ENERGY ENIGMA

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

ENERGY SOURCES

GRADE LEVEL

7–12

SUBJECT AREAS

Science
Social Studies
Language Arts

NEED 2008-2009
Putting Energy into Education

NEED Project PO Box 10101 Manassas, VA 20108 1-800-875-5029 www.NEED.org

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 Vision Statement

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

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NEED

Putting Energy into Education

Correlations to National Science Standards

(Bolded standards are emphasized in the unit.)

INTERMEDIATE (5-8) STANDARD–B: PHYSICAL SCIENCE

3. Transfer of Energy

a. Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical.

b. Energy is transferred in many ways.

g. The sun is the 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 earth, transferring energy from the sun to the earth. The sun's energy arrives as light with a range of wavelengths.

INTERMEDIATE–D: EARTH AND SPACE SCIENCE

3. Earth in the Solar System

b. 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.

INTERMEDIATE–E: SCIENCE AND TECHNOLOGY

2. Understandings about Science and Technology

c. Technological solutions are temporary and have side effects. Technologies cost, carry risks, and have benefits.

SECONDARY (9-12) STANDARD–F: SCIENCE IN PERSONAL & SOCIAL PERSPECTIVES

3. Natural Resources

a. Human populations use resources in the environment to maintain and improve their existence.

b. The earth does not have infinite resources; increasing human consumption places severe stress on the natural processes that renew some resources, and depletes those resources that cannot be renewed.

c. Humans use many 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.

Teacher Guide

A CRITICAL THINKING GAME 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 game is appropriate for grades 7–12.

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

- **Energy Enigma Ballot** (seven copies)
- **Energy Enigma Graph Shee**t (14 copies)
- **Nonrenewable and Renewable Infosheets** (14 copies of each)
- **Energy Enigma Game Sheet** (18 copies)
- **Energy Enigma Data Sheet** (18 copies)
- **Clue Order Envelope** (seven copies)
- **Energy Enigma Source Clue Sheets** (one transparency of each)

PROCEDURE

Step One—Preparation

- Make copies of the **Energy Enigm**a materials listed above.
- Cut the **Energy Enigma Game Sheets** and clip together seven stacks of ten.
- Cut the **Data Sheets** and clip seven together in a stack. Staple together seven stacks of nine.
- Fold the **Clue Order Envelopes** in half and tape the sides closed.
- Make a transparency of each of the ten **Energy Enigma Source Clue Sheets**. Cut each sheet into its eight clues and clip together.
- 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 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 Graph Sheets**, one **Data Sheet**, two nonrenewable and two renewable **Energy Source Infosheets**, and a **Clue 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 game 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 a game 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 clue 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 two Energy Source Infosheets—one on renewable sources and one 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 Energy Source 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 Graph and place an X in one of the five boxes.*
- *Do the same thing for Question Three, using the Electrical Energy Production 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.*
- *When everyone is finished, please tell me your team name—but not your number—and how you answered Questions Two and Three.*
- *For Questions Four through Seven, you must consult your Energy Enigma Source 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 Energy Enigma Source Infosheet will let you know about any facts that are particular to your source of energy.*

Step Four—Determining the Sequence of Clues

- *Now, each team should take out the eight clues from their Energy Enigma Clue 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, i.e., 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 Clue 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 Clue 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 Clue Envelopes when you are finished and check your rationale for clue selection.*

Step Five—Developing Opposing Teams' Data Sheets

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

- *Using the Renewable and Nonrenewable Source Infosheets and the graphs, develop the remaining nine 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 game, I will take away your infosheets and graphs—you can only use your Data Sheets.*

Step Six—Playing the Game (Day Two)

Give each team an Energy Enigma Ballot and a stack of ten Game Sheets. Read the following instructions to the students:

- *I have placed ten Energy Enigma Game Sheets and an Energy Enigma Ballot on your table. Number the Game Sheets one through ten. Write your team number and the name of your team's energy source on the Ballot.*
- *Now, it is time for the evaluation portion of this game. 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 row 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 clue one) of the appropriate game sheet.*
- *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 Ballot 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, and 10 points for the fourth round. If you guess correctly, I'll circle your choice, and I will put the number of points you won in the box at the top of the ballot. If you guess wrong, I'll put an X through your choice. At the end of the game, I'll deduct 10 points for every X or incorrect guess the team has made.*
- *Before I turn on the overhead projector and reveal the clues, I will give the teams 90 seconds to devise a plan on how they will monitor the Energy Enigma Game Sheets.*

- *Here are the first clues for round one; write them in the top box (marked clue one) on your game sheets. 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, so it may be better to leave most of them blank for the first round or two. At the end of the six minutes no ballots 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 any boxes on your Energy Enigma Ballot 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—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 require imports?*
    5. *Which energy sources have fuel sources that are free?*

- *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 developing **Data Sheet**—15 points
- Working together as a team during the game—10 points
- **Enigma Ballot Scores**—60 points (The number of grading points a team receives is based on the team's **Energy Enigma Ballot** score.)
- Explanation to class—15 points

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—68 percent; industry—25 percent; homes and businesses—6 percent; and electric utilities—1 percent.

U.S. production of petroleum is not enough to meet the nation's demand of about 20 million barrels a day. About two-thirds of the nation's supply of petroleum is imported, mostly from Canada, Mexico, Saudi Arabia, Venezuela and Nigeria. Currently, Texas is the nation's leading producer of petroleum, followed by Alaska, California, Louisiana, New Mexico, 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 60 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. At current consumption rates, the United States has about a 260-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 Texas.

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 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. Over half of the nation's homes use natural gas for heating; the major consumer of natural gas is industry.

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 a quarter from offshore wells. Most natural gas production comes from Texas, Wyoming, Oklahoma,New Mexico, and Louisiana. The U.S. imports about 18 percent of total consumption from Canada and Mexico 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 20 percent of our electricity. There are over 100 nuclear power plants operating in the U.S. Almost ninety 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. The U.S. government is in the process of licensing a disposal site in Yucca Mountain, Nevada, to store the waste. 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. A small amount 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 -43.8° 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 three percent of propane is used for transportation. Propane-fueled engines emit cleaner exhaust than gasoline engines.

Renewable Energy 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 65 percent of biomass energy comes from burning wood and 23 percent is made into biofuels such as ethanol. About 12 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 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 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. 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 simply 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 California, 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 hot 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 Ballot

TEAM NUMBER _____ **ENERGY SOURCE** _____

POINTS WON *game leaders' use only*

____ HYDROPOWER	____ BIOMASS
____ NATURAL GAS	____ PROPANE
____ GEOTHERMAL	____ COAL
____ PETROLEUM	____ WIND
____ URANIUM	____ SOLAR

NOTE: *If you have already made a correct choice, do not mark your choice again in subsequent rounds.*

ROUND ONE *30 points*

____ HYDROPOWER	____ BIOMASS
____ NATURAL GAS	____ PROPANE
____ GEOTHERMAL	____ COAL
____ PETROLEUM	____ WIND
____ URANIUM	____ SOLAR

ROUND TWO *25 points*

____ HYDROPOWER	____ BIOMASS
____ NATURAL GAS	____ PROPANE
____ GEOTHERMAL	____ COAL
____ PETROLEUM	____ WIND
____ URANIUM	____ SOLAR

ROUND THREE *15 points*

____ HYDROPOWER	____ BIOMASS
____ NATURAL GAS	____ PROPANE
____ GEOTHERMAL	____ COAL
____ PETROLEUM	____ WIND
____ URANIUM	____ SOLAR

ROUND FOUR *10 points*

____ HYDROPOWER	____ BIOMASS
____ NATURAL GAS	____ PROPANE
____ GEOTHERMAL	____ COAL
____ PETROLEUM	____ WIND
____ URANIUM	____ SOLAR

ENERGY *enigma*

GAME SHEET

TEAM _____

CLUE *1*

CLUE *2*

CLUE *3*

CLUE *4*

ENERGY *enigma*

GAME SHEET

TEAM _____

CLUE *1*

CLUE *2*

CLUE *3*

CLUE *4*

ENERGY *enigma*

GAME SHEET

TEAM _____

CLUE *1*

CLUE *2*

CLUE *3*

CLUE *4*

ENERGY *enigma*

GAME SHEET

TEAM _____

CLUE *1*

CLUE *2*

CLUE *3*

CLUE *4*

ENERGY *enigma*

DATA SHEET

ENERGY SOURCE ____________________

1. ___ Renewable ___ Nonrenewable

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

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

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

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

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

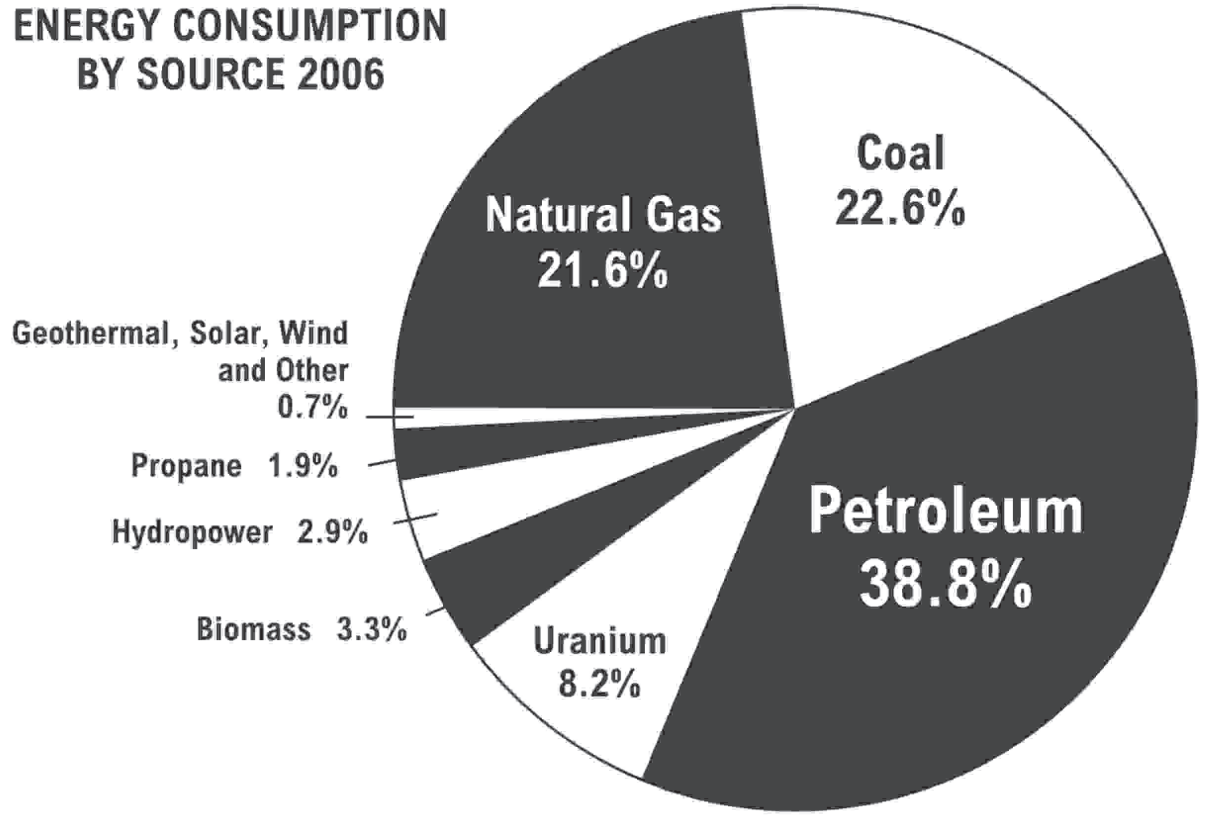
4. Major Uses: ____________________

5. Nationwide or areas of domestic production:
____

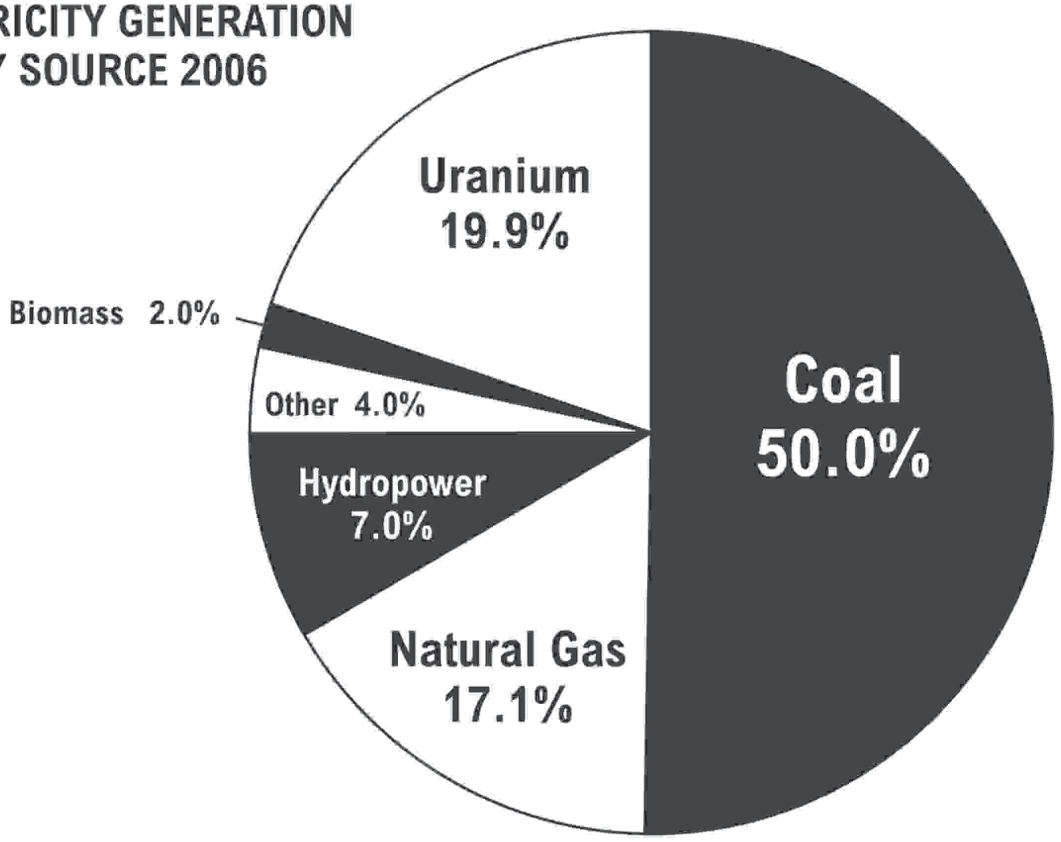
6. Does domestic consumption require imports?
___ Yes ______% ___ No

7. Facts particular to your source:
____
____
____

ENERGY ENIGMA GRAPH 1
ENERGY CONSUMPTION BY SOURCE 2006



ENERGY ENIGMA GRAPH 2
ELECTRICITY GENERATION BY SOURCE 2006



ENERGY *enigma*

CLUE ORDER ENVELOPE

LETTER

1. _____ *least revealing*
2. _____
3. _____
4. _____ *most revealing*

TEAM NUMBER | **TEAM NAME** | **SOURCE**

fold here

ENERGY ENIGMA SOURCE CLUES

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

TEAM 1 COAL

ENERGY ENIGMA SOURCE CLUES

GROUP _____ * 2A **It generates a moderate amount of U.S. electricity.**	GROUP _____ * 2B **It's a fossil fuel.**
GROUP _____ * 2C **It's nonrenewable.**	GROUP _____ * 2D **Industry is its largest consumer.**
GROUP _____ * 2E **It's a colorless and odorless gas.**	GROUP _____ * 2F **It supplies almost a fourth of total U.S. energy demand.**
GROUP _____ * 2G **It's a clean-burning fossil fuel.**	GROUP _____ * 2H **It can be used as a transportation fuel.**

TEAM 2 NATURAL GAS

ENERGY ENIGMA SOURCE CLUES

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

TEAM 3 BIOMASS

ENERGY ENIGMA SOURCE CLUES

GROUP _____ * 4A **It is used mostly as a transportation fuel.**	GROUP _____ * 4B **Two-thirds of U.S. consumption is imported.**
GROUP _____ * 4C **It's nonrenewable.**	GROUP _____ * 4D **It generates a small amount of U.S. electricity.**
GROUP _____ * 4E **It's the leading supplier of U.S. energy.**	GROUP _____ * 4F **It's a fossil fuel.**
GROUP _____ * 4G **A third of U.S. production is from offshore wells.**	GROUP _____ * 4H **Burning it can produce air pollution.**

TEAM 4 PETROLEUM

ENERGY ENIGMA SOURCE CLUES

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

TEAM 5 SOLAR

ENERGY ENIGMA SOURCE CLUES

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

TEAM 6 GEOTHERMAL

ENERGY ENIGMA SOURCE CLUES

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

TEAM 7 PROPANE

ENERGY ENIGMA SOURCE CLUES

GROUP _____ * 8A **It was first used commercially in 1957.**	GROUP _____ * 8B **It's nonrenewable.**
GROUP _____ * 8C **It is used mainly to generate electricity.**	GROUP _____ * 8D **There are about 100 generating locations in the U.S.**
GROUP _____ * 8E **Over three-fourths of its supply is imported.**	GROUP _____ * 8F **Its waste products will be stored in Nevada.**
GROUP _____ * 8G **Using it doesn't produce air pollution.**	GROUP _____ * 8H **It generates a moderate amount of U.S. electricity.**

TEAM 8 URANIUM

ENERGY ENIGMA SOURCE CLUES

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

TEAM 9 WIND

ENERGY ENIGMA SOURCE CLUES

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

TEAM 10 HYDROPOWER

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 activity?	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 use the activity again?	Yes	No

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:
NEED Project
PO Box 10101
Manassas, VA 20108
FAX: 1-800-847-1820

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New York Power Authority

North Carolina Department of Administration–State Energy Office

Nebraska Public Power District

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