



## The History of Bioenergy: A Timeline Puzzle

**Objectives:** Students will recognize the sources of bioenergy and be able to explain the evolution of bioenergy over time.

### Oklahoma Academic Standards:

Science: 7.PS1.3 ; 7.ESS3.3; 7.ESS3.4

### Teacher Background:

Bioenergy is a form of renewable energy that comes from recently living organic materials known as biomass. Biomass can be derived from plant or algae based materials and includes things such as crop and food waste, forest residue, microalgae, and purposefully grown grasses and energy crops. Biomass provides us with biofuels, biopower, and bioproducts that are used for transportation, heat and electricity, and many industrial products such as plastics. Biomass has been used for over 100,000 years to generate energy (heat) for humans. Throughout history the use of biomass to create bioenergy has continued to evolve. Currently, the United States is looking to bioenergy to reduce dependency on foreign oil exports and fossil fuels, provide increased domestic clean energy, generate U.S. jobs, and revitalize rural communities. By completing this lesson, students will recognize the sources of bioenergy and how its use has changed over time.

### Important Vocabulary:

**Biomass:** organic matter used as a fuel

**Bioenergy:** renewable energy produced by living organisms

**Biofuel:** a fuel derived directly from living matter

**Biopower:** technologies used to convert biomass fuels into electricity and heat

**Bioproducts:** everyday commodities made from biomass

**Fossil Fuel:** a natural fuel, such as coal or gas, formed in the geologic past from the remains of living organisms

**Renewable Energy:** energy from a source that is not depleted when used

### Materials:

- [Bioenergy History Cards](#) (1 printed set per group of 3-4 students)
- Paper
- Pen/Pencil
- [Bioenergy History Slides](#)

### Optional Materials:

- Chromebooks, iPads, books, or pre printed articles about biomass/bioenergy

# Bioenergy: *From Field to Fuel*

## Lesson:

1. Prior to students arriving, print one set of [Bioenergy History Cards](#) for each group of 3-4. Cut the cards and fold on dotted line if you would like to provide them with hints. Otherwise, just cut out the images.
2. Ask students: What is energy? What are some forms of energy?
  - a. Accept all answers. They may recognize energy in the form of electricity or driving our cars. It could also be energy in their bodies from eating food. Guide students to realize that energy is the ability to do work. Some of the forms of energy are heat, light, gravitational, chemical, electrical, and motion (mechanical).
3. Group students in groups of 3-4. Ask students: What are our sources of energy? Have them brainstorm as many energy sources as they can in 1 minute on a sheet of paper.
  - a. After brainstorming, have them discuss the difference in renewable and nonrenewable sources with their group, then classify the sources they brainstormed into those two categories.
4. Explain to students that many of the sources of energy we use today are carbon resources. Carbon makes up a large portion of living things. Humans are over 18% carbon! Carbon easily forms chemical covalent bonds and when burned these bonds break, releasing a large amount of energy!
5. Ask students: Which energy sources, either renewable or nonrenewable are formed from living things?
  - a. Answer: fossil fuels (coal, oil or petroleum, and natural gas), and biomass
  - b. Clarify that the difference is that fossil fuels were formed from living things that lived long ago, whereas biomass is from recently living things.
6. Have students turn and talk with their group to brainstorm biomass sources.
7. Tell students that humans have used biomass to produce heat and light (energy) for thousands of years! Over time we have begun to utilize more biomass sources and use them for different forms of energy- such as electricity!
8. Pass out the Bioenergy History image cards to each group of 3-4.

# Bioenergy: *From Field to Fuel*

## Lesson:

9. Have students work together to put the cards in chronological order (based on historic record) of which biomass sources were used by humans from the oldest to the most recent, they should also include the inventions in their timeline.. Once complete, review the answers with them.
  - a. You may utilize the [Bioenergy History Slides](#) to help you. Feel free to make a copy and edit the information to meet the academic needs of your students.
  - b. You may end the lesson here with wrapping up what biomass is, how we use biomass to produce bioenergy, and telling them about the important role it plays in transportation, heat and electricity production, and its use for bioproducts (plastics, etc).

## Extension Opportunities:

- Provide students with Chromebooks, iPads, pre-printed articles, or books about bioenergy and biomass sources. Have them research a biomass source and create a poster or presentation about how we use that source for energy.
- Have students research and include fossil fuels in their timeline of energy use in the United States. It is interesting to see how government policy has affected the use of energy sources over time.
- Have students research and create a presentation or poster over the production process of biofuels.



# Bioenergy: From Field to Fuel

## Information Sources:

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## Image Sources:

Cattail Image: Image by [Clker-Free-Vector-Images](#) from [Pixabay](#)

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