2012-2013

Energy Enigma

Students put on their detective hats to uncover the mysteries of the major energy sources.

ENERGY SOURCES

Grade Level:
- Intermediate
- Secondary

E
GENERAL ENERGY

Subject Areas:
- Science
- Social Studies
- Language Arts

NEED
National Energy Education Development Project

Teacher Advisory Board

NEED Mission Statement

The mission of The NEED Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs.

Teacher Advisory Board Statement

In support of NEED, the national Teacher Advisory Board (TAB) is dedicated to developing and promoting standards-based energy curriculum and training.

Permission to Copy

Energy Data Used in NEED Materials

NEED believes in providing the most recently reported energy data available to our teachers and students. Most statistics and data are derived from the U.S. Energy Information Administration's Annual Energy Review that is published in June of each year. Working in partnership with EIA, NEED includes easy to understand data in our curriculum materials. To do further research, visit the EIA web site at www.eia.gov. EIA's Energy Kids site has great lessons and activities for students at www.eia.gov/kids.

NEED
National Energy Education Development

1.800.875.5029
www.NEED.org

Printed on Recycled Paper

Energy Enigma

Table of Contents

Correlations to National Science Education Standards: Grades 6-12

This book has been correlated to National Science Education Content Standards.

For correlations to individual state standards, visit **www.NEED.org**.

Content Standard B | *PHYSICAL SCIENCE*

- **Transfer of Energy (Intermediate)**
  - Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical. Energy is transferred in many ways.
  - In most chemical and nuclear reactions, energy is transferred into or out of a system. Heat, light mechanical motion, or electricity might all be involved in such transfers.
  - The sun is a major source of energy for changes on the Earth's surface. The sun loses energy by emitting light. A tiny fraction of that light reaches the Earth, transferring energy from the sun to the Earth. The sun's energy arrives as light with a range of wavelengths, consisting of visible light, infrared, and ultraviolet radiation.

Content Standard D | *EARTH AND SPACE SCIENCE*

- **Earth in the Solar System (Intermediate)**
  - The sun is the major source of energy for phenomena on the Earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the Earth's rotation on its axis and the length of the day.

- **Energy in the Earth System (Secondary)**
  - Earth systems have internal and external sources of energy, both of which create heat. The sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from the Earth's original formation.

Content Standard E | *SCIENCE AND TECHNOLOGY*

- **Understandings about Science and Technology (Intermediate)**
  - Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.
  - Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.

Content Standard F | *SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES*

- **Natural Resources (Secondary)**
  - Human populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations.
  - The Earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and it depletes those resources that cannot be renewed.
  - Humans use natural systems as resources. Natural systems have the capacity to reuse waste, but that capacity is limited. Natural systems can change to an extent that exceeds the limits of organisms to adapt naturally or humans to adapt technologically.

- **Science and Technology in Local, National, and Global Challenges (Secondary)**
  - Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics, and ethics of various science- and technology-related challenges. However, understanding science alone will not resolve local, national, or global challenges.

Teacher Guide

A critical thinking activity that focuses on the nation's ten leading sources of energy.

Background

In *Energy Enigma*, student teams are each assigned a different energy source. Working cooperatively, students use their reading, brainstorming, and organizational skills to hide the identity of their team's energy source while trying to guess which energy sources the other teams represent. The activity is appropriate for grades 6–12.

Note: If you teach younger students, download *Energy in the Balance* from www.NEED.org. This activity has students learning about each source and discussing the advantages and disadvantages of each energy source. A similar activity for grades 6-12 is the *Great Energy Debate*.

Concepts

- We use ten major sources of energy in the United States.
- Some energy sources are nonrenewable while others are renewable.
- Some energy sources may affect the environment more than others.
- Energy is used for transportation, heating, manufacturing, and for making electricity.
- Some energy sources provide a lot of the energy used in the U.S., while others provide only a small amount.

Time

Three 45 minute class periods

Materials

- *Nonrenewable* and *Renewable Enigma Infosheets* (two copies of each), pages 9 and 10
- *Energy Enigma Graphs* (two for each group), page 11
- *Energy Enigma Data Sheet* (each group needs 10 Data Sheets), page 12
- *Energy Enigma Clue Card* (each group needs 10 Clue Cards), page 13
- *Energy Enigma Score Card* (one for each group), page 14
- *Energy Enigma Clue Order Envelope* (one for each group), page 15
- *Energy Enigma Source Clues* (one paper copy or transparency of each), pages 16-25
- Optional: *Energy Enigma Computer File*, available at www.NEED.org

Resources

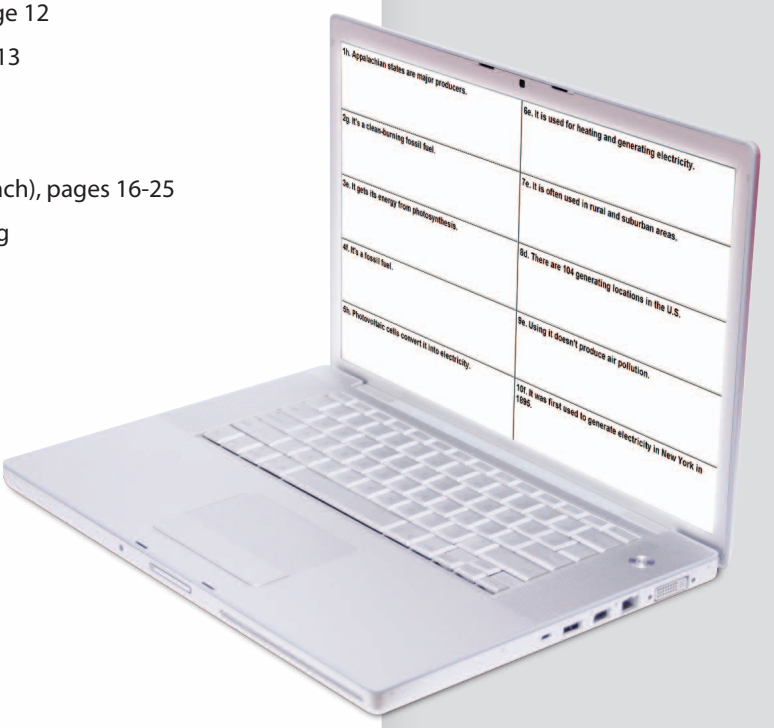
NEED has many resources on each of the energy sources available to download online at www.NEED.org.

- *Intermediate Energy Infobook*
- *Secondary Energy Infobook*

NEED also has specific curriculum units on:

- Solar
- Wind
- Hydropower
- Nuclear
- Fossil Fuels

The *Energy Enigma* computer file is an HTML, browser-based method for revealing clues during the activity. It can substitute for an overhead projector or extra printing and can be downloaded for easy use at www.NEED.org with instructions.



Procedure

Step One—Preparation

- Make copies of the *Energy Enigma* materials listed on the previous page.
- Cut the *Energy Enigma Clue Cards* and clip together seven stacks of ten.
- Cut the *Energy Enigma Data Sheets* and clip seven together in a stack. Staple together seven stacks of nine.
- Clip the remaining nine sheets together.
- Fold the *Energy Enigma Clue Order Envelopes* in half and tape the sides closed.
- Make copies of each of the ten *Energy Enigma Source Clues* sheets. (If using an overhead projector, make a transparency of each of the ten *Energy Enigma Source Clues* sheets.) Cut each sheet into its eight clues and clip together.
- Optional: Download the *Energy Enigma Computer File* from **www.NEED.org**.
- Divide the students into seven groups with three to five students per group.
- Choose seven out of the ten energy sources to assign to the groups. Next, place the *Energy Enigma Source Clues* for the seven sources you chose in separate envelopes, and write the team number and name of the energy source in the space provided. You will need to determine the clue order for the three energy sources not represented by student groups.
- Place on each table two *Energy Enigma Graphs* sheets, one *Energy Enigma Data Sheet*, two *Nonrenewable* and two *Renewable Enigma Infosheets*, and an *Energy Enigma Clue Order Envelope* face down.

Step Two—Introduce Unit to the Class (Day One)

Explain to the students that they will be working in small groups and how they must work together. Give students the following introduction:

- The name of this activity is *Energy Enigma*. Everyone knows what the word energy means, but the word enigma may be a mystery to you. Actually, a mystery is a good way to define enigma. So, if we put together the words ENERGY and ENIGMA, we get an activity in which teams look for clues about energy sources. You will need to communicate with others, solve problems, and use your academic and critical thinking skills.

Step Three—Developing the Data Sheet

Read the following instructions to the students:

- Each team has been assigned an energy source. To find out which energy source your team is, pick up your *Energy Enigma Clue Order Envelope*. Your team's goal is to be the best at eliminating energy enigmas. You will do this by identifying which energy source the other teams represent, using as few clues as possible. Naturally, it's best if the other team(s) can't guess which energy source you represent, or take a lot of clues guessing who you are, because this will give them a lower score.
- The first thing you must do to become the best team of *Energy Enigma* eliminators is to learn something about your source of energy. To accomplish this objective, each team has been given four energy source infosheets—two on renewable sources and two on nonrenewable sources. Each team also has an *Energy Enigma Data Sheet*. Someone from the team should write the name of your energy source in the space at the top of the data sheet. When the data sheet is completed, it will be for your eyes only; no other team should see it.
- To successfully complete the data sheet, you'll need to run an efficient team. This means each team will need a facilitator and a recorder. A facilitator keeps the session orderly and your team moving smoothly. The facilitator calls on people with their hands raised to prevent everyone from yelling out their facts all at once. He or she will point to members of the group, keeping pace with the writing speed of the recorder. The recorder writes down the information on the data sheet for the team. You have one minute to select your team's facilitator and recorder.
- The first question on the data sheet will be easy to answer. Just look at the *Nonrenewable* and *Renewable Enigma Infosheets* to determine on which one your source appears. Mark on the data sheet whether your source is renewable or nonrenewable.
- You'll get your data for Questions Two and Three by looking at the *Energy Enigma Graphs* on your table. Question Two asks how much energy your source of energy contributed to total energy demand. Read the *Energy Consumption By Source Graph* and place an X in one of the five boxes.
- Do the same thing for Question Three, using the *Electricity Generation By Source Graph*, to determine how much your source contributed to the production of electricity. You have one and a half minutes to answer Questions Two and Three.
- For Questions Four through Seven, you must consult your *Enigma Infosheet*. You have five minutes to answer Questions Four through Seven. When reading through the infosheet, try to answer the following questions:
    - Is your energy source's major use for heating, transportation, or generating electricity?
    - Is your source of energy found everywhere in the country, or more so in certain regions of the nation?
    - Is your energy source imported from another country?
- For Question Seven, the *Enigma Infosheet* will let you know about any facts that are particular to your source of energy.

Step Four—Determining the Sequence of Clues

Read the following instructions to the students:

- Now, each team should take out the eight clues from their *Energy Enigma Clue Order Envelope* and arrange them in one column, A through H. Place your completed *Energy Enigma Data Sheet* next to this column. Your opponents will construct data sheets on your source of energy using the same resources you did—keep this in mind as you complete the next task.
- Starting with clue A, the facilitator should call upon members of the group to comment on the clue, e.g., this clue gives away too much information and why. You have two minutes to discuss the strengths and weaknesses of the clues.
- Before deciding which clues you will be giving to the opposing teams, the facilitator should lead a discussion on the pros and cons of keeping or eliminating each of the clues. You will need to select four of the least revealing clues. These clues will be given to your opposing teams. Try to come up with the four clues through discussion with members of the group. When you've completed this task, take the four eliminated clues and put them back in the envelope.
- Now, you must arrange the remaining four clues so the first clue is the least revealing of the four, the second clue should be a little more revealing, and so on. You may decide as a team to arrange the clues so that they confuse your opposing teams. Put the least revealing clue on the top of the stack and the most revealing clue on the bottom. Once the clues are in order, clip the stack of clues to the front of the *Energy Enigma Clue Order Envelope*.
- At the end of this unit, your group will explain to the class why you kept or eliminated each clue. What were your reasons for choosing the four clues that you kept? Why were the others eliminated? How did you decide on the order of the clues? You have ten minutes to select your clues, to write down your reasons for choosing or eliminating them, and to organize the clues from least revealing to most revealing. I will pick up your *Energy Enigma Clue Order Envelopes* when you are finished and check your rationale for clue selection.

Step Five—Developing Opposing Teams' Data Sheets

Pick up *Energy Enigma Clue Order Envelopes* and give each team a stack of nine stapled *Energy Enigma Data Sheets*. Read the following instructions to the students:

- Using the *Renewable* and *Nonrenewable Enigma Infosheets* and the graphs, develop the remaining nine *Energy Enigma Data Sheets*. Be sure to indicate which energy source you are working on in the space provided at the top of each sheet. As a team, complete Questions One, Two, and Three using the graphs provided. Divide the nine sheets equally among the team members. During the activity, I will take away your infosheets and graphs—you can only use your *Energy Enigma Data Sheets*.

Step Six—Playing the Activity (Day Two)

Option: You may use the Energy Enigma Computer File to reveal clues rather than an overhead. You can download this for free at www.NEED.org.

Give each team an *Energy Enigma Score Card* and a stack of ten *Energy Enigma Clue Cards*. Read the following instructions to the students:

- I have placed ten *Energy Enigma Clue Cards* and an *Energy Enigma Score Card* on your table. Number the *Energy Enigma Clue Cards* one through ten. Write your team number and the name of your team's energy source on the *Energy Enigma Score Card.*
- Now, it is time for the evaluation portion of this activity. The seven teams have given me the clue order for their energy sources, and I have chosen the clue order for the remaining three energy sources. Shortly, I will project the first clue of each of the ten teams on the screen. The first column of five clues will be for teams one through five, and the second column of clues for teams six through ten.
- Two or more members of your team should write the information for each clue in the top box (marked Round One) of the appropriate clue card.
- Your team will then have six minutes to decide if you wish to guess which energy source is represented by an opposing team. This is done by writing the number of the team in the box next to the energy source you think they represent on your *Energy Enigma Score Card* for Round One.
- Your team receives 30 points for guessing correctly during the first round, 25 points for the second round, 15 points for the third round, and 10 points for the fourth round. If you guess correctly, I'll circle your choice and put the number of points you won in the box at the top of the score card. If your guess is wrong, I'll put an X through your choice. At the end of the activity, I'll deduct 10 points for every X or incorrect guess the team has made.
- Before I reveal the clues, I will give the teams 90 seconds to devise a plan on how they will monitor the *Energy Enigma Clue Cards*.
- Here are the first clues for round one; write them in the top box (marked Round One) on your *Energy Enigma Clue Cards*. You will have six minutes to make a guess for any or all of the ten sources. Remember, incorrect guesses will cost your team ten points. At the end of the six minutes no score cards will be accepted.
- The first round is over. We will follow the same procedure as before, and you will have six minutes again to fill in any boxes on your *Energy Enigma Score Cards* for Round Two. If you have already made a correct choice, there is no need to mark your choice in subsequent rounds.

Continue giving the same instructions and following the same scoring procedures for the remaining rounds. For rounds three and four allow only four minutes. After the fourth round, have teams add their scores and check their math.

▪ Step Seven—Discussion (Day Three)

Discuss with the students the following questions about the ten energy sources:

- What type of questions might you ask about an unknown energy source?
  1. Is the source renewable or nonrenewable?
  2. Is the energy source imported?
  3. Does the source provide a lot of the energy used in the U.S., or only a small amount?
  4. What are the major uses of the energy source?
  5. How much does the energy source affect the environment?
- What things were similar about the different energy sources?
  1. Which energy sources can be used as transportation fuels?
  2. Which energy sources produce air pollution when consumed?
  3. Which energy sources have the primary or sole use of generating electricity?
  4. Which energy sources are imported?
  5. Which energy sources are free to harness?

Read the following instructions to the students:

- One at a time, each team will come to the front of the class and place their eight clues on the overhead projector. Arrange the four clues that you chose to keep on one side of the projector and the four clues that you eliminated on the other side. Explain your reasons for keeping or eliminating the clues. (Follow with discussion.)

▪ Step Eight–Grading

You can use the grading outline below, or come up with your own grading scheme.

- Working together as a team while completing *Energy Enigma Data Sheets*—15 points
- Working together as a team during the activity—10 points
- The number of points a team receives is based on the team's *Energy Enigma Score Card*—60 points
- Explanation to class—15 points

Energy Enigma Answer Key

1 Coal
2 Natural Gas
3 Biomass
4 Petroleum
5 Solar
6 Geothermal
7 Propane
8 Uranium
9 Wind
10 Hydropower

Nonrenewable Enigma Infosheet

Petroleum

Petroleum (also known as crude oil) is a fossil fuel that took millions of years to form. When tiny sea plants and animals died, they sank to the bottom of the ocean where they were buried by layers of sand and sediment, which turned into sedimentary rock. Over time, this organic matter was subject to enormous pressure and heat, causing it to change into petroleum-saturated rock.

Since 1950, petroleum has replaced coal as the nation's leading source of energy. The four biggest uses of petroleum are transportation—71.3 percent; industry—22.28 percent; homes and businesses—5.37 percent; and electric utilities—1.05 percent.

U.S. production of petroleum is not enough to meet the nation's demand of about 19 million barrels a day. About half of the nation's supply of petroleum is imported, mostly from Canada, Mexico, Saudi Arabia, Nigeria, and Venezuela. Currently, Texas is the nation's leading producer of petroleum, followed by Alaska, California, North Dakota, and Oklahoma. About one-third of domestic production is from offshore wells.

Coal

Coal is a fossil fuel created from the remains of plants that lived and died 100 to 400 million years ago. The dead plant matter fell into swampy water, partially decaying. Under heat and pressure this plant matter was gradually changed into carbon-rich coal deposits.

The U.S. is the world leader in known coal reserves. Depending on consumption rates, the United States has about a 168-239 year supply of coal. A small percentage of the coal mined in the nation is exported to other countries. The top five coal producing states are Wyoming, West Virginia, Kentucky, Pennsylvania, and Montana.

The major method for transporting coal is by train. About 92 percent of the coal is used by electric utility companies, the rest is used by industry. Only a very small portion is used for heating buildings and homes. A major effort is made to remove the sulfur found in coal before it is burned, and from the sulfur dioxide gas that is formed when it is burned.

Natural Gas

Natural gas, the cleanest burning fossil fuel, was formed millions of years ago when plants and tiny marine organisms died and were buried by sand and sedimentary rock. Methane, a colorless and odorless gas, constitutes about 90 percent of the gas extracted from a gas well. The methane is separated from the other gases and is transported by pipeline to customers. About 44 percent of the nation's homes use natural gas for heating. Natural gas is used almost equally by the residential and commercial (33.82 percent), industrial (32.91 percent), and electric power (30.5 percent) sectors. A small amount is used by the transportation sector.

Compressed Natural Gas (CNG) can be used to fuel automobiles and buses. CNG vehicles are cleaner than gasoline powered vehicles and they make use of a domestic energy source.

Most of the natural gas consumed in the nation is domestically produced—about ten percent from offshore wells. Most natural gas production comes from Texas, Wyoming, Louisiana, Oklahoma, and Colorado. The U.S. imports about 10.8 percent of total consumption, mostly from Canada via pipeline.

Uranium

Nuclear energy is energy in the nucleus (core) of an atom. Nuclear power plants use a process called nuclear fission to release this energy by splitting uranium atoms. Once mined and processed, uranium is ready to be used in a nuclear power plant. The atoms are split to release heat energy that is used to superheat water into steam. The steam turns a turbine generator to make electricity.

The first nuclear power plant began operation in 1957. The U.S. is the number one producer of nuclear power, which generates about 20 percent of our electricity. There are 104 nuclear power plants operating in the U.S. The U.S. Navy even uses it to power some submarines. About 92 percent of the uranium the U.S. uses is imported. Although the United States has a sufficient supply of uranium, the prices are much cheaper overseas.

Nuclear power plants produce radioactive waste. The main concern is not the amount of waste but its radioactivity. There is currently no permanent disposal facility in the U.S. for nuclear waste. Nuclear waste is stored on-site at nuclear plants. While nuclear power produces radioactive waste, it does not contribute to air pollution because the fuel is not burned.

Propane

Propane is found in natural gas and petroleum deposits and is separated during processing and refining. Propane, therefore, comes from petroleum and natural gas producing states. About 11 percent of the nation's propane is imported. Propane is a colorless and odorless gas that can be changed into a liquid by putting it under a moderate amount of pressure, or cooling it to -43.8º Fahrenheit. When liquefied, it is a portable and clean source of heat energy. Liquid propane is sold by the gallon.

The largest market for propane is in industry and in rural and suburban areas that do not have natural gas service. Farms are big users. Propane is used for heating barns and homes, heating water, operating equipment, and cooking.

Because it is so portable, it can be used in hot air balloons and recreational vehicles. About one percent of propane is used for transportation. Propane-fueled engines emit cleaner exhaust than gasoline engines.

Renewable Enigma Infosheet

Biomass

Biomass is any organic material—plants, wood, animal and agricultural waste—that can be used as an energy source. During photosynthesis, plants use the sun's energy to combine carbon dioxide and water into carbohydrates. These carbohydrates can be burned to release energy.

About 46 percent of biomass energy comes from burning wood and 43 percent is made into biofuels such as ethanol. About 11 percent comes from burning garbage and agricultural waste. The energy released from burning this waste is used to generate electricity. Although burning biomass produces some air pollution, sophisticated systems reduce the level of emissions significantly.

In a landfill, decaying biomass gives off methane gas. This gas can be captured and sent through pipelines to heat homes and buildings. Another method of using biomass is to change it into ethyl alcohol, or ethanol, through a process called fermentation. Corn is usually the source of this type of biomass. Ethanol can be mixed with gasoline to make gasohol. Much of the nation's motor fuels are a blend of gasoline and ethanol.

Hydropower

Hydropower is energy that comes from the force of moving water. Gravity causes water to flow from higher to lower ground creating a force that can be used to turn turbine generators and produce electricity. The first hydroelectric power plant was built in 1895 at Niagara Falls in New York. Currently there are more than 2,000 dams in the U.S. producing 5–10 percent of the nation's electricity, depending on the amount of rainfall.

Hydropower is the cheapest way to generate electricity today. While a hydropower plant is expensive to build, its energy source is free and does not contribute to air pollution. Hydropower plants do change the local environment, however, because of the reservoir formed by the dam. A reservoir can flood thousands of acres of land and disrupt wildlife in the area that is flooded.

Most good sites for hydropower dams in the U.S. are already in use. Many existing dams that are not now generating electricity could be equipped with generating equipment.

Geothermal

Geothermal energy comes from heat within the Earth. The heat, produced from the radioactive decay of elements deep below the Earth's surface, is absorbed by rocks. Its energy is technically a result of nuclear energy within the Earth. When water comes in contact with these heated rocks, it absorbs the energy, sometimes changing to steam. The hot water or steam can be used to heat buildings or to generate electricity.

The major use of high-temperature geothermal energy is to generate electricity. Most geothermal electric power plants are in western states. While the source of geothermal energy is free, the cost to develop a geothermal field is expensive. The pipes and equipment must be maintained carefully because of the corrosive nature of the steam.

Geothermal heat pumps—or geothermal exchange units—use the constant temperature of the Earth under the ground to heat and cool buildings. This low-temperature geothermal energy is available everywhere.

Wind

Wind is air in motion. It is created by the uneven heating of the Earth's surface by the sun. Hot air expands and rises, and heavier, cooler air rushes in to take its place, creating wind. Prior to 1935, windmills were used primarily to grind grain and pump water. Today, wind turbines are used primarily to generate electricity.

Most wind turbines are located on huge wind farms covering hundreds of acres. Many of the nation's wind turbines are located in Texas, but many places in the U.S. have enough wind to run wind machines and have begun installing them. New wind turbines generate electricity about as cheaply as thermal power plants.

Since the wind doesn't blow constantly, wind turbines only run on average about three-fourths of the time and not always at full capacity. Wind turbines do not pollute the air or water.

Solar

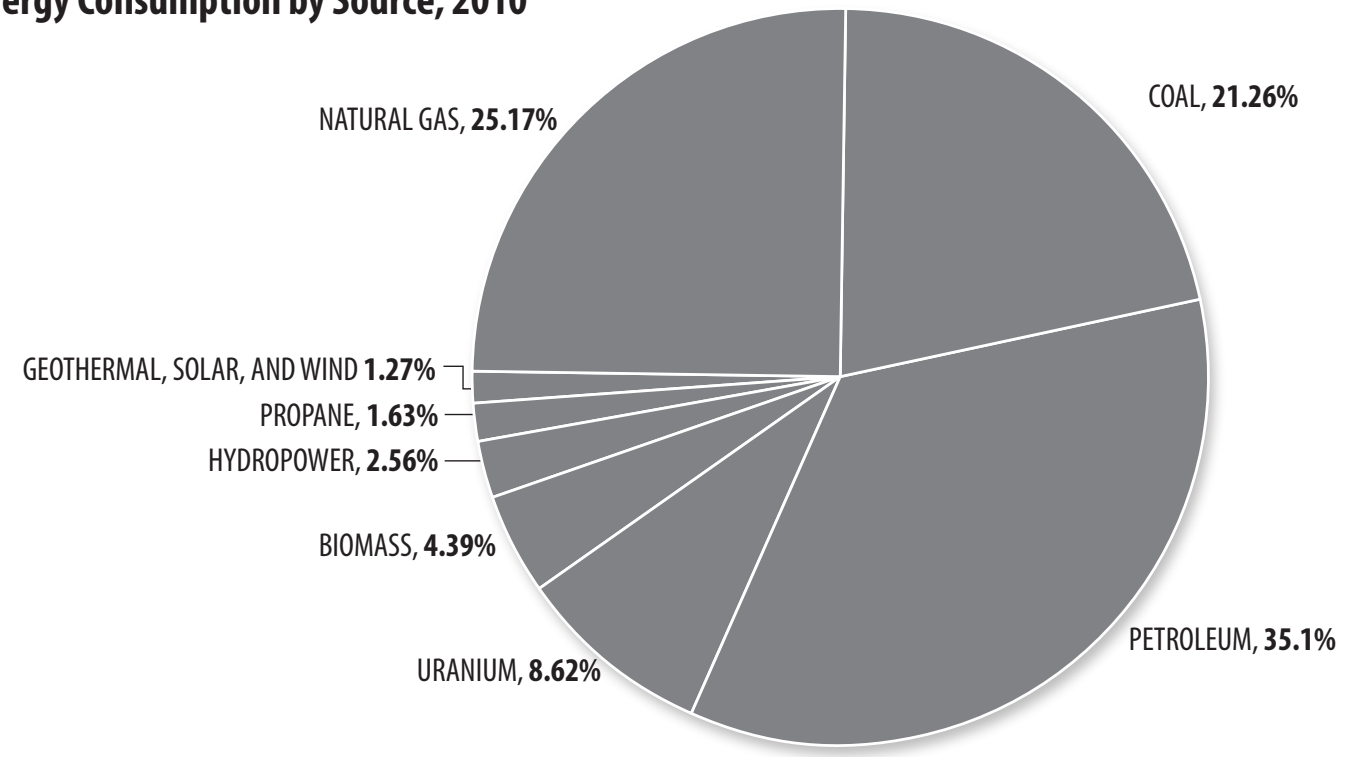
Solar energy is created in the sun when hydrogen atoms are combined to form heavier atoms of helium. This process is called nuclear fusion. A small amount of mass is lost during this process and is converted into heat and radiant energy. The energy radiates from the sun in all directions, and less than one percent reaches the Earth.

Solar energy can be used to heat buildings and water. South-facing windows, brick walls, or solar collectors are used to absorb the solar energy. Water, stones, and other materials are used to store the solar energy at night or on cloudy days. Solar energy is also used to make electricity. One way is by concentrating the sun's rays on pipes to heat water to very high temperatures. The hot water turns into steam and turns a turbine generator, as other conventional power plants do.

The sun's radiant energy can also be converted directly into electricity using photovoltaic cells. PV cells power calculators and emergency phones on highways.

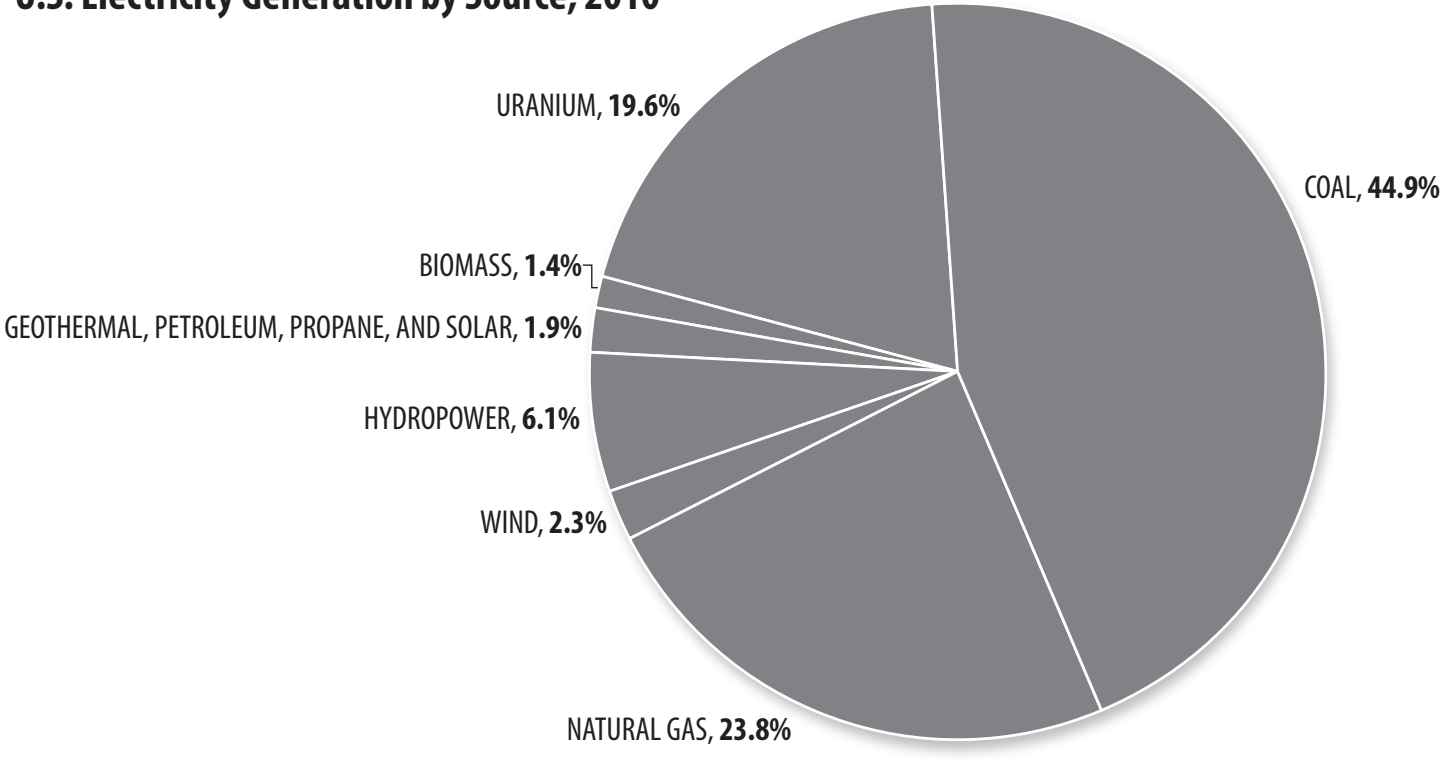
ENERGY ENIGMA GRAPH 1

U.S. Energy Consumption by Source, 2010



ENERGY ENIGMA GRAPH 2

U.S. Electricity Generation by Source, 2010



ENERGY *enigma*

DATA SHEET

ENERGY SOURCE ______________________

1. ___ Renewable ___ Nonrenewable

2. Contribution to total U.S. energy consumption:
___ Majority ___ Substantial ___ Moderate
___ Small ___ Very Small

3. Contribution to total U.S. electricity generation:
___ Majority ___ Substantial ___ Moderate
___ Small ___ Very Small

4. Major Uses: ______________________

5. Nationwide or areas of domestic production:
____

6. Does domestic consumption require imports?
___ Yes _____% ___ No

7. Facts particular to your source:
____
____
____

ENERGY *enigma*

DATA SHEET

ENERGY SOURCE ______________________

1. ___ Renewable ___ Nonrenewable

2. Contribution to total U.S. energy consumption:
___ Majority ___ Substantial ___ Moderate
___ Small ___ Very Small

3. Contribution to total U.S. electricity generation:
___ Majority ___ Substantial ___ Moderate
___ Small ___ Very Small

4. Major Uses: ______________________

5. Nationwide or areas of domestic production:
____

6. Does domestic consumption require imports?
___ Yes _____% ___ No

7. Facts particular to your source:
____
____
____

ENERGY *enigma*

DATA SHEET

ENERGY SOURCE ______________________

1. ___ Renewable ___ Nonrenewable

2. Contribution to total U.S. energy consumption:
___ Majority ___ Substantial ___ Moderate
___ Small ___ Very Small

3. Contribution to total U.S. electricity generation:
___ Majority ___ Substantial ___ Moderate
___ Small ___ Very Small

4. Major Uses: ______________________

5. Nationwide or areas of domestic production:
____

6. Does domestic consumption require imports?
___ Yes _____% ___ No

7. Facts particular to your source:
____
____
____

ENERGY *enigma*

DATA SHEET

ENERGY SOURCE ______________________

1. ___ Renewable ___ Nonrenewable

2. Contribution to total U.S. energy consumption:
___ Majority ___ Substantial ___ Moderate
___ Small ___ Very Small

3. Contribution to total U.S. electricity generation:
___ Majority ___ Substantial ___ Moderate
___ Small ___ Very Small

4. Major Uses: ______________________

5. Nationwide or areas of domestic production:
____

6. Does domestic consumption require imports?
___ Yes _____% ___ No

7. Facts particular to your source:
____
____
____

ENERGY*enigma*

CLUE CARD

TEAM _____

Round 1

Round 2

Round 3

Round 4

ENERGY*enigma*

CLUE CARD

TEAM _____

Round 1

Round 2

Round 3

Round 4

ENERGY*enigma*

CLUE CARD

TEAM _____

Round 1

Round 2

Round 3

Round 4

ENERGY*enigma*

CLUE CARD

TEAM _____

Round 1

Round 2

Round 3

Round 4

Energy Enigma Score Card

Team Number: **Energy Source:**

Points Won *(game leader's use only)*

_____ **Biomass**
_____ **Coal**
_____ **Geothermal**
_____ **Hydropower**
_____ **Natural Gas**
_____ **Petroleum**
_____ **Propane**
_____ **Solar**
_____ **Uranium**
_____ **Wind**

NOTES: Subtract 10 points for every incorrect answer. If you have already made a correct choice, do not mark your choice again in subsequent rounds.

Round One *30 Points for each correct answer*

_____ **Biomass**
_____ **Coal**
_____ **Geothermal**
_____ **Hydropower**
_____ **Natural Gas**
_____ **Petroleum**
_____ **Propane**
_____ **Solar**
_____ **Uranium**
_____ **Wind**

Round Two *25 Points for each correct answer*

_____ **Biomass**
_____ **Coal**
_____ **Geothermal**
_____ **Hydropower**
_____ **Natural Gas**
_____ **Petroleum**
_____ **Propane**
_____ **Solar**
_____ **Uranium**
_____ **Wind**

Round Three *15 Points for each correct answer*

_____ **Biomass**
_____ **Coal**
_____ **Geothermal**
_____ **Hydropower**
_____ **Natural Gas**
_____ **Petroleum**
_____ **Propane**
_____ **Solar**
_____ **Uranium**
_____ **Wind**

Round Four *10 Points for each correct answer*

_____ **Biomass**
_____ **Coal**
_____ **Geothermal**
_____ **Hydropower**
_____ **Natural Gas**
_____ **Petroleum**
_____ **Propane**
_____ **Solar**
_____ **Uranium**
_____ **Wind**

Energy Enigma Clue Order Envelope

LETTER

1. _____ *Least revealing*

2. _____

3. _____

4. _____ *Most revealing*

Team Number: **Team Name:** **Energy Source:**

Fold Here

Energy Enigma Source Clues

1A REVEAL _____ **It generates almost half of U.S. electricity.**	1B REVEAL _____ **A small percent of U.S. production is exported.**
1C REVEAL _____ **The U.S. has the largest amount of known reserves.**	1D REVEAL _____ **It is a fossil fuel.**
1E REVEAL _____ **It is transported mostly by train.**	1F REVEAL _____ **It supplies one-fifth of total U.S. energy demand.**
1G REVEAL _____ **Burning it can produce air pollution.**	1H REVEAL _____ **Appalachian states are major producers.**

Team 1 Coal

Energy Enigma Source Clues

2A REVEAL _____ **It generates about one-fourth of U.S. electricity.**	2B REVEAL _____ **It is a fossil fuel.**
2C REVEAL _____ **It is nonrenewable.**	2D REVEAL _____ **Used almost equally by homes and businesses, industry, and for power generation.**
2E REVEAL _____ **It is a colorless and odorless gas.**	2F REVEAL _____ **It supplies one-fourth of total U.S. energy demand.**
2G REVEAL _____ **It is a cleaner-burning fossil fuel.**	2H REVEAL _____ **It can be used as a transportation fuel.**

Team 2 Natural Gas

Energy Enigma Source Clues

3A REVEAL _____ **It generates a small amount of U.S. electricity.**	3B REVEAL _____ **It is renewable.**
3C REVEAL _____ **Methane gas can be made from it.**	3D REVEAL _____ **Burning it can produce air pollution.**
3E REVEAL _____ **It gets its energy from photosynthesis.**	3F REVEAL _____ **It supplies a small amount of total U.S. energy demand.**
3G REVEAL _____ **Forty-six percent of its energy production is from wood.**	3H REVEAL _____ **It can be made into a transportation fuel.**

Team 3 Biomass

Energy Enigma Source Clues

4A REVEAL _____ **It is used mostly as a transportation fuel.**	4B REVEAL _____ **About half of what the U.S. consumes is imported.**
4C REVEAL _____ **It is nonrenewable.**	4D REVEAL _____ **It generates a very small amount of U.S. electricity.**
4E REVEAL _____ **It is the leading supplier of U.S. energy.**	4F REVEAL _____ **It is a fossil fuel.**
4G REVEAL _____ **A third of U.S. production is from offshore wells.**	4H REVEAL _____ **Burning it can produce air pollution.**

Team 4 Petroleum

Energy Enigma Source Clues

5A REVEAL _____ **It generates a very small amount of U.S. electricity.**	5B REVEAL _____ **It is renewable.**
5C REVEAL _____ **It is free to use, but you must build and maintain its equipment.**	5D REVEAL _____ **It is used to directly heat buildings.**
5E REVEAL _____ **It supplies a very small amount of U.S. energy demand.**	5F REVEAL _____ **It cannot provide energy all of the time.**
5G REVEAL _____ **Its energy is a result of a nuclear reaction.**	5H REVEAL _____ **Photovoltaic cells convert it into electricity.**

Team 5 Solar

Energy Enigma Source Clues

6A REVEAL _____ **It generates a very small amount of U.S. electricity.**	6B REVEAL _____ **It is renewable.**
6C REVEAL _____ **Most electricity production is in western states.**	6D REVEAL _____ **It supplies a very small amount of total U.S. energy demand.**
6E REVEAL _____ **It is used for heating and generating electricity.**	6F REVEAL _____ **Its energy is a result of radioactive decay.**
6G REVEAL _____ **It is used to heat buildings directly.**	6H REVEAL _____ **It is free to use, but you must build and maintain its equipment.**

Team 6 Geothermal

Energy Enigma Source Clues

7A REVEAL _____ **It can be used as a transportation fuel.**	7B REVEAL _____ **It is nonrenewable.**
7C REVEAL _____ **It is a by-product of natural gas and crude oil processing.**	7D REVEAL _____ **It is a colorless and odorless gas.**
7E REVEAL _____ **It is often used in rural and suburban areas.**	7F REVEAL _____ **It supplies a small amount of total U.S. energy demand.**
7G REVEAL _____ **It turns into a liquid under moderate pressure.**	7H REVEAL _____ **It is a cleaner-burning fossil fuel.**

Team 7 Propane

Energy Enigma Source Clues

8A REVEAL _____ **It was first used commercially in 1957.**	8B REVEAL _____ **It is nonrenewable.**
8C REVEAL _____ **The U.S. Navy uses it to fuel some submarines.**	8D REVEAL _____ **There are 104 generating locations in the U.S.**
8E REVEAL _____ **Over 90 percent of its supply is imported.**	8F REVEAL _____ **Its waste products are stored at the power plant.**
8G REVEAL _____ **Using it doesn't produce air pollution.**	8H REVEAL _____ **It generates one-fifth of U.S. electricity.**

Team 8 Uranium

Energy Enigma Source Clues

9A REVEAL _____ **It generates a small amount of U.S. electricity.**	9B REVEAL _____ **It is renewable.**
9C REVEAL _____ **It is free to use, but you must build and maintain its equipment.**	9D REVEAL _____ **Texas is its leading producer of electricity.**
9E REVEAL _____ **Using it doesn't produce air pollution.**	9F REVEAL _____ **It supplies a very small amount of U.S. energy demand.**
9G REVEAL _____ **Its production facilities require lots of land.**	9H REVEAL _____ **It cannot provide electricity all of the time.**

Team 9 Wind

Energy Enigma Source Clues

10A REVEAL _____ **It generates a moderate amount of U.S. electricity.**	10B REVEAL _____ **It is renewable.**
10C REVEAL _____ **It supplies a small amount of total U.S. energy demand.**	10D REVEAL _____ **There are over 2,000 generating locations in the U.S.**
10E REVEAL _____ **Production facilities may disturb large areas of land.**	10F REVEAL _____ **It was first used to generate electricity in New York in 1895.**
10G REVEAL _____ **It is free to use, but you must build and maintain its equipment.**	10H REVEAL _____ **Using it doesn't produce air pollution.**

Team 10 Hydropower

2013 Youth Awards for Energy Achievement

All NEED schools have outstanding classroom-based programs in which students learn about energy. Does your school have student leaders who extend these activities into their communities? To recognize outstanding achievement and reward student leadership, The NEED Project conducts the National Youth Awards Program for Energy Achievement.

This program combines academic competition with recognition to acknowledge everyone involved in NEED during the year—and to recognize those who achieve excellence in energy education in their schools and communities. What's involved? Students and teachers set goals and objectives, and keep a record of their activities. In April, students combine their materials into scrapbooks and send them in and write summaries of their projects for inclusion in the Annual Report.

Want more info? Check out www.need.org/Youth-Awards for more application and program information, previous winners and photos of past events.

Energy Enigma
Evaluation Form

State: _____ **Grade Level:** _____ **Number of Students:** _____

1. Did you conduct the entire activity?	❑ Yes	❑ No
2. Were the instructions clear and easy to follow?	❑ Yes	❑ No
3. Did the activity meet your academic objectives?	❑ Yes	❑ No
4. Was the activity age appropriate?	❑ Yes	❑ No
5. Were the allotted times sufficient to conduct the activities?	❑ Yes	❑ No
6. Was the activity easy to use?	❑ Yes	❑ No
7. Was the preparation required acceptable for the activity?	❑ Yes	❑ No
8. Were the students interested and motivated?	❑ Yes	❑ No
9. Was the energy knowledge content age appropriate?	❑ Yes	❑ No
10. Would you teach this activity again?	❑ Yes	❑ No

Please explain any 'no' statement below.

How would you rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor
How would your students rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor

What would make the activity more useful to you?

Other Comments:

Please fax or mail to: **The NEED Project**
P.O. Box 10101
Manassas, VA 20108
FAX: 1-800-847-1820

NEED National Sponsors and Partners

American Association of Blacks in Energy
American Chemistry Council
American Electric Power
American Electric Power Foundation
American Solar Energy Society
American Wind Energy Association
Appalachian Regional Commission
Areva
Arkansas Energy Office
Armstrong Energy Corporation
Association of Desk & Derrick Clubs
Robert L. Bayless, Producer, LLC
BP
BP Alaska
C&E Operators
Cape and Islands Self Reliance
Cape Cod Cooperative Extension
Cape Light Compact–Massachusetts
L.J. and Wilma Carr
Central Virginia Community College
Chevron
Chevron Energy Solutions
ComEd
ConEdison Solutions
ConocoPhillips
Council on Foreign Relations
CPS Energy
Dart Foundation
David Petroleum Corporation
Desk and Derrick of Roswell, NM
Dominion
Dominion Foundation
DTE Energy Foundation
Duke Energy
East Kentucky Power
El Paso Foundation
E.M.G. Oil Properties
Encana
Encana Cares Foundation
Energy Education for Michigan
Energy Training Solutions
Energy Solutions Foundation
Entergy
Equitable Resources
First Roswell Company
Foundation for Environmental Education
FPL
The Franklin Institute
GenOn Energy–California
Georgia Environmental Facilities Authority
Government of Thailand–Energy Ministry
Guam Energy Office
Gulf Power
Halliburton Foundation
Hawaii Energy
Gerald Harrington, Geologist
Houston Museum of Natural Science
Hydro Research Foundation
Idaho Department of Education
Idaho National Laboratory
Illinois Clean Energy Community Foundation
Independent Petroleum Association of America
Independent Petroleum Association of New Mexico
Indiana Michigan Power
Interstate Renewable Energy Council
iStem–Idaho STEM Education
Kansas City Power and Light
KBR
Kentucky Clean Fuels Coalition
Kentucky Department of Education
Kentucky Department of Energy Development and Independence
Kentucky Oil and Gas Association
Kentucky Propane Education and Research Council
Kentucky River Properties LLC
Kentucky Utilities Company
Lenfest Foundation
Littler Mendelson
Llano Land and Exploration
Los Alamos National Laboratory
Louisville Gas and Electric Company
Maine Energy Education Project
Maine Public Service Company
Marianas Islands Energy Office
Massachusetts Division of Energy Resources
Lee Matherne Family Foundation
Michigan Oil and Gas Producers Education Foundation
Midwest Energy Cooperative
Mississippi Development Authority–Energy Division
Montana Energy Education Council
The Mosaic Company
NADA Scientific
NASA
National Association of State Energy Officials
National Fuel
National Grid
National Hydropower Association
National Ocean Industries Association
National Renewable Energy Laboratory
Nebraska Public Power District
New Mexico Oil Corporation
New Mexico Landman's Association
New Orleans Solar Schools Initiative
New York Power Authority
NSTAR
OCI Enterprises
Offshore Energy Center
Offshore Technology Conference
Ohio Energy Project
Pacific Gas and Electric Company
PECO
Petroleum Equipment Suppliers Association
Phillips 66
PNM
Puerto Rico Energy Affairs Administration
Puget Sound Energy
Rhode Island Office of Energy Resources
RiverWorks Discovery
Roswell Climate Change Committee
Roswell Geological Society
Sacramento Municipal Utility District
Saudi Aramco
Schneider Electric
Science Museum of Virginia
C.T. Seaver Trust
Shell
Snohomish County Public Utility District–WA
Society of Petroleum Engineers
SolarWorld USA
David Sorenson
Southern Company
Southern LNG
Southwest Gas
Space Sciences Laboratory–University of California Berkeley
Tennessee Department of Economic and Community Development–Energy Division
Tennessee Valley Authority
Toyota
TXU Energy
United States Energy Association
University of Nevada–Las Vegas, NV
U.S. Department of Energy
U.S. Department of Energy–Hydrogen Program
U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy–Office of Fossil Energy
U.S. Department of Energy–Wind for Schools
U.S. Department of Energy–Wind Powering America
U.S. Department of the Interior–Bureau of Land Management
U.S. Department of the Interior–Bureau of Ocean Energy Management, Regulation and Enforcement
U.S. Energy Information Administration
U.S. Environmental Protection Agency
Van Ness Feldman
Virgin Islands Energy Office
Virginia Department of Education
Virginia Department of Mines, Minerals and Energy
Walmart Foundation
Washington and Lee University
Western Kentucky Science Alliance
W. Plack Carr Company
Yates Petroleum Corporation