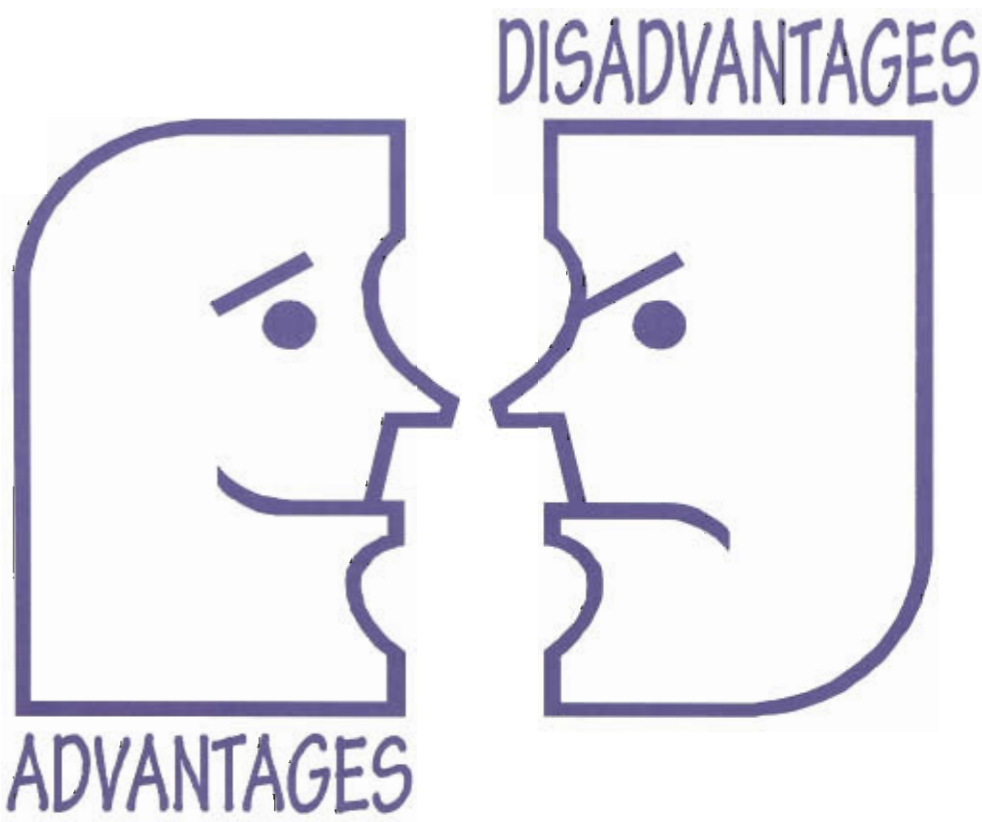
GREAT ENERGY DEBATE GAME



Grades 5-12

Student teams debate the advantages and disadvantages of the major energy sources.

GREAT ENERGY DEBATE GAME

ENERGY SOURCES

A QUICK LOOK

In this activity, students evaluate the advantages and disadvantages of the major energy sources.

GRADES 5-12

- Teacher Guide
- Correlations to the National Science Content Standards
- Student Guide
- Game Board
- Energy Source Sheets
- Evaluation Form

The NEED Project
PO Box 2518
Reston, VA 20195
1-800-875-5029

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NEED Project
Curriculum Review Committee

George Dewey, Educator, NSTA Liaison, Fairfax, VA
Linda Hutton, Educator, Kitty Hawk, NC
Carol Timms, Consultant, Educational Dividends, Champaign, IL
Keith Etheridge, Educator, East Lansing, MI
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Irene B. P. Morris, Educator, Washington, DC
Dee Stout, Educator, Bellefonte, PA
Jennifer York, Educator, Presque Isle, ME
Jeri Preddy, Energy Manager, Wake County Public Schools, Raleigh, NC
Dr. JoAnn Daly, Energy Specialist, Arlington Public Schools, Arlington, VA
Pam Schmidt, Educator, Aurora, CO
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Nancy Brock, Educator, Sugar Land, TX
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Peter Zack, MEEP Coordinator, Parsonsfield, ME
Stephanie Wyatt, Curriculum Specialist, Murray, KY
Mary Starks, Educator, Enid, OK
Jeffrey Salmon, George C. Marshall Institute, Washington, DC
Marilyn Nemzer, Geothermal Education Office, Tiburon, CA
Dan Barzel, Circuit City, Richmond, VA
John Weiner, Energy Information Administration, U.S. Department of Energy

Great Energy Debate Game
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Teacher Guide

GOAL

TO INVESTIGATE THE ENVIRONMENTAL AND ECONOMIC ADVANTAGES AND DISADVANTAGES OF THE MAJOR ENERGY SOURCES.

BACKGROUND

In the **Great Energy Debate Game**, student teams are assigned different energy sources to research. Working cooperatively, students develop arguments on the merits of their source over the others. *This activity was developed by Rich Ammentorp, Elementary School District 54, Schaumburg, Illinois.*

CONCEPTS

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

TIME

Two 45-minute class periods

MATERIALS

- One **Student Guide** per student.
- One **Energy Source Debate Sheet** per student for the team's source.
- A set of **Energy Source Debate Sheets** for each team.
- A set of **YES/NO** cards for the judges.
- A transparency of the **Game Board**.

PROCEDURE

Step One—Preparation

- Familiarize yourself with the **Student Guide** and the **Energy Source Debate Sheets**. Make copies of the student guide and the **Energy Source Debate Sheets** you will be using.
- Decide how many groups you will divide your class into and choose the corresponding number of energy sources, one for each group. For large groups of 30 or more, you can use all ten energy sources. For smaller groups, choose fewer energy sources. You need a minimum of three students in each group.
- If you are using fewer than ten energy sources, make transparencies of one or more of the energy source sheets that you are not using. Complete these source sheets as a class after you introduce the activity. This will ensure that all the students understand the concepts of relevant/irrelevant and advantages/disadvantages.

- Copy the game board on transparency paper. Make sets of **YES/NO** cards for the judges.
- Decide who will be in each of the groups. If your students are not used to working in groups, you may want to come up with some guidelines for group work.

Step Two—Introduce unit to the class

- Introduce the **Great Energy Debate Game** to the class, using the concepts as a guide.
- Select a panel of judges. The teacher can serve as the judge, or each group can select one person from their team to serve as a judge. Each judge is given a **YES/NO** card.

Step Three—Monitor group work

- Once students are in their groups, have them read the **Student Guide**. Answer any questions they have about the activity. Have the teams decide the advantages, disadvantages, and irrelevant facts of their source. This should take about five minutes.
- Divide the teams into small subgroups. Each subgroup is assigned two or three of the opposing energy sources. The subgroups are responsible for discovering the disadvantages of their assigned sources. The number of students participating in the game determines the amount of time given to this step. Usually, 15 minutes is sufficient. Subgroups should only be assigned the opposing sources that are being used to play the game.

Step Four—Play the game

Begin the game by giving the teams the following instructions from the Student Guide:

- The object of this game is to be the first team to reach the top of the game board. The game is played in rounds, with each team given the opportunity to move its token up by giving an advantage of its energy source. You may instead choose to move an opponent's token down by giving a disadvantage of the opponent's energy source.
- The teams will present their advantages or disadvantages to a panel of judges. If a team gives an advantage of its energy source and the judges agree, then the team moves up one space. An opposing team can object to the judges' decision. The opposing team must convince the judges that the statement is not an advantage. The team that stated the advantage will then have the opportunity to defend its position. The judges will vote again and one of two things will happen. The judges may vote in favor of the defending team. In this case, the defending team maintains its new position and the opposing team moves down one space. Or the judges may decide the statement is a disadvantage or irrelevant. In this case, the defending team moves back to its original position.
- If a team states a disadvantage to try to move an opposing team down, then the opposing team can defend itself without penalty.
- Ask the first team to give an advantage or disadvantage. Action continues until one team reaches the top line, until time is called, or until each team has had the opportunity to begin a round. Each team should have the opportunity to begin a round.
- **DAY ONE**—complete the first round.
- **DAY TWO**—finish the remaining rounds.

Step Five—Interpret the game results

At the conclusion of the game, point out that all sources of energy have advantages and disadvantages. Ask the class the following questions:

- Why isn't there an obvious winner in this game?
- Even if the game continued, would there be a winner? Why or why not?
- Why do we use energy sources that have negative impacts on the environment?
- What are some other factors that we need to consider in our choice of energy sources?

National Science Standards

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

3. Transfer of Energy

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

1. Structure of the Earth System

a. The solid earth is layered with a lithosphere; hot, convecting mantle; and dense, metallic core.

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.

f. Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Risk is part of living in a highly technological world. Reducing risk often results in new technology.

g. Technological designs have constraints. Some constraints are unavoidable, such as properties of materials, or effects of weather and friction. Other constraints limit choices in design, such as environmental protection, human safety, and aesthetics.

INTERMEDIATE–F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES

3. Natural Hazards

b. Human activities can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal.

SECONDARY (GRADES 9-12) CONTENT STANDARD–B: PHYSICAL SCIENCE

1. Structure of Atoms

f. Fission is the splitting of a large nucleus into smaller pieces.

SECONDARY–D: EARTH AND SPACE SCIENCE

1. Energy in the Earth System

d. Global climate is determined by energy transfer from the sun at and near the earth's surface.

SECONDARY–F: SCIENCE IN PERSONAL AND 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.

4. Environmental Quality

a. Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. Humans are changing many of these basic processes, and the changes may be detrimental to humans.

National Science Teachers Association

Student Guide

LET'S GO!

Step One—Complete Your Team's Energy Source Debate Sheet

- Take out the **Energy Source Debate Sheet** that corresponds to your assigned energy source. Your team needs to decide if each statement on the fact sheet is an advantage, a disadvantage, or an irrelevant fact.
- The ADVANTAGES of your energy source will help your team advance in the game. The DISADVANTAGES of your energy source may allow your opponents to move you backwards. IRRELEVANT facts are true, but they do not defend your energy source, nor are they disadvantages of your energy source. You will be given five minutes to fill out your team's **Energy Source Debate Sheet.**

Step Two—Complete Energy Source Debate Sheets for Opposing Teams

- Fill out the **Energy Source Debate Sheets** for the other sources. Once again, decide which statements are advantages, disadvantages, or irrelevant facts. In order to complete all the fact sheets, you may need to divide your team into smaller groups.

Step Three—Play the Game

- The object of this game is to be the first team to reach the top of the game board. Each team will be given the opportunity to move its token up by giving an advantage of its energy source, or the team may choose to move an opponent's token down by giving a disadvantage of an opponent's energy source.

Step Four—Debate

- The teams will present their advantages or disadvantages to a panel of judges. If a team gives an advantage of its energy source and the judges agree, then the team moves up one space. An opposing team can object to the judges' decision. The opposing team will try to convince the judges why the statement is not an advantage. The team that stated the advantage will then have the opportunity to defend its position. The judges will vote again and one of two things will happen. The judges may vote in favor of the defending team. In this case, the defending team remains one space up and the opposing team moves down one space. If the judges reverse their decision, the defending team must return to its original position.
- If a team states a disadvantage to try to move an opposing team down, the opposing team can defend itself without penalty.

SAMPLE

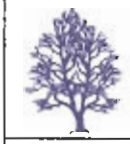
ENERGY*debate*

SOLAR

	RELEVANT		
	IRRELEVANT	ADVANTAGE	DISADVANTAGE
1. The sun's energy is renewable.		X	
2. The sun is 93 million miles from the earth.	X		
3. The sun does not always shine.			X

1. The fact that the sun's energy is renewable is considered an advantage.
2. The sun's distance from the earth is a fact that is neither an advantage nor a disadvantage—it is just information about the source.
3. One of the disadvantages of solar as an energy source is the fact that the sun doesn't always s hine.

GREAT ENERGY DEBATE GAME BOARD

									
BIOMASS	COAL	GEOTHERMAL	HYDROPOWER	NATURAL GAS	PETROLEUM	PROPANE	SOLAR	URANIUM	WIND

ADVANTAGES START HERE DISADVANTAGES

ENERGY*debate*
BIOMASS

		RELEVANT	
	IRRELEVANT	ADVANTAGE	DISADVANTAGE
1. Biomass is a source of energy from plant materials and animal waste.			
2. Biomass is a renewable energy source; we can grow more biomass.			
3. Biomass is difficult to store and transport because it decays.			
4. As biomass decays, more of its energy is available for use as fuel.			
5. Biomass was the first source of energy used by humans.			
6. Biomass is found throughout the nation.			
7. The amount of energy stored in biomass is less than the energy stored in the same amount of a fossil fuel.			
8. Biomass can be used as a fuel because it captures and stores radiant energy from the sun through the process of photosynthesis.			
9. One fifth of American homes use biomass (burn wood) for heat.			
10. Biomass is abundant and can be produced almost everywhere in the U.S.			
11. Burning biomass can produce harmful emissions.			
12. Burning biomass in a waste-to-energy plant produces electricity and heat.			
13. Biomass provides almost three percent of the nation's energy demand.			
14. Almost 80 percent of biomass energy comes from wood at the present time.			
15. Scientists are developing trees that can be grown to full size in less than half the time of the average tree.			
16. Biomass can be made into ethanol, a transportation fuel that is cleaner-burning than unleaded gasoline and produces less carbon monoxide when burned.			
17. Alcohol fuels made from biomass are more expensive than gasoline.			
18. Mixing ethanol with gasoline produces gasohol, a cleaner burning fuel used mostly in the Midwest.			
19. Burning biomass in a waste-to-energy plant reduces the amount of garbage sent to landfills.			
20. Waste-to-energy plants use scrubbers and other technologies to reduce emissions and odors.			

ENERGY*debate*
COAL

	IRRELEVANT	RELEVANT: ADVANTAGE	RELEVANT: DISADVANTAGE
1. Coal is the most abundant fuel in the United States. We have a 270 year supply at the current rate of consumption.			
2. Although coal is still being formed today, we use it thousands of times faster than it is formed.			
3. Coal is a fossil fuel created from the remains of plants that lived and died about 100 to 400 million years ago.			
4. The United States exports nine percent of the coal it produces to other countries.			
5. Coal has been burned to heat food, air and water for thousands of years.			
6. Today, about 90 percent of U.S. coal is used to make electricity.			
7. When coal is burned, carbon dioxide, sulfur dioxide, nitrous oxides and other residues are produced.			
8. To remove coal from deep in the earth, mine shafts are constructed to bring the coal to the surface.			
9. An easier way to mine coal near the earth's surface is to remove the layers of earth to uncover the coal. This is called surface mining.			
10. Large amounts of land are disturbed in the process of surface mining.			
11. Surface mines can be restored to grasslands or parks after the coal is removed.			
12. More than 60 percent of the nation's coal is produced from surface mines.			
13. The water that filters through abandoned mines can pick up chemicals that pollute the water if the mines are not closed correctly.			
14. Coal can be turned into other materials or products we can use.			
15. Coal can be turned into a gas. This process is too expensive to be used to replace oil and natural gas.			
16. Coal miners can develop lung diseases if they breathe too much coal dust at mine sites.			
17. New technologies allow coal to be mined and burned in cleaner ways.			
18. Clean coal technologies require less coal to produce the same amount of electricity.			
19. The methane gas that is found in much of the coal in the U.S. is a valuable resource.			
20. The coal industry spends billions of dollars to reduce harmful emissions from coal.			

ENERGY*debate*
GEOTHERMAL

		RELEVANT	
	IRRELEVANT	ADVANTAGE	DISADVANTAGE
1. Geothermal energy comes from heat within the earth.			
2. Features of geothermal energy are hot springs, volcanoes and geysers.			
3. Geothermal energy is generated in the earth's core, which is made of magma, or molten iron, surrounding a solid iron center.			
4. Red hot temperatures are continuously produced inside the earth by the slow decay of radioactive particles found in all rocks.			
5. Geothermal energy is renewable. The hot water used by power plants is continuously replenished by rain and the heat is continually produced.			
6. Wells can be built to pump superheated water to the surface.			
7. Geothermal energy is used to produce electricity and heat buildings.			
8. Geothermal energy was used by ancient people for heating and bathing. Hot springs are said to have therapeutic effects today.			
9. In 1904, the Italians first used the steam erupting from the earth to power a turbine generator.			
10. Dry steam reservoirs are the most efficient, but they are very rare.			
11. Geothermal energy is expected to grow in the future. It is estimated that geothermal energy could provide California with 15 percent of its electricity in the next ten years.			
12. High temperature geothermal resources that are able to produce electricity are not economically available in all parts of the nation.			
13. The most active geothermal resources are found along major tectonic plate boundaries, where magma comes up to the earth's surface.			
14. Geothermal energy produces about 15 billion kWh, or 0.4 percent of the electricity consumed in the nation.			
15. Geothermal energy does little damage to the environment, because the plants sit on or near the geothermal reservoir and do not burn any fuel.			
16. Geothermal steam and hot water contain traces of hydrogen sulfide and other gases and chemicals that are harmful at high concentrations.			
17. The gases and chemicals from geothermal power plants are usually injected back into the earth.			
18. The temperature of the earth a few feet underground remains constant year round – about 52 degrees Fahrenheit in moderate climates.			
19. Low temperature geothermal energy is available everywhere in the U.S.			
20. Geothermal heat pumps use the earth's constant temperature as an energy source to heat buildings in winter and cool them in summer.			

ENERGY*debate*
HYDROPOWER

		RELEVANT	
	IRRELEVANT	ADVANTAGE	DISADVANTAGE
1. Moving water has been used as a source of energy for thousands of years.			
2. Hydropower is considered the cleanest and cheapest energy source in widespread use today.			
3. Water is considered a renewable resource as long as rain continues to fall.			
4. Moving water can turn a turbine to generate electricity.			
5. Hydropower was first used to turn water wheels to grind grain.			
6. Hydroelectric power is considered reliable because dams can be built to store water. Controlling the flow of the stored water allows a power plant to operate in all weather conditions.			
7. About ten percent of total U.S. electricity is generated by hydroelectric plants, depending on the amount of rainfall.			
8. Hydropower provides the U.S. with about four percent of our total energy consumption.			
9. In the last 50 years, hydropower production in the United States has increased by 900 percent.			
10. The nation's largest producer of hydroelectric power is the federal government, which operates many large dams and power plants.			
11. There are about 2,000 hydroelectric power dams in the U.S. today.			
12. There are about 63,000 dams that *do not* have generating plants on them.			
13. If we build generating stations at the most suitable dams and build new dams on suitable rivers, we can double our hydroelectric capacity.			
14. When a hydro dam is built, thousands of acres of nearby land are flooded to create a reservoir.			
15. Flooding alters or destroys many plant and animal habitats in the area.			
16. Dams can disturb the migration and spawning of fish populations in the river.			
17. Dams can alter the natural flow of the river and change the amount of water that reaches communities downstream.			
18. The reservoirs are often developed for recreational purposes, such as boating and fishing.			
19. The use of hydropower in the United States is not expected to increase significantly in the future.			
20. Some countries use hydropower as their main source to produce electricity. South America produces 75 percent of its electricity from hydropower.			

ENERGY *debate*
NATURAL GAS

		RELEVANT	
	IRRELEVANT	ADVANTAGE	DISADVANTAGE
1. Natural gas is the result of the decomposition of tiny sea plants and animals that died millions of years ago.			
2. The chemical name for natural gas is methane.			
3. Natural gas is odorless; an odorant is added for safety.			
4. Natural gas can be processed and other products recovered from it.			
5. Natural gas is the cleanest burning fossil fuel.			
6. Usually, natural gas and petroleum are found together in underground deposits.			
7. In the past, oil drillers were not interested in the natural gas that was found at the site of an oil well. Often the gas was burned off at the site and wasted.			
8. The invention of high pressure pipelines has made it possible to ship gas all over the U.S.			
9. Leaks can occur in natural gas pipelines. Fires and explosions can result from these leaks if proper safety precautions are not taken.			
10. About 27 percent of the natural gas we use comes from offshore wells.			
11. Natural gas is considered a nonrenewable resource.			
12. Today, we have a large supply of natural gas and prices are low.			
13. Industry is the number one consumer of natural gas.			
14. Natural gas can be used as a clean burning transportation fuel.			
15. It is estimated that natural gas supplies will last from 30 to 50 years at today's prices and consumption rate.			
16. There are large reserves of natural gas offshore, on the outer continental shelf and in the Gulf of Mexico.			
17. It is estimated that natural gas supplies could last 200 years at higher prices.			
18. More than half of the homes in the U.S. use natural gas for heat.			
19. Natural gas is used to produce peak load electricity because gas furnaces can be brought on line and shut down quickly and efficiently.			
20. Methane is a greenhouse gas. Scientists think that changing the levels of greenhouse gases in the atmosphere can affect the global climate.			

ENERGY*debate*
PETROLEUM

	IRRELEVANT	RELEVANT: ADVANTAGE	RELEVANT: DISADVANTAGE
1. The word petroleum is derived from the word *petro* meaning rock, and the word *oleum* meaning oil.			
2. Petroleum deposits were formed over millions of years from the remains of marine plants and animals.			
3. Petroleum is a nonrenewable energy source.			
4. Oil deposits are found in many areas, especially along the ocean coasts.			
5. The U.S. imports about two-thirds of the petroleum it uses from other countries.			
6. The U.S. has large petroleum deposits in Alaska and offshore.			
7. Many offshore resources are not now being developed because of Federal government regulations against drilling in these areas.			
8. About 20 percent of the oil the U.S. produces comes from offshore wells, mostly in the Gulf of Mexico.			
9. Petroleum straight from the well – crude oil – is not usable. It must be refined into gasoline and other products.			
10. Refining – or cooking – petroleum at different temperatures makes the hydrogen and carbon atoms combine in many different ways.			
11. We get many fuels from refining petroleum – gasoline, kerosene, jet fuel – that can be burned to produce heat, light, electricity or motion.			
12. Many chemical products from petroleum can be used to make plastics, medicines, fertilizers and other products.			
13. When petroleum products are burned, potentially harmful emissions are produced.			
14. To protect the environment, oil drilling and production are regulated by federal and state governments.			
15. Oil is transported by pipeline, truck, or tanker to where it is refined and/or used.			
16. If oil is spilled into the water or onto the land, it can cause damage to the environment.			
17. Petroleum products are efficient, economical transportation fuels. Most transportation in the United States is fueled by petroleum products.			
18. Today, gasoline powered vehicles produce fewer emissions than they did in the 1970s, because of advances in engine design and fuel formulation.			
19. Petroleum is the United States' leading source of energy, supplying almost 38 percent of the energy used in the U.S.			
20. At current rates of consumption, there is a 75-125 year worldwide reserve of petroleum.			

ENERGY*debate*
PROPANE

		RELEVANT	
	IRRELEVANT	ADVANTAGE	DISADVANTAGE
1. Forty-six percent of propane comes from processing natural gas and 45 percent comes from refining petroleum. The rest is imported.			
2. Under normal conditions propane is a gas, but under moderate pressure or low temperature, propane becomes a liquid.			
3. Propane is stored as a liquid in pressurized tanks because it takes up 1/270 of the space and is very portable.			
4. Propane becomes a gas when it is released from the pressure in the tank. As a gas, it is used to fuel appliances.			
5. Like natural gas, propane is colorless and odorless. An odorant called mercaptan is added as a safety measure.			
6. Propane is a nonrenewable energy source. It is the cleanest burning fossil fuel.			
7. Propane is moved through pipelines to distribution terminals.			
8. Propane is taken from distribution terminals to bulk plants by trains, trucks, barges and supertankers. Here, local dealers fill their small tank trucks and distribute it to their clients.			
9. Propane is mostly used in rural areas that do not have natural gas service. Homes and businesses use it for heating, hot water, cooking and clothes drying.			
10. Half of all America's farms rely on propane to dry crops, power tractors, heat greenhouses and warm chicken houses.			
11. Propane is also used by taxicab companies, government agencies and school districts to fuel their vehicles.			
12. Propane is clean burning and leaves car engines free of deposits. Engines fueled by propane also emit fewer pollutants.			
13. There is a slight drop in miles per gallon when propane is used to fuel vehicles.			
14. Propane isn't widely used as a transportation fuel because it is not as conveniently available.			
15. An automobile engine must be adjusted to use propane, which can be a costly process.			
16. Propane gas is heavier than air and can explode if a leak occurs.			
17. Propane is more expensive than natural gas, heating oil or kerosene.			
18. About nine percent of propane supplies are imported.			
19. Propane supplies and price are tied to oil and natural gas supplies and costs.			

ENERGY*debate*
SOLAR

	IRRELEVANT	RELEVANT: ADVANTAGE	RELEVANT: DISADVANTAGE
1. The sun radiates more energy in one second than people have used since time began.			
2. The sun is a big gas ball made up mostly of hydrogen and helium gas. It produces radiant energy in a process called nuclear fusion.			
3. Harnessing radiant energy from the sun is difficult because the energy that reaches the earth is very spread out.			
4. Only a small part of the solar energy radiated ever reaches the earth.			
5. It takes the sun's energy just over eight minutes to travel 93 million miles to the earth.			
6. Solar energy is a renewable energy source.			
7. Solar energy is used to heat buildings and water and to generate a small amount of electricity.			
8. The amount of solar energy reaching an area depends on the time of day, season of the year, cloud coverage and geographic location.			
9. Most of the solar energy we use every day cannot be measured.			
10. A solar collector can be used to capture sunlight and change it into usable heat energy.			
11. An active solar home in the Northern Hemisphere uses special collectors facing south to absorb sunlight and change it into heat. Air or water flows through the collector and is warmed by the heat.			
12. Passive solar homes do not need special equipment.			
13. Photovoltaic cells can convert radiant energy from the sun directly into electricity.			
14. Photovoltaic comes from the words *photo* meaning light and *volt*, a measurement of electricity.			
15. Photovoltaic – or PV – systems are expensive and are used mainly to generate electricity in remote areas.			
16. Small PV cells are used to power roadside telephones, calculators and toys.			
17. PV cells convert about 10 percent of the energy they receive into electricity.			
18. Electricity from PV cells costs about $0.20/kWh. The average cost of electricity in the U.S. today is a little more than $0.08/kWh.			
19. Large solar systems can take up a large amount of land.			
20. Solar energy does not pollute the air.			

U235 ENERGY*debate* URANIUM

		RELEVANT	
	IRRELEVANT	ADVANTAGE	DISADVANTAGE
1. In 1939, scientists discovered that certain atoms could be split. The splitting of these atoms releases a great deal of energy.			
2. One hundred and seven nuclear power plants using uranium for fuel are operating in the U.S.			
3. Nuclear plants provide almost 20 percent of the electricity generated in the U.S.			
4. A nuclear reactor can supply a large amount of energy using a small amount of fuel.			
5. The construction of nuclear power plants is expensive compared to fossil fuel plants.			
6. Nuclear reactors do not burn uranium to generate electrical power, they split the uranium atoms, so their emissions are minimal.			
7. Uranium is easy to transport.			
8. Uranium is very inexpensive.			
9. The U.S. has abundant supplies of uranium. Today, however, we import most of the uranium used in power plants because it is cheaper to do so.			
10. Nuclear power plants produce electricity by heating water into steam, in the same way as fossil fuel plants.			
11. Workers at nuclear power plants receive less radiation from the plant than they do from other sources like medical x-rays and color TV sets.			
12. Some parts of reactors become radioactive after they have been used.			
13. Radioactive waste from nuclear power plants is stored underground in huge concrete tanks or in spent fuel pools at the plant sites.			
14. A permanent nuclear waste repository is planned for Yucca Mountain, Nevada.			
15. Uranium is a nonrenewable energy source.			
16. A nuclear power plant produces a lot of waste heat. If this heat is put into a moving water system, the water temperature can increase.			
17. The main health risk from a nuclear power plant is potential radiation exposure.			
18. Nuclear power plants in the U.S. are highly regulated and very safe.			
19. An accident at a nuclear power plant could cause widespread damage if people or the environment were exposed to high-level radioactivity.			

ENERGY*debate*
WIND

	IRRELEVANT	RELEVANT: ADVANTAGE	RELEVANT: DISADVANTAGE
1. Wind is air in motion caused by the uneven heating of the earth's surface by the sun.			
2. Wind machines do not cause air or water pollution because no fuel is burned to generate electricity.			
3. Wind is a renewable source of energy.			
4. Wind machines operate on average about 25 percent of the time.			
5. For hundreds of years, windmills were used to grind wheat and corn, to pump water and to cut wood at sawmills.			
6. Wind machines have turning blades to collect the wind's kinetic energy. The blades are connected to drive shafts that turn electric generators to make electricity.			
7. Wind plants can convert about 30 percent of the wind's kinetic energy into electricity.			
8. Windmills usually have batteries to store the electricity produced until it is needed.			
9. The location of a wind farm is carefully planned, with good sites including the tops of smooth, rounded hills, open plains or shorelines, and mountain gaps.			
10. Wind machines provided the U.S. with 4.0 billion kilowatt-hours of electricity in 1998, less than 0.1 percent of our total electricity.			
11. Wind power plants, or wind farms, are clusters of hundreds of wind machines spread over a large area. The land around the wind machines can be used for grazing or growing crops.			
12. Wind farms are often owned and operated by business people who sell the electricity to utility companies.			
13. Wind machines can be used in remote areas that do not have easy access to other electricity.			
14. Thirty-seven states have the capacity to produce electricity from wind.			
15. The U.S. produces about 25 percent of the wind energy in the world.			
16. Wind machines produce noise pollution from the sound of hundreds of spinning blades.			
17. Windmills can injure birds that fly into the spinning blades.			
18. It cost about $.05/kWh to produce electricity from wind farms in 1998.			
19. New wind machines can generate electricity at about the same cost as coal plants.			

Great Energy Debate Game
Evaluation Form

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

1.	Did you conduct the entire activity?	Yes	No
2.	Were the teacher instructions clear and easy to follow?	Yes	No
3.	Were the student instructions clear and easy to follow?	Yes	No
4.	Did the unit meet your academic objectives?	Yes	No
5.	Was the activity age appropriate?	Yes	No
6.	Was the allotted time sufficient to conduct the activity?	Yes	No
7.	Was the preparation time acceptable for the activity?	Yes	No
8.	Were the students interested and motivated?	Yes	No
9.	Was the reading level age appropriate?	Yes	No
10.	Would you use the activity again?	Yes	No

How would you rate the activity overall?

How would your students rate the activity overall?

What would make the activity more useful to you?

Additions/Suggestions/Comments:

Please fax or mail to:

The NEED Project
PO Box 2518
Reston, VA 20195
FAX: (703) 471-6306

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