid

BACKGROUND:

Fossil fuels are natural fuel sources formed by historical geological processes from the remains of living organisms. The most famous fossil fuels include **coal, oil, and natural gas**. These are **non-renewable**, meaning these sources of energy are depleted by use and can be permanently eliminated. Alternate fuel sources include **solar, wind, biomass, hydroelectric, and geothermal energy**, which are **renewable**. These sources occur naturally by the sun, wind, and plant life.

PREPARATION:

Cut sentence strips into sets to give to each group and prepare copies of the follow-along Energy worksheets for each student. Prepare copies of each fuel source for groups and sort poster making materials (posters, markers, construction paper, glue, scissors). Cut out energy cards for each group.

ENGAGE:

Introduce the lesson with a visual of the words “From Resources to Energy” and a question below it, such as “how do we get our energy?” Define energy source as the resource used to create electricity, heat, or fuel. Pass out sentence strips to each group and ask groups to begin sorting them into different energy source categories (coal, gas, oil, water, wind, etc). Tell the students that the sentence strips describe the following categories: solar, wind, oil, water, natural gas, wood, and coal, and they should group the sentence strips accordingly, or for added critical thinking, only tell the students there are seven kinds of energy and they decide on the group (10 minutes). Walk to each group and ask why certain strips are grouped together and ask what groups they are familiar with. Have students write down the energy sources for each of their groups (oil, wind, sun, etc.)

Ask:

Why do we need energy sources?

Describe the perfect energy source. Do you see one in your groups?

Which energy sources did you use today (riding the bus, turning on lights, heater)?

Which energy sources could we use here in Texas?

Note to teachers: Some groups may not understand energy source, so give them an example of coal. Coal is formed underground, and we burn it to get energy. Therefore, coal is the energy source.

EXPLORE:

1. Hand out identical worksheets of a given energy source to groups (see materials list above) of four students (there are 5 different energy source worksheets; one energy source per group). Explain that each group is responsible for a unique energy source and will be teaching their peers about how we use it.
2. Each student in the group is accountable for their own worksheet. The first table in the worksheet (Renewable vs. Non-renewable vs. indefinite) is completed individually by each student. Afterwards, the group should be instructed to collectively work on answering the questions following the energy paragraph. This will require routine check-ins with each group by the teacher to keep the activity moving forward.
3. The questions about their energy sources are tricky, students must understand that there are problems reaching energy sources and then turning them into energy. Guiding questions such as “where do you find this resource? Is it easily accessible?” and “how does the electricity from the power plant get to your house?” can help groups think in a logical sequence.

EXPLAIN:

When all groups are finished, have group members representing a given energy source (e.g., wind) present to the class. Have the listeners write down in a notebook or sheet of paper that will be turned in following the lesson:

- What is the energy source?
- Where is it found?
- How is it harnessed?
- How is it transported?

ELABORATE:

1. Give each group a poster and energy cards.
2. Assign each group a different geographical region that is related to a specific energy source. These could be: a desert, a breezy coastline, former swamplands, a forest, a region that used to be underwater, and central Texas.
3. Using the energy cards, the students will glue an energy pathway (energy source → how we get it → transport) and describe the process underneath, along with why they chose that energy source over other sources.

EVALUATE:

On the overhead, have the energy source pro and con table. Each student should have his or her own copy. Fill in the first energy source, natural gas with the class. Then brainstorm different energy sources to fill in the table, and leave the pros and cons to be done as individuals. Have students list in order the most environmentally friendly to the least environmentally friendly.

This will tell you if:

1. Students can list important energy sources.
2. Students understand the process of attaining energy from a resource, and how this affects the environment.
3. Students can contrast the impacts of certain energy sources.

Uses wind to spin fan blades.

Uses flowing water to spin a turbine.

Uses a turbine to create electrical energy.

Created by the remains of organic matter.

Uses a drill to cut through shale.

Cleanest burning fossil fuel.

Produces high carbon dioxide emissions.

Can be transported by pipeline or ocean tanker.

Uses a special sheet to absorb sunlight.

Can be put on your roof.

Only produces energy during the day.

Helpful fuel source in poor regions.

Contributes to deforestation.

Uses a renewable energy source.

Uses a renewable energy source.

Can destroy aquatic ecosystems.

Needs a dam to create different water heights.

Consists of a giant windmill.

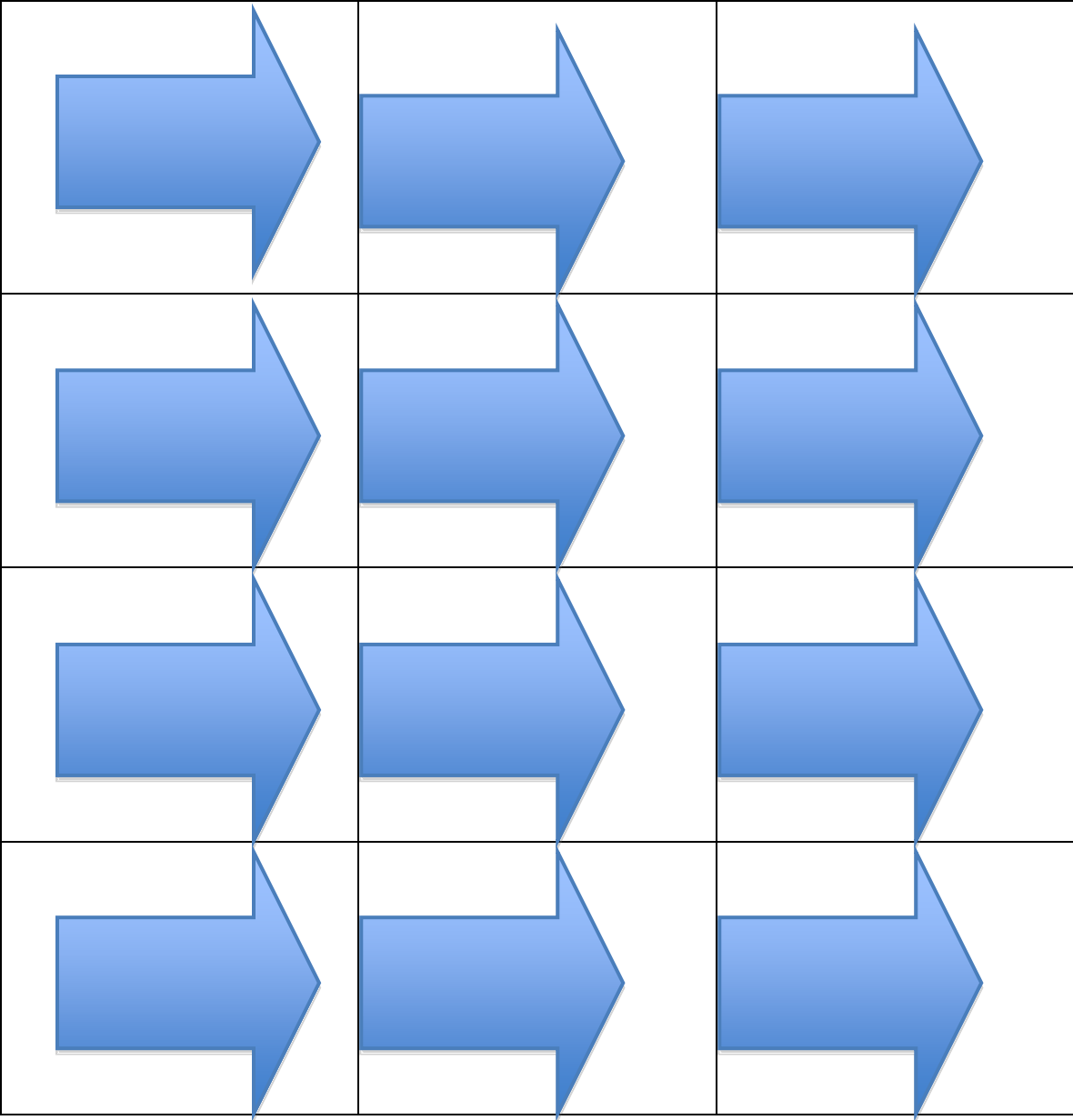
Uses a gas (methane) as an energy source.

Can pollute underground water sources.

Uses a turbine to create electrical energy.

Can be built on open plains and by the ocean.

Tanker	Coal	Generator
Wind	Natural gas	Organic matter
Dam	Drill	Turbine
Cap rock	River	Swamp
Steam	Pipelines	Oil
Land area	Shale	Power lines



Gaining energy from coal

Using this list of fuels, place them into the correct category

- Oil
- Coal
- Sun rays
- Ocean tides
- Natural gas
- Nuclear fission
- Wood
- Compost

Renewable	Non-renewable	Indefinite

What is your definition of a non-renewable resource?

You are an electrical engineer and are in charge of gaining energy from coal. **Coal** is formed when fallen plant matter in a swamp is subjected to heat and pressure over time. When coal is burned, it provides energy in the form of heat. In a coal power plant, we use **turbines**, machines that produce continuous power when a wheel or fan is turned by a fast-moving flow of water, steam, gas, or air. **Generators** can turn this power into electricity.

1. How will you make the turbine spin? Hint: think about the uses of the heat produced by the burning coal.
2. Draw a diagram of your water powered plant and label all your components.
3. What natural resources are needed in a coal powered plant?
4. To keep the plant efficient, it is important to reuse resources. How can resources be reused?
5. How will the electricity produced by the generator be transported for use?

Gaining energy from natural gas

Using this list of fuels, place them into the correct category

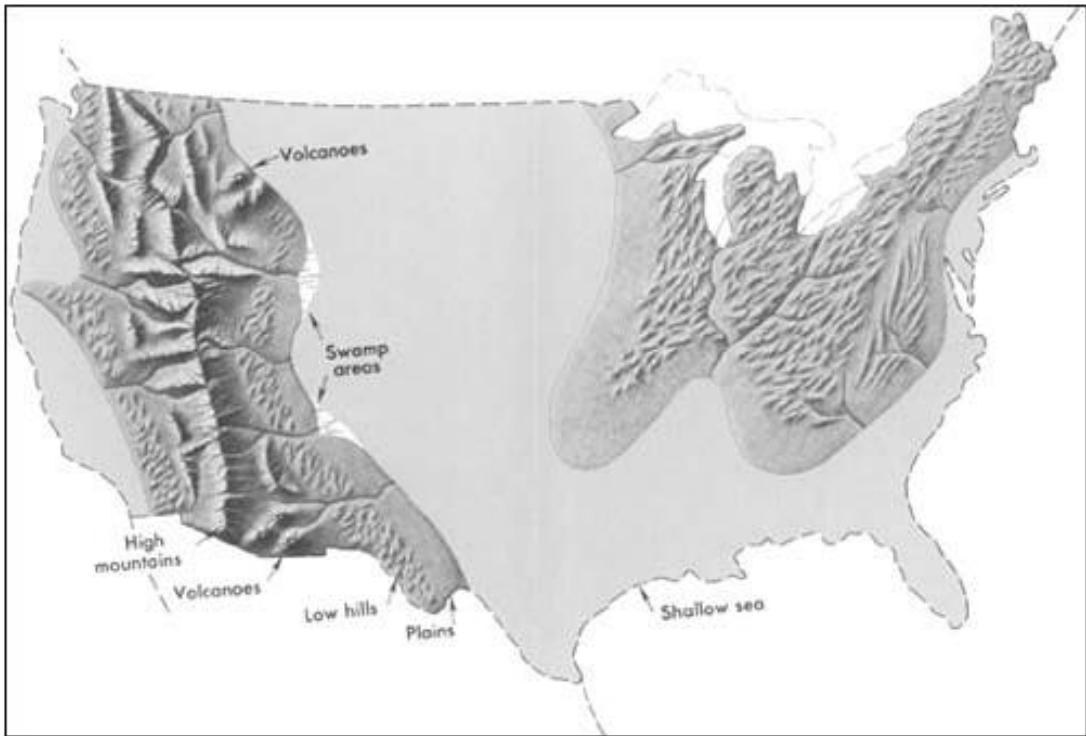
- Oil
- Coal
- Solar rays
- Ocean tides
- Natural gas
- Nuclear fission
- Wood
- Compost

Renewable	Non-renewable	Indefinite

What is your definition of a non-renewable resource?

You are a geological engineer assigned to the task of retrieving natural gas to use as an energy source. Natural gas forms when organic matter is heated to high temperatures and compressed by high pressure. **Shale**, a sedimentary rock, is found underground and is composed of deposits found in water sources, such as the ocean, lakes, and rivers and often overlays natural gas. Shale is not very porous or permeable.

1. Where would you find shale deposits in the United States? What is required for shale to be deposited? Use the historical maps to help.
2. Once you find shale, how would you see if natural gas is underneath?
3. Natural gas flows naturally towards the Earth's surface. Knowing this, how would you retrieve natural gas from the underground deposits?
4. Once the natural gas has been found, how can it be transported for use?



Generalized geographic map of the United States in Late Cretaceous time.

Gaining energy from oil

Using this list of fuels, place them into the correct category

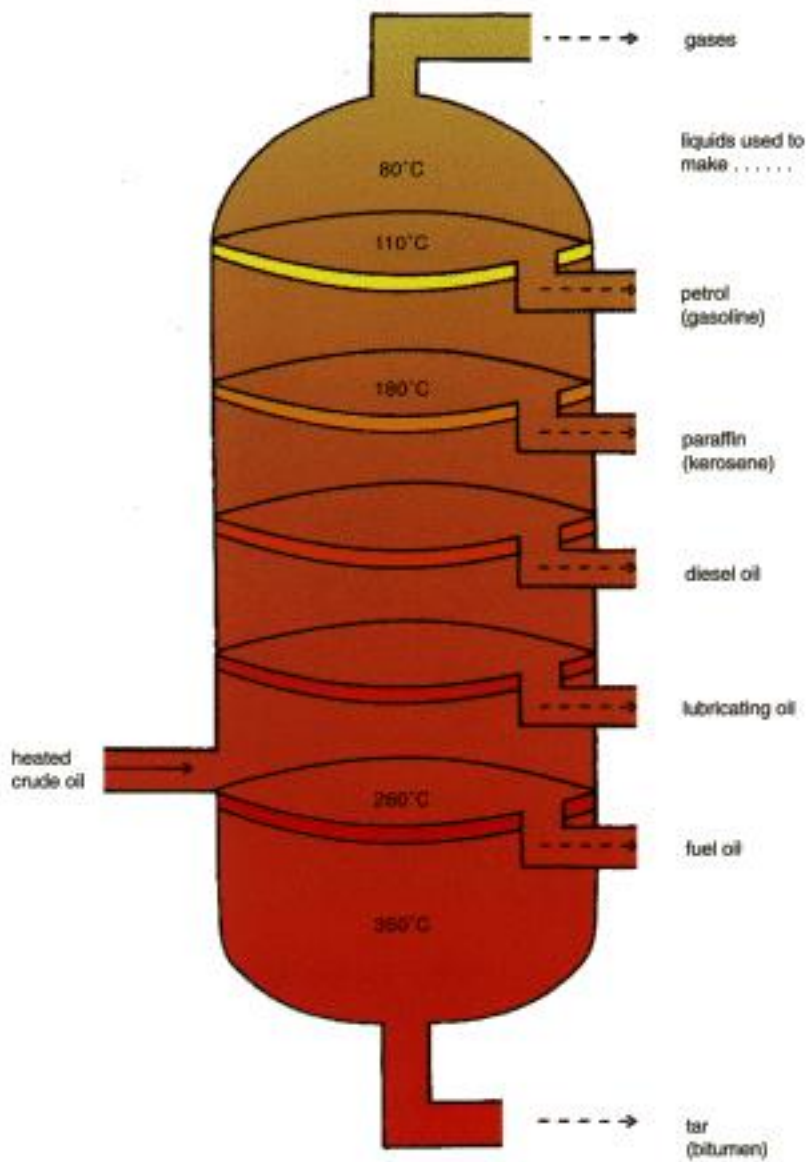
- Oil
- Coal
- Solar rays
- Ocean tides
- Natural gas
- Nuclear fission
- Wood
- Compost

Renewable	Non-renewable	Indefinite

What is your definition of a non-renewable resource?

You are a geological engineer assigned to the task of retrieving oil to use as an energy source. Oil is formed when organic matter accumulates at the bottom of oceans, rivers, and swamps, and is then layered with sediment. With more sediment, the organic matter is subject to high pressures and heat from deep within the earth. These factors break the organic matter into carbons and hydrogens, which we can use as fuel. Many oil deposits are found beneath **cap rocks**, which are non-permeable rocks prevent things below them from migrating to the surface.

1. How will you know you found oil underneath a cap rock? Hint: cap rock can produce high amounts of pressure.
2. Once you find oil, what does it look like and composed of? Is it ready for use?
3. How is oil transported for use? Think about the different places where oil is found.
4. What is going in the diagram below?



Gaining energy from water

Using this list of fuels, place them into the correct category

- Oil
- Coal
- Solar rays
- Ocean tides
- Natural gas
- Nuclear fission
- Wood
- Compost

Renewable	Non-renewable	Indefinite

What is your definition of a non-renewable resource?

You are an aquatic engineer and are in charge of gaining energy in the form of electricity from a river. Energy is produced when **kinetic energy**, or energy something possesses by being in motion, is turned into electrical energy. Moving water possesses a lot of kinetic energy. **Turbines** are machines that produce continuous power when a wheel or fan is revolved by a fast-moving flow of water, steam, gas, or air. **Generators** can turn power into electricity.

1. How will you make sure that water is constantly moving over the turbine?
Hint: have some water at a higher height than the rest of the water.
2. Draw a diagram of your water powered plant and label all your components.
3. How will the energy produced by the generator be transported for use?

Gaining energy from wind

Using this list of fuels, place them into the correct category

- Oil
- Coal
- Solar rays
- Ocean tides
- Natural gas
- Nuclear fission
- Wood
- Compost

Renewable	Non-renewable	Indefinite

What is your definition of a non-renewable resource?

You are an electrical engineer and are in charge of gaining energy in the form of electricity from the wind. Energy is produced when **kinetic energy**, or energy something possesses by being in motion, is turned into electrical energy. Wind possesses a lot of kinetic energy. **Turbines** are machines that produce continuous power when a wheel or fan is revolved by a fast-moving flow of water, steam, gas, or air. **Generators** can turn power into electricity.

1. How would you design a machine that can turn wind energy into electricity? What components does it need?
2. What locations are good for harnessing wind power?
3. What direction will your machine face to get the most energy? Why?
4. What forms of energy are seen in this process? How are they being transformed?
5. How will the electricity produced by the generator be transported for use?

Energy source	Benefits	Drawbacks
Natural gas	- cleanest burning fossil fuel	- drilling procedure -
Petroleum/oil	- useful energy source for transportation, heating, and daily products	- high carbon dioxide emissions - cost and global trade
Coal	- abundant	- highly polluting, environmentally degrading mining process
Solar	- cleanest energy source - renewable and useful for electricity, heat, and food cooking	- only works during day - needs sunny environment
Wind	- useful for driving pumps and creating electrical energy	- unpredictable - unsightly turbines
Wood	- helpful in poor regions - renewable	- contributes to deforestation - low amounts of energy produced from burning with high carbon dioxide emissions
Hydroelectric	- renewable energy source - no pollution	- decreased number of places to build dams - can destroy aquatic ecosystems
Ocean tides	- powerful source of energy	- needs added technology
Geothermal	- renewable resource	- limited supply of geysers and usable sites
Biomass	- reuses organic waste for methane	- needs manure and septic supply
Nuclear fission	- huge amounts of heat energy released	- danger of radioactive waste products