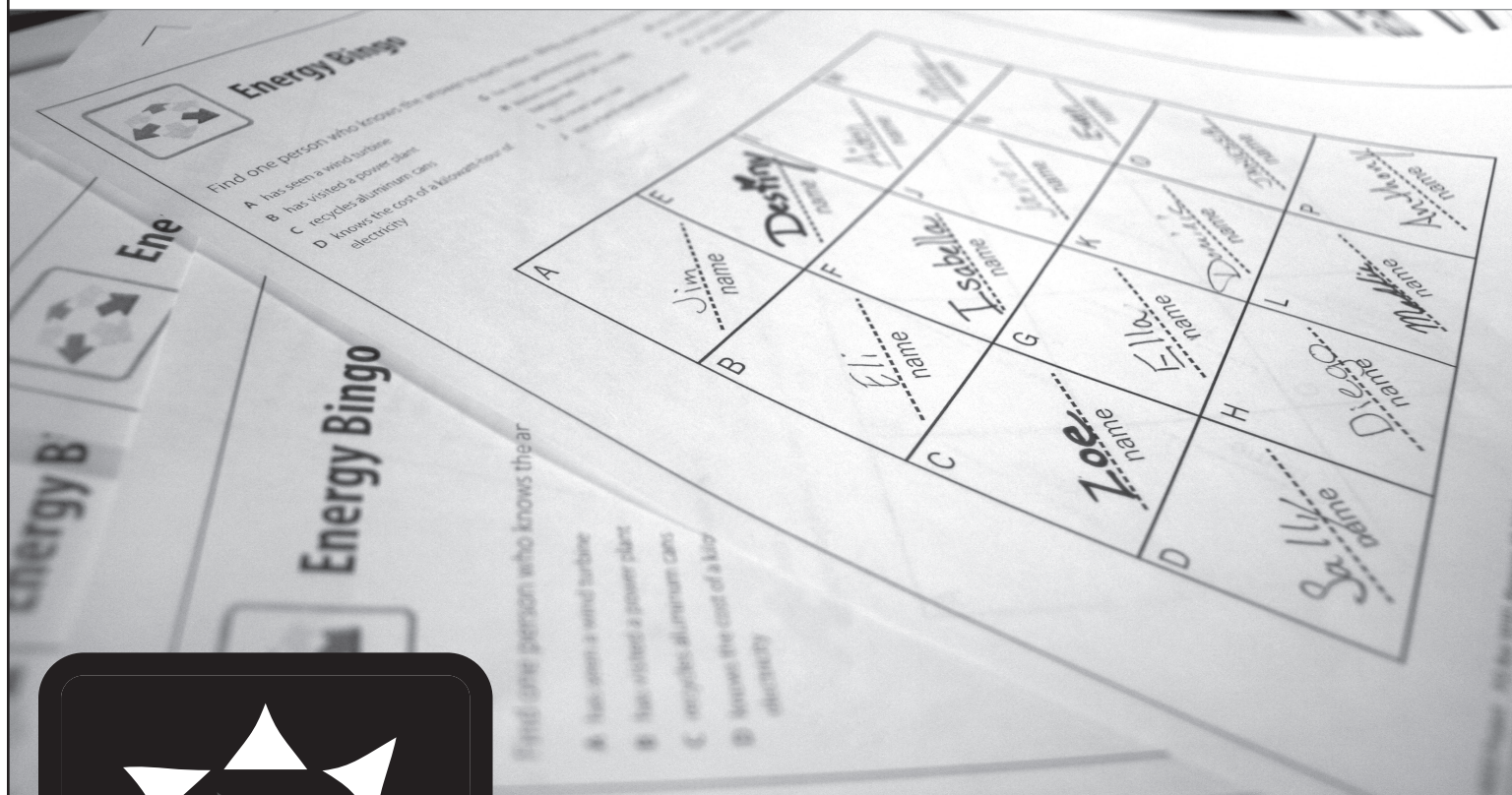


Energy Games and Icebreakers

This guide offers entertaining activities to introduce energy, efficiency, and conservation to students, as well as reinforce the information that has already been presented.



Grade Level:

K-12 All Levels

Subject Areas:



Science



Social Studies



Language Arts



Creative Arts



Math



Public Speaking



National Energy Education Development Project



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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.

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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 yearly. 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.



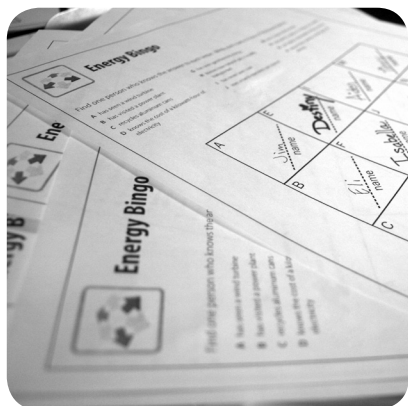
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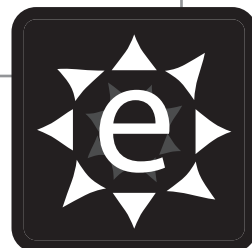
Printed on Recycled Paper



Energy Games and Icebreakers

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Energy Name Game

Energy Name Game is a quick, easy way to introduce people to each other in a group. It requires no preparation and very little time.

Grades

▪All

Preparation

▪Low

Time

▪10 minutes for a group of 12

Get Ready

If you have 20 or more students in the group, separate into groups of 10 to 12.

Get Set

Seat the members of the group in a circle facing inward.

Go

- The group leader should instruct the students that they will be choosing new last names. Their new last names should begin with the same letter as their first names and be energy-related—a source of energy, an energy-consuming or -producing device, or energy term. For example: Bob Biomass, Martha Microwave, Gina Generator, etc. Tell the members of the group that no relatives will be allowed in the game—there can't be both Bob and Barbara Biomass.
- Before you get started, ask if anyone in the group is having a problem thinking of an energy last name. For those who are, ask them to tell the group their first names. Then have the group brainstorm several last names for them.
- The group leader begins by saying, "Hi, my name is..." and then his/her first name, followed by his/her new energy last name. The person to the left of the leader says the first person's first and last name, and then his/her own new energy name. The third person continues by giving the first two names, then his/her own energy name. This continues until the final person, sitting to the right of the group leader, gives everyone's name and then his/her own name.
- If, during the game, someone in the group has a problem remembering a person's first or last name, have members of the group give that person a hint. For example: If the person's name is Tim Toaster, someone in the group could say, "You put your bread in it in the morning." If the person's name is Pedro Petroleum, a group member could say, "You make gasoline from it."



Electric Connections

Get Ready

Make an appropriate number of copies of the *Electric Connections Game Instructions* and the *U.S. Electric Power Generation Sources* worksheets found on pages 6 and 7.

Get Set

Divide the class into groups of three to five students.

Go

- Give each student a copy of the game instructions. Review the instructions with the students.
- Have the students individually rank the ten sources of energy in order of their contribution to U.S. electricity production. Give them two minutes to complete this task.
- As a group, give the students six minutes to rank the ten sources of energy. When they are finished, give each student a copy of the *U.S. Electric Power Generation Sources* sheet. Have students transfer their individual and group rankings to the appropriate columns.
- Provide the students with the rankings for column one, or have them research the rankings independently using NEED's *Energy Infobooks*, or an online resource.

(Alphabetical Order)

Biomass-6

Coal-1

Geothermal-8

Hydropower-4

Natural Gas-2

Petroleum-7

Propane-10

Solar-9

Uranium-3

Wind-5

(Numerical Order)

Coal-1

Natural Gas-2

Uranium-3

Hydropower-4

Wind-5

Biomass-6

Petroleum-7

Geothermal-8

Solar-9

Propane-10

Electric Connections teaches students how different energy sources contribute to the generation of electricity. This activity demonstrates the advantages of working together in a group and reinforces the ideas of group sharing and cooperative learning.

Grades

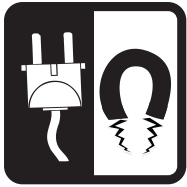
▪ 5-12

Preparation

▪ Low

Time

▪ 40 minutes



Electric Connections

GAME INSTRUCTIONS

Forty percent of the nation's energy is used to make electricity today. Experts predict that this figure will continue to increase. The U.S. is becoming more dependent on electricity to meet its energy needs as we depend on more technology. To meet the growing demand, many energy sources are used to generate electricity. Some energy sources produce a substantial amount of the electricity we consume, while others produce less than one percent.

Individual Instructions

Your task is to rank the ten sources of energy in order of their contribution to U.S. electricity production. Place a number **one** by the source that provides the **largest amount** of electricity, a number two by the source that provides the second largest, down to a number ten by the one that provides the least amount of electricity. Use critical reasoning skills to determine the order.

Group Instructions

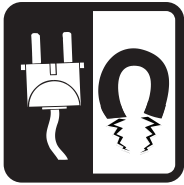
Starting at the top of the list, ask members to contribute any knowledge they have about each energy source. Brainstorm by asking group members questions such as:

- Is this source limited to a certain area of the country?
- Are there any problems or limitations associated with this source?
- Have you ever seen a power plant that uses this particular source of energy?

One person in the group should take notes. Once the group has gone through the list, it should divide the ten energy sources into three levels of importance: the top three most significant energy sources, the middle four moderately significant energy sources, and the bottom three least significant energy sources. The group should then rank the ten sources of energy in order of their contribution to U.S. electricity production.

SOURCES USED TO GENERATE ELECTRICITY

SOURCE	YOUR RANK	GROUP RANK
BIOMASS		
COAL		
GEOTHERMAL		
HYDROPOWER		
NATURAL GAS		
PETROLEUM		
PROPANE		
SOLAR		
URANIUM		
WIND		



Electric Connections

U.S. ELECTRIC POWER GENERATION SOURCES

SOURCES USED TO GENERATE ELECTRICITY

SOURCE	STATISTICS	RANK	YOUR RANK	ERROR POINTS	GROUP RANK	ERROR POINTS
BIOMASS	In 2011, biomass produced 56.7 billion kilowatt-hours of electricity, 1.4 percent of the nation's total. Biomass electricity is usually the result of burning wood waste, landfill gas, and solid waste.					
COAL	Ninety-two percent of the nation's coal is consumed by electric utility companies to produce electricity. In 2011, coal produced 1,734.3 billion kilowatt-hours of electricity, which was 42.2 percent of the nation's electricity.					
GEO THERMAL	In 2011, geothermal power plants produced 16.7 billion kilowatt-hours of electricity, chiefly from facilities in the western U.S. Geothermal energy produced 0.4 percent of the nation's electricity.					
HYDROPOWER	7.8 percent of U.S. electricity is generated by 2,210 hydro plants nationwide. Hydro plants produced 319.2 billion kilowatt-hours of electricity in 2011. It is the leading renewable energy source used to provide electricity.					
NATURAL GAS	Natural gas produced 1,016.6 billion kilowatt-hours of electricity in 2011, generating 24.8 percent of the nation's electricity. Natural gas is used by gas turbines to provide electricity during peak hours of demand.					
PETROLEUM	Petroleum provided 0.7 percent of U.S. electricity, generating 28.2 billion kilowatt-hours of electric power in 2011.					
PROPANE	There are no statistics available for propane's contribution to electrical production. Very little propane, if any, is used to produce electricity.					
SOLAR	Solar energy provided less than one-tenth of one percent of U.S. electricity in 2011, amounting to 1.8 billion kilowatt-hours of electricity. Electricity was generated by solar thermal systems or photovoltaic arrays.					
URANIUM	104 nuclear reactors provided the nation with 19.2 percent of its electrical energy needs in 2011. Nuclear energy produced 790.2 billion kilowatt-hours of electricity.					
WIND	Wind energy produced 119.7 billion kilowatt-hours of electricity in 2011, providing 2.9 percent of the nation's electricity. Most of the wind-generated electricity is produced in Texas, Iowa, and California.					

ERROR POINTS TOTALS _____

Error points are the absolute difference between your ranks and EIA's (disregard plus or minus signs).

Data: Energy Information Administration, Annual Energy Report

SCORING:

0-12 Excellent

13-18 Good

19-24 Average

25-30 Fair

31-36 Poor

37-42 Very Poor



Energy Source Relay Race

Energy Source Relay Race tests students' ability to recognize important pictorial representations of energy sources or energy producing, consuming, or conserving devices and materials. It is based on the game show "Win, Lose, or Draw."

Grades

▪3-12

Preparation

▪Low

Time

▪20 minutes

Get Ready

- Gather together six pieces of paper and two pencils for each group of five students.
- Determine five energy terms to use during the game. For elementary level students you might choose light bulb, solar, biomass, television, and petroleum. For middle school students, coal, insulation, natural gas, wind, and thermostat would be good choices. High school level terms might include propane, nuclear fission, geothermal, hydropower, and photosynthesis.

Get Set

- Assign one student to be the game leader.
- Divide the remaining students into groups of about five. Arrange the groups of students in circles on the floor or around a table.
- On five of the six pieces of paper, instruct the students to write the name of their group in small print on the bottom and number the pages one through five. They should fold and tear the sixth sheet into eight equal pieces.
- Inform the students that there must be no talking at all during the game, and they must walk to the game leader and back to their groups. If they run, they will be asked to return and walk. If they talk, they will automatically be disqualified.

Go

- One student from each group is chosen as the opening artist. He/she will approach the game leader and receive the first energy term as soon as the starting signal is given. All artists are given the first term at the same time. The artists return to their groups and draw representations of the term. Tell the students that writing words or letters, pointing, or using numbers are forbidden.
- When someone in the group thinks he/she knows the answer, he/she should take the second pencil and write his/her guess on one of the eight small pieces of paper. Remind the students that they are allowed eight guesses for five terms, so they can only afford three mistakes. The artist nods to inform whether or not the guesser is correct. If not, guessing continues.
- If the person is correct, he/she takes the drawing and slip of paper with the correct term and gives them to the game leader. The game leader whispers or shows the next term to the student. The student then returns to the group and the game continues with that person as the new artist. The person who correctly guesses the term is always the one who draws next. The game leader should move around the room to avoid being closer to one group than another.
- The first group to correctly guess all five terms wins. Follow up with a discussion of the energy terms and display various drawings from the individual groups.



Energy Pantomime

Get Ready

Duplicate the sheet of pantomimes (ten per sheet) according to the number of people you want to have in each group. A sheet of pantomimes is included on page 10. Feel free to use this sheet, or to make up your own. You will need enough slips to hand out to everyone. If you have a small group, you may want to use less than ten pantomimes.

Get Set

- Cut the pantomime sheets into separate pantomime slips.
- If you want your groups to contain a random mixture of people, hand out the slips randomly. If you want to divide the groups by age level, or by students' strengths and personalities, fold the pantomime slips in half, write a student's name on each slip, and distribute the slips.

Go

- Explain to the students that they are going to be broken into smaller groups using this activity.
- Explain that each of them will be handed a slip of paper with an energy source or user on it. They must not say the name of their source or energy-producing or energy-consuming device aloud—just read it and put it in their pockets.
- Hand out (or have assistants hand out) the pantomimes. Once all the slips have been handed out, tell the students to begin to pantomime their energy source or user. They may make sound effects and hand motions, but no talking, whispering, or reading lips.
- The students should walk around the room searching for others pantomiming the same source or object. Once all the members of the groups have found each other, the students will be neatly divided into groups that can be used for other activities.

***Energy Pantomime* is a quick and easy way to break a group into several smaller groups. It gets the participants moving, looking, thinking, and acting. *Energy Pantomime* will produce a random mix of groups or a mix of groups by age depending on how the slips are handed out. It is short, easy to prepare, and fun for your audience. It requires only one adult to run, although many can be involved. This activity is suited for most ages.**

Grades

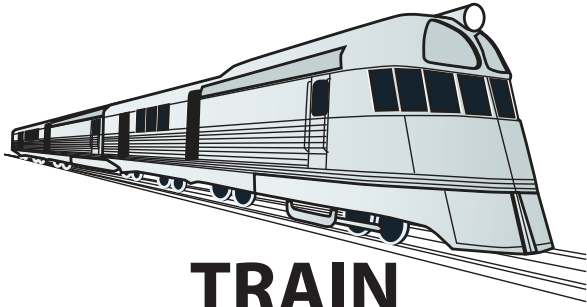
- 2-12

Preparation

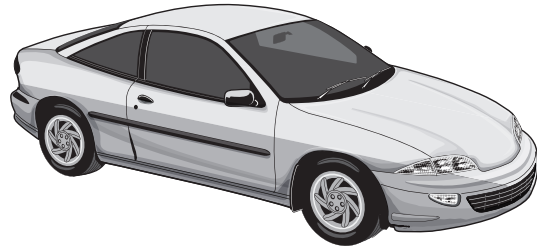
- Low

Time

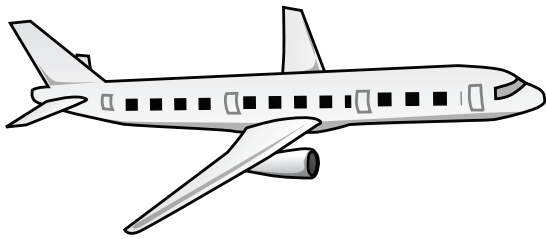
- 5 minutes



TRAIN



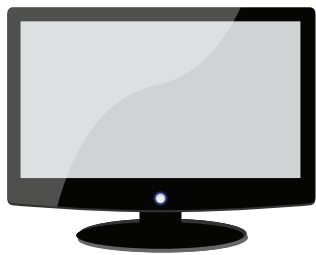
CAR



AIRPLANE



WIND TURBINE



TELEVISION



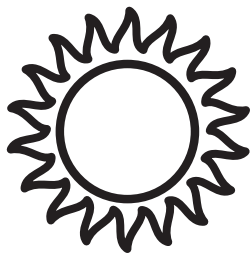
LIGHT BULB



TREE



TELEPHONE



SUN



BICYCLE



Energy Chants

Get Ready

For each student playing the game, make one copy of the *Energy Chants* sheet found on page 13. Then, depending on the number of small groups you need and the number of students in each group, make the appropriate number of copies of the energy symbols, found on page 14. Cut out the energy symbols and have masking tape ready.

Get Set

Hand out one *Energy Chants* sheet to each student and tape an energy source symbol to his/her back. Inform the students that they are not to look at their backs or ask friends what energy sources they are.

Go

- Introduce the energy sources to the students. Go through each source and reinforce one or two of the facts found on the chant sheet. Tell whether the source is renewable or nonrenewable, and add some of your own information about each source. Usually, three or four facts are enough—the students can read the others on their own.

OPTIONAL: You may wish to add visual aids to your presentation. Make posters or project visuals that relate to each energy source.

- After you introduce a source, demonstrate its chant. The words are on the top of the chant sheet. Hand motions are printed on page 12 to go with each chant.
- Tell the students they have an energy source symbol taped onto their backs. Their job is to discover what source it is. Using their energy chant sheets, they should go around to other students asking yes or no questions, asking each person no more than one question. Naturally, the first question should be, "Am I (non)renewable?"
- Once the student has discovered his or her source, he or she should start to do the energy chant for that source, to find others who are the same source.
- After about two minutes of questions and searching, have everyone stop. To help the students who have not yet found their group, give three clues about one group's source and tell that group to do their chant once.
- Go through this process with each group, and the large group will be successfully divided into smaller groups by energy source.

***Energy Chants* introduces the ten leading energy sources in an entertaining manner. This activity also divides a large group into ten or fewer small groups. This activity is most effective in elementary.**

Grades

- 3-12

Preparation

- Low

Time

- 30 minutes

Technology Integration

Check out the video of our NEED *Energy Chants* by visiting the multimedia section of our web site, www.NEED.org.



Hand Motions for the Energy Chants

PETROLEUM: Blup, blup, petroleum!

Begin with your hands below your waist in a cup shape facing down. As you say “Blup” move your hands upward like oil coming from the ground. When you reach “petroleum!” throw your hands up in the air like an old-fashioned oil well that just struck oil.

COAL: Working in a coal mine (grunt)—hard hat!

While chanting, “Working in a coal mine,” pretend that you are shoveling coal. At “grunt—hard hat!” throw the coal over your shoulder.

NATURAL GAS: Natural gas, gas (snap, snap)...a real gas!

After chanting, “Natural gas, gas,” snap once with your right hand, once with your left, and follow with “a real gas!”

URANIUM: Uranium, uranium, split goes the atom!

Begin by clenching your hands in fists and begin hitting your fists together. As you say “split” take your hands and pull them apart with your fingers spread like atoms splitting.

PROPANE: Compress, compress, compress...pro-pane!

During the “Compress” sequence, start with your hands apart facing each other and move them closer together. When you clasp your hands together, say “pro-pane” and begin a wave motion (like a liquid).

HYDROPOWER: Falling water, hydropower, hydropower!

With your finger tips touching, hold your hands under your chin and glide your hands down like a waterfall during “Falling water.” For “hydropower, hydropower” spin your hands like a turbine.

BIOMASS: Garbage, wood, landfill gas...it's all biomass!

Hold your nose while chanting, “Garbage, wood, landfill gas.” During “it's all biomass!” shake your hands near your shoulders.

GEOHERMAL: Shhhhh...ge-o-ther-mal!

Place your hands together flat (without interlocking fingers) below your waist. As you say “Shhhhh” slowly move your hands upward and on “geothermal,” separate your hands to act like a geyser.

WIND: Wind is moving air; energy is there!

Throughout the chant, spin one arm like a wind turbine.

SOLAR: Sun shine bright, give us light!

Make a circle with your arms over your head as you say “Sun shine bright,” then throw your hands out like rays of the sun as you say “give us light!”



Energy Chants

Petroleum: Blup, blup, petroleum!

Coal: Working in a coal mine (grunt)—hard hat!

Natural Gas: Natural gas, gas, (snap, snap) . . . a real gas!

Uranium: Uranium, uranium, split goes the atom!

Propane: Compress, compress, compress . . . pro-pane!

Hydropower: Falling water, hydropower, hydropower!

Biomass: Garbage, wood, landfill gas...it's all biomass!

Geothermal: Shhhhhhhh, ge-o-ther-mal!

Wind: Wind is moving air; energy is there!

Solar: Sun shine bright, give us light!

Nonrenewable Energy Sources

PETROLEUM

1. My major use is for transportation.
2. Forty-five percent of me is imported from other countries.
3. Most of me is refined into gasoline.
4. I'm number one in the U.S., providing 34.7 percent of America's total energy consumption.
5. Texas, Alaska, and California are the leading states that produce me.
6. Saudi Arabia is the world's top producer of me.

COAL

1. I generate 42.2 percent of the nation's electricity.
2. I'm transported mostly by trains.
3. Efforts are made to remove sulfur from me.
4. I'm America's most abundant fossil fuel.
5. Almost ten percent of me that is produced in the U.S. is exported to other countries.
6. Wyoming, West Virginia, and Kentucky are states that produce me.

NATURAL GAS

1. I heat more than half of the nation's homes.
2. I'm colorless and odorless.
3. My chemical name is methane.
4. Industry is my largest consumer in the U.S.
5. I'm a cleaner burning fossil fuel.
6. I'm transported mostly by pipeline.

URANIUM

1. I'm the nation's third leading source for generating electricity.
2. I'm presently being used in over 100 reactors in the U.S.
3. I was first used in 1957 to make electricity.
4. I supply 19.2 percent of U.S. electricity.
5. The U.S. leads the world in production of electricity from me.
6. My power plants store my spent fuel waste products on site.

PROPANE

1. I'm colorless and odorless.
2. My supply comes from processing natural gas and petroleum.
3. I'm often used in rural areas and on farms.
4. I supply 1.6 percent of the nation's energy.
5. I'm a portable source of heat energy.
6. I'm normally stored under pressure.

Renewable Energy Sources

HYDROPOWER

1. I supply 5-10 percent of U.S. electricity, depending on the amount of rainfall.
2. I'm limited to certain geographic areas of the U.S.
3. I provide 16.8 percent of the world's electricity.
4. I'm being used in over 2,200 locations in the U.S.
5. My facilities can disrupt wildlife and fish populations.
6. I require the Earth's gravity to work.

BIOMASS

1. Methane gas can be made from me.
2. Photosynthesis stores radiant energy in me.
3. I get my energy from wood, garbage, and agricultural waste.
4. I can be used to generate electricity.
5. Ethanol can be made from me and used as a transportation fuel.
6. Burning me can produce air pollution.

GEOHERMAL

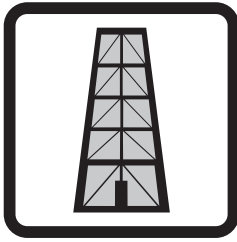
1. I produce less than one percent of U.S. energy.
2. I'm used mainly in western states.
3. I can be used for home heating.
4. My energy comes from the Earth's core.
5. My major use is the production of electricity.
6. I get my energy as a result of radioactive decay.

WIND

1. Most of my electricity is from Texas, Iowa, and California.
2. I convert my motion energy directly into electrical energy with no cost for the fuel.
3. I produce no air pollution.
4. My turbines operate both on land and offshore.
5. I produce 2.9 percent of U.S. electricity.
6. I'm caused by uneven heating of the Earth's surface.

SOLAR

1. I'm not available at all hours of the day.
2. I can be converted directly into electricity using photovoltaic cells.
3. I'm great for water and home heating.
4. I work better in some parts of the country.
5. My energy is stored in fossil fuels.
6. I'm free to use, but you have to purchase and maintain my equipment.



PETROLEUM



HYDROPOWER



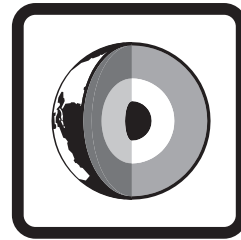
COAL



BIOMASS



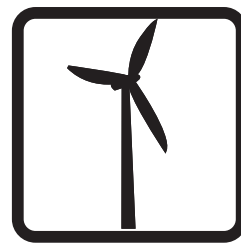
NATURAL GAS



GEO THERMAL



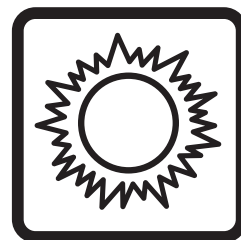
URANIUM



WIND



PROPANE



SOLAR



Primary Energy Chants

Get Ready

For each student playing the game, make one two-sided copy of the energy chants sheets found on pages 17 and 18. Make enough copies of the energy symbols (found on page 14) so that you will have one renewable energy symbol and one nonrenewable energy symbol for each student. Cut out energy symbols and divide into renewable and nonrenewable sources. You will need a roll of masking tape, ten large sheets of drawing paper, and crayons or markers.

Get Set

Hand out one energy chant sheet to each student and tape a renewable symbol to his/her back. Tell students not to look at their symbols or ask their friends for help.

Go

- Ask students to look at the renewable energy side of their chant sheets. Explain what renewable means. Read over the chant sheets with the students, emphasizing the essential facts about each energy source. For the youngest students, you may only want to use the first two or three facts listed. As you introduce each source, demonstrate the energy chant for that source. You can create your own hand motions, or use the sample hand motions listed on page 16.
- After you have practiced each chant with the students, review by reading the first fact on each source and having the students act out the chant. For older students, begin at the bottom of the list to see how many facts it takes before the students figure out which energy source you are describing.
- When you are sure that all students know the chants, explain that each student has an energy symbol on his/her back and their mission is to discover which energy source they represent. Using the chant sheets, they must ask fellow students questions that require a yes or no answer. Give examples of acceptable questions. They may not ask, "Am I Biomass?" Explain to them that once they figure out which energy source they represent, they should begin performing the chant and seek out their fellow source members. Once all students are in groups, have them design and draw a poster about their energy source.
- Repeat the activity for nonrenewable energy sources.

Primary Energy Chants introduces the ten leading sources of energy to primary students.

Grades

- K-2

Preparation

- Low

Time

- Two 30 minute periods



Hand Motions for the Primary Energy Chants

Renewable Chants and Hand Motions

BIOMASS: Garbage, wood, landfill gas...it's all BIOMASS!

Hold your nose while chanting, "Garbage, wood, landfill gas." During "It's All Biomass," shake your hands near your shoulders.

GEOTHERMAL: Geo-Earth, Thermal-heat—GEOTHERMAL—Earth-heat!

Hold arms in a circle in front of you during "Geo-Earth." Cross arms and hug yourself for "Thermal-heat." Shout "GEOTHERMAL," then repeat the motions quickly for "Earth-heat."

HYDROPOWER: Falling water, HYDROPOWER, HYDROPOWER!

With your finger tips touching, hold your hands under your chin and glide your hands down like a waterfall during "Falling water." For "HYDROPOWER, HYDROPOWER" spin your hands like a turbine.

SOLAR: SOLAR ENERGY—sun shine bright, SOLAR ENERGY—give me light!

Begin with arms over head in a big circle, swaying from side to side during "SOLAR ENERGY." Spread arms out wide during "sun shine bright." Repeat motions for second part of the chant.

WIND: Energy is flowin' in the WIND!

Make big arm circles, mimicking a wind turbine, as you say this chant.

Nonrenewable Chants and Hand Motions

COAL: COAL in the hole—makes light in the night!

During "COAL in the hole," point down with thumbs, hands in fists. During "makes light in the night," point thumbs upward in rhythm with the cadence of the chant.

NATURAL GAS: Burn clean, burn fast—NATURAL GAS!

During "Burn clean," bring one hand up in front of you, palm facing inward. During "burn fast," bring the other hand up to the first hand. During "NATURAL GAS," move hands upward together to make the shape of a flame.

PETROLEUM: Pump, pump—PETROLEUM!

Place hands together in fists in front of you. During "Pump, pump," partially extend fingers twice and return them to a fist. During "PETROLEUM," fully extend hands and move them upward, representing oil shooting from a well.

PROPANE: Put a little pressure on me—PROPANE!

Begin with hands wide apart and bring palms closer together at each word of the chant.

URANIUM: URANIUM, URANIUM—split goes the atom!

Clap twice during "URANIUM, URANIUM." During "split goes the atom," clap and bring hands out and up, representing the splitting atom.



Renewable Energy Chants

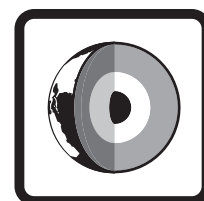
Garbage, wood, landfill gas...it's all BIOMASS!

1. Bio means life. I am the energy in things that used to be alive.
2. My energy is stored in trees, plants, and garbage.
3. My energy comes from the sun.
4. You can burn me to make heat and electricity.
5. I can pollute the air when I am burned.



Geo-Earth, Thermal-heat—GEOTHERMAL—Earth-heat!

1. Geo means Earth. Therme means heat. I am heat energy from inside the Earth.
2. I heat underground rocks and water.
3. My hot water can heat houses.
4. My power can make electricity.
5. I am clean energy.



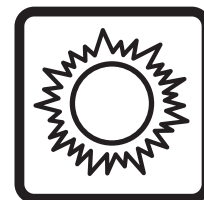
Falling water, HYDROPOWER, HYDROPOWER!

1. Hydro means water. I am the energy in moving water.
2. Dams can harness my energy.
3. I am only available in certain parts of the United States.
4. My power can make electricity.
5. I am clean, cheap energy.



SOLAR ENERGY—sun shine bright, SOLAR ENERGY—give me light!

1. Sol means sun. I am energy from the sun.
2. I make plants grow and I give you light.
3. When my energy reaches the Earth, it can heat homes and water.
4. Photovoltaic cells can turn my energy into electricity.
5. I am clean, expensive energy.



Energy is flowin' in the WIND!

1. I am the energy in moving air.
2. The sun makes the air move.
3. Some places have a lot of me, others only a little.
4. I can't make electricity 24 hours a day.
5. I don't pollute the air, except with sound.





Nonrenewable Energy Chants

COAL in the hole—makes light in the night!

1. I look like shiny, black rock.
2. I am a fossil fuel that is buried underground.
3. There is a lot of me in the United States.
4. I am burned to make electricity.
5. I can pollute the air when I am burned.



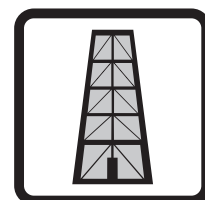
Burn clean, burn fast—NATURAL GAS!

1. I am a gas with no color, no taste, and no smell.
2. I am a clean burning fossil fuel.
3. Companies drill wells to pump me from the ground.
4. I am moved by pipeline.
5. I am burned to heat buildings and to make electricity.



Pump, pump—PETROLEUM!

1. I am buried underground and under the ocean.
2. I am a fossil fuel that makes more energy than any other energy source.
3. I am made into lots of things—like gasoline and plastics.
4. The U.S. must buy 45 percent of my supply from other countries.
5. I can pollute the air when I am burned.



Put a little pressure on me—PROPANE!

1. I am a gas with no color, no taste, and no smell.
2. I am a clean burning fossil fuel.
3. I am buried underground with other fossil fuels.
4. I turn into a liquid under pressure.
5. I am used on farms and in backyard grills.



URANIUM, URANIUM—split goes the atom!

1. I am buried underground in rocks.
2. There is plenty of me; I am cheap.
3. My energy is used to make electricity.
4. Using me doesn't pollute the air.
5. My waste is radioactive; it can be dangerous.





This Week in Energy Conservation

Get Ready

Prior to class, make copies of the six lead stories (found on pages 20-22) that you will be distributing among the student groups. You may also want to gather the supplies students may use in constructing props to accompany their energy stories.

Get Set

- Review with the students the structure of an actual news program. Explain the role of an anchor in providing the background information or "lead" to a news story. Ask the students to recall the various ways they have seen news stories covered in the past (in a studio, on-site, through interviews, or taped recordings). This will help them understand what they will be asked to do during the *This Week in Energy Conservation* show.
- Divide the class into six groups, and distribute a news lead to each group.

Go

- Explain to the students that each group is now a team of energy reporters. They should read the introduction to their segment of *This Week in Energy Conservation*, making note of the energy conservation tips listed below each lead. Their job will be to develop a story that follows the guidelines of the anchor's introduction and includes six of the energy tips listed on their sheet of paper. Each story should be limited to two or three minutes and the groups will be allowed 20 minutes to develop and rehearse their stories.
- After each story is presented, the other groups will have one minute to try to list six energy tips from the presentation they just heard. Next, the presenting group reveals their tips. Each group grades themselves using the honor system, getting one point for every tip they remembered correctly. Tally the scores of all the groups watching the presentation, and award this amount to the presenting group. This gives the presenters an incentive to do a thorough job conveying their facts and information to the audience. The team with the highest score after all the presentations is the winner. Either you or a student from each group can serve as the anchor, providing the show's introduction and the lead-in to each news story.

OPTIONAL: This activity can be expanded to include props and costumes for actual public service announcements on school TV stations for Energy Awareness Month, NEED Week, or Earth Day.

This Week in Energy Conservation is designed as a television show with student-correspondents reporting on a variety of energy conservation topics. This activity will introduce students to ways of saving energy both in the home and on the road.

Grades

- 4-12

Preparation

- Low

Time

- 45 minutes



This Week in Energy Conservation

NEWS STORY STARTERS

Hot Water Heating Energy News Team Introduction

Now for tonight's micro-cam report. We have once again miniaturized a member of our Energy News Team staff to give you an inside look at what actually goes on inside your hot water heater. Heating water is the second largest energy job in the home, so it's important to know what these drops of water are thinking while they're still inside the tank. We find their biggest fear is that their lives may be wasted by carelessness. Here's _____, who always seems to be getting into hot water, with this in-depth report.

- Do not let hot water run needlessly. About 18 percent of all the energy we consume in our homes is used to heat water.
- Use cold water instead of hot water when running the garbage disposal and when rinsing dishes before they go in the dishwasher. Using cold water saves energy.
- Repair leaky faucets promptly. A leaky faucet can waste gallons of water in a short period of time. A leak of one drip per second can cost \$1 per month.
- Wash and rinse clothes in cold water. Operating a washing machine takes very little energy. Most of the energy used by clothes washing machines goes to heating the water.
- Use low-flow shower heads. These easy-to-install devices save energy and still provide more than adequate shower pressure.
- Lower the water heater's thermostat to 120 degrees. Most hot water heaters are set for 140 degrees or higher. You can save on your energy bill by lowering the temperature.
- Insulate hot water storage tanks and water pipes connected to the water heater.

Home Heating Energy News Team Introduction

The theft of home heating energy is a normal occurrence. So why the next story? Because our undercover reporter has been able to infiltrate a gang of home heating energy criminals. For the first time ever, we can bring you the story from the point of view of the criminals. Seeing how they operate might help you, our Energy News Team viewer, prevent them from stealing your energy dollars.

- Keep heating equipment well maintained. To get the most from your heating fuel, keep furnace filters clean and equipment well tuned.
- Add insulation in the attic and walls where needed. Adding insulation can pay for itself within a few years.
- Plant trees to act as a windbreak. Trees act as a natural barrier to cold air in the winter and hot sun in the summer.
- During the winter, set the thermostat to 68 degrees during the day, and lower at night or when no one is home. Use a programmable thermostat to easily adjust the temperature for different times of the day. Lowering the thermostat 7 to 10 degrees for eight hours can save 10 percent a year.
- Close off unoccupied rooms, and shut off their heating vents. Shutting heat vents in rooms that are not used every day saves fuel.
- Caulk and weatherstrip doors, windows, and other areas in the home where drafts might occur. Caulking and weatherstripping is one of the quickest energy- and money-saving tasks you can do.
- Keep draperies and shades open in sunny windows, and closed at night. Energy from the sun provides natural warmth. Close drapes in summer when you want the house cooler.



This Week in Energy Conservation

NEWS STORY STARTERS

Cooking Energy News Team Introduction

Do you hate to cook? If slaving over a hot stove isn't your idea of a good time, tonight's Energy Gourmet segment is for you. Imagine telling your family, "We're having microwaved pizza for dinner tonight because I'm trying to save energy." The Energy Gourmet has a few simple tips that will save you energy and money. Who knows, you may even save enough money to eat out more often.

- Always boil water in a pan that is covered. Water will boil faster and use less energy in a covered pan.
- Whenever possible, use a toaster oven or microwave instead of a regular oven. These smaller appliances take less time to cook food so you save energy.
- When baking, keep the oven door closed rather than opening it to look inside. An open door lets valuable heat escape; maintain the heat by keeping the door shut.
- Clean range pans (under the burners) regularly. A clean range pan reflects more heat than a dirty one.
- Only preheat the oven for five minutes or not at all. It's also a good energy practice to cook several dishes in the oven at once to make maximum use of this concentrated heat source.
- Use the right size pan for each burner. A small pan on a large burner wastes energy because the air surrounding the pan will be heated, too.

Lighting Energy News Team Introduction

And now for the segment of the show that enables you, the viewer, to help put a dangerous energy criminal behind bars. It's time for America's Most Wanted Energy Criminals. The FBI has just put Killer Kilowatt-hour on its most wanted list. He has been terrorizing homes throughout the nation by forcing families to waste energy in lighting their homes. Recently, he forced a family to leave ten 100-watt light bulbs on for an hour. If you recognize him from this next segment, please don't try to apprehend him yourself, just call our toll-free number, 1-800-TURNOFF. Remember, he's very dangerous because he's very bright.

- Make sure lights are turned off in rooms where you don't regularly go, such as the cellar or attic. Consider installing indicator lights to tell you when those unseen lights are on.
- Use outdoor lights only when needed. Consider using an automatic timer that switches off outdoor lighting in the morning.
- Use fluorescent lights or CFLs whenever possible. A fluorescent light lasts 10 times longer and uses 75 percent less energy than an incandescent bulb.
- Dust bulbs and light fixtures frequently because dirt absorbs light. Clean fixtures and bulbs give you more light.
- Reduce light in non-working areas. Lighting needs vary with each task. Over-lighting an area wastes lots of energy. Adjust your lights accordingly.
- Turn down three-way light bulbs to the lowest setting when watching television. Dimmer light reduces glare on the TV and saves energy.
- Use one large bulb, instead of several small ones, in areas where bright lights are needed. Concentrate lighting in study areas and in stairwells where it's needed for safety.



This Week in Energy Conservation

NEWS STORY STARTERS

Auto Driving Habits Energy News Team Introduction

Our next story may have some of you saying that group therapy sessions have gone too far. This time it's automobiles. Their operators have very bad driving habits, and these habits are driving the cars crazy. We visited one of these sessions to learn what can be done to reduce this conflict between cars and their drivers.

- Drive the speed limit and don't exceed it. Driving more than 50 mph decreases gas mileage. Slow down to save fuel.
- Do not overfill the gas tank. To avoid spilling gasoline, consider your tank full when the automatic valve shuts off.
- Eliminate unnecessary or frequent starts and stops. Aggressive driving can lower highway gas mileage by 33 percent.
- Be a carpooler, and share a ride. Carpooling can save energy, reduce pollution, and make your car last longer.
- Do not let an automobile idle for more than one minute when waiting for someone. Idling equals zero miles per gallon in fuel economy.
- Eliminate unnecessary trips, and plan trips carefully. Combining errands can use less gasoline than several independent trips.
- Use public transportation. Try to substitute another means of transportation (bus, subway, bicycle, walking) for your automobile at least once a week.

Auto Maintenance Energy News Team Introduction

I've just been handed a bulletin. American automobiles have just called a wildcat strike. They refuse to operate again until their list of demands is met. Their major concern is health care. They feel that their previous owners did not give them the maintenance they deserved. An Energy News Team mobile unit brings us this late breaking story from a used car lot, where used cars are refusing to leave the car lot with their new owners until they are promised better care. That's right folks, these autos are demonstrators.

- When replacing tires, look for ones with low rolling resistance. This type of tire will use less energy to roll along the road.
- Keep the oil and air filters clean. For older cars with a carbureted engine, clean air filters can increase gas mileage 2 to 6 percent. For fuel-injected, computer-controlled engines, a clean air filter can improve acceleration time.
- Remove unnecessary weight from the car. A heavier car uses more gas to reach its destination. The lighter the load, the better the gas mileage will be.
- Check tire pressure every two weeks. Properly inflated and aligned tires improve gas mileage by 3.3 percent.
- Have the car's engine tuned regularly. A well-tuned engine can improve gas mileage.
- Select the correct gasoline octane and grade of oil for your car. If you change the oil yourself, take the used oil to a service station for recycling.



Conservation for Our Nation

Get Ready

You will need a marker and a large sheet of paper (about poster-size) for each group. Seat the group in a circle near a chalkboard or wall where you can hang up the paper.

Get Set

Divide the class into groups of eight to fifteen students. Select one person from each group as the group leader, and one person from each group as the recorder.

Go

- Instruct the groups to brainstorm ideas on energy conservation. Each idea should be simple and no longer than five syllables. For example, "Turn off lights," "Tune-up," and "Insulate." Continue brainstorming until the group has at least the same number of ideas as there are group members.
- Explain the game to the group with this introduction: "Slap your thighs once with both hands and say CON; clap once and say SER; snap your right fingers and say VA; and then snap your left fingers and say TION. Slap your thighs again and say FOR; clap your hands and say OUR; snap your right fingers and say NA; and snap your left fingers and say TION. Slap your thighs a third time and say CON, clap once and say SER; snap your right fingers and say VA; and then snap your left fingers and say TION. Slap your thighs a fourth time and say READY, clap your hands and say GO. This time between the snaps you must give a conservation tip."
- After the introduction, you should give three or four sample conservation tips between consecutive snaps. Do not repeat the introduction with each tip. You can reinforce the cadence by giving the instructions to the class between the snaps.
- Tell the groups to study the sheet of paper because it will not be posted during the game. If someone forgets or repeats, the circle must begin again. The person who has made the mistake begins with the introduction, and the game continues until you have made a complete circle with everyone giving a tip between the snaps.

NOTE: If you are running more than one circle at a time, instruct the groups that they may have to begin again on their own.

This activity teaches brainstorming and cooperation skills to a group or groups of 8-15 people. It also reinforces knowledge of some energy conservation tips.

Grades

- All

Preparation

- Low

Time

- 20 minutes for a group of ten



Energy Roundup

Energy Roundup is a good activity to introduce an energy unit or to reinforce students' knowledge of the nation's leading sources of energy. **Energy Roundup** divides a large group into ten or fewer small groups.

Grades

▪4-12

Preparation

▪Moderate

Time

▪10-50 minutes

Get Ready

- On sheets of white paper, write down six energy facts for each energy source, found on the *Energy Chants* sheet located on page 13. Do NOT write the names of the energy sources on these white sheets of paper.
- Number ten pieces of heavy paper, one through ten, in large numbers.
- Prepare five black poster boards for the nonrenewable energy sources and five yellow poster boards for the renewable energy sources, as follows. Mount one fact sheet to the lower half of each poster board, making sure the fact sheets correspond to the colors of the poster boards. Mount the top edge of the number sheets near the top of the posters. Do not secure the bottom edge of the number sheets to the posters; the number sheets will be used as flaps.
- Write the names of the energy sources on the posters, underneath the number sheet flaps. Lightly secure the bottom edge of the number sheets with tape to the posters.
- Mount the posters around the walls of the room. Space the posters as equally apart as possible and set up chairs for each station. Place a piece of paper and a pencil by each poster station. The players will use these toward the end of the game.

Get Set

- Assign players to groups using the *Energy Chants* graphics on page 14—let the players draw these out of a hat or pass them out randomly.
- You will need to have one slip for each person and an equal number of slips for each energy source. (You can assign players to fewer than ten groups by eliminating one or more energy sources from the hat. Even if you have fewer groups, keep all ten posters on the walls.) Instruct the players NOT to tell anyone which group they've picked.

Go

PART I

Give the players these instructions for playing the game:

- You have all been assigned to an energy source group. In a minute, you'll be getting into these groups. You must follow these instructions.
- You cannot speak or communicate with anyone during the first phase of the game.
- Decide if your energy source is a renewable or nonrenewable source of energy. The ten posters on the walls around the room have been color-coded to help you find your energy source. The yellow posters represent renewable energy sources; the black posters represent nonrenewable sources. If you don't know if your energy source is renewable or nonrenewable, then it may take you a little longer to find your group.
- When I say go, walk to the closest poster and read the six clues that describe the energy source. If you think these clues describe your energy source, simply sit down in one of the chairs (or bring over a chair). If the clues don't describe your energy source, move on to another poster. Repeat the process until you think you've found your energy source.
- You'll have three minutes to find your energy source. Remember, no talking or communicating is allowed. Does anybody have any questions? Ready? Go! (The first round lasts three minutes.)

- Your three minutes are up and everyone must be seated. Remember, remain silent. Now, will the person closest to each poster lift the flap of the poster so that only the people in your group can see which energy source the clues describe. (Players lift flaps to reveal energy sources.)
- Please close the flap. If you're in the correct group, remain seated. If you're not, stand up and look for your energy source again. This time you have only one minute. Go! (Round two lasts one minute. You can continue rounds until everyone has found his or her energy source. Remember, no talking or communicating! Subsequent rounds last 30 seconds to one minute each.)

PART II

After all the rounds are finished, give the groups these instructions:

- You will be allowed to talk during this part of the game. The members of your group must now decide which three of the six clues reveal the least about your energy source. Keep the least revealing clues and eliminate the three clues that reveal the most. I'll give you two minutes to do this, and then I'll ask three people in your group to stand up one at a time and read a clue. After the third clue has been read, everyone in your group will say in unison, "What are we?"
- Now, one person in your group should take the pencil and paper at your station and write the numbers one through ten down the side of the paper. After a groups says "What are we?" the other groups will have 15 seconds to write down the name of the energy source. Since every source has a number, just write the group's name by the corresponding number on your piece of paper.
- The group that correctly identifies the most energy groups wins.

Use the graphics on page 14 for this activity.



America's Most Wanted Energy Wasters

America's Most Wanted Energy Wasters increases students' awareness of their energy wasting habits and reinforces simple energy-saving behaviors.

Grades

▪All

Preparation

▪Low

Time

▪30 minutes

Get Ready

Before class, make a sample wanted poster. Have an ink pad, paper, and markers available.

Get Set

Explain the activity to the students. Exhibit the sample wanted poster. Use a digital camera to take front and side view mug shots of each student to generate enthusiasm for the activity. Print out the pictures.

Go

- Brainstorm with the students a list of the common ways that they waste energy daily, for example:
 - Leaving the TV on.
 - Taking long (or too many) showers.
 - Leaving the water running while brushing teeth/washing dishes.
 - Leaving doors/windows open with heat/AC on.
 - Asking for a ride when walking or riding a bike would be appropriate.
 - Running dishwasher/washing machine half empty.
 - Leaving unnecessary lights on.
- Brainstorm appropriate punishments for the crimes. (Skipping a favorite TV show, for example, as punishment for leaving the TV on. Or, washing the dishes by hand as punishment for running the dishwasher half empty.)
- Using the list, have each student keep a daily record of the energy crimes that he/she has committed over a designated time period.
- Construct wanted posters for each student. If you did not take mug shots of the students before you began the activity, have the students draw pictures of themselves. Use a water-soluble ink pad to take fingerprints. Students should write their own crime descriptions using their daily crime records.



Energy Bingo

Get Ready

Duplicate as many *Energy Bingo* sheets (found on page 29) as needed for each person in your group. In addition, decide now if you want to give the winner of your game a prize and what the prize will be.

Get Set

Pass out one *Energy Bingo* sheet to each member of the group.

Go

PART ONE: FILLING IN THE BINGO SHEETS

Give the group the following instructions to play the game:

- *Energy Bingo* is very similar to regular bingo. However, there are a few things you'll need to know to play this game. First, please take a minute to look at your *Energy Bingo* sheet and read the 16 statements at the top of the page. Shortly, you'll be going around the room trying to find 16 people about whom the statements are true so you can write their names in one of the 16 boxes.
- When I give you the signal, you'll get up and ask a person if a statement at the top of your bingo sheet is true for them. If the person gives what you believe is a correct response, write the person's name in the corresponding box on the lower part of the page. For example, if you ask a person question "D" and he or she gives you what you think is a correct response, then go ahead and write the person's name in box D. A correct response is important because later on, if you get bingo, that person will be asked to answer the question correctly in front of the group. If he or she can't answer the question correctly, then you lose bingo. So, if someone gives you an incorrect answer, ask someone else! Don't use your name for one of the boxes or use the same person's name twice.
- Try to fill all 16 boxes in the next 20 minutes. This will increase your chances of winning. After the 20 minutes are up, please sit down and I will begin asking players to stand up and give their names. Are there any questions? You'll now have 20 minutes. Go!

PART TWO: PLAYING BINGO

During the next 20 minutes, move around the room to assist the players. Every five minutes or so tell the players how many minutes are remaining in the game. Give the players a warning when just a minute or two remains. When the 20 minutes are up, stop the players and ask them to be seated. Then give them the following instructions.

- When I point to you, please stand up and in a LOUD and CLEAR voice give us your name. Now, if anyone has the name of the person I call on, put a big "X" in the box with that person's name. When you get four names in a row—across, down, or diagonally—shout "Energy Bingo!" Then I'll ask you to come up front to verify your results.
- Let's start off with you (point to a player in the group). Please stand and give us your name. (Player gives name. Let's say the player's name was "Joe.") Okay, players, if any of you have Joe's name in one of your boxes, go ahead and put an "X" through that box.
- When the first player shouts "Energy Bingo," ask him (or her) to come to the front of the room. Ask him to give his name. Then ask him to tell the group how his bingo run was made, e.g., down from A to M, across from E to H, and so on.
- Now you need to verify the *Energy Bingo* winner's results. Ask the bingo winner to call out the first person's name on his bingo run. That player then stands and the bingo winner asks him the question

***Energy Bingo* is a great icebreaker for a NEED workshop or conference. As a classroom activity, it also makes a great introduction to an energy unit.**

Grades

- All

Preparation

- Low

Time

- 45 minutes

Bingos are available on several different topics. Check out these resources for more bingo options!

- Science of Energy Bingo—*Science of Energy* guides
- Transportation Bingo—*Transportation Fuels Infobooks*
- Renewable Energy Bingo—*Energy Infobook Activities*
- Marine Renewable Energy Bingo—*Ocean Energy*
- Wind Energy Bingo—Wind guides
- Biomass Bingo—*Energy Stories and More*
- Hydrogen Bingo—*H2Educate*
- Solar Bingo—Solar guides
- Hydropower Bingo—Hydropower guides
- Change a Light Bingo—*Energy Conservation Contract*
- Energy Efficiency Bingo—*Monitoring and Mentoring and Learning and Conserving*
- Nuclear Energy Bingo—Nuclear guides
- Oil and Gas Bingo—Oil and Gas guides
- Offshore Oil and Gas Bingo—*Ocean Energy*

which he previously answered during the 20-minute session. For example, if the statement was “can name two renewable sources of energy,” the player must now name two sources. If he can answer the question correctly, the bingo winner calls out the next person’s name on his bingo run. However, if he does not answer the question correctly, the bingo winner does not have bingo after all and must sit down with the rest of the players. You should continue to point to players until another person yells “Energy Bingo.”

▪ In case of a tie, ask the winners to come to the front one at a time to verify their results. If time permits, you may wish to continue the game for second or third place winners. You may want to change some of the questions to fit your group. Below are eight extra statements you can use instead.

- Knows what energy source C_3H_8 is (*propane*)
- Knows what ethanol is made from in the U.S. (*corn*)
- Knows which state produces the most oil (*Texas*)
- Knows which state produces the most coal (*Wyoming*)
- Can name two products made from petroleum (*gasoline, diesel, jet fuel, fuel oil, plastic, tires, etc.*)
- Knows which energy source generates the most electricity (*coal*)
- Knows the main ingredient in natural gas (*methane*)

ANSWERS

- A. Student should share location
- B. Coal, petroleum, natural gas, propane
- C. (no answer needed)
- D. Students should be able to describe a clothes line.
- E. Students should describe plant or location of plant.
- F. Turning off lights, insulation, saving water, etc.
- G. (no answer needed)
- H. Tire pressure, maintenance, removing excess weight
- I. (no answer needed)
- J. Student should describe volcano, geyser, or hot spring.
- K. Student should list where: home, street light, calculator, etc.
- L. Hydropower, solar, geothermal, wind, biomass
- M. 12 cents/kWh national average
- N. pipeline
- O. propane
- P. fission



Energy Bingo

For each letter, find one person about whom the statement is true. Write each name in one of the boxes below.

- | | | | |
|---|---|--|--|
| A has seen a wind turbine | B can name two fossil fuels | C has never seen coal | D uses a solar clothes dryer |
| E has visited a power plant | F can name two ways to save energy at home | G uses a hand-operated can opener | H can name two ways to increase a car's MPG |
| I recycles aluminum cans | J has seen geothermal energy | K has seen a photovoltaic cell | L can name two renewable energy sources |
| M knows the cost of a kilowatt-hour of electricity | N knows how natural gas is usually transported | O knows which fuel is used in barbecue grills | P knows how uranium atoms give off energy |

A NAME	B NAME	C NAME	D NAME
E NAME	F NAME	G NAME	H NAME
I NAME	J NAME	K NAME	L NAME
M NAME	N NAME	O NAME	P NAME



Energy Match Game

Energy Match Game reviews and reinforces students' knowledge about energy. The activity can take as little as ten minutes or as much as an entire class period.

Grades

▪All

Preparation

▪Low

Time

▪30 minutes

Get Ready

Select eight of the energy match questions listed on the next page, according to the grade level of the students playing the game. The two most difficult questions of the eight will serve as the final *Energy Match Game* questions and will be awarded a double point value. For each student, take two sheets of 8 1/2" x 11" paper and cut them in half (or use small dry erase boards).

Get Set

Put students into four to six rows so that students cannot see what their fellow team members are writing. You need a minimum of four students per team. Prepare a scoreboard to keep point values for each team. Give each student four sheets of paper. Explain to the students that they will have to write on both sides of each sheet of paper in order to have enough paper for all eight rounds.

Go

Give the students the following instructions for how to play the game:

- Today, we're going to play the *Energy Match Game*. There will be eight rounds in the game. The final two rounds will have double point value.
- To begin a round, I will read a statement and you will have to write your answer in large letters on one of the pieces of paper I have given you. You may not look at the responses that any of your team members are writing down. If you do, your team will be penalized 25 points and will be eliminated from that round. You will have 15 seconds to write your answer and then you must put your pen or pencil down. Every match will be worth five points for the first six rounds.
- Let me give you an example of how the game is played and scored. The sample statement is "Name a renewable source of energy." You will have 15 seconds to write your answer on one of the sheets of paper, and then everyone will put their pens and pencils down.
- Next, the first person on team one will show me his/her answer while telling the class what his/her answer is. Say, for example, he has written SOLAR.
- The next person on the team will then show me his answer. If the second person has written SOLAR, then team one would have a match and it will receive five points. If the second person has written WIND, then there would be no match. The third person on the team will then show me his answer. If the third person's answer matches either the first or second person's answer, then team one will receive five more points. The fourth person on the team will then show me his answer. If the fourth person's answer matches either the first, second, or third person's answer, then team one will receive another five points.
- We will continue in this manner until all members of team one have revealed their answers. Then, we will repeat this process for the remainder of the teams. Are there any questions? Let's go! Here's the first statement.

Energy Match Questions

- Name an energy source, other than coal, that is used to generate electricity.
(wind, uranium, natural gas, etc.)
- Name a nonrenewable source of energy.
(petroleum, coal, propane, natural gas, uranium)
- Name a way to save energy in your car using proper driving habits.
(drive the speed limit, carpool, limit quick trips)
- Name a way to save energy in your car using proper maintenance.
(regular oil changes, proper tire pressure)
- Name a major energy consuming device in your home.
(refrigerator, clothes washer/dryer, air conditioner, etc.)
- Name a country from which the U.S. imports petroleum.
(Canada, Saudi Arabia, Venezuela, Mexico, Iraq, etc.)
- Name a product, other than gasoline, made from petroleum.
(plastics, medicines, kerosene, motor oil, etc.)
- Name a chemical characteristic of propane. (flammable)
- Name a unit used to measure electrical power. (watt, kilowatt)
- Name a source of energy that does not produce air pollution when used.
(hydropower, solar, wind, geothermal, nuclear)
- Other than the United States, name a country that uses a lot of energy.
(China, Germany, Russia, Saudi Arabia)
- Name a major petroleum producing state in the U.S.
(Texas, Alaska, California, North Dakota)
- Name a major coal producing state in the U.S. (Wyoming, Kentucky, Pennsylvania)
- Name an energy consuming device you could not live without.
(cell phone, television, etc.)
- Name your favorite source of energy.
- Name the first energy source used by people. (solar)
- Name the leading provider of U.S. energy in the year 2030.
- Name a way of saving energy for home heating.
(use a programmable thermostat, insulating or sealing cracks, etc.)
- Name an energy saving device you could use in your home.
(CFL or LED bulb, power strip, etc.)



Energy Eliminators

Energy Eliminators
strengthens students'
brainstorming skills while
reviewing major energy
topics.

Grades

▪4–12

Preparation

▪Low

Time

▪45 minutes

Get Ready

For each team, make a list of five to ten words or phrases that describe the team's energy source. The number of words or phrases you use will depend on the age level and experience of the students playing the game. You may use the lists on page 33 and cross out the words and phrases that you do not want to use, leaving five to ten words or phrases for each energy source. (If you feel that the words provided are too difficult, or revealing, feel free to make up your own list of words.) Next, write the name of each energy source on the top of a blank sheet of paper. Students will use these sheets to brainstorm their own lists.

Get Set

Divide the students into ten teams. Give students an overview of the game. Give each team the sheet of paper with their energy source name and remind them not to reveal their energy source to the other teams.

Go

Give the students the following instructions for how to play the game:

- Each team has been given a sheet of paper with the name of an energy source. Remember, don't let the other teams see your name. You will have four minutes to brainstorm as many words or phrases as possible that relate to your energy source. For example, if your energy source is ELECTRICITY, what words might you brainstorm that relate to electricity? (List student examples on the board—words might include: kilowatt-hour, generator, megawatt, power plant, and peak demand.) You will now have four minutes to brainstorm words and phrases for your energy source. Write the words you have brainstormed on the sheet of paper that I have given you. Please do your brainstorming quietly so that the other teams will not be able to hear you.
- Now, I will give each team a list of words and phrases that I have selected for their energy source. Compare my list with the list of words you have developed. On your list, cross off all the words that match the ones on my list.
- Next, take your sheet of paper and write the numbers one through ten on the reverse side. A student from team one will now stand up and tell the class in a loud, clear voice the words and phrases that have not been crossed off their list. The other teams will write these words next to the number one on their sheet of paper. After all ten teams have given their remaining words, you will have three minutes to decide which energy source each team represents.
- One at a time, each team will stand up and tell the class the energy source they represent. On your sheet of paper, place check marks next to the teams that you guessed correctly. Do not check your own team—the most you can guess correctly is nine. You receive ten points for each correct guess.
- Starting with team one, how many teams correctly guessed the first team's identity? Team one receives five points for each team that guessed their identity. (The leader continues this process with the remaining teams.)
- Teams should now add up their scores.



Energy Eliminators

Word List | *RENEWABLE*

▪ BIOMASS

organic matter
photosynthesis
burning
bacterial decay
methane
wood
renewable
fermentation
corn
landfills
garbage
gasohol

▪ GEOTHERMAL

Earth
electricity
hot springs
volcanoes
radioactive decay
plate tectonics
Ring of Fire
magma
heating buildings
steam
core
renewable

▪ SOLAR

nuclear fusion
radiation
hydrogen
renewable
space heating
collector
greenhouse effect
passive system
active system
photovoltaic cells
silicon
electricity

▪ HYDROPOWER

water
waterwheels
grind grain
electricity
Niagara Falls
kinetic energy
turbine generator
dams
reservoir
tidal power
Grand Coulee
renewable

▪ WIND

air
windmill
rotor blades
electricity
wind farms
anemometer
renewable
Holland/Dutch
pump water
tower
kinetic energy
turbine

Word List | *NONRENEWABLE*

▪ URANIUM

nuclear
fission
chain reaction
radioactive
electricity
1957
104 reactors
Fukushima
neutrons
cooling towers
Three Mile Island
Chernobyl

▪ COAL

surface mines
underground mines
sulfur
trains
electricity
fossil fuel
carbon
nonrenewable
black lung
shaft
bituminous
anthracite

▪ PETROLEUM

oil
crude
imported
fossil fuel
OPEC
refinery
gasoline
heating oil
transportation
tankers
offshore drilling
air pollution

▪ PROPANE

heating
transportation
LPG
pressurized tanks
odorless
portable gas
fossil fuel
refining
nonrenewable
farms
industry
barbecue grills

▪ NATURAL GAS

heating
fossil fuel
methane
processing plant
wells
cubic feet
compressor stations
pipelines
industry
CNG
LNG
nonrenewable



Energy Bumper Stumpers

Energy Bumper Stumpers is an activity to review and reinforce students' knowledge about energy.

Grades

▪3–8

Preparation

▪Low

Time

▪20 minutes

Get Ready

Before class, choose five to ten of the license plates listed on page 35. The number of license plates you use will depend on the age level and experience of the students playing the game.

Get Set

Divide the students into five or more teams. Explain to the students how the game is played. Instruct each team to take out one sheet of paper for their answers. Next, write the license plates that you have chosen on the blackboard or on transparencies.

Go

- In the first round, give the students five to ten minutes to solve the *Energy Bumper Stumpers* without the clues. Once the round is over, check the teams' answers. The teams receive ten points for each *Energy Bumper Stumper* they guessed correctly.
- In round two, read the clues that correspond to the license plates on the board. The teams should now try to guess the *Energy Bumper Stumpers* they missed in the first round. When round two is completed, check the teams' answers again. The teams receive five points for each *Energy Bumper Stumper* they guessed with the clues. The team with the most points is the winner.



Energy Bumper Stumpers

1. **NRGWSTR**—This license plate would be ideal for a person who doesn't believe in conserving our resources. (*Energy Waster*)
2. **NDSTRE**—This plate would be appropriate for the leading consumer of energy. (*Industry*)
3. **SRMIK**—This plate describes the protective covering that surrounds a uranium fuel pellet. (*Ceramic*)
4. **DSTL8N**—This plate refers to the process in which petroleum is separated into various components. (*Distillation*)
5. **SWNDOO**—This plate identifies the most favorable method of access for passive solar heating. (*South Windows*)
6. **CREWDOYL**—This plate suggests another name for a liquid fossil fuel. (*Crude Oil*)
7. **SLRNRG**—This plate describes a type of renewable energy. (*Solar Energy*)
8. **GNR8R**—This plate names a device containing a magnet and a coil of wire. (*Generator*)
9. **NSL8ORS**—This plate describes the type of materials that do not conduct electricity well. (*Insulators*)
10. **POWRLYN**—This plate identifies the method of transporting electricity across our nation. (*Power Line*)
11. **NCANDSNT**—This plate refers to one type of device that turns electrical energy into light energy. (*Incandescent*)
12. **FLAMNT**—This plate describes the wire inside an incandescent light bulb that conducts the electricity. (*Filament*)
13. **YRAINEM**—This plate refers to the source of a nonrenewable energy that is not a fossil fuel. (*Uranium*)
14. **POLUTNT**—This plate identifies a hazard of burning fossil fuels. (*Pollutant*)
15. **DARYK**—This plate refers to the instrument used to recover petroleum. (*Derrick*)
16. **GRENHOWS**—This plate describes a building that effectively uses passive solar heating. (*Green House*)
17. **NEWKLEYE**—This plate identifies the place where nuclear fission takes place. (*Nuclei*)
18. **RAD8**—This plate describes heat energy transfer. (*Radiate*)
19. **SLYCON**—This plate identifies the material used in turning solar energy into electrical energy. (*Silicon*)
20. **POWRTOWR**—This plate refers to a device used to collect solar energy. (*Power Tower*)
21. **POWRPUL**—This plate names the cooperative of utilities linked together to share electricity efficiently. (*Power Pool*)
22. **BBKUGRIL**—This plate names a device that many people use during the summer, some of which require propane to operate. (*Barbecue Grill*)
23. **DSYLFUL**—This plate identifies a product of petroleum distillation used by large trucks. (*Diesel Fuel*)
24. **SIZMIK**—This plate names a method of exploration used to locate types of fossil fuels. (*Seismic*)
25. **C-NMLS**—This plate names what scientists believe to be the source of several fossil fuels. (*Sea Animals*)
26. **SDIMNT**—This plate refers to the material that settled on top of ferns to form fossil fuels. (*Sediment*)
27. **FIRTLIZR**—This plate identifies a way to encourage plant growth for biomass fuels. (*Fertilizer*)
28. **YOTYLTEE**—This plate identifies the companies responsible for distributing electricity. (*Utilities*)
29. **RSRFOR**—This plate names the location of potential energy at a hydropower plant. (*Reservoir*)
30. **PNSTOK**—This plate signals the portion of a hydropower plant that brings the water to the turbine. (*Penstock*)
31. **FASYLFUL**—This plate identifies a term given to several of the nonrenewable energy sources. (*Fossil Fuel*)
32. **TITLPOWR**—This plate names a type of hydropower that is affected by the moon. (*Tidal Power*)
33. **WINTRBIN**—This plate refers to another name for a windmill. (*Wind Turbine*)
34. **LYMSTON**—This plate identifies a type of rock in which petroleum is often trapped. (*Limestone*)



Energy Squares

Based on tic-tac-toe, *Energy Squares* reinforces students' knowledge of energy sources and energy-related topics.

Grades

▪ 3–12

Preparation

▪ Low

Time

▪ 30 minutes

Get Ready

Before class, make nine nametags for the celebrity energy guests. Next, make a transparency or digital projection of the game board found on page 39. Cut out X and O shapes from black construction paper or make sure interactive board markers are available. There are five questions provided for each guest. Most likely, only three or four questions will be needed, so choose the ones you feel are most important. You can also come up with alternative questions appropriate to the grade level of the students playing the game.

ENERGY NAMES

Peter Petroleum

Natalie Natural Gas

Colin Coal

Reba Renewable

Uri Uranium

Christy Conserve

Paul Propane

Elaine Electricity

Herman History

Get Set

- Choose nine students to act as energy guests for the game. Provide each guest with a nametag and stand them in front of the room. Another student acts as the game show host. Props and costumes may be used.
- Divide the remaining students into four teams. Each team must choose one spokesperson.
- Only two teams can participate at one time—decide which two teams will play in the first round and which two will play in the second round.
- Flip a coin to determine which first round team begins the game. The winner of the coin toss decides who goes first, and the losing team chooses either X or O as their symbol. Repeat this procedure with the second round teams.

Go

Give the students the following instructions for how to play the game:

- This game is similar to tic-tac-toe. The goal is to get three X's or O's in a row on the game board. The first two teams will play each other and then the remaining two teams will play. The winners will face off in the final championship round.
- The first team chooses a guest and his or her accompanying square on the game sheet. The guests' names correspond to the topic of the question they will be asked. The host asks the guest a question and the guest answers to the best of his knowledge and ability. It is now the team's responsibility to decide whether or not they agree with the answer given by the energy guest. If they answer correctly, the team's symbol is placed in the square. However, if they answer incorrectly, the other team's symbol is placed in the square. After each question, it is the other team's turn to choose a guest.
- When choosing guests, keep in mind that this game is played like tic-tac-toe. You are trying to get three of your symbols in a row while blocking your opponents from doing the same thing. Play continues in this manner until a team succeeds in getting three in a row or all squares are filled with either X's or O's. One final rule—when a team is going for the winning square to get three in a row, the team members must answer the question correctly. If the question is answered incorrectly, the other team does not place its symbol in that square. Again, this is only applicable when one of the teams is going for the winning square. In case neither team succeeds in getting three in a row, the team with the most symbols on the board wins.



Energy Squares

QUESTIONS AND ANSWERS FOR PETROLEUM

1. What is the major use of petroleum in the U.S.? (*Transportation*)
2. What is the major product produced during petroleum refining? (*Gasoline*)
3. How many gallons of oil are in one barrel? (*42*)
4. True or false? Alaska is the nation's top oil producing state. (*False, Texas is*)
5. What percentage of U.S. petroleum supply is imported—25%, 45%, 55%, or 75%? (*45%*)

QUESTIONS AND ANSWERS FOR NATURAL GAS

1. How is natural gas usually transported? (*By pipeline*)
2. True or false? Natural gas is a light yellow color. (*False, it's colorless*)
3. What is the major use of natural gas by a family? (*Home heating*)
4. What is the chemical name for natural gas? (*Methane*)
5. True or false? Natural gas is measured in, and sold by, gallons? (*False, by cubic feet*)

QUESTIONS AND ANSWERS FOR COAL

1. What is the major use of coal? (*Producing electricity*)
2. True or false? Canada is the world leader of known reserves of coal. (*False, the United States is*)
3. How is coal mainly transported? (*By railroad*)
4. Is coal the youngest or the oldest fossil fuel? (*The youngest*)
5. Most U.S. coal is produced from which type of mining, surface or underground? (*Surface*)

QUESTIONS AND ANSWERS FOR RENEWABLES

1. What type of solar cell produces electricity directly from sunlight? (*Photovoltaic cell*)
2. Renewables supply approximately what percentage of total U.S. energy demand—1%, 9%, 19%, or 29%? (*9%*)
3. Which renewable source of energy is NOT a result of the sun's energy striking the Earth? (*Geothermal*)
4. True or false? Wind is the result of uneven heating of the Earth's mantle. (*False, uneven heating of the Earth's surface*)
5. Which energy source gets its energy from garbage and agricultural wastes? (*Biomass*)

QUESTIONS AND ANSWERS FOR URANIUM

1. Where is nuclear waste stored? (*On-site in spent fuel pools and dry casks/vaults*)
2. True or false? The isotope of uranium that splits in nuclear reactors is U238. *False, it's U235*
3. What is the name of the subatomic particle that causes nuclear fission when it strikes U235—an electron, a neutron, or a proton? (*A neutron*)
4. Plus or minus ten years, in what year did America's first nuclear power plant go into operation? [*1957 (accept 1947-1967)*]
5. In what part of a nuclear power plant does nuclear fission take place? (*The reactor*)

QUESTIONS AND ANSWERS FOR CONSERVATION

1. Which letter of the alphabet is used to measure the value of insulation? (*R value*)
2. True or false? Incandescent light bulbs provide the same amount of light that fluorescent bulbs do for one-fourth the energy. (*False, it's exactly the opposite*)
3. After home heating and cooling, what is the most energy-consuming job in the home? (*Water heating*)
4. What two items are used to seal cracks around windows and doors? (*Caulking and weatherstripping*)
5. As the energy efficiency rating of an appliance increases, the amount of energy it requires to operate: increases, decreases, or remains the same? (*Decreases*)

QUESTIONS AND ANSWERS FOR PROPANE

1. Is propane used mostly in metropolitan or rural areas? (*Rural*)
2. By what quantity is propane sold? (*By the gallon*)
3. What physical state does propane turn into when it's stored under moderate pressure or cooled to -45° Fahrenheit? (*A liquid*)
4. Propane comes from processing which fossil fuels? (*Natural gas and petroleum*)
5. Is the weight of propane lighter than, heavier than, or equal to the weight of air? (*Heavier than*)

QUESTIONS AND ANSWER FOR ELECTRICITY

1. How is electricity used, measured, and sold? (*By the kilowatt-hour*)
2. What is the average cost of a kilowatt-hour of electricity for consumers? [*12 cents, accept 10 to 14 cents*]
3. Is electricity produced by rotating wires in a magnetic field in a turbine or a generator? (*A generator*)
4. In the summer, during what time period does the demand for electricity peak—6:00 a.m. to noon, noon to 6:00 p.m., or 6:00 p.m. to midnight? (*Noon to 6:00 p.m.*)
5. What is the leading energy source used to generate electricity? (*Coal*)

QUESTIONS AND ANSWERS FOR HISTORY

1. Whose motorized vehicle created a great demand for gasoline? (*Henry Ford*)
2. Where was the world's first hydroelectric power plant built in 1882? (*Appleton, Wisconsin on the Fox River*)
3. Who invented the steamboat, Robert Fulton or Edwin Drake? (*Robert Fulton*)
4. Who invented the light bulb and other electrical devices? (*Thomas Edison*)
5. After World War II, this energy source replaced coal as the number one energy source. (*Petroleum*)



Energy Squares

Peter Petroleum	Natalie Natural Gas	Colin Coal
Reba Renewable	Uri Uranium	Christy Conserve
Paul Propane	Elaine Electricity	Herman History



Energy Source Detective

Energy Source Detective is a critical thinking activity to reinforce understanding of the basic characteristics of the major energy sources.

Grades

▪ 2–4

Preparation

▪ Low

Time

▪ 10 minutes

Get Ready

Make one copy of the activity on page 41 for each student.

Go

- Distribute a copy of the activity to each student.
- Explain to the students how to complete each energy source box, using hydropower as an example. The students begin with number 1 and decide whether the energy source is 1a or 1b, write the correct number in the box, draw an arrow, then follow the directions after the number until they discover the name of the energy source. When they discover the correct name, they write it at the bottom of the box.

For the example for hydropower, the students must first decide whether hydropower is renewable or nonrenewable. It is renewable, so 1a is the first number to be written in the box. They follow the directions to 2 and decide whether the source can be burned. Hydropower is not burned, so they write the number 2b and follow the directions to the next clue, until they discover the name of the energy source.

Extension

- Have students work in pairs to design a flow chart that displays all of the information on this game, and extra information if they desire. It may serve as a graphic study tool for later.



Energy Source Detective

1a Renewable go to 2

1b Nonrenewable go to 6

2a Can be burned Biomass

2b Is not burned go to 3

3a Energy from space Solar

3b Energy in/on the Earth go to 4

4a Inside the Earth Geothermal

4b On the Earth's surface go to 5

5a Moving water Hydropower

5b Moving air Wind

6a Fossil fuel go to 7

6b Energy-rich mineral Uranium

7a A gas go to 8

7b A solid or liquid go to 9

8a Moved by pipeline Natural Gas

8b Shipped in tanks Propane

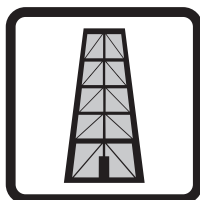
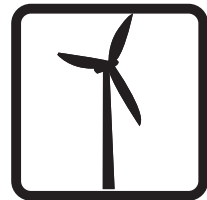
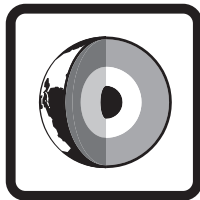
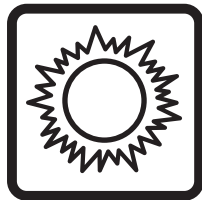
9a Mined from the Earth Coal

9b Pumped from the Earth Petroleum

1a → 2b →
3b → 4b →
5a



hydropower





Energy Source Puzzle

Energy Source Puzzle is a critical thinking activity to reinforce renewable and nonrenewable energy sources.

Grades

▪K-6

Preparation

▪Low

Time

▪15-30 minutes

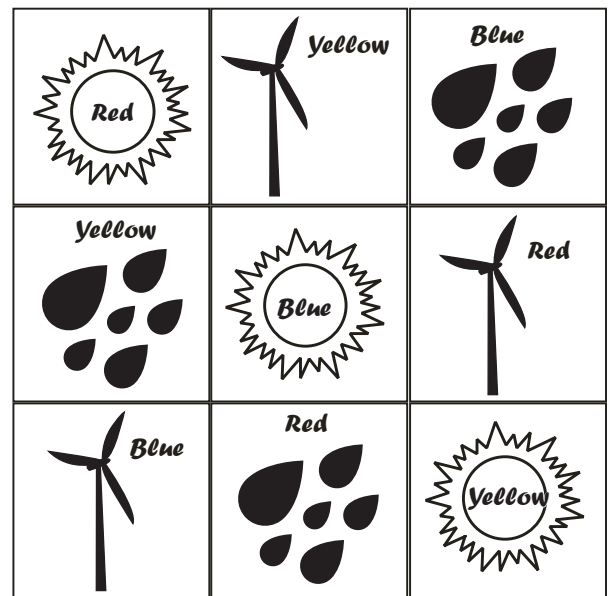
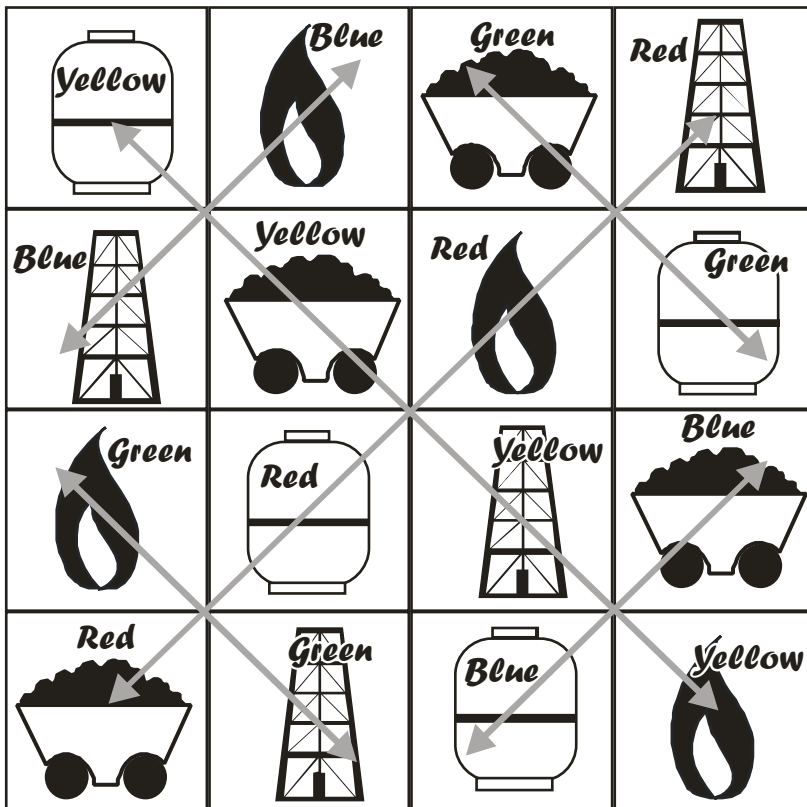
Get Ready

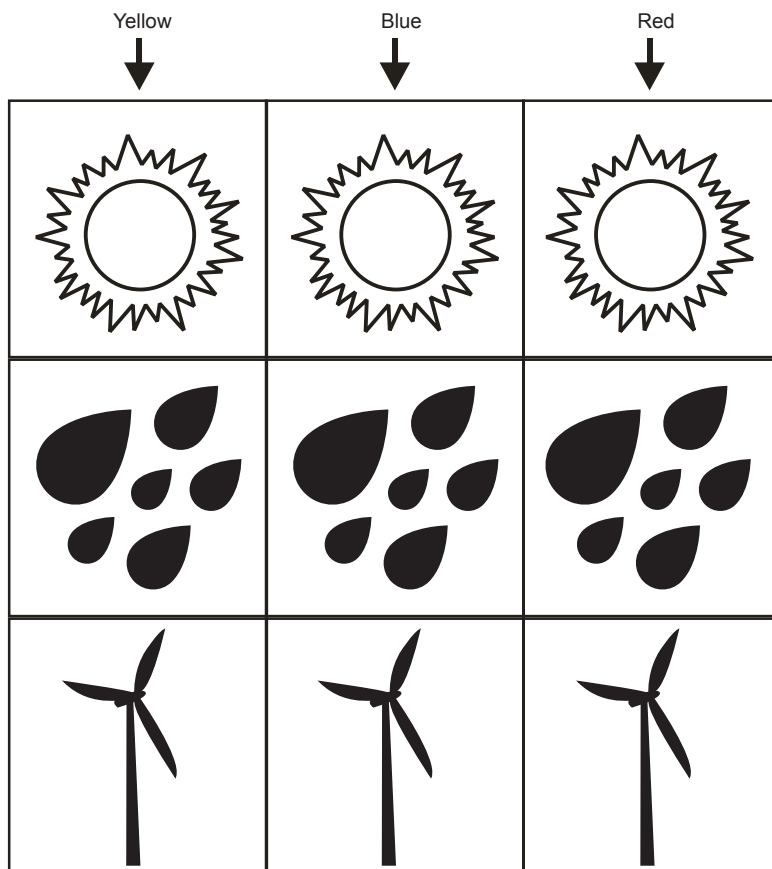
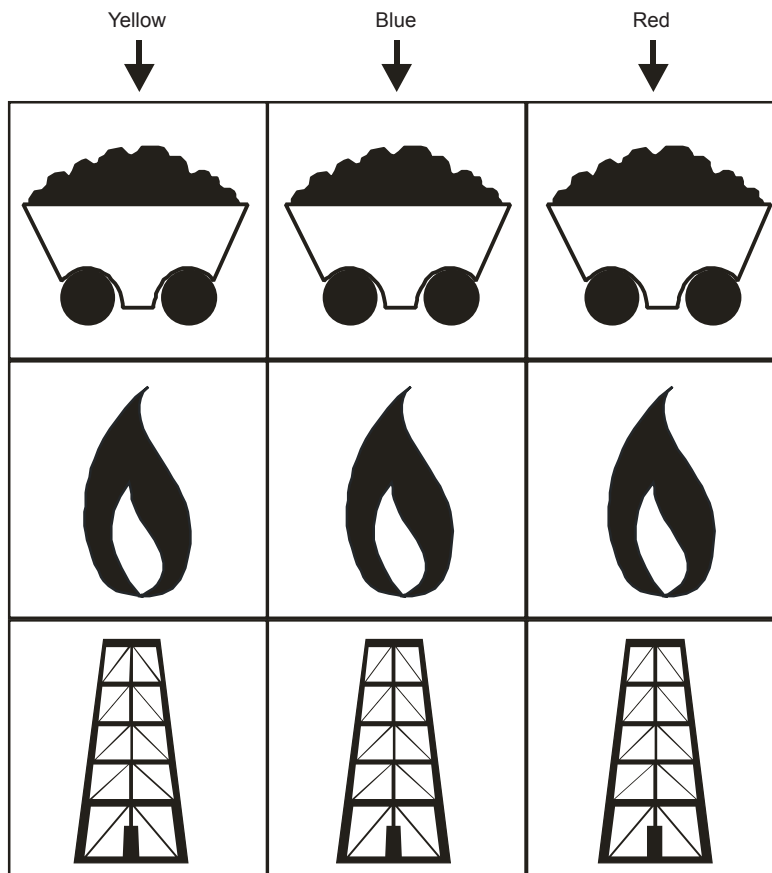
Make one copy of the puzzle you choose from pages 43-44 for each student.

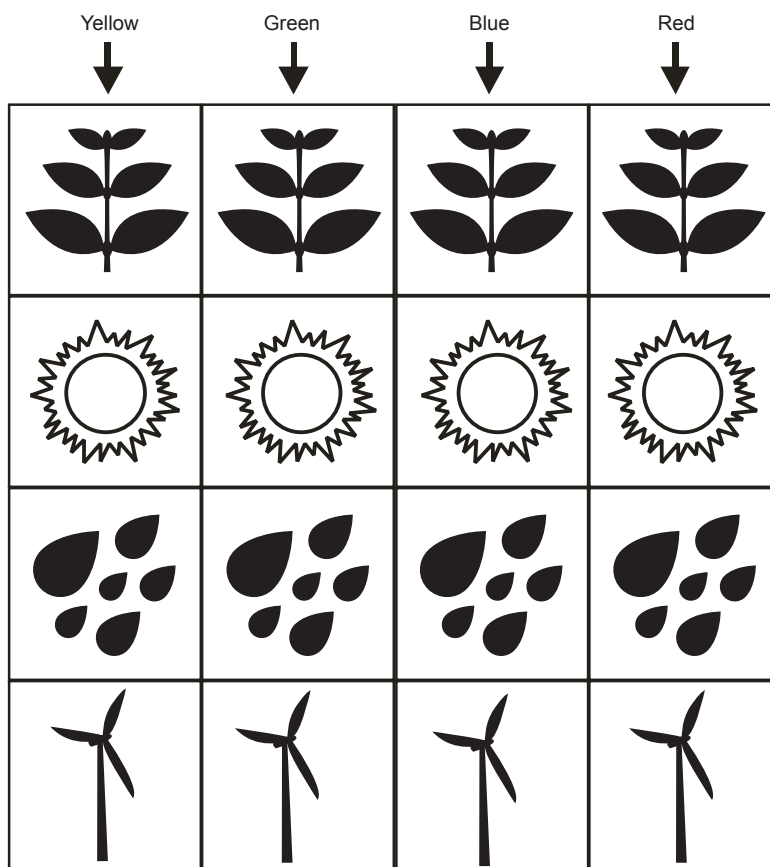
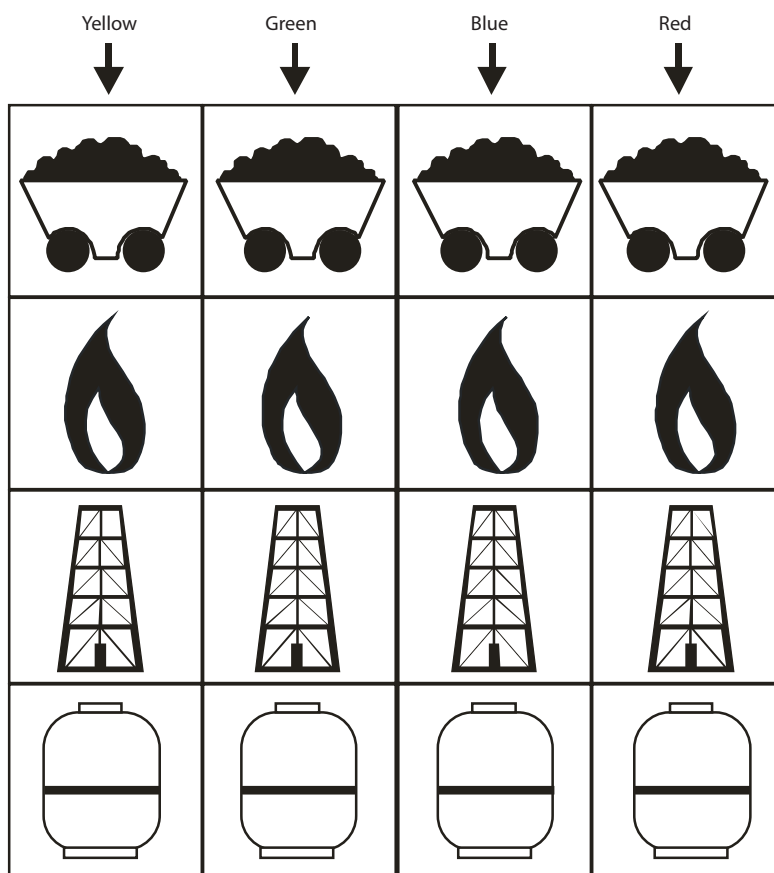
Go

- Distribute a copy of the puzzle to each student.
- Instruct the students to color the squares in each column using the key at the top of the puzzle, then cut apart the squares. While the students are doing this, discuss which energy sources the icons represent, how they are used, and whether they are renewable or nonrenewable.
- Explain to the students that the goal of the activity is to arrange the squares so that only one icon and one color is in each row and column. Explain that there are several ways to solve the puzzle and to look for patterns to help solve it. Hint: The key is to find a pattern, such as beginning with a diagonal row of the same color or icon.

Sample Solutions:









Energy in the Round

Get Ready

- Copy one set of the *Energy in the Round* cards on pages 46-48 on card stock and cut into individual cards.
- Have a class set of the *Intermediate Energy Infobooks* available for quick reference.

Get Set

- Distribute one card to each student. If you have cards left over, give some students two cards so that all of the cards are distributed.
- Have the students look at their bolded words at the top of the cards. Give them five minutes to review the information about their words using the *Intermediate Energy Infobooks*.

Go

- Choose a student to begin Round 1 and give the following instructions:
 - Read Question 1 on your card. The student with the correct answer will stand up and read the bolded answer, "I have ____."
 - That student will then read Question 1 on his/her card, and the round will continue until the first student stands up and answers a question, signaling the end of the round.
- Continue the game with Rounds 2 and 3.
- If there is a disagreement about the correct answer, have the students listen to the question carefully looking for key words (forms versus sources, for example) and discuss until a consensus is reached about the correct answer.

Answer Key

Round 1—Starting with Propane's clue

- | | | | | |
|------------------|------------------|------------------|-------------------|---------------|
| ▪ Solar | ▪ Ethanol | ▪ Electricity | ▪ Geothermal | ▪ Water Cycle |
| ▪ Energy | ▪ Thermal Energy | ▪ Petroleum | ▪ Nuclear Fission | ▪ Mining |
| ▪ Sustainability | ▪ Wind | ▪ Nonrenewable | ▪ Radiant Energy | ▪ Propane |
| ▪ Natural Gas | ▪ Fossil fuel | ▪ Greenhouse | ▪ Industry | |
| ▪ Biomass | ▪ Nuclear Fusion | ▪ Uranium | ▪ Energy | |
| ▪ Renewable | ▪ Hydropower | ▪ Energy Sources | ▪ Photosynthesis | |
| ▪ Coal | ▪ Hydrogen | ▪ Power Plant | ▪ Texas | |

Round 2—Starting with Propane's clue

- | | | | | |
|------------------|------------------|-------------------|------------------|------------------|
| ▪ Industry | ▪ Mining | ▪ Water Cycle | ▪ Thermal Energy | ▪ Uranium |
| ▪ Coal | ▪ Nuclear Fusion | ▪ Nonrenewable | ▪ Photosynthesis | ▪ Energy Sources |
| ▪ Power Plant | ▪ Renewable | ▪ Biomass | ▪ Radiant Energy | ▪ Propane |
| ▪ Energy | ▪ Texas | ▪ Ethanol | ▪ Petroleum | |
| ▪ Sustainability | ▪ Geothermal | ▪ Energy | ▪ Fossil Fuels | |
| ▪ Hydrogen | ▪ Hydropower | ▪ Nuclear Fission | ▪ Natural Gas | |
| ▪ Wind | ▪ Solar | ▪ Greenhouse | ▪ Electricity | |

Round 3—Starting with Propane's clue

- | | | | | |
|------------------|-------------------|------------------|------------------|-------------|
| ▪ Mining | ▪ Solar | ▪ Hydrogen | ▪ Geothermal | ▪ Industry |
| ▪ Greenhouse | ▪ Ethanol | ▪ Energy | ▪ Photosynthesis | ▪ Renewable |
| ▪ Biomass | ▪ Nuclear Fission | ▪ Petroleum | ▪ Uranium | ▪ Propane |
| ▪ Fossil Fuel | ▪ Wind | ▪ Energy Sources | ▪ Natural Gas | |
| ▪ Power Plant | ▪ Electricity | ▪ Nonrenewable | ▪ Texas | |
| ▪ Thermal Energy | ▪ Coal | ▪ Energy | ▪ Nuclear Fusion | |
| ▪ Hydropower | ▪ Radiant Energy | ▪ Sustainability | ▪ Water Cycle | |

Energy in the Round is a quick, entertaining game to reinforce information about energy sources, forms of energy, and general energy information from the *Intermediate Energy Infobook*.

Grades

▪ 5–8

Preparation

▪ Low

Time

▪ 20–30 minutes

Alternative Instructions

- Give each student or pair a set of cards.
- Students will put the cards in order, taping or arranging each card so that the answer is directly under the question.
- Have students connect the cards to fit in a circle or have them arrange them in a column.

"In the Rounds" are available on several different topics. Check out these guides for more, fun "In the Round" examples!

- Hydrogen in the Round—*H₂ Educate*
- Oil and Gas Industry in the Round—*Fossil Fuels to Products, Exploring Oil and Gas*
- Conservation in the Round—*Monitoring and Mentoring, Learning and Conserving*
- Forms of Energy in the Round—*Science of Energy guides*
- Uranium in the Round—*Nuclear guides*
- Solar Energy in the Round—*Energy from the Sun*
- Transportation Fuels in the Round—*Transportation Fuels Infobooks*

I HAVE PROPANE.

1. Who has the energy source converted directly into electricity using PV cells?
2. Who has the sector of the economy that uses about 31 percent of the nation's energy?
3. Who has the processes of surface, deep, underground, room-and-pillar, and longwall?

I HAVE BIOMASS.

1. Who has the energy sources that are replenished in a short time?
2. Who has the transportation fuel that can be made from biomass?
3. Who has the group of nonrenewable energy sources used most in the U.S.?

I HAVE SOLAR.

1. Who has an energy concept based on efficiency and conservation?
2. Who has the process during which precipitation replenishes oceans, rivers, and lakes?
3. Who has the alcohol made by adding yeast to biomass?

I HAVE RENEWABLE.

1. Who has the energy source that generates 42 percent of the nation's electricity?
2. Who has the number one state for producing natural gas?
3. Who has the gas that becomes a liquid under moderate pressure or when cooled?

I HAVE RADIANT ENERGY.

1. Who has the sector of the economy that makes the goods and materials we use every day?
2. Who has the energy source almost half of which is imported from other countries?
3. Who has the energy carrier that may become a significant transportation fuel in the future?

I HAVE COAL.

1. Who has a renewable fuel often made from corn that is mixed with gasoline to burn cleaner?
2. Who has what can use many different fuels to produce most of the electricity in the U.S.?
3. Who has the form of energy released by compact fluorescents light bulbs?

I HAVE ENERGY SUSTAINABILITY.

1. Who has the energy source transported by more than two million miles of underground pipeline?
2. Who has the resource that fuel cells use to generate electricity?
3. Who has the energy source that produces volcanoes and hot springs?

I HAVE ETHANOL.

1. Who has the internal energy of atoms and molecules?
2. Who has what can be changed into other forms, but cannot be created or destroyed?
3. Who has the process in which atoms are split apart, releasing thermal energy as radiation?

I HAVE NATURAL GAS.

1. Who has the energy source that makes renewable methane gas?
2. Who has a secondary source of energy defined as moving electrons?
3. Who has the state that produces and consumes the most electricity in the U.S.?

I HAVE THERMAL ENERGY.

1. Who has the energy source caused by uneven heating of the Earth's surface?
2. Who has the process in which water, carbon dioxide, and sunlight are turned into glucose and oxygen?
3. Who has the energy source that requires the Earth's gravity to work?

I HAVE WIND.

1. Who has a term that describes petroleum, coal, natural gas, and propane?
2. Who has the process in which uranium and coal are brought to the Earth's surface?
3. Who has what is generated when a magnet is spun in a coil of copper wire?

I HAVE HYDROGEN.

1. Who has the secondary energy source generated by a waste-to-energy plant?
2. Who has the energy source that produces noise pollution but no air pollution?
3. Who has the item that makes light, heat, motion, growth, and powering technology possible?

I HAVE FOSSIL FUEL.

1. Who has the process in which the sun's extremely high pressure and hot temperature cause hydrogen atoms to combine?
2. Who has a clean burning fossil fuel used to heat many homes in the U.S.?
3. Who has what uses a generator, turbine, and transformer?

I HAVE PETROLEUM.

1. Who has the type of energy source we can't make more of in a short time?
2. Who has the group of sources that were formed from plant and animal remains long ago?
3. Who has resources that are used specifically to meet energy needs?

I HAVE HYDROPOWER.

1. Who has the smallest element is only found on Earth combined with other elements?
2. Who has the energy source that takes eight minutes to reach the Earth?
3. Who has the source of energy that can be concentrated on a dish, trough, or tower to create electricity?

I HAVE NONRENEWABLE.

1. Who has the gases that make up one percent of the atmosphere?
2. Who has the energy source that uses sunlight in photosynthesis to store radiant energy?
3. Who has a long-term energy plan that meets the needs of today as well as tomorrow?

I HAVE ELECTRICITY.

1. Who has the energy source whose major use is for transportation?
2. Who has the energy source that is the nation's third leading producer of electricity?
3. Who has the energy source that can produce acid rain when it is burned?

I HAVE GREENHOUSE.

1. Who has the radioactive mineral used to produce electricity in over 100 reactors in the U.S.?
2. Who has the form of energy released deep within the Earth by the slow decay of radioactive particles?
3. Who has a renewable source of energy from wood, garbage, and agricultural waste?

I HAVE NUCLEAR FUSION.

1. Who has the energy source that depends on the amount of rainfall?
2. Who has energy sources whose supplies are readily replenished?
3. Who has the process in which water changes from liquid to vapor and back?

I HAVE GEOTHERMAL.

1. Who has the process in which an atom of uranium is split by a neutron?
2. Who has the energy source that might disrupt fish and wildlife when its production facility is built?
3. Who has the process used by green plants to store the sun's energy?

I HAVE URANIUM.

1. Who has the resources that can be categorized as either renewable or nonrenewable?
2. Who has natural resources that are used to do work?
3. Who has the energy source that consists mostly of methane?

I HAVE ENERGY SOURCES.

1. Who has the production facility where electricity is generated?
2. Who has the portable energy source used in barbecue grills and hot air balloons?
3. Who has the energy sources whose supplies are limited?

I HAVE NUCLEAR FISSION.

1. Who has the form of energy that comes from the sun?
2. Who has the effect that traps heat in the atmosphere?
3. Who has the renewable energy source that produces most of its electricity in Texas and California?

I HAVE TEXAS.

1. Who has the process of evaporation, condensation, and precipitation?
2. Who has the energy source that is abundant in the Ring of Fire in the Pacific Ocean?
3. Who has the nuclear combining process that gives off radiant energy?

I HAVE ENERGY.

1. Who has the process green plants use to change radiant energy into chemical energy?
2. Who has the process nuclear power plants use to produce electricity?
3. Who has the energy source of which most is refined into gasoline?

I HAVE THE WATER CYCLE.

1. Who has the continuous process used to reach energy sources buried underground?
2. Who has the type of energy sources in which fossil fuels are grouped?
3. Who has the sector of the economy that uses natural gas and propane the most?

I HAVE PHOTOSYNTHESIS.

1. Who has the number one petroleum producing state?
2. Who has the form of energy transformed by plants into energy stored in its roots and leaves?
3. Who has the energy source whose waste products can be stored in spent fuel pools?

I HAVE MINING.

1. Who has the energy source Dr. Walter Snelling discovered in 1911?
2. Who has the process in which larger atoms are made by combining smaller atoms?
3. Who has the gases that include CO₂, methane, and water vapor?

I HAVE POWER PLANT.

1. Who has the energy source that comes from the Earth's core?
2. Who has the belief that every generation should meet their energy needs without compromising the energy needs of future generations?
3. Who has the form of energy commonly called "heat"?

I HAVE INDUSTRY.

1. Who has the ability to do work or make a change?
2. Who has the energy source that is transported chiefly by train?
3. Who has the type of energy source that includes biomass, solar, geothermal, hydropower, and wind?



Energy Web Games

SCHOOL AS A SYSTEM WEB GAME **HOME AS A SYSTEM WEB GAME**

Get Ready

- Copy one set of hangtags (school or home) on pages 50-57.
- Cut the cards horizontally so the object and its description are in one strip.
- Fold in half on the dotted line. For extra durability, copy on card stock and laminate.
- Get a ball of yarn or string.
- Use a single hole punch to make holes in the top corners of each folded card.
- Lace one length of yarn or string through each and tie off creating a necklace.

Get Set

- Explain that a building is an interactive system consisting of the occupants, the mechanical systems, and the movement of heat, air, and moisture. All of these aspects relate to indoor air quality, the cost of energy, and environmental quality. This activity will help students understand the systemic nature of energy use and its impacts on the broader environment.
- Hand out the role card hangtags and ask students to read the backs of their cards. Give students a chance to ask any questions they have about what is written on their cards.

Go

- Have students put on their hangtags and stand in a circle.
- Hand the ball of yarn to one of the students. Explain that he/she should look around the circle and identify another component of a system that is related to his/hers.
- The student should hold on to the end of the yarn, then pass the ball of yarn to the identified student, explaining how that part of the system is related. The next student repeats the process, holding onto the yarn and passing the ball to another student with a related component of the system.
- Continue passing the yarn around until all students are holding onto the yarn. The students will have created a web made of yarn connecting all of them.
- Choose one student to give a tug on the string. Explain that this tug represents a stress of some sort on that part of the system. For instance, the person wearing the Heating System tag might give a tug, and you would say, "There is a malfunction in our heating system. It is not operating efficiently."
- Repeat this several times with different students tugging on the yarn. For each tug, describe a possible scenario for the component that is causing stress on the system.
- Ask students to describe how the system is dependent on all of the components. Students should be able to explain that a change in one part of the system can affect all other parts of the system—sometimes in unexpected ways!

Energy Web Games helps students understand the interactions that affect energy use, energy costs, and indoor air quality.

Grades

- 5–12

Preparation

- Low

Time

- 20–30 minutes

Check out NEED's other web games that can found within the following resources:

- Liquefied Natural Gas as a system—LNG
- Climate Changes Web—Climate Change Guides



School Hangtags

Lights

It's important to have good quality lighting in a school and enough light to complete tasks.

Lights use electricity, which costs money and can cause pollution.

Air Conditioning

AC helps you stay cool in hot weather.

AC uses a lot of electricity, which costs money and can cause pollution.

Is there AC anywhere in your school?

Electric Bills

Electricity costs money. Whenever you use electrical devices or lighting, the school district is charged.

This means there is less money available for classroom books and supplies and other things the district must provide.

Heat

Most areas need heat in the winter. The heat in a school building probably comes from a boiler that burns natural gas or oil.

It takes a lot of these fuels to heat a building. This is very expensive for the school district.

Books and Supplies

You probably don't think about it much, but the materials you use in class cost money.

The more money spent on energy, the less money there is to get the materials you need to help you learn.

Weather

The weather greatly affects energy use.

The colder it is outside, the more it costs to heat the building. The hotter it is, the more it costs to run the AC.

Students

When you are comfortable, you learn better. Schools need to heat and cool buildings to maintain comfortable temperatures, which costs money.

Students can do a lot to save energy around the school. Can you think of some ways?

Oil and Natural Gas Prices

The boiler that heats your school probably runs on oil or natural gas. When the cost of these fuels increases, it costs more to heat the building. The cost of these fuels usually rises during winter months.

Indoor Air Quality

Clean air in a school is important for students to be healthy and comfortable. Your building has a system that brings in fresh air.

This system uses a lot of energy, which costs money. The more students there are in a building, the harder these systems must work.

District Budget

The school district has a limited amount of money it can spend each year.

The less money it spends on energy, the more it can spend on classroom supplies and hiring more teachers.

Heating Bills

Heating a building costs money. The more heat used, the more the school district has to pay.

This means there is less money available for classroom books and supplies and other things the district must provide.

Hot Water

Heating water costs money. Your school probably uses natural gas or oil to heat water. The more hot water used, the more the school district has to pay.

This means there is less money available for classroom books and supplies and other things the district must provide.

Air Pollution/ Global Warming

Every time the heating system is operating in your building, the boiler is releasing emissions that can pollute the air. The electricity used in the building comes from a power plant, which can also add pollution to the air.

Many of these emissions can contribute to global warming.

Computers

Computers use electricity that costs money. If you leave computers on when they're not in use, it wastes energy.

Computers also cost a lot of money to buy. The more your district has to pay for energy, the less money there is to buy computers.

Teachers

Teachers are more effective when the building is at a comfortable temperature. Buildings must be heated in cold months, which costs money.

Teachers can do a lot to save energy around the school. Can you think of some ways?

Comfort

Your comfort is important. You need heat in the winter; you need good lighting and clean air in your school.

All of these use energy, which the school district has to pay for.



Home Hangtags

Lights

It's important to have good quality lighting at home and enough light to accomplish tasks.

Lights use electricity, which costs money and can cause pollution.

Air Conditioning

AC helps you stay cool in hot weather. AC also removes moisture from your home, which helps you be more comfortable when the air is humid. In humid climates, drier air is also better for your health in the summertime.

AC uses a lot of electricity, which costs money and can cause pollution.

Electric Bills

Electricity costs money. Whenever you use electrical appliances or lighting, your parents are charged for it.

This means there is less money available for other things your family needs and wants.

Insulation

Insulation helps keep your house warm in winter and cool in summer. If your house is well insulated, the heating and AC systems don't have to work as hard.

Good insulation saves money on heating and cooling costs and can reduce air pollution.

Clean Air

You need clean air to be comfortable and healthy. If too much air flows through your home, however, it removes heat, making the heating system work harder.

Sealing your home too tightly, on the other hand, can trap moisture, causing health problems.

Weather

The weather greatly affects energy use.

The colder it is outside, the more it costs to heat a home. The hotter it is, the more it costs to keep it cool.

People

You want to be comfortable in your home. That means you need heat in the winter, which costs money.

One way that people affect indoor air quality is by adding moisture to the air through their activities.

Oil and Natural Gas Prices

Most homes are heated by a furnace that burns oil or natural gas.

When the cost of these fuels increases, it costs more to heat your home. The cost of these fuels usually rises during winter months.

Moisture

Too much moisture in a home can lead to mold growth, which can cause health problems. Too little moisture in the air can cause health problems, too.

How does moisture get into your home? How does it get into the air?

Household Budget

Your family has a limited amount of money it can spend each month.

The less money your family spends on energy, the more you can spend on other things that you need and want.

Heating Bills

Heating your home uses a lot of energy and costs money. The more heat you use, the more your parents must pay.

This means there is less money available for other things you need and want.

Hot Water

Heating water uses energy and costs money. Most homes use electricity or burn natural gas or oil to heat water.

The more hot water you use, the more your parents have to pay. This means less money is available for other things you need and want.

Air Pollution/ Global Warming

When you heat your home, the furnace is releasing emissions that can pollute the air. The electricity you use comes from a power plant, which may also add pollution to the air.

Many of these emissions can contribute to global warming.

Heating System

The colder it is outside, the more fuel your heating system uses.

Insulation in the walls and attic can reduce the amount of heat your home needs, saving energy and money, and reducing pollution.

Electrical Appliances

Refrigerators, TVs, and other appliances use electricity, which costs money. If you leave appliances on when they're not being used, that wastes energy. Appliances also add heat to a home. In the summer, that means the AC has to work harder, using more energy.

Comfort

Comfort is important. You need heat in the winter; you need good lighting and clean air in your home. All of these use energy, which your parents have to pay for.



The NEED Clap

DEVELOPED BY LINDA HUTTON AND THE NEED STUDENTS IN KITTY HAWK, NC

***We are NEED energy students,
Saving energy is our plan,
We save energy for our future,
Saving energy throughout the land.***

***Hydropower, geothermal, solar, wind, and biomass,
Coal and petroleum, uranium, propane,
the clean burning flame of natural gas.***

***Energy sources light our future,
Saving energy takes all hands,
Working together, conserving forever,
Saving energy throughout the land.***

The 14 Easy Steps

Find a partner and place your palms together (thumbs up) in front of you, facing your partner.

1. Slap your hands back and forth (keeping palms together).
2. Slap hands back and forth once with the backs of your hands landing together and stop.
3. Take your right hand away from the left and clap once.
4. Clap once with your right hand and your partner's hand above your left hands.
5. Clap your hands together once as in number 3.
6. Grab your partner's right hand with your right hand below your left hands.
7. Take your left hand below your right hand and grab your partner's other hand.
8. Take your right hand and slap your right hip twice.
9. Move that hand above your other two, shaking hands, and slap your partner's hand once back and forth.
10. Grab your partner's hand and hold together with thumbs up.
11. Hit the top of your hand once.
12. Hit the top of your hand again.
13. Repeat steps 1-12.
14. Have FUN!



Energy Games and Icebreakers Evaluation Form

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

1. Did you conduct all of the activities? If no, specify which ones below.

☐ Yes ☐ No

2. Were the instructions clear and easy to follow?

☐ Yes ☐ No

3. Did the activities meet your academic objectives?

☐ Yes ☐ No

4. Were the activities age appropriate?

☐ Yes ☐ No

5. Were the allotted times sufficient to conduct the activities?

☐ Yes ☐ No

6. Were the activities easy to use?

☐ Yes ☐ No

7. Was the preparation required acceptable for the activities?

☐ 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 these activities again?

☐ Yes ☐ No

Please explain any 'no' statement below.

How would you rate the activities overall?

☐ excellent ☐ good ☐ fair ☐ poor

How would your students rate the activities overall?

☐ excellent ☐ good ☐ fair ☐ poor

What would make the activities 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



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National Grid
National Hydropower Association
National Ocean Industries Association
National Renewable Energy Laboratory
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