

# Energy Sources

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<b>Strands</b>	Force, Motion and Energy; Earth Resources
<b>Topic</b>	Comparing energy sources
<b>Primary SOL</b>	6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include c) nonrenewable energy sources; d) renewable energy sources.
<b>Related SOL</b>	6.2 The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include a) potential and kinetic energy. 6.5 The student will investigate and understand the unique properties and characteristics of water and its roles in the natural and human-made environment. Key concepts include e) the importance of water for agriculture, power generation, and public health. 6.9 The student will investigate and understand public policy decisions relating to the environment. Key concepts include a) management of renewable resources; b) management of nonrenewable resources.

## Background Information

Suggested sequence for Enhanced Scope and Sequence lessons related to SOL 6.2:

1. Energy
2. Energy Transformations
3. Energy Sources
4. Electricity Generation

Energy causes things to happen all around us. The sun gives out light and heat energy. At night, street lamps use electrical energy to make light. Cars driving by are powered by gasoline, which contains stored energy. We eat food, which has energy in it and which our bodies use to play or study. Energy makes everything happen.

Energy can be divided into two different types, depending on whether the energy is stored or moving:

- *Potential energy* is energy that is stored.
- *Kinetic energy* is energy that is moving.

Energy cannot be created or destroyed; it can only be changed, or transformed, into other forms. Some examples of the transformation of energy from one form to another are the following:

- The sun shines on a plant, which transforms the solar energy into food through the process called photosynthesis. Fortunately for us, plants often produce more food than they need, which they store in stems, roots, seeds, or fruit. We can obtain this energy directly by eating the plant itself or its products.

- Humans eat a plant, transforming the potential chemical energy stored in it into kinetic mechanical energy or into another form of potential chemical energy stored as fat.
- Potential chemical energy in flashlight batteries is transformed into electrical energy and then light energy when the flashlight is turned on.
- A car engine transforms the potential chemical energy in gasoline into heat, which creates kinetic mechanical energy to power the car.
- A toaster transforms electrical energy into thermal energy.
- A television transforms electrical energy into light and sound energy.
- A power plant transforms some form of potential or kinetic energy into electrical energy (i.e., electricity). Most power plants burn a fuel to make thermal energy. In some power plants, thermal energy is used to boil water to make steam. The steam is fed under high pressure to a turbine, which spins. The turbine's spinning shaft is connected to a turbogenerator that changes the mechanical spinning energy into electricity.

The most commonly used *sources of energy* are the following:

- **Sun.** *Solar energy* comes to Earth from the sun in two forms—heat and light. Solar radiation can be used directly to make electricity in a solar cell, or it can be changed into steam for making electricity, heating homes, or heating water.
- **Wind.** Wind, like the sun, is a source of energy that has been used by mankind throughout history. Wind is still used to turn blades on windmills, and the resulting movement can be used to pump water or produce electricity.
- **Water motion—hydro.** Moving water, such as water flowing in a stream or river or falling over a waterfall or dam can be used to generate electricity, called *hydro power*. The water turns wheels that run turbines that, in turn, run generators that make electricity.
- **Water motion—tidal.** Water in motion because of the ebb and flow of the ocean tides can also run turbines that generate electricity.
- **Earth's heat.** *Geothermal energy* is the natural heat of the Earth, originating in the interior of the Earth and flowing outward to the surface. This heat can be used in its unchanged form to heat homes, among other things, or it can be harnessed in the form of steam to turn turbines and generate electricity.
- **Fossil fuels.** Fossil fuels, like petroleum (oil), natural gas, and coal, are the results of solar energy being transformed in the distant past into potential chemical energy. These fuels are found under the ground or ocean, and it is usually necessary to drill deeply into the Earth to extract them. These fuels are used to make heat and/or electricity, as well as other products like gasoline.
- **Wood.** Wood is another example of solar energy being transformed into potential chemical energy. Unlike fossil fuels, however, it is a renewable resource, as more trees can always be grown to make more wood. When wood is burned, it gives off heat, which can be used for various purposes.
- **Atomic fuel.** *Nuclear energy* is made in power plants by splitting the nuclei of heavy atoms such as uranium. This splitting of nuclei, or *nuclear fission*, releases a very large amount of heat energy. This heat can be used to boil water and make steam, which then turns turbines to make electricity.

People and other living organisms are dependent upon many renewable and nonrenewable sources of energy, but usage of these resources must be considered in terms of their cost/benefit

tradeoffs. All living organisms also depend on having clean air and water—i.e., a healthy environment. Many sources of energy are managed and supplied by the private sector (private individuals and corporations), often at considerable cost to the environment. Local, state, and federal governments have significant roles in managing and protecting the environment. The need for sources of energy and the need for protecting the environment are often at odds, and the government must set priorities. Ultimately, however, resource conservation and environmental protection begin with the individual.

## Materials

- Index cards
- Research materials
- Copies of the attached handout

## Vocabulary

*electrical energy, energy transformation, geothermal energy, hydro power, kinetic energy, mechanical energy, nonrenewable, nuclear energy, potential energy, renewable, solar energy, sound energy, thermal energy, turbine*

## Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

### Introduction

1. Tell students that they are going to research the eight most commonly used energy sources to compare and contrast them. Make sure students understand that there are two types of energy, kinetic and potential, and that the many forms of energy, such as electrical and chemical, can be classified as one type or the other. Also, emphasize that there are many sources of energy, most of which, with the exception of geothermal and tidal, originate directly or indirectly with the sun.
2. Ask students to work in pairs to list as many forms of energy as possible. Work together to refine the list to come to the eight types of energy you will be researching.
3. Provide each student with the information outlined under Background Information, and review each energy source briefly. Discuss the meanings of *renewable* and *nonrenewable*. Ask students for examples of *renewable* and *nonrenewable* energy and support their ideas with a reason.
4. Optional: Have students complete the National Energy Education Development (NEED) Project Pre Energy Knowledge Poll.

### Procedure

1. Write the name of each energy source on an index card. Divide students into eight groups, and have each group draw a card to determine the energy source that will be their research topic.
2. Have the groups use classroom, library, and Internet resources to research the answers to the following questions and gather data for a classroom presentation and discussion:
  - What is your energy source?
  - What is the origin of your energy source?

- What uses does your energy source currently have?
  - How readily available is energy from your energy source? What is required to acquire energy from this source?
  - What advantages does your energy source have?
  - What disadvantages does your energy source have?
  - Is your energy source renewable or nonrenewable?
  - Has the use of your energy source changed over time?
  - How long will your energy source be available on Earth?
  - What type of management is necessary for your energy source?
  - Rate the overall desirability of your energy source on a scale of 1 to 10. Be prepared to defend your answer.
3. Have student groups present their answers to the research questions and other data orally in class. During the presentations, have students individually fill in the attached Sources of Energy chart, comparing and contrasting the various energy sources. Use this data to lead a discussion of the sources of energy.

### *Observations and Conclusions*

1. Based on the data presented in the group reports, have the class rank the various sources of energy in terms of desirability, considering whether the sources are renewable, whether they cause pollution, whether they are readily available, whether they are economical, and other factors.
2. Use the Sources of Energy chart to generate additional activities and assessment.

### **Assessment**

- **Questions**
  - What are the features of, and management options for, renewable sources of energy?
  - What are the features of, and management options for, nonrenewable sources of energy?
- **Journal/Writing Prompts**
  - Write a newspaper-style editorial, extolling the virtues of your favorite energy source.
  - Explain the similarities and differences between managing renewable sources of energy and managing nonrenewable sources of energy.
- **Other**
  - Have students complete the NEED Project Post Energy Knowledge Poll.
  - Have students create an electronic slide or digital video presentation about energy sources, including the pros and cons of each.

### **Extensions and Connections (for all students)**

- See the “Energy in the Balance” project in Chapter 5 of the *Virginia Naturally* Web site for additional project ideas.
- Have students host The Great Energy Debate, available from the National Energy Education Development (NEED) Project.

### **Strategies for Differentiation**

- Label a state, regional or national map to show where sources of energy are found. Include all sources, if possible.

- Assign small groups three energy sources to research and become “resident experts” about. Have each group create a poster to explain where the three sources of energy originate, how they are transformed, and whether they are renewable or nonrenewable.
- Set up a visual/tactile representation for each energy source. For example
  - use a flashlight or light bulb to represent the sun
  - have students stand in front of a fan to demonstrate wind energy
  - use a desktop waterfall or pour water from a cup to demonstrate hydro-powered water motion
  - float a ping pong ball in a small bucket of water and move the bucket back and forth to show tidal motion
  - use a heating pad to symbolize Earth’s heat
  - light a candle to illustrate fossil fuel burning
  - give students small pieces of wood and have them form a pile to illustrate wood as a source energy and discuss ways in which the wood can be used
  - have students fill a straw with small ball bearings or metal beads to model an atomic fuel rod.
- Have students record the different types of resources they have used in a one week period. Hold a discussion about the types that were used.
- Have students create a crossword puzzle based on the answers to the questions conducted during their research.

# Sources of Energy

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

Energy Source	Advantages	Disadvantages
Sun		
Wind		
Moving water— hydro		
Water motion— tidal		
Earth's heat		
Fossil fuels		
Wood		
Atomic fuel		