Elementary Energy Infobook Activities

A companion guide to the *Elementary Energy Infobook* that includes activities to reinforce general energy information, energy sources, electricity, and conservation.

Grade Level:

**Elem**  Elementary

Subject Areas:

- 📚 Science
- 🌍 Social Studies
- 📚 Language Arts

NEED
National Energy Education Development Project
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.

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Teacher Advisory Board

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

Energy Data Used in NEED Materials

NEED believes in providing teachers and students with the most recently reported, available, and accurate energy data. Most statistics and data contained within this guide are derived from the U.S. Energy Information Administration. Data is compiled and updated annually where available. Where annual updates are not available, the most current, complete data year available at the time of updates is accessed and printed in NEED materials. To further research energy data, visit the EIA website at www.eia.gov.
Elementary Energy Infobooks

Activities

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NEED Curriculum Resources

For more in-depth information, inquiry investigations, and engaging activities, download these curriculum resources from shop.need.org:

- Elementary Science of Energy
- Elementary Energy Infobooks
- Energy Flows
- Energy Stories and More

Also, check out our digital and interactive infobook activities at www.need.org/energyinfobooks
Standards Correlation Information

www.NEED.org/curriculumcorrelations

Next Generation Science Standards

- This guide effectively supports many Next Generation Science Standards. This material can satisfy performance expectations, science and engineering practices, disciplinary core ideas, and cross cutting concepts within your required curriculum. For more details on these correlations, please visit NEED’s curriculum correlations website.

Common Core State Standards

- This guide has been correlated to the Common Core State Standards in both language arts and mathematics. These correlations are broken down by grade level and guide title, and can be downloaded as a spreadsheet from the NEED curriculum correlations website.

Individual State Science Standards

- This guide has been correlated to each state’s individual science standards. These correlations are broken down by grade level and guide title, and can be downloaded as a spreadsheet from the NEED website.
Background

*Elementary Energy Infobook Activities* is a series of student worksheets designed to reinforce the vocabulary and concepts contained in the *Elementary Energy Infobook*. You can download the *Elementary Energy Infobook* or specific energy fact sheets from [www.NEED.org/energyinfobooks](http://www.NEED.org/energyinfobooks). Digital and interactive versions of some of these activities can also be accessed at [www.NEED.org/games](http://www.NEED.org/games).

Preparation

- Decide which fact sheets and worksheets you will use with your class.
- Obtain a class set of the *Elementary Energy Infobooks* or make copies of the fact sheets you plan to use.
- Make copies of the worksheets you plan to use from this guide.

Procedure

1. Distribute one *Elementary Energy Infobook* or selected fact sheets and one of each selected worksheet to each student.
2. Have the students read the selected fact sheets. Discuss the concepts and new vocabulary in the fact sheets.
3. Have the students complete the selected worksheets using information from the fact sheets.
4. Once students have read all of the energy source fact sheets and completed the worksheets for the sources (pages 9-19), have the students complete the worksheets on pages 20-25. These worksheets reinforce and synthesize the information in the fact sheets.
5. Have students read about electricity in the *Elementary Energy Infobook*, and complete the worksheets on pages 26-29. These worksheets reinforce electricity concepts and vocabulary.
6. Critical Thinking Questions are included on page 8. You may choose to use any or all questions with your students for discussion or writing integration.
7. Answer keys can be found on pages 31-44.
8. As an extension, play *Renewable Energy Bingo* as a class. Instructions can be found on pages 6-7, and the student worksheet can be found on page 30.
9. Use the *Evaluation Form* on page 45 to evaluate the activities.
Get Ready
Duplicate as many Renewable Energy Bingo sheets (found on page 30) 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 Renewable Energy Bingo sheet to each member of the group.

Go

PART ONE: FILLING IN THE BINGO SHEETS
Give the group the following instructions to create bingo cards:

- This bingo activity 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 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!

- 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.

PART TWO: PLAYING BINGO
Give the class the following instructions to play the game:

- 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 “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 “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 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 which he previously answered during the 20-minute session. For example, if the statement was “can name at least three renewable energy sources,” the player must now name three 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.”

### RENEWABLE ENERGY BINGO

<table>
<thead>
<tr>
<th>A. Has been to a renewable power plant</th>
<th>B. Knows which state generates the most geothermal energy</th>
<th>C. Can name at least three renewable energy sources</th>
<th>D. Knows the percentage of electricity produced by renewable sources in the U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Can name two types of biomass</td>
<td>F. Knows the source of energy that drives the water cycle</td>
<td>G. Can name two factors to consider when siting a wind farm</td>
<td>H. Has used a solar clothes dryer</td>
</tr>
<tr>
<td>I. Has seen a modern wind turbine</td>
<td>J. Knows the renewable source that produces the most energy in the U.S.</td>
<td>K. Knows the renewable source that produces the most electricity in the U.S.</td>
<td>L. Knows the cost per kilowatt-hour of electricity for residential customers</td>
</tr>
<tr>
<td>M. Knows how radiant energy travels through space</td>
<td>N. Can name two kinds of hydropower</td>
<td>O. Has used wind energy for transportation</td>
<td>P. Can name the device in a hydropower plant that captures the energy of flowing water</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A. waste-to-energy, solar thermal, solar PV, hydropower plant</th>
<th>B. California</th>
<th>C. solar hydropower, wind geothermal, biomass</th>
<th>D. 14% (13.58)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. wood, crops, manure, garbage, landfill gas, alcohol fuels, ethanol, and biodiesel</td>
<td>F. Solar energy drives the water cycle</td>
<td>G. Wind speed, wind blocks, environmental impact, ability to transport electricity to population centers, etc.</td>
<td>H. Anyone who has hung clothes to dry outside</td>
</tr>
<tr>
<td>I. ask for location/description</td>
<td>J. biomass</td>
<td>K. hydropower</td>
<td>L. The national average is $0.127 per kWh for residential customers</td>
</tr>
<tr>
<td>M. in electromagnetic waves (or transverse waves)</td>
<td>N. pumped storage or run of river hydropower plant, tidal power, wave power, ocean thermal energy conservation</td>
<td>O. sailboat sailboard etc.</td>
<td>P. A turbine captures the energy of flowing water.</td>
</tr>
</tbody>
</table>
1. Energy does a lot for us. Which of its jobs do you think is the most important? Why?

2. Write a paragraph explaining all the ways you could use biomass in a day.

3. Do you think people mining for coal should have to use reclamation on the land? Why or why not?

4. Which layer of the Earth do you think is the most important? Why?

5. Two drops of water meet in a cloud. They start talking about their last trip to Earth. One went through a hydropower plant. The other helped provide water for wheat to grow. They got into an argument over who did a more important job. Write a dialogue between the two water drops.

6. What do you think some of the problems would be in capturing methane gas from rotting garbage?

7. Explain how you use petroleum in your life. Can you reduce the amount of petroleum you use? How?

8. Explain why we switch propane into a liquid. Draw a picture to illustrate your explanation.

9. Do you think the sun’s light or heat is more important? Explain your answer.

10. The radiation from nuclear fuel can be dangerous if not taken care of properly. Describe at least two other things that can be dangerous if not taken care of properly.

11. Draw a picture of a wind farm. Include and label as many details as you can.

12. Add at least 5 more energy words to one of the crossword puzzles. Make sure they attach to a current letter. Write clues for your words.

13. Explain, with diagrams and words, what “opposite charges attract each other” means.

14. When we flip a switch, our lights go on. When we plug something in, and turn it on, it works. We don’t think about where electricity comes from. Pretend you are a spark of electricity. Explain your journey from an energy resource to your game console or system.
Forms of Energy Crossword

ACROSS

5. The energy we use to run many machines.
7. Sugars give us energy to _____.
8. Energy doesn't disappear; it changes to another _____.

DOWN

1. We use _____ energy to see.
2. We use energy to _____ from place to place.
3. Energy gives us _____ to keep us warm.
4. _____ is the ability to do work.
6. Energy is the power to make a ___.

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Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Biomass is any __________________________ that was alive a short time ago.

2. Biomass is a __________________________ energy source, because we can always grow more plants.

3. We __________________________ most biomass to make heat.

4. We burn garbage in a __________________________ plant to make __________________________.

5. When biomass rots, it forms a __________________________ called __________________________ that we can use for energy.

6. Biomass can be turned into a liquid fuel like gasoline called __________________________.

7. Most of the biomass we use is __________________________.

8. Plants __________________________ energy from the sun in their roots and leaves.

**Word Bank**
- burn
- electricity
- ethanol
- gas
- material
- methane
- renewable
- store
- waste-to-energy
- wood
Coal

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Coal is called a __________________________ because it was made from plants millions to hundreds of millions of years ago.

2. Coal is __________________________; you can't make more in a short time.

3. When coal is near the surface, the Earth is scraped off the coal in a __________________________.

4. To reach coal buried far underground, __________________________ are dug. This is called __________________________ mining.

5. Making the mined land usable again is called __________________________.

6. Coal is burned in a power plant to make __________________________.

7. Most coal is moved by __________________________ and __________________________.

8. Coal __________________________ the air when it is burned.

9. Power plants use __________________________ to clean the emissions from burning the coal.

Word Bank
- barges
- deep
- electricity
- fossil fuel
- nonrenewable
- pollutes
- reclamation
- shafts
- surface mine
- trains
- scrubbers
Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. The Greek word for Earth is __________________________.

2. The Greek word for heat is __________________________.

3. The center of the Earth has an iron __________________________.

4. Hot melted rock inside the Earth is called __________________________.

5. The Earth layer with rock and magma is the __________________________.

6. The shell of the Earth is called the __________________________.

7. The heat inside the Earth will always be there. We call geothermal a __________________________ energy source.

8. When hot water inside the Earth comes to the surface, it can form __________________________.

9. A geothermal mountain called a __________________________ will sometimes pour out hot __________________________, which was once magma.

10. Geothermal power plants make __________________________.

Word Bank
- core
- crust
- electricity
- geo
- hot springs
- lava
- magma
- mantle
- renewable
- therme
- volcano
Hydropower

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Hydro means __________________________.

2. The movement of water between the Earth and the clouds is called the __________________________.

3. When water turns into a gas it is called __________________________.

4. The force that moves water from high ground to lower ground is __________________________.

5. We can build a __________________________ across a river to control the flow of water and form a lake called a __________________________.

6. In a hydropower plant, the water flows through a tube called a __________________________ and spins a __________________________ to make __________________________.

7. The water cycle will keep water moving on the Earth; we call hydropower a __________________________ energy source.

Word Bank
- dam
- electricity
- gravity
- penstock
- renewable
- reservoir
- turbine
- water cycle
- water vapor
- water
Natural Gas

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Natural gas is called a __________________________ because it was made from marine plants and animals hundreds of millions of years ago.

2. We can’t make natural gas in a short time, so we say it is a __________________________ energy source.

3. The energy in natural gas once came from the __________________________.

4. Natural gas is underground; we drill __________________________ to find it.

5. Decaying garbage makes a gas called __________________________.

6. We add a smell like __________________________ to natural gas so we know if there is a leak.

7. __________________________ use natural gas for heat.

8. __________________________ use natural gas to make products.


Word Bank

- burn
- factories
- fossil fuel
- homes
- methane
- nonrenewable
- rotten eggs
- sun
- wells
Petroleum

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Petroleum is called a __________________________ because it was made from marine plants and animals hundreds of millions of years ago.

2. Another name for petroleum is __________________________.

3. We can’t make more petroleum in a short time, so we say it is a __________________________ energy source.

4. Some oil is underground; we drill __________________________ to find it.

5. Some oil is under the ocean; we use oil __________________________ to reach it and pump it to the surface.

6. We move petroleum by __________________________ and __________________________.

7. After we pump petroleum from the ground, we send it to a __________________________ where some is made into __________________________.

8. We __________________________ 48 percent of the oil we use from other countries.

9. Burning petroleum products causes air __________________________.

Word Bank

- wells
- fossil fuel
- gasoline
- import
- nonrenewable
- oil
- pipelines
- pollution
- refinery
- rigs
- ships
Propane

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Propane is called a __________________________ because it was formed from marine plants and animals hundreds of millions of years ago.

2. We can’t make more propane in a short time, so we say it is a __________________________ energy source.

3. Propane is found underground, mixed with __________________________ and __________________________.

4. At home, we use propane to fuel barbecue __________________________.

5. When we put propane gas under __________________________, it turns into a __________________________.

6. We store liquid propane in __________________________ and move it from place to place with __________________________.

7. Propane is called a __________________________ fuel because it is easy to move as a liquid.

Word Bank

- fossil fuel
- grills
- liquid
- natural gas
- nonrenewable
- petroleum
- portable
- pressure
- tanks
- trucks
Solar

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. We get solar energy from the __________________________, which is a big ball of __________________________.

2. Solar energy travels to the Earth in __________________________.

3. The sun will always shine, so we say solar energy is a __________________________ energy source.

4. Plants __________________________ solar energy in their leaves.

5. Some solar energy is __________________________ that helps us see.

6. Solar energy can turn into __________________________ when it hits things.

7. People use __________________________ on their roofs to heat their homes and water.

8. Solar calculators use __________________________ to turn energy from the sun into __________________________.

**Word Bank**
- electricity
- gas
- heat
- light
- renewable
- solar cells
- solar collectors
- rays
- sun
- store
Uranium

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Everything in the world is made of __________________________.

2. At the center of an atom is the __________________________. It is made of __________________________ and __________________________.

3. Moving around the nucleus are __________________________.

4. The energy stored in atoms is __________________________.

5. Uranium is buried underground. We can’t make more, so we call uranium a __________________________ energy source.

6. Uranium atoms can be split; we call this __________________________.

7. When uranium atoms are split, energy is released as __________________________ and __________________________.

8. In a nuclear power plant, we split uranium atoms and use the heat to make __________________________.

**Word Bank**
- atoms
- electricity
- electrons
- fission
- heat
- neutrons
- nonrenewable
- nuclear energy
- nucleus
- protons
- radiation
Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. The ___________________________ shines on the Earth. The ___________________________ heats up faster than the water. The warm air over the land ___________________________.
   The ___________________________ air over the water moves in to take its place. This ___________________________ is wind.

2. The sun will always shine; the wind will blow. We call wind a ___________________________ energy source.

3. A ___________________________ can capture the energy in the wind.

4. The spinning blades of a wind turbine turn a ___________________________ to make ___________________________.

5. Sometimes there are many wind turbines together to make electricity. This is called a ___________________________.

**Word Bank**
- cool
- electricity
- generator
- land
- moving air
- renewable
- rises
- sun
- wind farm
- wind turbine

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Energy Source Matching 1

Write the number of the energy source on the line next to its symbol.

1. Petroleum (oil) __________
2. Wind __________
3. Biomass __________
4. Uranium __________
5. Propane __________
6. Solar __________
7. Geothermal __________
8. Hydropower __________
9. Coal __________
10. Natural Gas __________
Energy Source Matching 2

Write the number of the energy source on the line next to its definition.

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Petroleum (oil)</td>
<td>Black rock burned to make electricity.</td>
</tr>
<tr>
<td>2. Wind</td>
<td>Energy from heat inside the Earth.</td>
</tr>
<tr>
<td>4. Uranium</td>
<td>Energy from wood, waste, and garbage.</td>
</tr>
<tr>
<td>5. Propane</td>
<td>Energy from moving air.</td>
</tr>
<tr>
<td>7. Geothermal</td>
<td>Portable fossil fuel gas often used in grills.</td>
</tr>
<tr>
<td>8. Hydropower</td>
<td>Fossil fuel for cars, trucks, and jets.</td>
</tr>
<tr>
<td>10. Natural Gas</td>
<td>Energy in rays from the sun.</td>
</tr>
</tbody>
</table>
Energy Source Crossword

ACROSS

2. The energy of moving air.
5. The portable gas.
7. Gas moved in pipelines.
8. An atom of this element can be split.

DOWN

1. The energy in waste and wood.
3. Heat energy from inside the Earth.
4. The energy in flowing water.
5. Liquid fossil fuel.
Renewable or Nonrenewable 1

- Draw a circle around the renewables.
- Draw a square around the nonrenewables.
# Renewable or Nonrenewable 2

## Part 1

Calculate how much of the energy we use in the U.S. comes from renewable energy sources. Calculate how much comes from nonrenewable sources.

### U.S. Energy Consumption by Source, 2015

<table>
<thead>
<tr>
<th>Source</th>
<th>Percentage</th>
<th>Uses:</th>
<th>Nonrenewable: ____________________ %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NONRENEWABLE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PETROLEUM</td>
<td>36.6%</td>
<td>transportation, manufacturing - includes propane</td>
<td></td>
</tr>
<tr>
<td>NATURAL GAS</td>
<td>29.0%</td>
<td>heating, manufacturing, electricity - includes propane</td>
<td></td>
</tr>
<tr>
<td>COAL</td>
<td>16.0%</td>
<td>electricity, manufacturing</td>
<td></td>
</tr>
<tr>
<td>URANIUM</td>
<td>8.6%</td>
<td>electricity</td>
<td></td>
</tr>
<tr>
<td>PROPANE</td>
<td></td>
<td>heating, manufacturing</td>
<td></td>
</tr>
<tr>
<td>PETROLEUM</td>
<td>36.6%</td>
<td>transportation, manufacturing - includes propane</td>
<td></td>
</tr>
</tbody>
</table>

**Nonrenewable: ____________________ %**

<table>
<thead>
<tr>
<th>Source</th>
<th>Percentage</th>
<th>Uses:</th>
<th>Renewable: ____________________ %</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOMASS</td>
<td>4.9%</td>
<td>heating, electricity, transportation</td>
<td></td>
</tr>
<tr>
<td>HYDROPOWER</td>
<td>2.4%</td>
<td>electricity</td>
<td></td>
</tr>
<tr>
<td>WIND</td>
<td>1.8%</td>
<td>electricity</td>
<td></td>
</tr>
<tr>
<td>SOLAR</td>
<td>0.4%</td>
<td>heating, electricity</td>
<td></td>
</tr>
<tr>
<td>GEOTHERMAL</td>
<td>0.2%</td>
<td>heating, electricity</td>
<td></td>
</tr>
</tbody>
</table>

**Renewable: ____________________ %**

**Total does not add up to 100% due to independent rounding.**

Data: Energy Information Administration

## Part 2

Make a pie chart showing the percentage of energy that comes from nonrenewables and renewables. Color renewables and nonrenewables different colors.
Where We Get the Energy We Use

Make a graph showing how much energy each source provides the United States. Write the names of the energy sources in the boxes at the bottom of the graph. Fill in the columns to show the percentage each source provides. Use a different color or pattern for each column.

U.S. Energy Consumption by Source, 2015

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Percentage of Energy Provided</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NONRENEWABLE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PETROLEUM</td>
<td>36.6%</td>
<td>Transportation, manufacturing - includes propane</td>
</tr>
<tr>
<td>NATURAL GAS</td>
<td>29.0%</td>
<td>Heating, manufacturing, electricity - includes propane</td>
</tr>
<tr>
<td>COAL</td>
<td>16.0%</td>
<td>Electricity, manufacturing</td>
</tr>
<tr>
<td>URANIUM</td>
<td>8.6%</td>
<td>Electricity</td>
</tr>
<tr>
<td>PROPANE</td>
<td></td>
<td>Heating, manufacturing</td>
</tr>
<tr>
<td><strong>RENEWABLE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOMASS</td>
<td>4.9%</td>
<td>Heating, electricity, transportation</td>
</tr>
<tr>
<td>HYDROPOWER</td>
<td>2.4%</td>
<td>Electricity</td>
</tr>
<tr>
<td>WIND</td>
<td>1.8%</td>
<td>Electricity</td>
</tr>
<tr>
<td>SOLAR</td>
<td>0.4%</td>
<td>Heating, electricity</td>
</tr>
<tr>
<td>GEOTHERMAL</td>
<td>0.2%</td>
<td>Heating, electricity</td>
</tr>
</tbody>
</table>

**Total does not add up to 100% due to independent rounding.**

Data: Energy Information Administration

**ENERGY SOURCES**

**PERCENTAGE OF ENERGY THE SOURCE PROVIDES**

<table>
<thead>
<tr>
<th>Percentage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>40%</td>
<td></td>
</tr>
<tr>
<td>30%</td>
<td></td>
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<tr>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

*Propane consumption is included in petroleum and natural gas totals.

**Total does not add up to 100% due to independent rounding.**

Data: Energy Information Administration
Parts of an Atom

Write the names of the parts of an atom on the lines.

1. ________________
2. ________________
3. ________________
4. ________________
5. ________________
Electricity 1

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. In the center of an atom there are __________________________ that have a positive __________________________.

2. Electrons move around the nucleus in shells, or __________________________, and have a __________________________ charge.

3. Opposite charges __________________________ each other.

4. __________________________ have north and south __________________________.

5. The north poles of magnets __________________________ each other.

6. Magnets have a force called a __________________________.

7. Magnets can push __________________________ out of their shells; moving electrons is __________________________.

Word Bank

- attract
- charge
- electricity
- electrons
- energy levels
- magnetic field
- magnets
- negative
- poles
- protons
- repel
Electricity 2

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. A factory that makes electricity is a __________________________.

2. Power plants use __________________________ and __________________________ of copper wire to make electricity.

3. A giant wheel, called a __________________________, spins a coil of wire inside big magnets to produce a __________________________.

4. Many __________________________, such as coal, are used to spin the turbine and make __________________________.

5. Electricity flows in a big loop called a __________________________.

6. From the power plant, lots of electricity flows through large __________________________ held up by __________________________.

7. When electricity reaches the town, smaller wires, called __________________________, carry the electricity to __________________________ on __________________________.

Word Bank
- circuit
- coils
- distribution lines
- electricity
- electric poles
- fuels
- houses
- magnetic field
- magnets
- power plant
- power towers
- transmission lines
- turbine
Magnets

Does each set of magnets repel or attract? Circle the correct answer.

- S N N S
  - attract or repel

- S N S N
  - attract or repel

- S N S N
  - attract or repel

- S N S N
  - attract or repel
### RENEWABLE ENERGY BINGO

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Has been to a renewable power plant</td>
<td>B</td>
<td>Knows which state generates the most geothermal energy</td>
</tr>
<tr>
<td>C</td>
<td>Can name at least three renewable energy sources</td>
<td>D</td>
<td>Knows the percentage of electricity produced by renewable sources in the U.S.</td>
</tr>
<tr>
<td>E</td>
<td>Can name two types of biomass</td>
<td>F</td>
<td>Knows the source of energy that drives the water cycle</td>
</tr>
<tr>
<td>G</td>
<td>Can name two factors to consider when siting a wind farm</td>
<td>H</td>
<td>Has used a solar clothes dryer</td>
</tr>
<tr>
<td>I</td>
<td>Has seen a modern wind turbine</td>
<td>J</td>
<td>Knows the renewable source that produces the most energy in the U.S.</td>
</tr>
<tr>
<td>K</td>
<td>Knows the renewable source that produces the most electricity in the U.S.</td>
<td>L</td>
<td>Knows the cost per kilowatt-hour of electricity for residential customers</td>
</tr>
<tr>
<td>M</td>
<td>Knows how radiant energy travels through space</td>
<td>N</td>
<td>Can name two kinds of hydropower</td>
</tr>
<tr>
<td>O</td>
<td>Has used wind energy for transportation</td>
<td>P</td>
<td>Can name the device in a hydropower plant that captures the energy of flowing water</td>
</tr>
</tbody>
</table>
1. Energy does a lot for us. Which of its jobs do you think is the most important? Why?

Answers will vary, but may include powering our electronics and appliances, allowing us to move and grow, allowing plants to grow and provide food, and powering vehicles.

2. Write a paragraph explaining all the ways you could use biomass in a day.

Paragraphs may include burning wood to make a fire or cook food, burning garbage to make electricity, and using biofuels to power cars.

3. Do you think people mining for coal should have to use reclamation on the land? Why or why not?

Students should pick yes or no, and explain why the land should be taken care of after it has been used for mining or why not.

4. Which layer of the Earth do you think is the most important? Why?

Answers may vary, but should include a good description of the layer students pick as well as a statement about why their layer is more important than the other two.

5. Two drops of water meet in a cloud. They start talking about their last trip to Earth. One went through a hydropower plant. The other helped provide water for wheat to grow. They got into an argument over who did a more important job. Write a dialogue between the two water drops.

Dialogues should describe how the water droplets got to their “job sites” as well as how each droplet does work. The dialogue should also include a discussion of why each job is important, and potentially even identify a winning droplet with a more convincing argument.

6. What do you think some of the problems would be in capturing methane gas from rotting garbage?

Answers will vary, but may include that gases can escape easily so it must be trapped at the landfill. Students may suggest collection methods as well.

7. Explain how you use petroleum in your life. Can you reduce the amount of petroleum you use? How?

Students will likely suggest that they use a lot of petroleum in transportation from place to place. Students may also mention that many of the products they use every day, such as plastics, medicines, etc., are made from petroleum. Student answers should include descriptions of items used and a suggestion for reduction, like carpooling or using recycled materials.

8. Explain why we switch propane into a liquid. Draw a picture to illustrate your explanation.

Student explanations should describe that liquids take up less space than a gas, and that it makes it easier to move around and control use. Student illustrations may include size comparisons or examples of propane in use.

9. Do you think the sun’s light or heat is more important? Explain your answer.

Answers will vary. Students should pick light or heat, and explain why their choice is more important.

10. The radiation from nuclear fuel can be dangerous if not taken care of properly. Describe at least two other things that can be dangerous if not taken care of properly.

Answers will vary. Students may describe things like pets, firearms, cleaning supplies, gasoline, or even light bulbs.

11. Draw a picture of a wind farm. Include and label as many details as you can.

Pictures will vary, but should include more than one wind turbine and show detail of the turbines and where they are located.

12. Add at least 5 more energy words to one of the crossword puzzles. Make sure they attach to a current letter. Write clues for your words.

Answers will vary.

13. Explain, with diagrams and words, what “opposite charges attract each other” means.

Answers should describe or show a scenario with two different items close to each other. Student examples may include magnets, or even people coupled together who are different.

14. When we flip a switch, our lights go on. When we plug something in, and turn it on, it works. We don’t think about where electricity comes from. Pretend you are a spark of electricity. Explain your journey from an energy resource to your game console or system.

Students may identify the energy resource they begin as (uranium, coal, etc.). Students may explain how that resource turns into electricity. They should trace the path from the power plant to the transmission lines, to their homes. A diagram can be found in the “Electricity Travels through Wires” section of the Elementary Energy Infobook that may be helpful to reference.
**ACROSS**

5. The energy we use to run many machines.
7. Sugars give us energy to _____.
8. Energy doesn’t disappear; it changes to another _____.

**DOWN**

1. We use _____ energy to see.
2. We use energy to _____ from place to place.
3. Energy gives us _____ to keep us warm.
4. _____ is the ability to do work.
6. Energy is the power to make a _____.

**Crossword Answer Key**

1. LIGHT
2. MO
3. HEA
4. ELECTRICITY
5. R
6. HANCE
7. Y
8. FORM
Biomass Answer Key

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Biomass is any ____________ that was alive a short time ago.
2. Biomass is a ____________ energy source, because we can always grow more plants.
3. We ____________ most biomass to make heat.
4. We burn garbage in a ____________ plant to make ____________.
5. When biomass rots, it forms a ____________ called ____________ that we can use for energy.
6. Biomass can be turned into a liquid fuel like gasoline called ____________.
7. Most of the biomass we use is ____________.
8. Plants ____________ energy from the sun in their roots and leaves.

Word Bank
- burn
- electricity
- ethanol
- gas
- material
- renewable
- waste-to-energy
- wood
- methan

Coal Answer Key

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Coal is called a ____________ because it was made from plants millions to hundreds of millions of years ago.
2. Coal is ____________; you can't make more in a short time.
3. When coal is near the surface, the Earth is scraped off the coal in a ____________.
4. To reach coal buried far underground, ____________ are dug. This is called ____________ mining.
5. Making the mined land usable again is called ____________.
6. Coal is burned in a power plant to make ____________.
7. Most coal is moved by ____________ and ____________.
8. Coal ____________ the air when it is burned.
9. Power plants use ____________ to clean the emissions from burning coal.

Word Bank
- barges
- deep
- electricity
- ethanol
- fossil fuel
- nonrenewable
- pollute
- reclamation
- scrubbers
- shafts
- surface mine
- trains
**Geothermal Answer Key**

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. The Greek word for Earth is _____________geo__________.
2. The Greek word for heat is _____________therme__________.
3. The center of the Earth has an iron _____________core__________.
4. Hot melted rock inside the Earth is called _____________magma__________.
5. The Earth layer with rock and magma is the _____________mantle__________.
6. The shell of the Earth is called the _____________crust__________.
7. The heat inside the Earth will always be there. We call geothermal a _____________renewable__________ energy source.
8. When hot water inside the Earth comes to the surface, it can form _____________hot springs__________.
9. A geothermal mountain called a _____________volcano__________ will sometimes pour out hot _____________lava__________, which was once magma.
10. Geothermal power plants make _____________electricity__________.

**Word Bank**

- core
- crust
- electricity
- geo
- hot springs
- lava
- magma
- mantle
- renewable
- therme
- volcano

---

**Hydropower Answer Key**

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Hydro means _____________water__________.
2. The movement of water between the Earth and the clouds is called the _____________water cycle__________.
3. When water turns into a gas it is called _____________water vapor__________.
4. The force that moves water from high ground to lower ground is _____________gravity__________.
5. We can build a _____________dam__________ across a river to control the flow of water and form a lake called a _____________reservoir__________.
6. In a hydropower plant, the water flows through a tube called a _____________penstock__________ and spins a _____________turbine__________ to make _____________electricity__________.
7. The water cycle will keep water moving on the Earth; we call hydropower a _____________renewable__________ energy source.

**Word Bank**

- dam
- electricity
- gravity
- penstock
- renewable
- reservoir
- turbine
- water
- water cycle
- water vapor
Natural Gas Answer Key

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Natural gas is called a ___________ because it was made from marine plants and animals hundreds of millions of years ago.
   - fossil fuel

2. We can’t make natural gas in a short time, so we say it is a ___________ energy source.
   - nonrenewable

3. The energy in natural gas once came from the ___________.
   - sun

4. Natural gas is underground; we drill ___________ to find it.
   - wells

5. Decaying garbage makes a gas called ___________.
   - methane

6. We add a smell like ___________ to natural gas so we know if there is a leak.
   - rotten eggs

7. ___________ use natural gas for heat.
   - Homes

8. ___________ use natural gas to make products.
   - Factories

   - burn

Petroleum Answer Key

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Petroleum is called a ___________ because it was made from marine plants and animals hundreds of millions of years ago.
   - fossil fuel

2. Another name for petroleum is ___________.
   - oil

3. We can’t make more petroleum in a short time, so we say it is a ___________ energy source.
   - nonrenewable

4. Some oil is underground; we drill ___________ to find it.
   - wells

5. Some oil is under the ocean; we use oil ___________ to reach it and pump it to the surface.
   - rigs

6. We move petroleum by ___________ and ___________.
   - ships; pipelines

7. After we pump petroleum from the ground, we send it to a ___________ where some is made into ___________.
   - refinery; gasoline

8. We ___________ 48 percent of the oil we use from other countries.
   - import

9. Burning petroleum products causes air ___________.
   - pollution

Word Bank

- burn
- factories
- fossil fuel
- homes
- methane
- nonrenewable
- rotten eggs
- sun
- wells
- import
- nonrenewable
- oil
- pipelines
- pollution
- refinery
- rigs
- ships
**Proppane Answer Key**

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Propane is called a __________________________ because it was formed from marine plants and animals hundreds of millions of years ago.

2. We can't make more propane in a short time, so we say it is a __________________________ energy source.

3. Propane is found underground, mixed with __________________________ and __________________________.

4. At home, we use propane to fuel barbecue __________________________.

5. When we put propane gas under __________________________, it turns into a __________________________.

6. We store liquid propane in __________________________ and move it from place to place with __________________________.

7. Propane is called a __________________________ fuel because it is easy to move as a liquid.

**Word Bank**
- fossil fuel
- nonrenewable
- petroleum
- natural gas
- liquid
- pressure
- tanks
- trucks
- portable

**Solar Answer Key**

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. We get solar energy from the __________________________, which is a big ball of __________________________.

2. Solar energy travels to the Earth in __________________________.

3. The sun will always shine, so we say solar energy is a __________________________ energy source.

4. Plants __________________________ solar energy in their leaves.

5. Some solar energy is __________________________ that helps us see.

6. Solar energy can turn into __________________________ when it hits things.

7. People use __________________________ on their roofs to heat their homes and water.

8. Solar calculators use __________________________ to turn energy from the sun into __________________________.

**Word Bank**
- electricity
- gas
- heat
- light
- rays
- renewable
- solar collectors
- solar cells
- sun
- store
Uranium Answer Key

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. Everything in the world is made of __________________________.

2. At the center of an atom is the __________________________. It is made of __________________________ and __________________________.

3. Moving around the nucleus are __________________________.

4. The energy stored in atoms is __________________________.

5. Uranium is buried underground. We can’t make more, so we call uranium a __________________________ energy source.

6. Uranium atoms can be split; we call this __________________________.

7. When uranium atoms are split, energy is released as __________________________ and __________________________.

8. In a nuclear power plant, we split uranium atoms and use the heat to make __________________________.

Word Bank
- atoms
- electricity
- electrons
- fission
- heat
- neutrons
- nonrenewable
- nuclear energy
- nucleus
- protons
- radiation

Wind Answer Key

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. The ______________ sun ______________ shines on the Earth. The ______________ land ______________ heats up faster than the water. The warm air over the land ______________ rises ______________.

   The ______________ cool ______________ air over the water moves in to take its place. This ______________ moving air ______________ is wind.

2. The sun will always shine; the wind will blow. We call wind a __________________________ energy source.

3. A __________________________ can capture the energy in the wind.

4. The spinning blades of a wind turbine turn a __________________________ to make __________________________.

5. Sometimes there are many wind turbines together to make electricity. This is called a __________________________.

Word Bank
- cool
- electricity
- generator
- land
- moving air
- renewable
- rises
- sun
- wind farm
- wind turbine
Energy Source Matching 1

Write the number of the energy source on the line next to its symbol.

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

Energy Source Matching 2

Write the number of the energy source on the line next to its definition.

1. Petroleum (oil) 9 Black rock burned to make electricity.
2. Wind 7 Energy from heat inside the Earth.
4. Uranium 3 Energy from wood, waste, and garbage.
5. Propane 2 Energy from moving air.
7. Geothermal 5 Portable fossil fuel gas often used in grills.
8. Hydropower 1 Fossil fuel for cars, trucks, and jets.
10. Natural Gas 6 Energy in rays from the sun.
Energy Source Crossword

ACROSS
2. The energy of moving air.
5. The portable gas.
7. Gas moved in pipelines.
8. An atom of this element can be split.

DOWN
1. The energy in waste and wood.
3. Heat energy from inside the Earth.
4. The energy in flowing water.
5. Liquid fossil fuel.

Renewable or Nonrenewable 1

Draw a circle around the renewables.
Draw a square around the nonrenewables.
Part 1
Calculate how much of the energy we use in the U.S. comes from renewable energy sources. Calculate how much comes from nonrenewable sources.

U.S. Energy Consumption by Source, 2015

<table>
<thead>
<tr>
<th>Nonrenewable</th>
<th>Renewable</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PETROLEUM</strong> 36.6%</td>
<td><strong>BIOMASS</strong> 4.9%</td>
</tr>
<tr>
<td><strong>NATURAL GAS</strong> 29.9%</td>
<td><strong>WIND</strong> 1.8%</td>
</tr>
<tr>
<td><strong>COAL</strong> 16.0%</td>
<td><strong>HYDROPOWER</strong> 2.4%</td>
</tr>
<tr>
<td><strong>URANIUM</strong> 8.6%</td>
<td><strong>SOLAR</strong> 0.4%</td>
</tr>
<tr>
<td><strong>PROPANE</strong> uses electricity</td>
<td><strong>GEOHERMAL</strong> 0.2%</td>
</tr>
</tbody>
</table>

**Total does not add up to 100% due to independent rounding.**

Data: Energy Information Administration

Part 2
Make a pie chart showing the percentage of energy that comes from nonrenewables and renewables. Color renewables and nonrenewables different colors.

**Where We Get the Energy We Use**

Make a graph showing how much energy each source provides the United States. Write the names of the energy sources in the boxes at the bottom of the graph. Fill in the columns to show the percentage each source provides. Use a different color or pattern for each column.
Parts of an Atom

Write the names of the parts of an atom on the lines.

1. proton
2. neutron
3. electron
4. nucleus
5. energy level
Electricity 1

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. In the center of an atom there are protons that have a positive charge.

2. Electrons move around the nucleus in shells, or energy levels, and have a negative charge.

3. Opposite charges attract each other.

4. Magnets have north and south poles.

5. The north poles of magnets repel each other.

6. Magnets have a force called a magnetic field.

7. Magnets can push electrons out of their shells; moving electrons is electricity.

Word Bank
- attract
- charge
- electricity
- electrons
- energy levels
- magnetic field
- magnets
- negative
- poles
- protons
- repel
Electricity 2

Fill in the blanks with the words in the word bank at the bottom of the page. Use each word only once.

1. A factory that makes electricity is a __________ power plant.

2. Power plants use __________ magnets and __________ coils of copper wire to make electricity.

3. A giant wheel, called a __________ turbine, spins a coil of wire inside big magnets to produce a __________ magnetic field.

4. Many __________ fuels, such as coal, are used to spin the turbine and make __________ electricity.

5. Electricity flows in a big loop called a __________ circuit.

6. From the power plant, lots of electricity flows through large __________ transmission lines held up by __________ power towers.

7. When electricity reaches the town, smaller wires, called __________ distribution lines, carry the electricity to __________ houses on __________ electric poles.

Word Bank

- circuit
- coils
- distribution lines
- electricity
- electric poles
- fuels
- houses
- magnetic field
- magnets
- power plant
- power towers
- transmission lines
- turbine
Magnets

Does each set of magnets repel or attract? Circle the correct answer.

- Set 1: S N  N S
  - attract or repel

- Set 2: S N  S N
  - attract or repel

- Set 3: S N  S N
  - attract or repel

- Set 4: S N  S N
  - attract or repel
Elementary Energy Infobook Activities Evaluation Form

State: ___________     Grade Level: ___________     Number of Students: __________

1. Did you conduct all of the activities in the guide?     □ 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 this guide again?     □ Yes     □ No

Please explain any ‘no’ statement below.

How would you rate the guide overall?     □ excellent     □ good     □ fair     □ poor

How would your students rate the guide overall?     □ excellent     □ good     □ fair     □ poor

What would make the guide more useful to you?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Other Comments:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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Guilford County Schools – North Carolina  
Gulf Power  
Hawaii Energy  
Idaho National Laboratory  
Illinois Clean Energy Community Foundation  
Illinois Institute of Technology  
Independent Petroleum Association of New Mexico  
James Madison University  
Kentucky Department of Energy Development and Independence  
Kentucky Power – An AEP Company  
Kentucky Utilities Company  
League of United Latin American Citizens – National Educational Service Centers  
Leidos  
Linn County Rural Electric Cooperative  
Llano Land and Exploration  
Louisville Gas and Electric Company  
Mississippi Development Authority–Energy Division  
Mississippi Gulf Coast Community Foundation  
Mojave Environmental Education Consortium  
Mojave Unified School District  
Montana Energy Education Council  
The Mountain Institute  
National Fuel  
National Grid  
National Hydropower Association  
National Ocean Industries Association  
National Renewable Energy Laboratory  
NC Green Power  
New Mexico Oil Corporation  
New Mexico Landman’s Association  
NextEra Energy Resources  
NEXTTracker  
Nicor Gas  
Nisource Charitable Foundation  
Noble Energy  
Nolin Rural Electric Cooperative  
Northern Rivers Family Services  
North Carolina Department of Environmental Quality  
North Shore Gas  
Offshore Technology Conference  
Ohio Energy Project  
Opterra Energy  
Pacific Gas and Electric Company  
PECO  
Pecos Valley Energy Committee  
Peoples Gas  
Pepco  
Performance Services, Inc.  
Petroleum Equipment and Services Association  
Phillips 66  
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Rhode Island Office of Energy Resources  
Robert Armstrong  
Roswell Geological Society  
Salt River Project  
Salt River Rural Electric Cooperative  
Saudi Aramco  
Schlumberger  
C.T. Seaver Trust  
Secure Futures, LLC  
Shell  
Shell Chemicals  
Sigora Solar  
Singapore Ministry of Education  
Society of Petroleum Engineers  
Society of Petroleum Engineers – Middle East, North Africa and South Asia  
Solar City  
David Sorenson  
South Orange County Community College District  
Tennessee Department of Economic and Community Development–Energy Division  
Tesla  
Teso Foundation  
Tri-State Generation and Transmission  
TXU Energy  
United Way of Greater Philadelphia and Southern New Jersey  
University of Kentucky  
University of Maine  
University of North Carolina  
University of Tennessee  
U.S. Department of Energy  
U.S. Department of Energy–Wind for Schools  
U.S. Energy Information Administration  
United States Virgin Islands Energy Office  
Wayne County Sustainable Energy  
Western Massachusetts Electric Company  
Yates Petroleum Corporation