

2016-2017

# Energy Carnival

Entertaining, energy-related games to reinforce student learning and introduce energy to the classrooms, school, or community.



## Grade Levels:



Elementary



Intermediate

## Subject Areas:



Science



Social Studies



Math



Language Arts



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.

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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](http://www.eia.gov).



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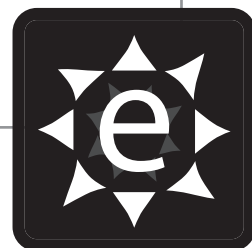
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# Energy Carnival

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# Standards Correlation Information

[www.NEED.org/curriculumcorrelations](http://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.





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## Curriculum Correlations

NEED has correlated their materials to the Disciplinary Core Ideas of the Next Generation Science Standards. NEED has also correlated all of their materials to The Common Core State Standards for English/Language Arts and Mathematics. All materials are also correlated to each state's individual science standards. Most files are in Excel format. NEED recommends downloading the file to your computer for use. Save resources, don't print!

- [Navigating the NGSS? We have What You NEED!](#)
- [NEED alignment to the Next Generation Science Standards](#)
- [Common Core State Standards for English and Language Arts](#)
- [Common Core Standards for Mathematics](#)
- [Alabama](#)
- [Alaska](#)
- [Arizona](#)
- [Arkansas](#)
- [California](#)





# Energy Carnival Guide

## Team Play

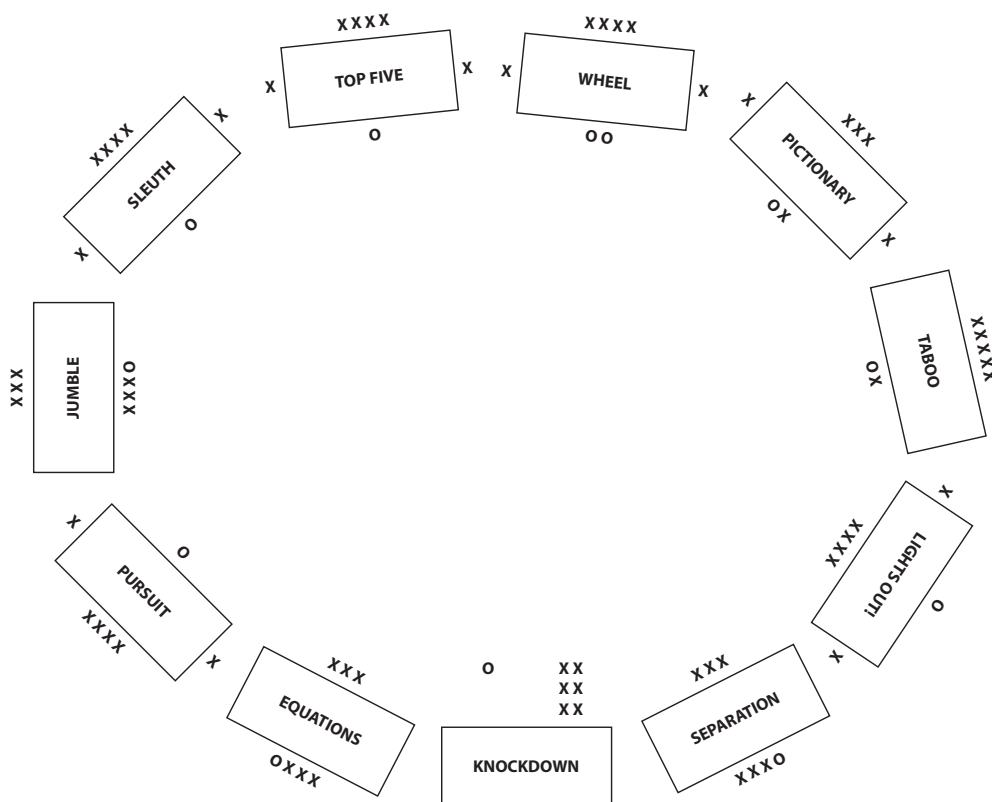
Welcome to the *Energy Carnival*: eleven games in which students combine their academic skills and energy knowledge with their ability to toss and throw—learning while playing. Each game comes with complete instructions and practical suggestions and can be played independently. Several games allow for topic selection to focus on content that is familiar to your students. A few games have two versions—one that focuses on general energy concepts and one that focuses more on efficiency and conservation. Preview each of the games at the start of your energy unit. When it is time for your carnival, select the games, questions, and/or game versions that will make the most sense for your students to play based on the content covered in your unit. Students will not enjoy playing the games if they cannot answer the questions. The games are also very easy to customize. For an authentic assessment, have students play the games and then write their own questions and rules before hosting a carnival for others, or playing again.

The carnival can be played by a single class or by several classes at the same time. Student teams spend five minutes at up to eleven stations and win energy bucks by answering questions and solving problems. The instructions are geared for an eleven station carnival program with up to six students on a team. For smaller groups, use fewer carnival games or reduce the number of students on each team. For larger audiences, organize additional carnival circles, or use multiple versions of games.

This *Energy Carnival Guide* will assist you with all the details before and during the carnival. However, if you do have a question, just call the NEED Hotline at (800) 875-5029 and ask for help. The NEED Project is also interested in any games that you invent, as well as any suggested modifications to the existing games.

## Get Ready

1. Create or assemble one or more sets of the *Energy Carnival* games you've chosen to play and gather any necessary materials. Reference the materials chart on pages 8-9 for an itemized list of materials for each game. See each game for more details.
2. Secure a room large enough to accommodate one or more carnival circles of eleven rectangular tables or the number of games your group will play.
3. Select students or adult helpers to lead each game. Familiarize each carnival game leader with the rules and operation of his/her game. The success of your carnival depends upon the ability of your leaders to be in command of their tasks.
4. Duplicate (on colored paper) and distribute at least 10-15 \$1 energy bucks and 5-10 \$5 energy bucks to each carnival game leader. Masters of the energy bucks are found on pages 11 and 12 of this guide. Give more energy bucks as needed, depending on the number of students playing.



5. Secure prizes for the winning teams. Prizes can be energy-related—such as solar calculators, yo-yos, flying discs, NEED shirts, and other NEED prizes. Contact NEED to order shirts or other branded items.
6. Select one or two individuals to be carnival ringmasters. They will be responsible for giving directions to the whole group and facilitating movement from one table to the next. Detailed instructions for the carnival ringmasters follow later in this guide.
7. To make the environment more fun, make or purchase outfits for each carnival game leader and the carnival ringmasters—vests, skimmer hats, arm-garter belts, etc.
8. Decorate the room with balloons, streamers, and table skirting.

## Get Set

1. For a carnival circle with all eleven games, set up eleven tables in a circular pattern. Set the chairs and tables according to the diagram on page 5 (X = students and O = carnival leaders). Adjust the circle if you'll be playing fewer games.
2. Organize students into teams of six or less students. Assign each team to a carnival game table. Have each team select a team spokesperson and a treasurer. The spokesperson will give the team's answer to the carnival game leader. The treasurer will be responsible for handling the energy bucks won at each station.
3. Have students create an energy name for their group such as The Atomic Splits, The Turbines, or The Geothermal Gems.
4. Choose a timekeeper to help the ringmaster keep track of the timing of the sessions. It may also be helpful for each game leader to have a watch to facilitate play.

## Go!

The carnival ringmaster should call everyone to attention and give the following instructions:

1. Welcome to the *Energy Carnival*. During the next 60 minutes, you and your team will use your academic skills, knowledge of energy, and carnival game skills to win energy bucks that can be redeemed for prizes.
2. Your team will have five minutes at each of the *Energy Carnival* stations. At each station, you can win a maximum of five energy bucks by playing the game and answering questions. Answers will only be accepted from your spokesperson. Each team should now select a spokesperson. (Allow 30 seconds for teams to choose a spokesperson.)
3. At the completion of each round, the carnival game leader will award the energy bucks you earned to the treasurer of your team. Each team should now select a treasurer. (Allow 30 seconds for teams to choose a treasurer.)
4. Do not move from station to station until you receive my signal. If you leave your station before my signal, your team will be penalized five energy bucks.
5. When you get to each station, your carnival game leader will give you instructions on how the game is played. The game will not start until each of the game leaders has his or her hand raised, signaling me that each team understands the instructions and is ready to play. No one starts until all teams are ready.
6. Carnival leaders, please explain the instructions for your game now. When ready, raise your hand. When all hands are raised, I will give the signal to start. You will then have five minutes to play. To help you pace your time, you will get two-minute and one-minute warnings. Any questions? Remember, don't move to the next station before my signal.

After all the games have been played, the treasurer of each team and the carnival game leader at the last game will count the energy bucks the team has won. Each carnival game leader will then give the team's name to the ringmaster and report the number of energy bucks won. The ringmaster will announce the third, second, and first place teams and award prizes to the winning teams.

# Individual Play

In some cases, you might find that team play of the *Energy Carnival* games does not work well. This is particularly true when you have parents and visitors arriving at various times to attend your energy program or NEED event. In this case, you will want to use the Individual Play instructions for the *Energy Carnival* games, which are included in the instructions for each of the eleven carnival games. For individual play, duplicate the coupon sheet on page 10 and give each participant a strip as he/she arrives to the carnival or event. Each strip has one coupon for each game.

In addition to the coupon distribution, you will need to set up a redemption table at which people can redeem their energy bucks for prizes. Try to obtain prize contributions from different organizations for use at the redemption table or buy prizes from NEED Headquarters.

Make sure the game leaders consider the level of difficulty of the participants who are playing the games. For example, in the game *Energy Equations*, the game leader would give an elementary school student a simple problem and a more advanced student or parent a more advanced problem.

Amend and use the 'Get Ready' 'Get Set' and 'Go' instructions from pages 5-6 as needed to prepare for and run your carnival with individual players.

In addition, be sure to time the duration of the games carefully in order to keep things running smoothly. Each game leader should have a watch to facilitate play.

## Additional Ideas

- Try to be creative and add exhibits and shows that will reinforce your theme of an energy carnival. If you choose to include exhibits at your carnival, you may also consider copying and distributing the *Energy Carnival* cards on page 13. Copy and cut out the cards. Each exhibit station leader can be given a different stamp or sticker and when a visitor arrives at the exhibit and witnesses or participates in the exhibit demonstration or information, they can be given a stamp or sticker. Carnival visitors can turn in their cards for prizes also. If you have more exhibits than the designated number of boxes on the card, simply copy the cards back-to-back.
- As an example of a creative carnival, a school from Dinwiddie, Virginia, constructed an Energy Jail. Students dressed in convict uniforms and told passersby of their energy crimes: running the dishwasher when it was only half full or leaving the lights on. If you develop new games or sideshows, please share them with us so that we can share them with other schools.



# Materials

## Materials needed for all game stations:

- Table
- Chairs
- Energy bucks
- Prizes
- Timer or watch
- Coupons (optional for individual play)

| CARNIVAL GAME            | MATERIALS NEEDED                                                                                                                                                                                                                                                     |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Energy Equations</i>  | <ul style="list-style-type: none"><li>▪Masking tape</li><li>▪Ring toss set or another tossing game</li><li>▪Math problems and answer key</li><li>▪Pencils or markers</li><li>▪Scrap paper or markerboards</li><li>▪Erasers</li><li>▪Calculators (optional)</li></ul> |
| <i>Energy Jumble</i>     | <ul style="list-style-type: none"><li>▪Pencils</li><li>▪Balloons</li><li>▪Sharp object (tack or button)</li><li>▪Energy jumbles and answer key</li></ul>                                                                                                             |
| <i>Energy Pictionary</i> | <ul style="list-style-type: none"><li>▪Pencils</li><li>▪Paper</li><li>▪Pictionary words</li></ul>                                                                                                                                                                    |
| <i>Energy Pursuit</i>    | <ul style="list-style-type: none"><li>▪Pursuit questions</li><li>▪Cardboard and/or cardstock</li><li>▪Pursuit game board and wedges</li><li>▪Crayons or colored pencils</li></ul>                                                                                    |
| <i>Energy Sleuth</i>     | <ul style="list-style-type: none"><li>▪Sleuth cards</li><li>▪Free pass cards</li><li>▪Sleuth sample words and clues (or answer key)</li><li>▪Dark paper</li><li>▪Paper clips or rubber bands</li></ul>                                                               |
| <i>Energy Taboo</i>      | <ul style="list-style-type: none"><li>▪Index cards</li><li>▪Paper clips</li><li>▪Taboo words list</li></ul>                                                                                                                                                          |
| <i>Energy Knockdown</i>  | <ul style="list-style-type: none"><li>▪10 Soda cans</li><li>▪Foam or foil ball</li><li>▪Knockdown graphics sheets</li><li>▪Masking tape</li><li>▪Knockdown questions</li></ul>                                                                                       |



| CARNIVAL GAME            | MATERIALS NEEDED                                                                                                                                                                                                                                                      |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Source Separation</i> | <ul style="list-style-type: none"> <li>▪ Cardboard box</li> <li>▪ Newspaper</li> <li>▪ Aluminum foil</li> <li>▪ Foam cup</li> <li>▪ Soup can</li> <li>▪ Masking tape</li> <li>▪ Source questions</li> </ul>                                                           |
| <i>Top Five</i>          | <ul style="list-style-type: none"> <li>▪ Top five board graphics (on darker paper)</li> <li>▪ Marker</li> <li>▪ Dark paper</li> <li>▪ Paper clips</li> <li>▪ Top five category list and answers</li> </ul>                                                            |
| <i>Wheel of Energy</i>   | <ul style="list-style-type: none"> <li>▪ <i>Wheel of Energy</i> or <i>Wheel of Energy Efficiency</i> graphic</li> <li>▪ Energy phrases and answers</li> <li>▪ Paper fastener</li> <li>▪ Cardboard or cardstock</li> <li>▪ Paper clips</li> <li>▪ Envelopes</li> </ul> |
| <i>Lights Out!</i>       | <ul style="list-style-type: none"> <li>▪ <i>Lights Out!</i> graphics</li> <li>▪ Cardboard or cardstock</li> <li>▪ Colored paper</li> <li>▪ Paper clips</li> <li>▪ Envelopes</li> </ul>                                                                                |

**Top Five**

**Top Five**

**Top Five**

**Top Five**

**Energy Sleuth**

**Energy Sleuth**

**Energy Sleuth**

**Energy Sleuth**

**Energy Pursuit**

**Energy Pursuit**

**Energy Pursuit**

**Energy Pursuit**

**Energy  
Knockdown**

**Energy  
Knockdown**

**Energy  
Knockdown**

**Energy  
Knockdown**

**Energy Jumble**

**Energy Jumble**

**Energy Jumble**

**Energy Jumble**

**Energy  
Equations**

**Energy  
Equations**

**Energy  
Equations**

**Energy  
Equations**

**Wheel of  
Energy**

**Wheel of  
Energy**

**Wheel of  
Energy**

**Wheel of  
Energy**

**Source  
Separation**

**Source  
Separation**

**Source  
Separation**

**Source  
Separation**

**Energy  
Pictionary**

**Energy  
Pictionary**

**Energy  
Pictionary**

**Energy  
Pictionary**

**Energy Taboo**

**Energy Taboo**

**Energy Taboo**

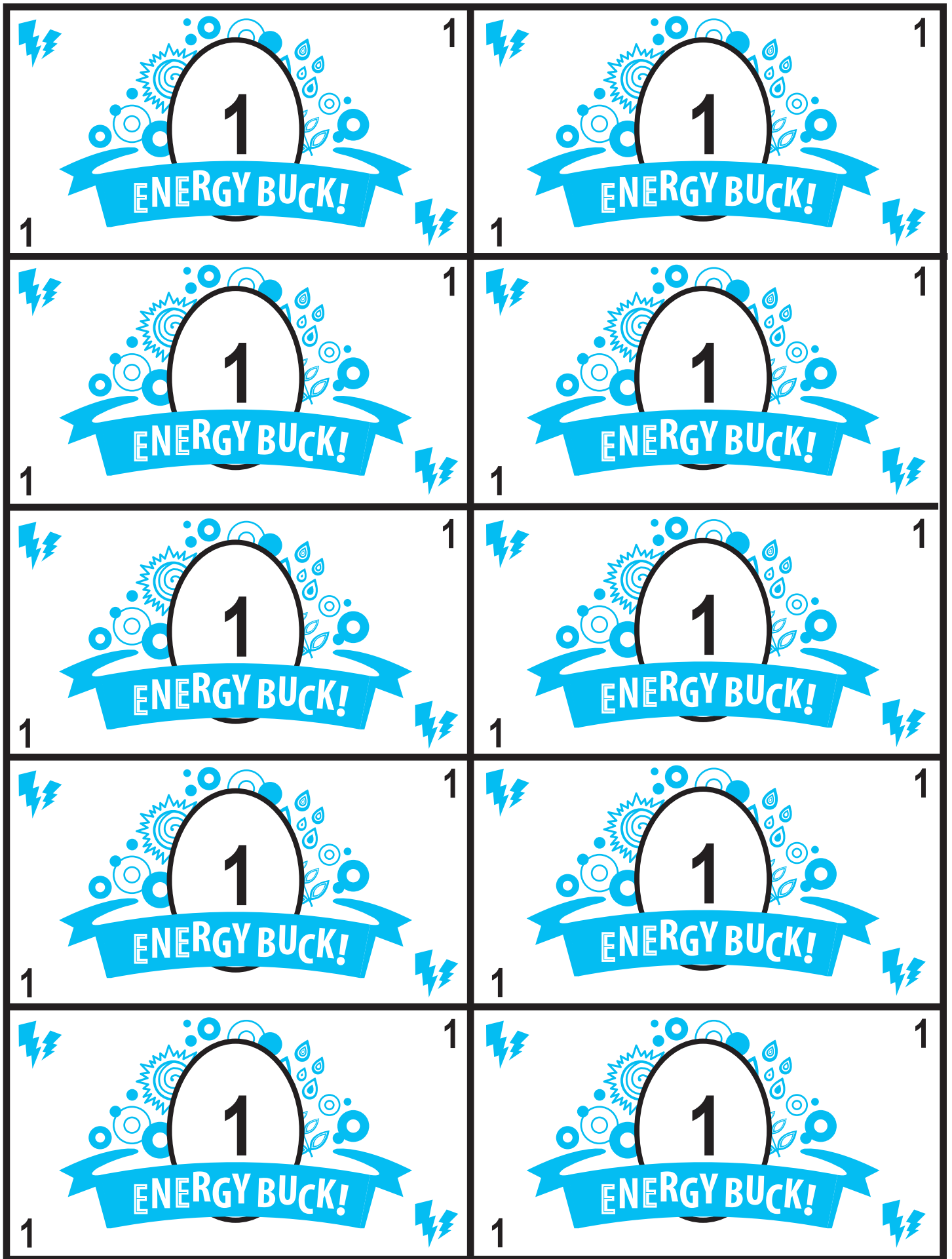
**Energy Taboo**

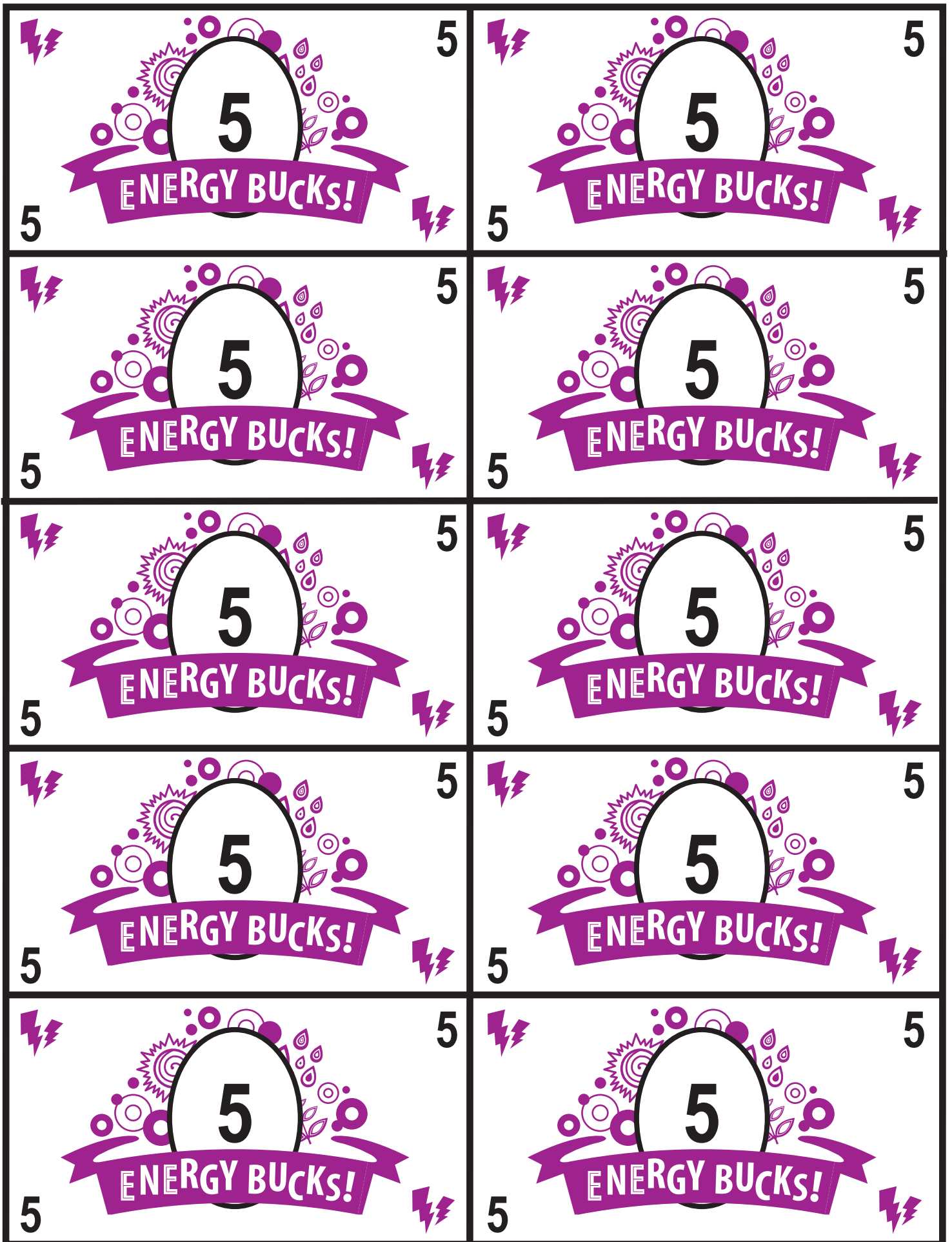
**Lights Out!**

**Lights Out!**

**Lights Out!**

**Lights Out!**





ENERGY CARNIVAL!

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ENERGY CARNIVAL!

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ENERGY CARNIVAL!

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ENERGY CARNIVAL!

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# Energy Equations

## Materials Needed

- Masking tape
- Ring toss set (or other tossing game)
- Math problems and answer key
- Pencils or markers
- Scrap paper or markerboards
- Erasers
- Calculators (optional)

## Energy Equations Team Play

Each team tries to solve five energy math problems. To receive a math problem, the team must first successfully complete a tossing game.

### Get Ready

1. We have provided 16 sample energy math problems. The earlier problems may be easier for younger students. The latter problems may be more difficult and better suited for older students. Look at all of the problems and carefully select a set of problems to use for the game. You may also make up your own problems, if necessary or desired.
2. If possible, laminate the math problems that you have chosen. Players may write answers and solve on scrap paper. Markerboards also work well for this activity.
3. Have pencils and scrap paper or markerboards, markers, and erasers available for each team's calculations and answers. Decide if you will allow students to use calculators. Modify the instructions to reflect your decision.

### Get Set

To play *Energy Equations*, each team must play a tossing game, such as tossing a clothespin into a bucket, tossing a ring over a bottle, or tossing a foam ball into a basket; any tossing skill will do. Mark a tossing line on the floor with masking tape. After each successful toss, the team receives a math problem. Members of the team should start work immediately as the tosses continue. There is no limit to the number of tosses the team can have. Keep playing until the team receives five math problems.

### Go!

Give these instructions to the carnival team:

1. I have five energy math problems for your team to solve. Each problem you answer correctly will win your team one energy buck. To receive a math problem, a member of your team must first toss (explain the tossing game you have chosen). Five successful tosses will get you the five math problems. You can have as many tosses as you need to receive all five problems.
2. As soon as you make your first successful toss, I will give you an energy math problem and members of your team can start working immediately.
3. You may use these pencils and paper or markerboard with markers to work out the problems. Please be sure to check each other's math! Once you are sure that you have the correct answer, give the paper to me. You will win one energy buck for each correct answer.
4. This is where you must stand when you toss the object. Are there any questions? Who will make the first toss? Who will be the spokesperson for your team?



# Energy Equations Individual Play

The player tries to solve an energy math problem after five attempts at a tossing game. The number of successful tosses determines the number of energy bucks earned if the math problem is correctly solved.

## Get Ready

1. We have provided 16 sample energy math problems. The earlier problems may be easier for younger students. The latter problems may be more difficult and better suited for older students. Look at all of the problems and carefully select a set of problems to use for the game. You may also make up your own problems, if necessary or desired.
2. If possible, laminate the math problems that you have chosen. The players can write their answers on scrap paper or markerboards. If your players are of different ages, it is suggested that you color-code the problems according to level of difficulty.
3. Have pencils and scrap paper or markerboards with markers and erasers available for the players' calculations and answers. Decide if you will allow players to use calculators. Modify the instructions to reflect your decision.
4. Collect each player's *Energy Equations* coupon.

## Get Set

To play *Energy Equations*, each player first must play a tossing game, such as tossing a clothespin into a bucket, tossing a ring over a bottle, or tossing a foam ball into a basket; any tossing skill will do. Mark a tossing line on the floor with masking tape. After five tosses with at least one successful toss, the player receives a math problem. After solving the math problem correctly, the player earns the number of energy bucks equal to the number of successful tosses. A few practice tosses are recommended for each player. Three to five individuals can play at the same time if you have several sets of problems.

## Go!

Give these instructions to the individual player(s):

1. I have one energy math problem for you to solve. However, before I give you the problem, you must toss (explain the tossing game you have chosen). After you have made five tosses, with at least one successful toss, I will give you an energy problem. If you correctly solve the math problem, you will earn energy bucks equal to the number of successful tosses you made. If you have five successful tosses and a correctly solved math problem, you will earn five energy bucks.
2. When you are sure you have the correct answer, give the answer to me.
3. This is where you should stand when you toss the object. Are there any questions?



# Answers to Energy Equations

1.  $\frac{\$6.50}{\$1.30/\text{lb.}} = 5.0 \text{ lbs.} \times 32 \text{ can/lb.} = 160 \text{ cans}$

2. 1998, accept 1997-1999

3. 4,094 billion kilowatt-hours

4.  $5.2 \text{ domestic} + 4.8 \text{ foreign} = 10 \text{ total usage}$   
 $4.8 \text{ foreign}/10 \text{ total} = .48 \times 100 = 48\%$

5.  $100 \text{ miles} / 5 \text{ miles per gallon} = 20 \text{ gallons of fuel;}$   
 $20 \text{ gallons} \times \$4.00/\text{gallon} = \$80.00$

6.  $\frac{1}{2} = \frac{5}{10}$      $\frac{1}{5} = \frac{2}{10}$   
 $\frac{5}{10} + \frac{2}{10} = \frac{7}{10}$   
 $\frac{10}{10} - \frac{7}{10} = \frac{3}{10}$

7. Year 6

8.  $\frac{2}{3} \times 1,266 \text{ therms} = 844 \text{ therms}$

9. Total production = 4,094 billion kWh  
Uranium = 797 billion kWh  
 $797/4,094 = 0.1947 = 19.5\%, \text{ round up}$   
 $= 20\%$

10. 16 cups to a gallon  
 $(\frac{1}{16}) \times (91,500) = 5,718.75 = 5,719 \text{ Btu}$

11. United States = 14.0 MBD  
Canada = 4.4 MBD  
Mexico = 2.8 MBD  
Total = 21.2 MBD

12. Total of fossil fuels:

$18.0\% \text{ (coal)} + 27.5\% \text{ (natural gas)} +$   
 $34.9\% \text{ (petroleum)} + 1.6\% \text{ (propane)} = 82.0\%$   
 $100 \text{ quads} \times 0.82 = 82.0 = 82.0 \text{ quads}$

13.  $A = P (1.0 + R)^T$

A = Final Amount

P = Principle

R = Rate of Increase

T = Number of Years

$A = 39 (1.0 + .02)^{10}$

$A = 39 (1.02)^{10}$

$A = 39 (1.219) = 47.54$

$A = 47.5 \text{ quads}$

14.  $A = 1.4B$      $C = 360 \text{ gallons}$      $C = 1.2B$   
360 gallons

$B = 1.2$

$B = 300 \text{ gallons}$

$A = 1.4 (300 \text{ gallons}) = 420 \text{ gallons}$

15.  $24 \text{ kWh} \times 3.5 \text{ miles/kWh} = 84 \text{ miles}$

16. 6,000 gallons

## Question 1

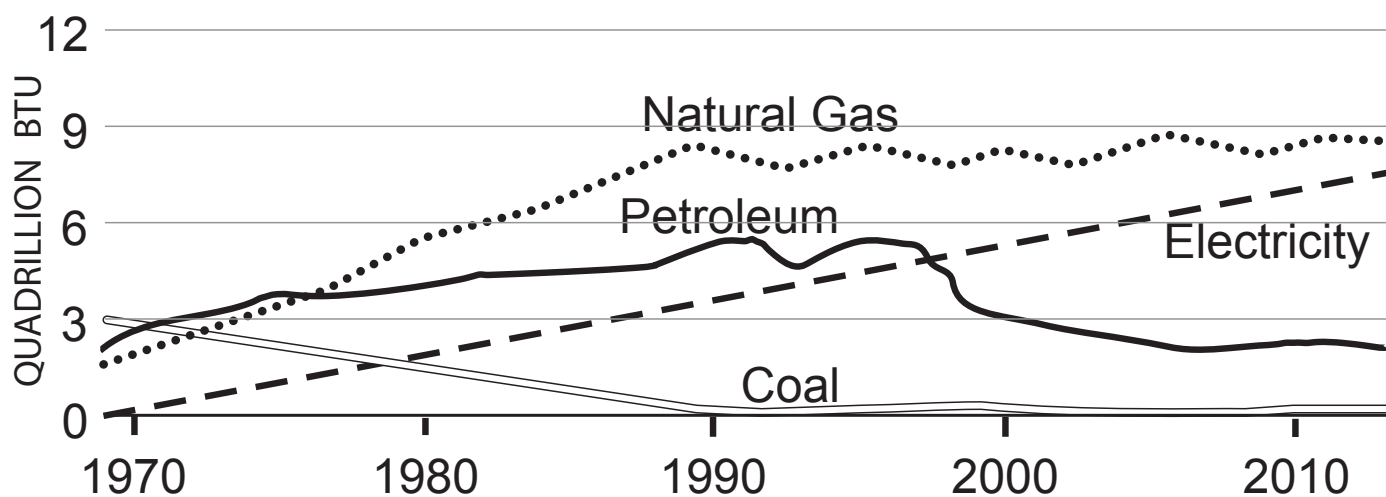


$$\times 32 = 1 \text{ lb.} = \$1.30$$

If an aluminum recycling center is paying \$1.30 per lb. for aluminum (32 cans per lb.), how many cans were cashed in at a recycling center if a person received \$6.50?

## Question 2

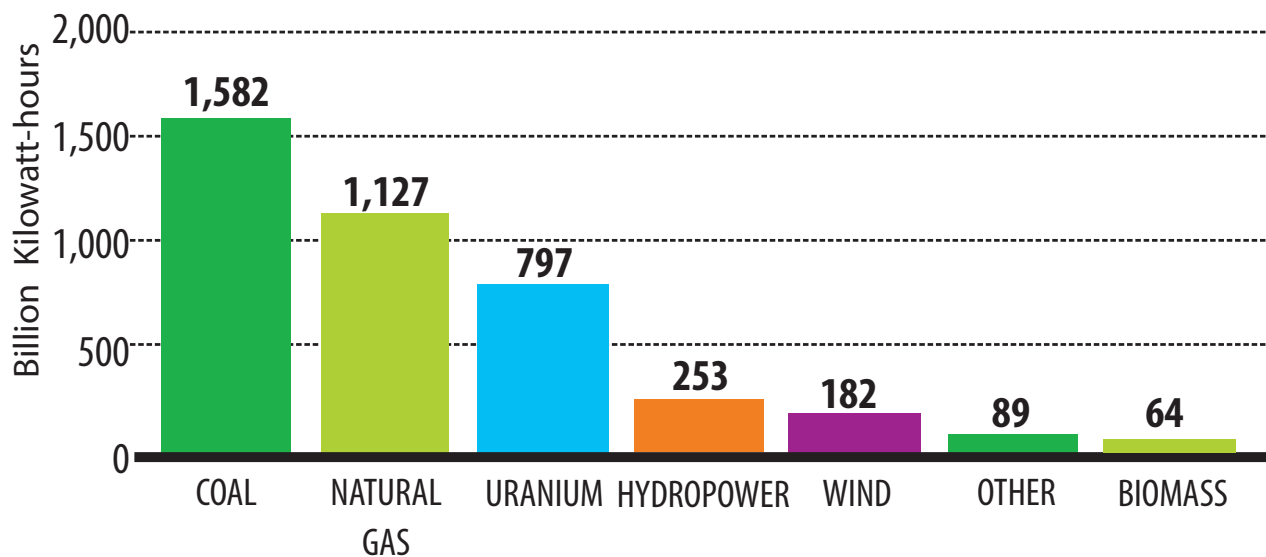
### Residential and Commercial Sectors



In approximately what year did the use of electricity match the use of petroleum in the residential and commercial sectors?

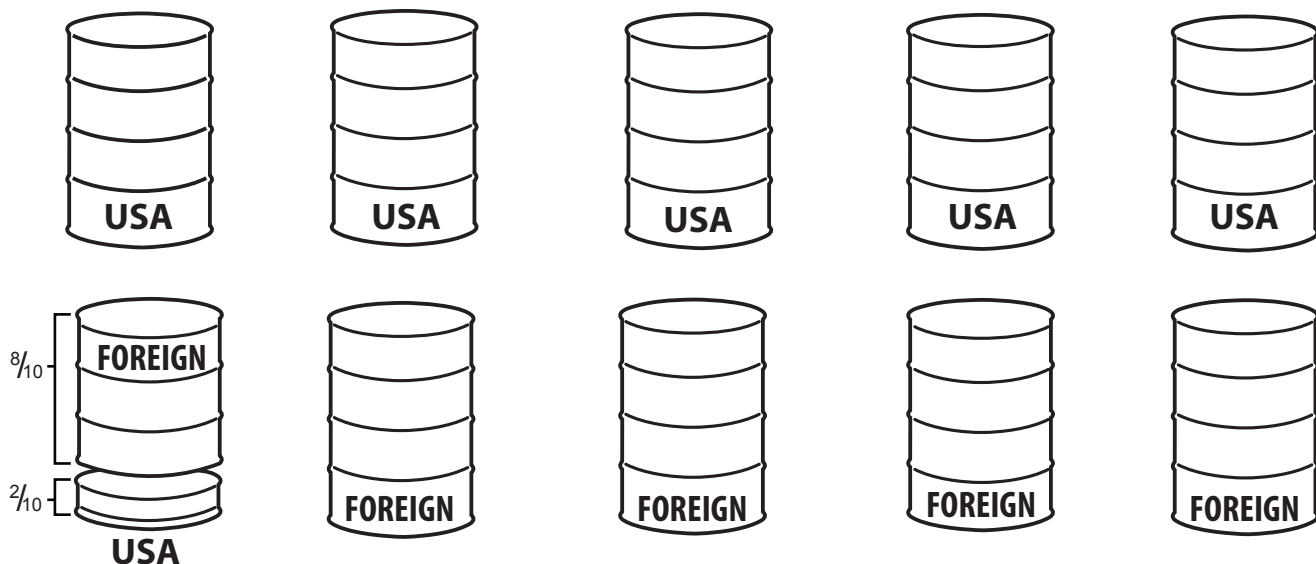
### Question 3

## Electricity Generation, 2014



How many billion kilowatt-hours of electricity were generated in the United States in 2014?

### Question 4



The ten barrels represent all of the petroleum consumed in the U.S. in 2014. What percentage of that petroleum had to be imported from other nations?

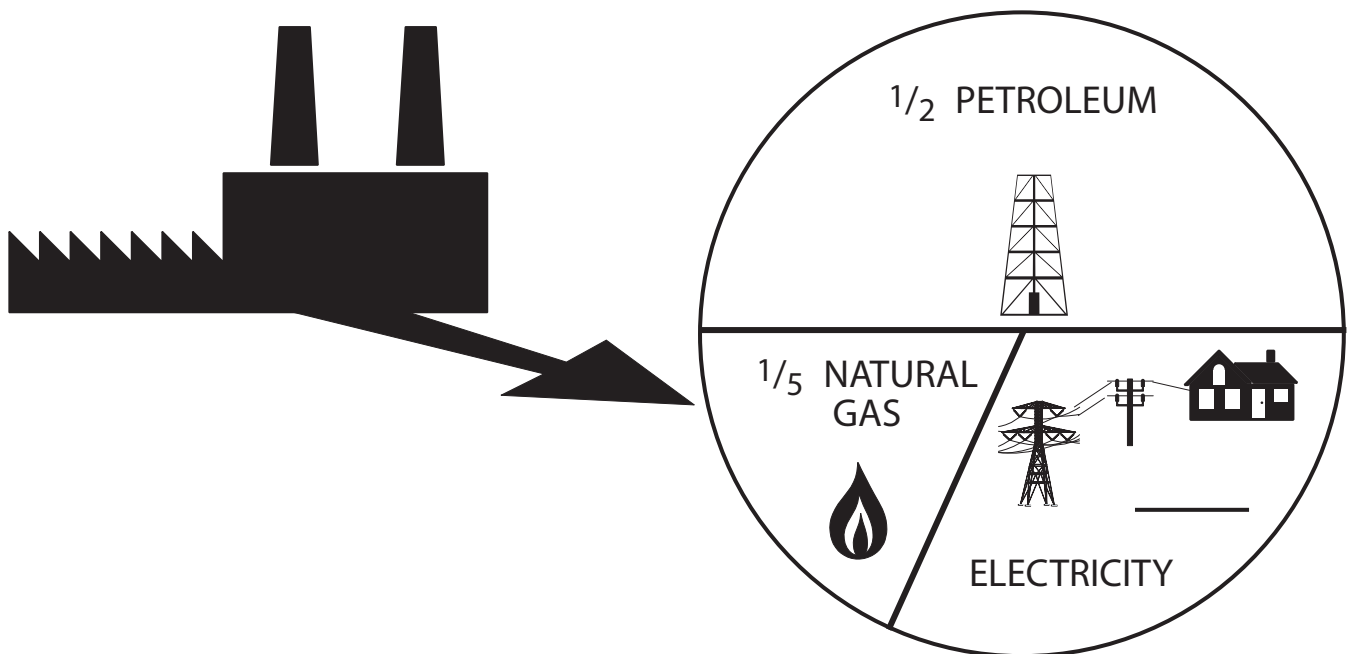
## Question 5



A semi-truck gets 5 miles per gallon. If the diesel fuel it uses costs \$4.00 per gallon, what would it cost for the truck to bring bread to your school from the factory 100 miles away?

---

## Question 6



What fraction of this factory's energy is supplied by electricity?

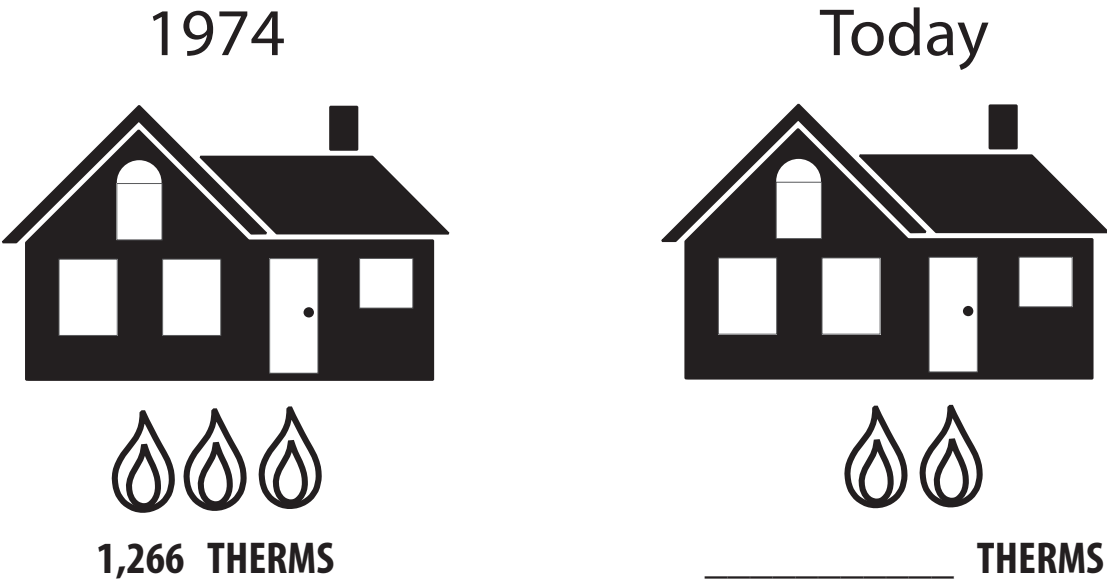
# Question 7

Let’s go shopping for a new refrigerator! We want to buy a refrigerator that will save us money and energy over the life of the appliance, not just with the purchase price. We can calculate how much it will cost each year for five years.

| MODEL 1        | EXPENSES | COST TO DATE               | MODEL 2        | EXPENSES | COST TO DATE               |
|----------------|----------|----------------------------|----------------|----------|----------------------------|
| Purchase Price | \$720    | \$720                      | Purchase Price | \$799    | \$799                      |
| Year One       | \$64     | $\$720 + \$64 = \$784$     | Year One       | \$49     | $\$799 + \$49 = \$848$     |
| Year Two       | \$64     | $\$784 + \$64 = \$848$     | Year Two       | \$49     | $\$848 + \$49 = \$897$     |
| Year Three     | \$64     | $\$848 + \$64 = \$912$     | Year Three     | \$49     | $\$897 + \$49 = \$946$     |
| Year Four      | \$64     | $\$912 + \$64 = \$976$     | Year Four      | \$49     | $\$946 + \$49 = \$995$     |
| Year Five      | \$64     | $\$976 + \$64 = \$1,040$   | Year Five      | \$49     | $\$995 + \$49 = \$1,044$   |
| Year Six       | \$64     | $\$1,040 + \$64 = \$1,104$ | Year Six       | \$49     | $\$1,044 + \$49 = \$1,093$ |

In the example above, in what year would you start to see a payback on the ENERGY STAR® appliance?

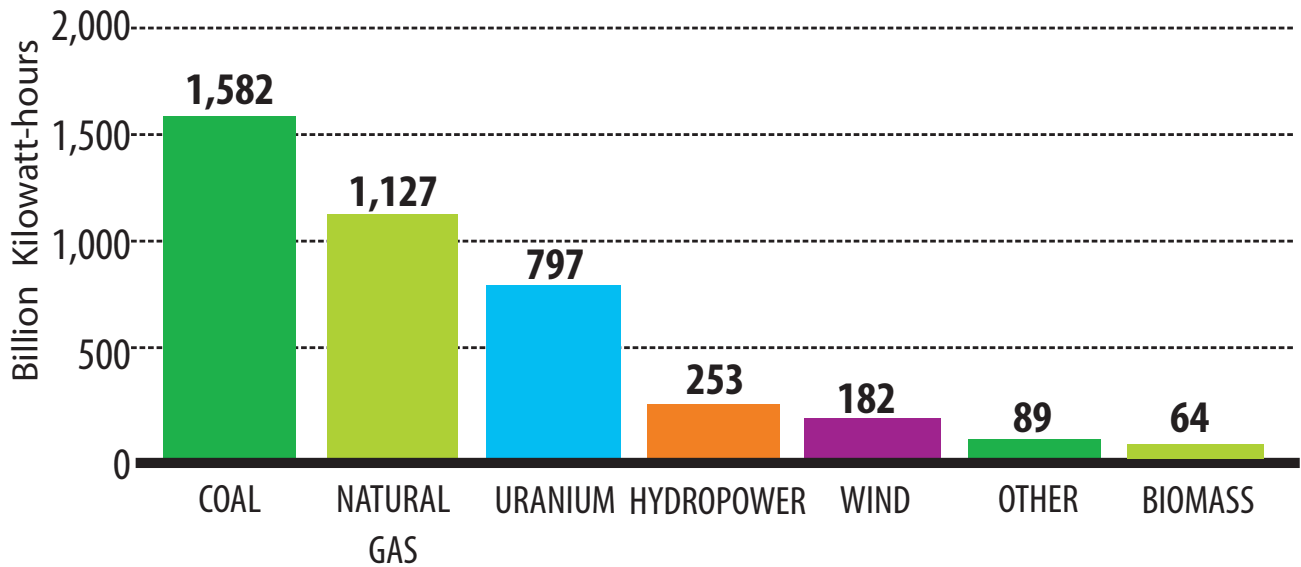
# Question 8



In 1974, the average home consumed 1,266 therms of natural gas. If a home today uses one-third less natural gas than the home of 1974, how many therms of natural gas does a home consume today?

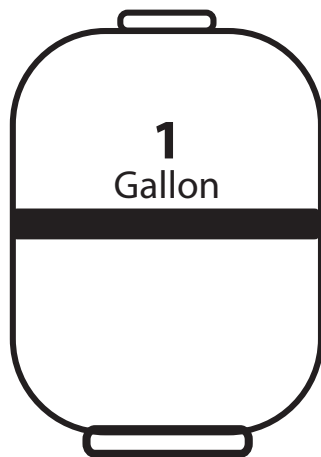
## Question 9

### Electricity Generation, 2014



To the nearest full percent, what percentage of the nation's electricity was generated by uranium in 2014?

## Question 10

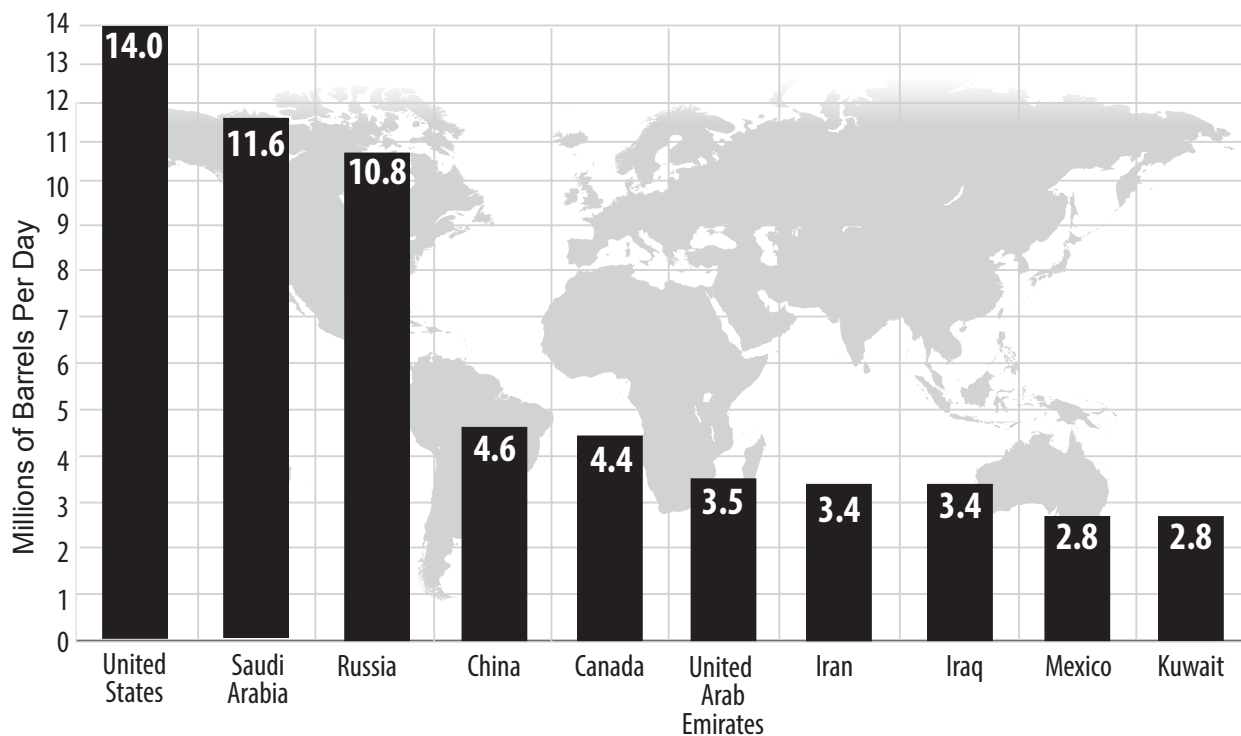


One gallon of propane provides 91,500 Btus of energy. How many Btus will one cup of propane provide (to the nearest Btu)?



## Question 11

### 2014 Top Oil Producing Countries



Of the top oil producing countries, how many millions of barrels per day (mbd) did countries in the Western Hemisphere produce in 2014?

## Question 12

### U.S. Energy Consumption by Source, 2014

#### NONRENEWABLE

|  |                    |                                                                  |
|--|--------------------|------------------------------------------------------------------|
|  | <b>PETROLEUM</b>   | <b>34.9%</b><br><i>Uses: transportation, manufacturing</i>       |
|  | <b>NATURAL GAS</b> | <b>27.5%</b><br><i>Uses: heating, manufacturing, electricity</i> |
|  | <b>COAL</b>        | <b>18.0%</b><br><i>Uses: electricity, manufacturing</i>          |
|  | <b>URANIUM</b>     | <b>8.3%</b><br><i>Uses: electricity</i>                          |
|  | <b>PROPANE</b>     | <b>1.6%</b><br><i>Uses: heating, manufacturing</i>               |

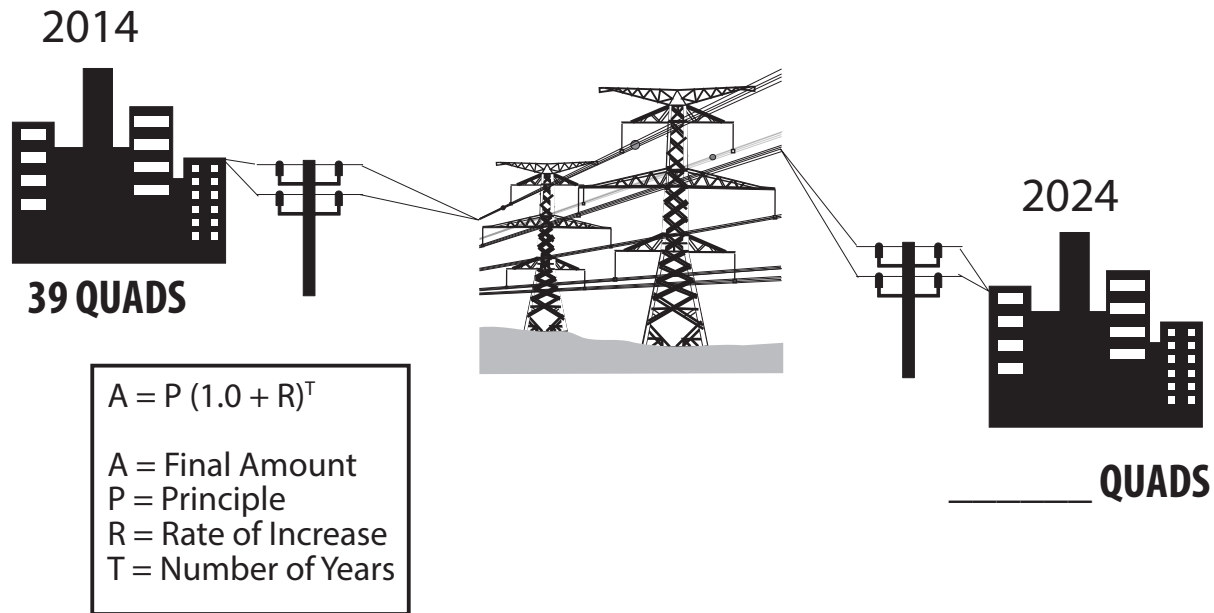
#### RENEWABLE

|  |                   |                                                                  |
|--|-------------------|------------------------------------------------------------------|
|  | <b>BIOMASS</b>    | <b>4.8%</b><br><i>Uses: heating, electricity, transportation</i> |
|  | <b>HYDROPOWER</b> | <b>2.5%</b><br><i>Uses: electricity</i>                          |
|  | <b>WIND</b>       | <b>1.7%</b><br><i>Uses: electricity</i>                          |
|  | <b>SOLAR</b>      | <b>0.4%</b><br><i>Uses: heating, electricity</i>                 |
|  | <b>GEOTHERMAL</b> | <b>0.2%</b><br><i>Uses: heating, electricity</i>                 |

\*Total does not add to 100% due to independent rounding.  
Data: Energy Information Administration

If the nation consumed 100 quads of energy in 2014, how many quads were provided by fossil fuels, to the nearest tenth of a quad?

## Question 13



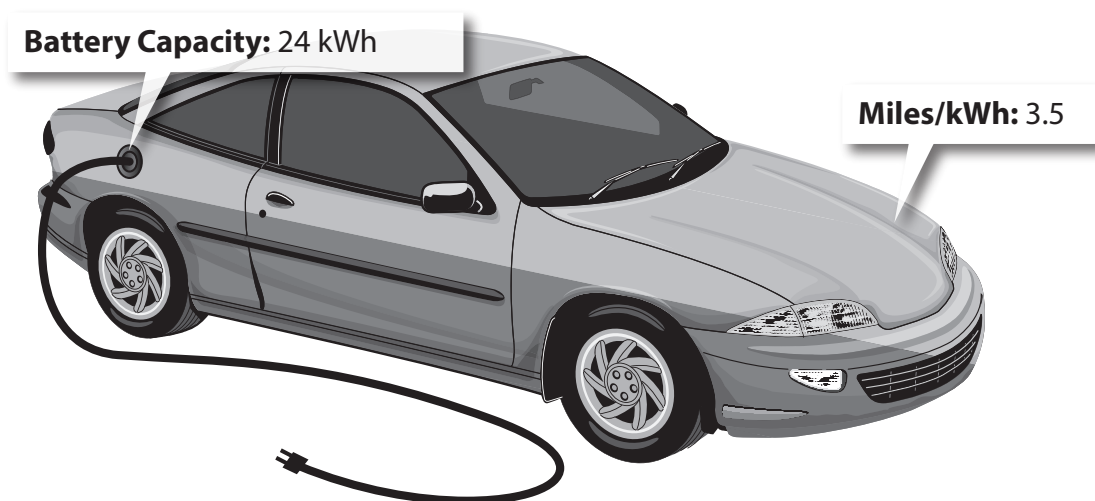
In 2014, the nation consumed about 39 quads of energy to generate its electricity. If demand increases by two percent a year, how many quads of energy (to the nearest tenth of a quad) will be consumed to generate the nation's electricity in 2024?

## Question 14



House A consumes 40% more heating fuel than House B. House C consumes 360 gallons of heating fuel a year, 20% more than House B. How many gallons of heating fuel does House A consume in one year?

## Question 15



An all electric automobile's battery can hold 24 kWh of energy. How many total miles can this vehicle travel if it can travel 3.5 miles on one kWh of electricity?

---

## Question 16



An average family washes 400 loads of laundry a year. An old washing machine uses 40 gallons of water per load. If an ENERGY STAR® washer uses 25 gallons per load, how much water will be saved in one year by switching?



# Energy Jumble

## Materials Needed

- Pencils
- Balloons
- Sharp object (tack or button)
- Energy jumbles and answer key

## Energy Jumble Team Play

Each team tries to solve three *Energy Jumbles*. For every three words unscrambled, the team earns one energy buck.

## Get Ready

1. Enclosed you will find eight *Energy Jumbles*. Based on the grade level of students playing the game, choose three appropriate *Energy Jumbles*.
2. Each jumble is a half page in length. Make copies of the pages and cut them in half. Each team should have its own set of three jumbles.
3. To add some fun and excitement to the game, roll each *Energy Jumble* as tightly as you can and insert each into a large balloon. Color-code the balloons according to the jumble's difficulty level.

## Get Set

1. Each *Energy Jumble* contains four scrambled words and an energy clue to find a fifth word at the bottom of the page. The fifth word on each page is found by using designated letters from the unscrambled words and the energy clue.
2. *Energy Jumble* is played exactly like the jumbles found in a newspaper. First, students unscramble the top four words. Then, using the letters with dots underneath, they solve the final word. The clue may help with this word. If the fifth word is solved sooner, it may be helpful in solving the remaining scrambled words.
3. One or two designated players from each team will toss the balloons and attempt to pop them on a sharp object that you have set up 5-8 feet away. A pin-on button, with the pin bent to point straight up, works well as the target.

## Go!

Give these instructions to the carnival team:

1. You will have five minutes to solve three *Energy Jumbles*. But, the jumbles are trapped inside these balloons! Pop the balloons by tossing them at the pin. Once you pop the balloons unscramble the top four words. Then, using the letters with dots underneath, solve the fifth word. Each *Energy Jumble* has an energy clue to help you solve the last word.
2. Your team will receive one energy buck for every three words that you correctly unscramble, or five energy bucks if all 15 words are unscrambled successfully.
3. Who wants to toss the balloons? As soon as a balloon pops, the rest of you will begin working on the first *Energy Jumble*. Are there any questions?

# Energy Jumble Individual Play

Each player tries to solve one *Energy Jumble*. For each word correctly unscrambled, the player earns one energy buck with a total earning potential of five energy bucks.

## Get Ready

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1. Enclosed you will find eight *Energy Jumbles*. Based on the grade level of the individual playing the game, choose a few appropriate *Energy Jumbles*.
2. Each jumble is a half page in length. Make copies of the pages and cut them in half. Each player should have his or her own jumble.
3. To add some fun and excitement to the game, roll each *Energy Jumble* as tightly as you can and insert each into a large balloon. Color-code the balloons according to the jumble's difficulty level.
4. Collect each player's *Energy Jumble* coupon.

## Get Set

---

1. Each *Energy Jumble* contains four scrambled words and an energy clue to find a fifth word at the bottom of the page. The fifth word on each page is found by using designated letters from the unscrambled words and the energy clue.
2. *Energy Jumble* is played exactly like the jumbles found in a newspaper. First, students unscramble the top four words. Then, using the letters with dots underneath, they solve the final word. The clue may help with this word. If the fifth word is solved sooner, it may be helpful in solving the remaining scrambled words.
3. The player will toss the balloon and attempt to pop it on a sharp object that you have set up 5-8 feet away. A pin-on button, with the pin bent to point straight up, works well as the target. After the balloon is popped, the student can start solving the jumbles.

## Go!

---

Give these instructions to the player:

1. You will have 90 seconds to break this balloon, retrieve, and solve one *Energy Jumble*. The jumbles are exactly like the jumbles you see in your newspaper. First, unscramble the top four words. Then, using the letters from the unscrambled words with dots underneath, solve the fifth word. The *Energy Jumble* has an energy clue to help you solve the last word. If you think you can solve the fifth word first, it's okay to do so. It may help you solve one or all of the remaining jumbled words.
2. You will receive one energy buck for every word that you correctly unscramble, or five energy bucks if all five words are unscrambled successfully.
3. Before you can solve the jumbles, you have to stand here and toss the balloon and pop it on that pin. As soon as the balloon pops, you can begin working on the first *Energy Jumble*. Are there any questions?



# Energy Jumble Answers

## ENERGY JUMBLE 1

THERMAL  
METHANE  
GASOLINE  
TURBINE

I save energy when I'm properly set.  
THERMOSTAT

## ENERGY JUMBLE 2

URANIUM  
CONSERVATION  
KILOWATT  
PHOTOVOLTAIC

Heat has trouble coming and going when I'm around.  
INSULATION

## ENERGY JUMBLE 3

PROPANE  
BIOMASS  
URANIUM  
LIGHT

I like to be used over and over again for beverages.  
ALUMINUM

## ENERGY JUMBLE 4

DAM  
PIPELINE  
SUN  
POWER

When the sun heats the Earth unevenly, I am created.  
WIND

## ENERGY JUMBLE 5

WOOD  
ENERGY  
COAL  
GARBAGE

Use my energy once, I'll still be around, because I'm...  
RENEWABLE

## ENERGY JUMBLE 6

GAS  
ELECTRIC  
BURN  
SOLAR

Being a gas is easy, because I'm a...  
NATURAL

## ENERGY JUMBLE 7

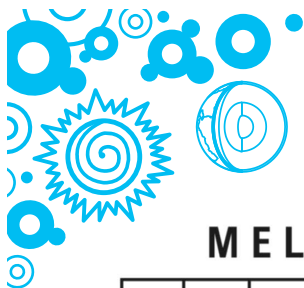
ENVIRONMENT  
GEOTHERMAL  
EFFICIENCY  
ENERGY STAR

It's not cool that I use the most energy in the kitchen.  
REFRIGERATOR

## ENERGY JUMBLE 8

BULB  
MAGNET  
PLUG  
KINETIC

I'm a unit of light output; I'm pretty bright.  
LUMEN



## ENERGY JUMBLE 1



MELTRHA

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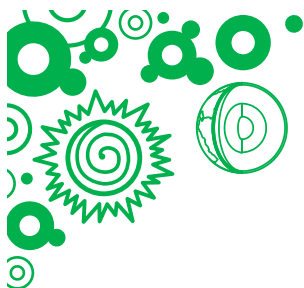
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I save energy when I'm properly set.

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## ENERGY JUMBLE 2



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Heat has trouble coming and going when I'm around.

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## ENERGY JUMBLE 3



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I T G L H

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I like to be used over and over again for beverages.

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## ENERGY JUMBLE 4



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R O W P E

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When the sun heats the Earth unevenly, I am created.

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## ENERGY JUMBLE 5



D O W O

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Use my energy once, I'll still be around, because I'm...

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## ENERGY JUMBLE 6



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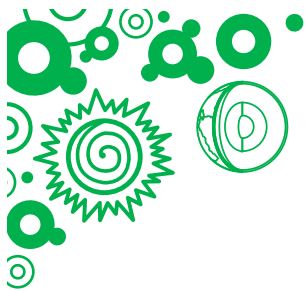
O R S A L

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• •

Being a gas is easy, because I'm a ...

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## ENERGY JUMBLE 7



NETRINVOMNE

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RETOMEGLAH

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RETNSAGREY

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It's not cool that I use the most energy in the kitchen.

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## ENERGY JUMBLE 8



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ETAMNG

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I'm a unit of light output; I'm pretty bright.

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# Energy Pictionary

## Materials Needed

- Pencils
- Paper
- Pictionary words

## Energy Pictionary Team Play

Team members must guess energy words or phrases by interpreting the drawings of a team member.

## Get Ready

Choose ten energy related words you want the artist to draw. You can choose from the word lists at the bottom of the page, or you may develop your own list of words. When selecting or developing the list, take the age of the students into account. Words such as solar and wind will be easier to draw, while propane and nuclear energy may be difficult for younger students. Place the words in order from the least difficult to the most difficult.

## Get Set

Select one member of the team to serve as the artist. It's more important that he or she know about energy than be a great artist. Also, select a spokesperson for the team. The spokesperson is responsible for telling the game leader what energy word the team believes the artist is drawing.

## Go!

Give these instructions to the carnival team:

1. The name of this game is *Energy Pictionary*. Your artist will be given a pencil, several sheets of scrap paper, and a list of ten energy related words or phrases. Starting with the first word written on this list, he/she will start drawing pictures that relate to that energy word. The artist cannot use any letters or words, and cannot talk or make any gestures.
2. Your team will have five minutes to guess all ten words. Team members can talk among themselves, but only the spokesperson can give the game leader the team's answer. The spokesperson has only 15 chances to guess the ten energy related words (the game leader should keep track of the number of guesses). For every two correct guesses your team will win one energy buck. If you wish, you can pass and move on to the next word. You may then return to it later. Remember, you only have 15 guesses for the ten energy words, so use them wisely!
3. Here is the list of ten energy related words or phrases. When I give the signal, start drawing pictures for the first word. Remember, you can pass and come back to the word later if time remains.

| Energy Sources                                                                                                 | Electricity                                                                                                                                        | Efficiency and Conservation                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Wind<br>Solar<br>Petroleum<br>Coal<br>Hydropower<br>Natural Gas<br>Propane<br>Geothermal<br>Biomass<br>Uranium | Generator<br>Photovoltaic Cell<br>Smart Meter<br>Wind Turbine<br>Solar Panel<br>Powerstrip<br>Unplug<br>Fuel Cell<br>Battery<br>Transmission Lines | Insulation<br>Recycle<br>Phantom Load<br>LED Bulb<br>Thermostat<br>Hybrid Car<br>Tire Pressure<br>Weather-strip<br>Green Roof<br>ENERGY STAR® |

# Energy Pictionary Two-Person Play

In *Energy Pictionary*, an individual must guess ten energy related words or phrases by interpreting the drawings of a second individual.

## Get Ready

1. Choose ten energy related words you want the artist to draw. You can choose from the word lists at the bottom of the page, or you may develop your own list of words. When selecting or developing the list, take the age of the students into account. Words such as solar and wind will be easier to draw, while propane and nuclear energy may be difficult for younger students. Place the words in order from the least difficult to the most difficult.
2. Collect each player's *Energy Pictionary* coupon.

## Get Set

When two individuals or a team of two arrives at this station, select one person to serve as the artist. It's more important that he or she be knowledgeable about energy than be a great artist.

## Go!

Give these instructions to each player:

1. The name of the game is *Energy Pictionary*. The artist will be given a pencil, several sheets of scrap paper, and a list of ten energy related words or phrases. Starting with the first word written on this list, the artist will start drawing pictures that relate to that energy word. The artist cannot use any letters or words, and cannot talk or make gestures.
2. You will have five minutes to guess all ten words. For every two correct guesses you will each win one energy buck. If you wish, you can pass and move onto the next word. You may then return to it later. You will only have 15 chances to guess the ten energy words.
3. Here is the list of ten energy related words or phrases. When I give the signal, start drawing pictures for the first word. Remember, you can pass and come back to the word later if time remains.

| Energy Sources                                                                                                 | Electricity                                                                                                                                        | Efficiency and Conservation                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Wind<br>Solar<br>Petroleum<br>Coal<br>Hydropower<br>Natural Gas<br>Propane<br>Geothermal<br>Biomass<br>Uranium | Generator<br>Photovoltaic Cell<br>Smart Meter<br>Wind Turbine<br>Solar Panel<br>Powerstrip<br>Unplug<br>Fuel Cell<br>Battery<br>Transmission Lines | Insulation<br>Recycle<br>Phantom Load<br>LED Bulb<br>Thermostat<br>Hybrid Car<br>Tire Pressure<br>Weather-strip<br>Green Roof<br>ENERGY STAR® |



# Energy Pursuit

## Materials Needed

- Pursuit questions
- Cardboard or cardstock
- Pursuit game board and wedges
- Crayons or colored pencils

## Energy Pursuit Team Play

Each team tries to win a wedge in each of the five categories by answering energy information questions. At the end of the game, each wedge earned is exchanged for one energy buck.

## Get Ready

1. Make two copies of the circular graphic (page 38) and one copy of each of the remaining attached graphics (pages 38-39). Save the originals.
2. To make the game board, tape the five energy category graphics together in this order: Saving Energy, Renewables, Fossil Fuels, Energy Trivia, Electricity. Add color to each graphic, mount on cardboard or cardstock, and/or laminate, if possible.
3. Mount both circular graphics on a piece of cardboard or cardstock and cut just outside the solid line. To make the team's wedges, cut one of the circles into five wedges representing the five energy areas. Lightly color each wedge. The other circle is the team's marker. Leave this piece white. Laminate the marker and wedges, if possible.

## Get Set

1. Enclosed are several questions for each energy category; question one is the most difficult, the later questions are the easiest. You are encouraged to develop your own questions for each energy area. All questions should have enriched answers—supplemental information relating to the topic. Select four questions for each category. Arrange the questions with the most difficult question first.
2. Teams are given four questions in each category, three of which must be answered correctly in order to win a wedge. To help the team, remind them of the category. If a team gives an incorrect answer, tell them the correct answer before moving to the next category.

## Go!

Give these instructions to the carnival team:

1. There are five energy areas. You must answer three out of four questions correctly to win a wedge in each category. I will read the first three questions. If you answer all three questions correctly, your team will earn a wedge in that area and you will move to the next energy area on the board. If you answer one of the questions incorrectly, I will ask you the fourth question. After four questions you will proceed to the next area. Each energy wedge your team earns is worth one energy buck. Are there any questions? Who will be the team's spokesperson?
2. Here is your first question from the Saving Energy category. When trying to think of an answer, it will help if you remember the energy category from which your question came.

# Energy Pursuit Individual Play

An individual tries to win a wedge in each of the five categories by answering energy information questions in a maximum of 90 seconds. At the end of the game, each wedge earned is exchanged for one energy buck.

## Get Ready

---

1. Make two copies of the circular graphic (page 38) and one copy each of the remaining attached graphics (pages 38-39). Save the originals.
2. To make the game board, tape the five energy category graphics together in this order: Saving Energy, Renewables, Fossil Fuels, Energy Trivia, Electricity. Add color to each graphic, mount on cardboard or cardstock, and/or laminate, if possible.
3. Mount both circular graphics on a piece of cardboard or cardstock and cut just outside the solid line. To make the player's wedges, cut one of the circles into five wedges representing the five energy areas. Lightly color each wedge. The other circle is the player's marker. Leave this piece white. Laminate the marker and wedges, if possible.
4. Collect each player's *Energy Pursuit* coupon.

## Get Set

---

1. Enclosed are several questions for each energy category; question one is the most difficult, the later questions are the easiest. You are encouraged to develop your own questions for each energy area. All questions should have enriched answers—supplemental information relating to the topic.
2. A player is given one chance to win a wedge in each energy category. Read the first question. If the player gives an incorrect answer, tell him or her the correct answer and then ask the selected question from the next category. If a player's answer does not exactly match the answer you have, either accept it or ask for a more specific answer. To help the player, remind him or her of the energy category.

## Go!

---

Give these instructions to the player:

1. There are five energy areas. You will have one chance to win a wedge in each of the five energy areas. I will read the first question. If you give the correct response, you will earn a wedge in that area and you will move to the next energy area on the board. If you give an incorrect answer, I will give you the correct answer and you will move on to the next energy area on the board without earning a wedge. Each energy wedge you earn is worth one energy buck. You may take up to 90 seconds to answer each question or go on to the next area. Are there any questions?
2. Here is your question from the Saving Energy category. When trying to think of an answer, it will help to remember the energy category from which your question came.



# Energy Pursuit Questions

## Saving Energy

1. When purchasing a new appliance, what does the EER sticker on the appliance stand for?

*Energy Efficiency Rating (The higher the number, the more efficient the product.)*

2. What letter of the alphabet is used to measure a substance's ability to resist heat loss or gain?

*R (The higher the R-value, the better the insulator.)*

3. Name one auto MAINTENANCE measure (not driving habit) that will increase an auto's fuel mileage.

*Tune-up*

*Proper tire inflation*

*Change oil and oil filter*

4. Which type of light bulb is more efficient, incandescent or fluorescent?

*Fluorescent*

5. Which of the following consumes the greatest amount of energy in the typical home: heating/cooling, water heating, or appliances and lighting?

*Heating/cooling*

6. Name one energy-saving measure that will lower a family's energy needs to heat or cool their home.

*Adding insulation*

*Weatherstripping and caulking windows*

*Lowering the thermostat in winter, raising it in summer*

*Cleaning and properly maintaining furnace and air conditioner*

*Using solar heating*

## Renewables

1. A photovoltaic cell is made of what element?

*Silicon (One of the Earth's most plentiful elements.)*

2. Plants store energy by combining water, carbon dioxide, minerals, and sunlight in a process called \_\_\_\_\_.

*Photosynthesis*

3. Plus or minus three percent, what percentage of the nation's energy demand is supplied by renewable energy sources?

*9.6 percent (Accept six to 12 percent.)*

4. What energy source is a result of the uneven heating of the Earth's surface?

*Wind*

5. Name the renewable energy source that includes garbage and agricultural waste.

*Biomass*

6. Which renewable energy source is responsible for producing wind, biomass, and hydropower?

*Solar*

7. In which compass direction should solar panels face in the Northern Hemisphere?

*South*

8. Which source of energy is a result of the radioactive decay of elements inside the Earth's core?

*Geothermal*

## Fossil Fuels

1. What does the acronym OPEC stand for?

*Organization of Petroleum Exporting Countries*

2. This gas provides the U.S. with about 1.6 percent of its energy and is a result of natural gas processing and petroleum refining.

*Propane*

3. Which fossil fuel is the largest supplier of U.S. energy, with about 35 percent of the total?

*Petroleum*

4. Which fossil fuel is used to generate approximately 39 percent of the United States' electricity?

*Coal*

5. What is the cleanest burning fossil fuel?

*Natural gas/propane*

6. Which fossil fuel is transported mostly by pipeline?

*Natural gas*

7. What is the major use of petroleum—generating electricity, transportation, home heating, or feedstock for plastics?

*Transportation*

## Energy Trivia

1. **Plus or minus ten years, in what year did the first power plant produce electricity?**

*1882—Manhattan, New York (Accept 1872 to 1892.)*

2. **Who was the president of the United States during the first month of the Arab oil embargo in 1973?**

*President Nixon (October 1973)*

3. **Which northeastern state was the site of the first commercial oil well?**

*Pennsylvania (Titusville—1859)*

4. **How many gallons are in a barrel of oil?**

*42 gallons*

5. **What department of the U.S. government oversees energy problems and research?**

*Department of Energy*

6. **Which state consumes the greatest amount of energy today?**

*Texas*

7. **What is the average residential retail cost of electricity in the U.S.?**

*12.5 cents per kWh*

8. **Whose motorized vehicle created a great demand for gasoline?**

*Henry Ford*

9. **Who invented the light bulb?**

*Thomas Edison*

## Electricity

1. **The unit used when measuring the size of a modern-day electric power plant is the kilowatt, megawatt, gigawatt, or septawatt?**

*Megawatt (one million watts)*

2. **Plus or minus five percent, what percentage of all U.S. energy is used to generate electricity?**

*39 percent (Accept 35 to 45 percent.)*

3. **Which energy source provides the U.S. with its second largest amount of electricity?**

*Natural gas (28 percent of total production.)*

4. **Plus or minus five percent, what percentage of the coal consumed in the United States today is used by the electric utility companies?**

*Ninety-three percent (accept 88-98%)*

5. **Who convinced the U.S. to use AC rather than DC power?**

*George Westinghouse*

6. **Electric companies use what unit of measure when they bill their customers for energy usage?**

*Kilowatt-hour*

7. **Light bulbs and other home appliances are measured in what electric power unit?**

*Watt*

8. **Name two sources of energy that are used to make electricity.**

*Coal*

*Natural Gas*

*Uranium (nuclear)*

*Hydropower*

*Biomass*

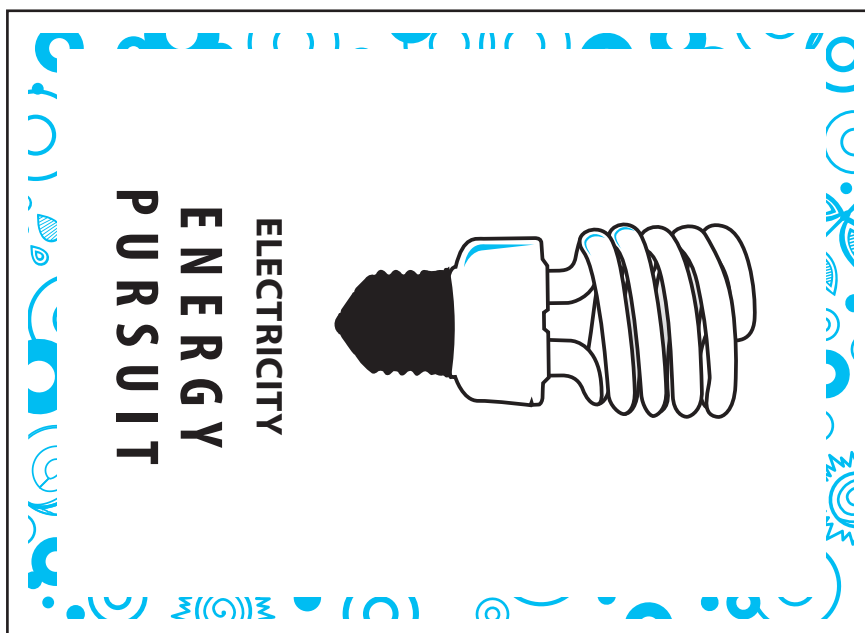
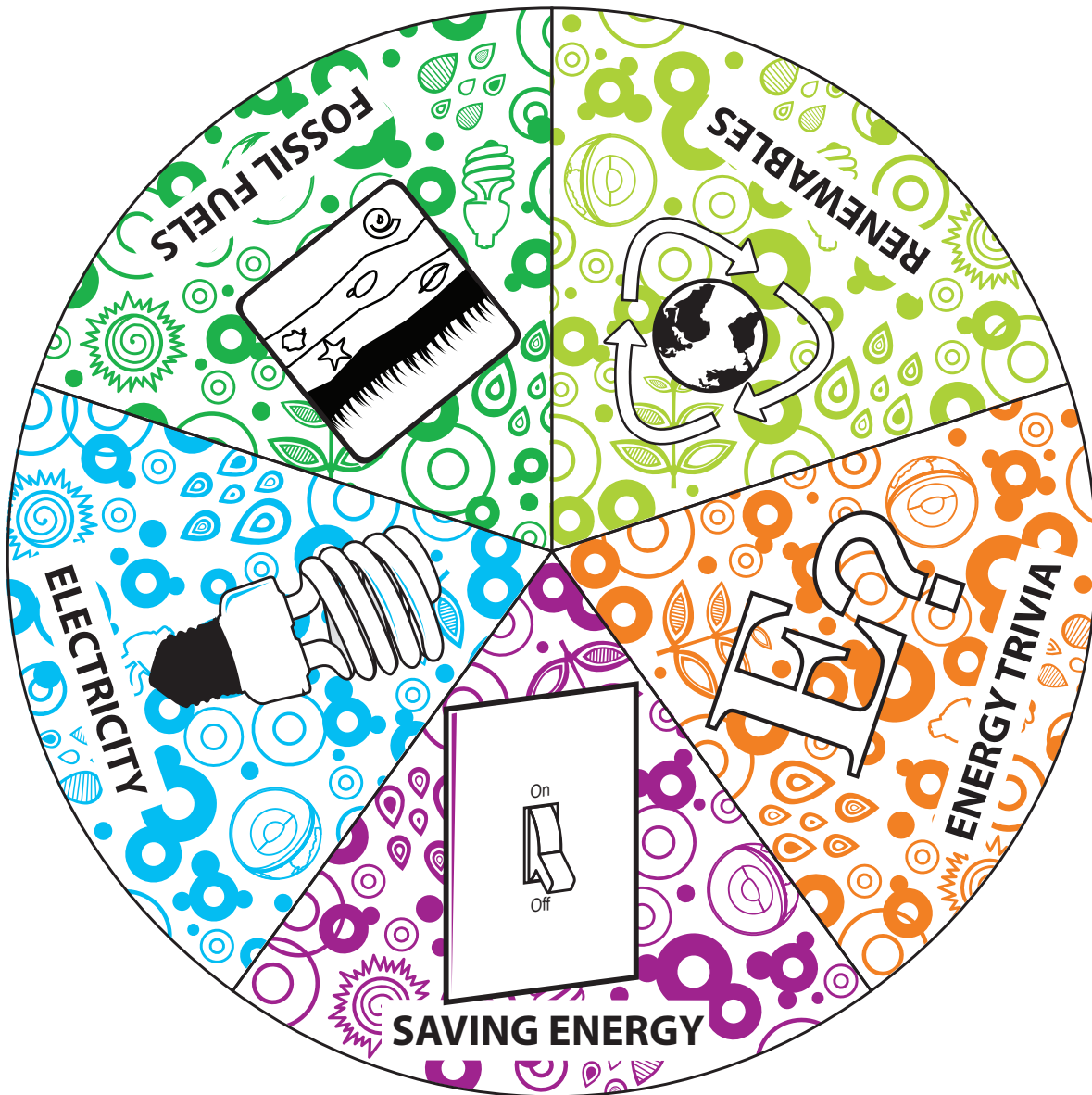
*Petroleum*

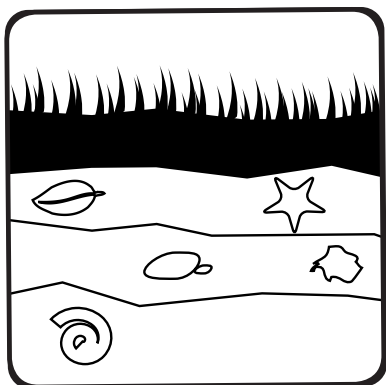
*Wind*

*Solar*

*Geothermal*



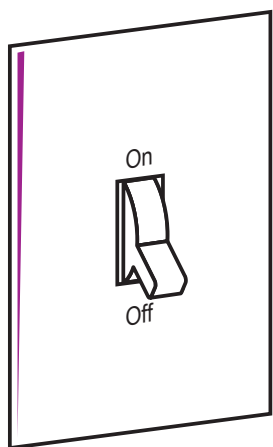




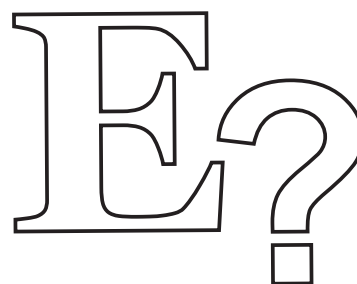
**FOSSIL FUELS  
ENERGY  
PURSUIT**



**RENEWABLES  
ENERGY  
PURSUIT**



**SAVING ENERGY  
ENERGY  
PURSUIT**



**ENERGY TRIVIA  
ENERGY  
PURSUIT**



# Energy Sleuth

## Materials Needed

- Sleuth cards
- Free pass cards
- Sleuth sample words and clues (or answer key)
- Dark paper
- Paper clips or rubber bands

## Energy Sleuth Team Play

Each team tries to guess five energy words, using up to five clues for each word. Points are awarded based on the number of clues revealed before the mystery word is guessed. The fewer clues revealed, the more points awarded. Points are later converted into energy bucks.

## Get Ready

1. Make five copies of the *Energy Sleuth Clue Cards*, page 47, and one copy of the *Free Pass Cards*, page 46. You may wish to copy the clue cards on dark-colored paper so answers are not visible through the paper. Save the originals.
2. Cut the *Free Pass Cards* on the solid lines and fold on the dashed line. Tape together so that “Energy Sleuth Free Pass” is on the outside. Laminate, if possible.
3. Cut each of the five *Energy Sleuth Clue Cards* along the solid lines, giving you a total of six pieces.
4. Using the given sample words and clues (or your own), write the mystery word on the reverse side of the *Energy Sleuth* category card. Write the accompanying five clues on the back of the appropriate strips. Write the mystery word and clues upside down so that when the graphics are flipped over, they will appear right side up, facing the team. Plan the spacing of your words before writing on the strip of paper.
5. Laminate each strip, if possible, and repeat this process for each of the four remaining *Energy Sleuth* games. Use a clip or rubber band to fasten together each group of strips for storage purposes.

## Get Set

1. To play *Energy Sleuth*, arrange all five sets of clue cards on a long table facing the team. Or, you can deal each game separately. Consult the attached sheets and find the category of your first mystery word. Tell the team the category before you turn over the first clue. (Remind students that the category for each mystery word is written under the words *Energy Sleuth*.)
2. Explain to the team that there are five clues for each of the five mystery words. Each clue is revealed one at a time. Points are awarded based on the number of clues revealed before the mystery word is guessed; the fewer clues revealed, the more points awarded. Points will later be converted into energy bucks.
3. Turn over Clue 1. At this point, the team can do one of two things: either try to guess the mystery word or proceed to the next clue. If the team guesses correctly, turn over the *Energy Sleuth* card that reveals the word. Turn over and read any remaining clues that weren’t given before proceeding to the next round.
4. Once all clues are turned over, go back and turn over the clue used to correctly guess the mystery word—this will remind you how many points the team should receive. If the team decides not to make a guess or decides to pass, reveal the next clue and proceed with the game. Make sure to keep the game moving. Allow the team only 15 seconds to make its decision, whether to pass or guess the mystery word.

**NOTE:** At the beginning of the game, each team is given three “free passes” that it can use during any of the five *Energy Sleuth* rounds. If the team gives an incorrect answer, one of two things happens: the team either uses one of its three free passes and continues trying to guess that word, or, if the team is out of free passes, it is eliminated from the round and moves on to the next mystery word. Advise the team that it is wise to use the three passes during the course of the game. There is no advantage to having passes left over.

## Go!

Give these instructions to the carnival team:

1. Behind each of the five sections labeled *Energy Sleuth* is a mystery word. You can have up to five clues to help you guess each mystery word. However, the fewer clues you need, the more points you'll receive. At the end of the five rounds, your points will be converted into energy bucks.
2. Before we start, I am going to give you three "free passes." If you give an incorrect answer, you may use one of your passes and receive the next clue. If you have used all your passes, your team will be eliminated from that round and we'll move on to the next mystery word. Make sure you use the three free passes during the course of the game. There is no advantage in having any left over.
3. At the end of each round, whether or not you have correctly solved the mystery word, I am going to reveal all remaining clues.
4. Are there any questions? Who will be the spokesperson for your team? The category of your first *Energy Sleuth* mystery word is \_\_\_\_\_ and your first clue is \_\_\_\_\_.

**FOR YOUR INFORMATION:** Points should be awarded in the following manner. Word guessed on the:

|                    |          |                 |
|--------------------|----------|-----------------|
| <b>First Clue</b>  | <b>=</b> | <b>5 points</b> |
| <b>Second Clue</b> | <b>=</b> | <b>4 points</b> |
| <b>Third Clue</b>  | <b>=</b> | <b>3 points</b> |
| <b>Fourth Clue</b> | <b>=</b> | <b>2 points</b> |
| <b>Fifth Clue</b>  | <b>=</b> | <b>1 point</b>  |

Energy bucks will be awarded based on the number of points earned for each word as follows:

|                     |          |                       |
|---------------------|----------|-----------------------|
| <b>18 points</b>    | <b>=</b> | <b>5 energy bucks</b> |
| <b>15-17 points</b> | <b>=</b> | <b>4 energy bucks</b> |
| <b>12-14 points</b> | <b>=</b> | <b>3 energy bucks</b> |
| <b>9-11 points</b>  | <b>=</b> | <b>2 energy bucks</b> |
| <b>6-8 points</b>   | <b>=</b> | <b>1 energy buck</b>  |

# Energy Sleuth Individual Play

Each player tries to guess an energy word, using up to five clues. Energy bucks are awarded based on the number of clues revealed before the mystery word is guessed. The fewer clues revealed, the more energy bucks awarded.

## Get Ready

---

1. Make five copies of the *Energy Sleuth Clue Cards*, page 47, and one copy of the *Free Pass Cards*, page 46. You may wish to copy the clue cards on dark-colored paper so answers are not visible through the paper. Save the originals.
2. Cut the *Free Pass Cards* on the solid lines and fold on the dashed line. Tape together so that "Energy Sleuth Free Pass" is on the outside. Laminate, if possible.
3. Cut each of the five *Energy Sleuth Clue Cards* along the solid lines, giving you a total of six pieces.
4. Using the given sample words and clues (or your own), write the mystery word on the reverse side of the *Energy Sleuth* category card. Write the accompanying five clues on the back of the appropriate strips. Write the mystery word and clues upside down so that when the graphics are flipped over, they will appear right side up, facing the team. Plan the spacing of your words before writing on the strip of paper.
5. Laminate each strip, if possible, and repeat this process for each of the four remaining *Energy Sleuth* games. Use a clip or rubber band to fasten together each group of strips for storage purposes.
6. Collect each player's *Energy Sleuth* coupon.

## Get Set

---

1. To play *Energy Sleuth*, arrange all five sets of clue cards on a long table facing the player. Have the player select one of the five games or a number from one to five. Selection can be made through various methods such as dice throwing, pulling a number out of a hat, etc. Give the player instructions on how to play the game. Tell the player the category before you turn over the first clue. The category for each mystery word can be found on the attached sheets. Remind students that the category for the mystery word is written under the words *Energy Sleuth*.
2. Explain to the player that there are five clues for the mystery word they're solving. Each clue is revealed one at a time. Energy bucks are awarded based on the number of clues revealed before the mystery word is guessed; the fewer clues revealed, the more energy bucks awarded.
3. Turn over Clue 1. At this point, the player can either try to guess the mystery word or proceed to the next clue. If the player guesses correctly, turn over the *Energy Sleuth* card that reveals the word and award the player the number of energy bucks written on the clue number card. Turn over and read aloud any remaining clues that weren't given before. If the player decides not to make a guess or decides to use a free pass, reveal the next clue and proceed with the game.

**NOTE:** At the beginning of the game, each player is given one "free pass." If the player gives an incorrect answer, he or she can use the free pass and continue trying to guess that word. If the player has used the free pass, and guesses incorrectly, the game is over. Again, remember to turn over and read all remaining clues.

## Go!

---

Give these instructions to the player after he or she has selected the game they will play:

1. Behind the section labeled *Energy Sleuth* is a mystery word. You can have up to five clues to help you guess one mystery word. But, the fewer clues you need, the more energy bucks you will receive.
2. Before we start, I am going to give you a “free pass.” If you give an incorrect answer, you may use your pass and receive the next clue. The second time you give an incorrect answer, the game will be over and no energy bucks will be awarded.
3. At the end of the round, whether or not you have correctly solved the mystery word, I am going to reveal all remaining clues.
4. Are there any questions? The category of your *Energy Sleuth* mystery word is \_\_\_\_\_ and your first clue is \_\_\_\_\_.

**FOR YOUR INFORMATION:** Energy bucks should be awarded in the following manner. Word guessed on the:

|                    |          |                       |
|--------------------|----------|-----------------------|
| <b>First Clue</b>  | <b>=</b> | <b>5 energy bucks</b> |
| <b>Second Clue</b> | <b>=</b> | <b>4 energy bucks</b> |
| <b>Third Clue</b>  | <b>=</b> | <b>3 energy bucks</b> |
| <b>Fourth Clue</b> | <b>=</b> | <b>2 energy bucks</b> |
| <b>Fifth Clue</b>  | <b>=</b> | <b>1 energy buck</b>  |

# Energy Sleuth Sample Mystery Words and Clues

## Category: Energy Producing Device

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MYSTERY WORD: Photovoltaic Cell (solar cell)

- Clue #1 Uses renewable energy
- Clue #2 Produces electricity
- Clue #3 Good in remote areas
- Clue #4 Mostly silicon
- Clue #5 Used in calculators

## Category: Energy Saving Measure

---

MYSTERY WORD: Aluminum Recycling

- Clue #1 Saves electricity
- Clue #2 No special equipment needed
- Clue #3 95% energy savings
- Clue #4 Reduces solid waste
- Clue #5 Cans and lawn furniture are sources

## Category: Energy Source

---

MYSTERY WORD: Hydropower

- Clue #1 Renewable
- Clue #2 Limited geographic areas
- Clue #3 About 3% of U.S. energy
- Clue #4 5–10% of U.S. electricity
- Clue #5 Requires Earth's gravity

## Category: Energy Source

---

MYSTERY WORD: Natural Gas

- Clue #1 Nonrenewable
- Clue #2 Supplies 27.5% of U.S. energy
- Clue #3 Heats about 50% of U.S. homes
- Clue #4 Clean-burning fossil fuel
- Clue #5 Transported by pipeline

## Category: Energy Saving Item

---

MYSTERY WORD: Insulation

- Clue #1 Lowers heating/cooling bills
- Clue #2 Resists heat transfer
- Clue #3 Fiberglass often used
- Clue #4 Measured in R-value
- Clue #5 Most effective in attic

## Category: Energy Source

---

MYSTERY WORD: Uranium

- Clue #1 Nonrenewable
- Clue #2 Generates 19% of U.S. electricity
- Clue #3 99 generating locations
- Clue #4 Waste is dangerous
- Clue #5 U<sup>235</sup> isotope splits

## Category: Energy Source

---

MYSTERY WORD: Coal

- Clue #1 Generates most electricity
- Clue #2 Fossil fuel
- Clue #3 Exported to other countries
- Clue #4 Produced in states like WY, WV, and KY
- Clue #5 Transported by train

## Category: Energy Saving Measure

---

MYSTERY WORD: Check Tire Pressure

- Clue #1 Increases MPG
- Clue #2 Reduces friction
- Clue #3 Check it weekly
- Clue #4 Important for safety
- Clue #5 Extends tire life

## Category: Energy Source

---

*MYSTERY WORD: Petroleum*

- Clue #1 Nonrenewable**
- Clue #2 Supplies 35% of U.S. energy**
- Clue #3 A little less than half is imported**
- Clue #4 Transportation is major use**
- Clue #5 Sold by the barrel**

## Category: Energy Source

---

*MYSTERY WORD: Biomass*

- Clue #1 Renewable**
- Clue #2 Found nationwide**
- Clue #3 Used by industry**
- Clue #4 Garbage used as fuel**
- Clue #5 Wood accounts for about half**

## Category: Energy Saving Item

---

*Mystery word: LED Bulb*

- Clue #1 Lowers electricity bills**
- Clue #2 Can be used all over the home**
- Clue #3 Holiday twinkle lights can be made of these**
- Clue #4 Last 25 times longer than incandescent bulbs**
- Clue #5 Found in exit signs**

## Category: Energy Consuming Device

---

*Mystery Word: Water Heater*

- Clue #1 Contributes to nearly 20% of home energy costs**
- Clue #2 Often run on natural gas or electricity**
- Clue #3 Look for these in basements or closets**
- Clue #4 May have a tank or may be tankless**
- Clue #5 Can save money when set to 120°F**

## Category: Energy Saving Item

---

*Mystery Word: EnergyGuide Label*

- Clue #1 Estimates yearly energy cost and consumption**
- Clue #2 Yellow and black**
- Clue #3 Are specifically made for certain appliances**
- Clue #4 Helps consumers compare costs**
- Clue #5 Look for these when purchasing new appliances**



**Energy Sleuth**

**FREE  
PASS**



**Energy Sleuth**

**FREE  
PASS**



**Energy Sleuth**

**FREE  
PASS**



**Energy Sleuth**

**FREE  
PASS**



**Energy Sleuth**

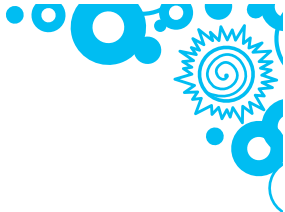
**FREE  
PASS**



**Energy Sleuth**

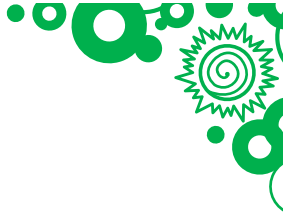
**FREE  
PASS**





# Energy Sleuth

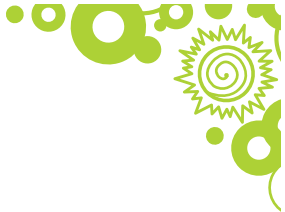
CATEGORY \_\_\_\_\_



## Energy Sleuth

CLUE 1

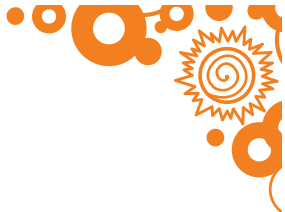
5 POINTS



## Energy Sleuth

CLUE 2

4 POINTS



## Energy Sleuth

CLUE 3

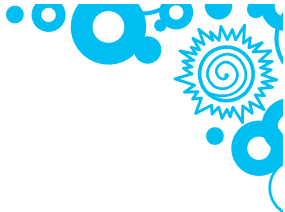
3 POINTS



## Energy Sleuth

CLUE 4

2 POINTS



## Energy Sleuth

CLUE 5

1 POINT



# Energy Taboo

## Materials Needed

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- Index cards
- Paper clips
- Taboo words

## Energy Taboo Team Play

Students try to get their teammates to guess energy mystery words while avoiding the use of certain taboo words.

### Get Ready

---

Choose 15 mystery words on page 50 that you would like to use in your game. According to your students' age and knowledge of energy, decide how many words will be taboo. For older students with a great deal of energy knowledge, you can make all four words taboo. For younger and less knowledgeable students, you can make just one or two words taboo.

### Get Set

---

On an index card, write one mystery word in large letters at the top of the card and the taboo word(s) below. Repeat this for the remaining 14 mystery words. Paper clip the index cards together in stacks of three.

### Go!

---

Give these instructions to the carnival team:

1. In *Energy Taboo*, a team member must get the other members of the team to guess an energy mystery word without saying the taboo word(s). The energy mystery word is written on the top of an index card in large letters. The taboo word(s) are written below and cannot be used as clues when trying to get your team to guess the mystery word. Also, you cannot make any sounds or hand motions.
2. You will have 45 seconds to give clues for three energy mystery words.
3. You can start with any of the three mystery words and you may pass and come back to a word if your team is guessing incorrectly.
4. After 45 seconds, the next team member will get the next stack of index cards and have 45 seconds to give clues to the team. The team must guess all three mystery words to win one energy buck (a total of five energy bucks may be won if the team guesses all 15 mystery words).
5. Which five team members will be giving clues? Are there any questions?

# Energy Taboo Two-Person Play

One person must get his or her partner to guess energy mystery words while avoiding the use of certain taboo words.

## Get Ready

---

1. Choose five mystery words on page 50 that you would like to use in your game. According to your students' age and knowledge of energy, decide how many words will be taboo. For older students with a great deal of energy knowledge, you can make all four words taboo. For younger and less knowledgeable students, you can make just one or two words taboo. If you have a variety of ages playing the game, make two sets of mystery words—one set for older students and one set for younger students.
2. Collect each player's *Energy Taboo* coupon.

## Get Set

---

On an index card, write one mystery word in large letters at the top of the card and the taboo word(s) below. Repeat this for the remaining four mystery words. When two individuals or a team of two arrives at this station, select one person to give clues. The other team member will try to guess the mystery words.

## Go!

---

Give these instructions to the players:

1. In *Energy Taboo*, a person must get his or her partner to guess energy mystery words without saying the taboo words. The energy mystery word is written on the top of an index card in large letters. The taboo word(s) are written below and cannot be used as clues. Also, the person giving the clues may not make any sounds or hand motions.
2. You will have two minutes to guess five energy mystery words.
3. The person giving the clues can start with any of the five mystery words and may pass and come back to a word if his or her partner is guessing incorrectly. Each person will win one energy buck for each mystery word that is guessed correctly.
4. Are there any questions?

# Energy Mystery Words and Taboo Words

Four taboo words are listed below each mystery word. To help you select taboo words, the easiest clues are in the first and second positions.

## PETROLEUM

1. Oil
2. Crude
3. Transportation
4. Refinery

## NATURAL GAS

1. Methane
2. Odor
3. Pipelines
4. Cleanest fossil fuel

## COAL

1. Mines
2. Trains
3. Electricity
4. Fossilized plants

## URANIUM

1. Nuclear
2. Reactor
3. Electricity
4. Radiation

## PROPANE

1. Gas
2. Barbecue grills
3. Rural areas
4. Tanks

## HYDROPOWER

1. Dams
2. Water
3. Reservoirs
4. Floods

## GEOTHERMAL

1. Earth
2. Volcanoes
3. Magma
4. Geysers

## BIOMASS

1. Garbage
2. Wood
3. Corn
4. Photosynthesis

## WIND

1. Turbine
2. Air
3. Uneven heating
4. Holland

## SOLAR

1. Sun
2. Light
3. PV cells
4. Collectors

## FOSSIL FUEL

1. Petroleum
2. Coal
3. Natural gas
4. Ancient plant remains

## RECYCLE

1. Reuse
2. Aluminum
3. Separate
4. Landfills

## ELECTRICITY

1. Power
2. Kilowatt-hour
3. Generator
4. Voltage

## CONSERVATION

1. Energy savings
2. Reduce waste
3. Turn off lights
4. Lower bills

## LIGHTING

1. Bulb
2. Fluorescent
3. Thomas Edison
4. Turn off

## AUTOMOBILE

1. Gasoline
2. Transportation
3. Drive
4. Henry Ford

## INSULATION

1. Attic
2. Pink
3. R-value
4. Foam

## AIR POLLUTION

1. Smog
2. Smoke stacks
3. Auto exhaust
4. Burning

## ENERGY STAR®

1. Appliance
2. Star
3. Savings
4. Label

## THERMOSTAT

1. Temperature
2. Heat
3. Cool
4. Adjust

## WATER HEATER

1. Thermostat
2. Shower
3. Temperature
4. Bath

## NON RENEWABLE

1. Coal
2. Natural gas
3. Petroleum
4. Reduce

## RENEWABLE

1. Reuse
2. Hydropower
3. Wind
4. Solar



# Energy Knockdown

## Materials Needed

- 10 Soda cans
- Ball
- Knockdown graphics sheets
- Masking tape
- Knockdown questions

## Energy Knockdown Team Play

Each team tries to knock down two cans representing nonrenewable energy sources, renewable energy sources, or energy efficiency topics. After the cans are knocked down, the team tries to answer related questions.

### Get Ready

1. Decide if you will focus on energy sources or energy efficiency.
2. Make copies of the enclosed graphics for your topic choice (pages 56-65), color each, and cut them out. Cover ten soda cans with the patterns.
3. Get a ball (such as a foam ball or a wad of aluminum foil) that will not bounce or damage the cans.

### Get Set

1. On a table, arrange the cans in a row so they are equally spaced. The cans should fall over easily. Place a piece of tape on the floor 8 to 10 feet from the table—this is where the pitcher will stand. Five team members, one at a time, will each get four chances to knock down two renewable, two nonrenewable, or two energy efficiency cans. After the cans are knocked down, the team is asked a corresponding question. If the team answers correctly, it gets an energy buck.
2. Keep playing until each team member has had a chance to knock down the cans. If two cans are not knocked down after four chances, no question is asked and another team member tries his/her luck.
3. Select your questions for each category. The grade level of the teams playing the game determines the difficulty of the questions you choose. The more difficult questions are at the top of the *Knockdown Questions and Answers* (pages 53-55), and the easier ones are at the bottom.

### Go!

Give these instructions to the carnival team:

1. Each team member will have four chances to knock down two renewable energy source cans, two nonrenewable energy source cans, or two energy efficiency cans. Two cans (renewable or nonrenewable) can be knocked down at once.
2. After you knock down two cans, I will ask you a corresponding question. If you answer correctly, you will receive one energy buck. If not, I will give you the answer and we will move on. If a team member does not knock down two cans after four chances, no question will be asked and another team member will try his/her luck. You will repeat the entire process a total of five times. Each time we will let a different team member throw the ball.
3. This is where you should stand when you throw the ball. Are there any questions? Who would like to be first to throw the ball at the cans? Who will be the spokesperson for the team?

# Energy Knockdown Individual Play

Each player tries to knock down renewable energy source cans, nonrenewable energy source cans, or energy efficiency cans and answer five related questions.

## Get Ready

---

1. Decide if you will focus on energy sources or energy efficiency.
2. Make copies of the enclosed graphics for your topic of choice (pages 56-65) on colored paper and cut them out. Cover ten soda cans with the patterns.
3. Get a ball (such as a foam ball or a wad of aluminum foil) that will not bounce or damage the cans.
4. Collect each player's *Energy Knockdown* coupon.

## Get Set

---

1. On a table, arrange the cans in a row so they are equally spaced. The cans should fall over easily. Place a piece of tape on the floor 8 to 10 feet from the table—this is where the player will stand. Each player will get five chances to knock down as many energy source cans as possible. For example, if the player knocks down one renewable and two nonrenewable energy source cans, he/she is asked one renewable and two nonrenewable energy source questions. If the player is playing with the efficiency cans, select a question related to the knocked down can. For each question answered correctly, the player gets one energy buck.
2. Keep playing until the player has had five opportunities to knock down the cans. After all five attempts have been made, ask the player the appropriate number of questions.
3. Select your questions for each category. The player's grade level should determine the difficulty of the questions you choose. The more difficult questions are at the top of the *Knockdown Questions and Answers* (pages 53-55), and the easier ones are at the bottom.

## Go!

---

Give these instructions to the player:

1. You will have five chances to knock down five cans.
2. After five throws, I will ask you one question for each can you have knocked down. If you answer correctly, you will receive one energy buck. If not, I will give you the answer and we will move on.
3. This is where you should stand when you throw the ball. Are there any questions?

# Knockdown Questions and Answers

## Renewable Sources

*Wind, Biomass, Solar, Geothermal, Hydropower*

- 1. Name the biological process that can convert agricultural products and waste into alcohol and carbon dioxide.**  
*Fermentation*
- 2. Name the renewable energy source that is produced by uneven heating of the Earth's surface.**  
*Wind*
- 3. Name one method of using the energy stored in biomass.**
  - a. Combustion (burning)*
  - b. Convert it into alcohol (ethanol)*
  - c. Convert it into a gas (methane)*
- 4. When sunlight hits a photovoltaic cell (solar cell), it produces what type of usable energy?**  
*Electrical energy (Ten to twenty percent of the sunlight is changed into electricity, and the rest is changed into heat.)*
- 5. What percent of the nation's energy is supplied by renewable sources of energy (plus or minus 3 percent)?**  
*Nine and a half percent (accept 6 to 12 percent)*
- 6. To best use solar energy for home heating, large windows or solar panels should be facing what compass direction?**  
*South*
- 7. Which renewable energy source provides the U.S. with 5-10 percent of its electricity?**  
*Hydropower*
- 8. In times of drought, which energy source would experience a drop in production?**  
*Hydropower*
- 9. Name one use of solar energy in the home.**
  - a. Hot water heating*
  - b. Space heating and cooling*
  - c. Cooking*
  - d. Clothes drying*
  - e. Electricity from photovoltaic cells*
- 10. Name the term used to describe the heat energy from the Earth.**  
*Geothermal*
- 11. What machine is used to convert wind energy into electricity?**  
*Wind turbine*

## Nonrenewable Sources

*Petroleum, Coal, Uranium, Propane, Natural Gas*

- 1. What type of alcohol fuel can be produced from coal and natural gas?**  
*Methanol*
- 2. What is the major air pollutant found in coal?**  
*Sulfur (less than one percent in Western coal and three percent in Eastern)*
- 3. What two chemical elements are the major components of fossil fuels?**  
*Hydrogen and carbon*
- 4. Plus or minus 10 percent, how much of the petroleum we use in the U.S. do we import today?**  
*48 percent (accept 38 to 58 percent)*
- 5. Plus or minus five percent, what percentage of energy consumed in the United States is supplied by nonrenewable sources?**  
*90.6 percent (accept 85 to 95 percent)*
- 6. Ninety percent of raw natural gas is composed of what gas?**  
*Methane (One carbon and four hydrogen atoms—CH<sub>4</sub>)*
- 7. Almost half the petroleum used in the U.S. is refined into what transportation fuel?**  
*Gasoline*
- 8. Which fossil fuel is most abundant in the U.S.?**  
*Coal*
- 9. What is the major use of coal in the U.S.?**  
*Production of electricity (93 percent of all coal consumed)*
- 10. What is the major method for transporting natural gas to homes and factories?**  
*Pipeline*
- 11. What is the cleanest fossil fuel to burn for energy?**  
*Natural Gas/Propane*
- 12. Name three fossil fuels.**
  - a. Coal*
  - b. Petroleum*
  - c. Natural gas*
  - d. Propane*



# Knockdown Questions and Answers

## Energy Efficiency

### CFL

1. **What does CFL Stand for?**  
*Compact Fluorescent Light bulb*
2. **How much energy can a CFL save compared to an incandescent bulb (plus or minus 5%)?**  
*75% (accept 70 – 80%)*
3. **How much longer can CFL bulbs last compared to an incandescent light bulb?**  
*10 times longer*

### Water Heater

1. **Water heating is one of the largest energy expenses in your home. Name one way to save energy while using hot water.**  
*Turn down the thermostat on the water heater, take shorter showers, use a low-flow shower head or aerator on the faucet*
2. **How can you reduce the amount of water you use while washing dishes?**  
*Fill the sink rather than letting the water run*
3. **What renewable resource works well for water heating?**  
*Solar*

### Transportation

1. **What is one way you can save energy getting from one place to another?**  
*Carpooling, riding a bike, walking, taking public transportation*
2. **What does MPG stand for?**  
*Miles per gallon*
3. **What is one way you can increase your MPGs when driving?**  
*Obey the speed limit, properly inflate tires, reduce junk in the trunk, get oil changes regularly, maintain consistent speed*

### Thermostat

1. **What should you do with your thermostat to save energy on heating and cooling?**  
*Use a programmable thermostat; turn your thermostat down in winter/up in summer*
2. **How can opening and closing the blinds help save on heating and cooling?**  
*Using day lighting can help bring in/trap warm sunlight in winter, closing the blinds can help keep a space cool in summer*
3. **Which renewable source of energy can be used to pump cooler or warmer air through your home using a heat exchanger?**  
*Geothermal*

### Appliances and Machines

1. **Which kitchen appliance uses the most electricity?**  
*Refrigerator*
2. **What are ENERGY STAR® products known for?**  
*Energy efficiency, saving money*
3. **What is a phantom load?**  
*Energy usage that is being drawn when the item is not in active use*

### Electricity

1. **What is the average residential cost of a kilowatt-hour in the United States?**  
*12.5 cents*
2. **Name a time during the day that energy use is in its peak.**  
*Afternoon (3-8 PM)*
3. **Name one of the top three resources used to generate U.S. electricity.**  
*Coal, natural gas, uranium*

### ***Building Envelope***

- 1. What is the material that helps to seal our homes so that warm or cool air doesn't escape?**  
*Insulation*
- 2. R-value describes the thickness of insulation needed. If you live in a cold climate you will have a \_\_\_\_\_ R-value than a warm climate.**  
*Higher*
- 3. What is an example of a place heat loss might occur in a home?**  
*Attics, vents, doors, windows, outlets, chimneys*

### ***Lighting***

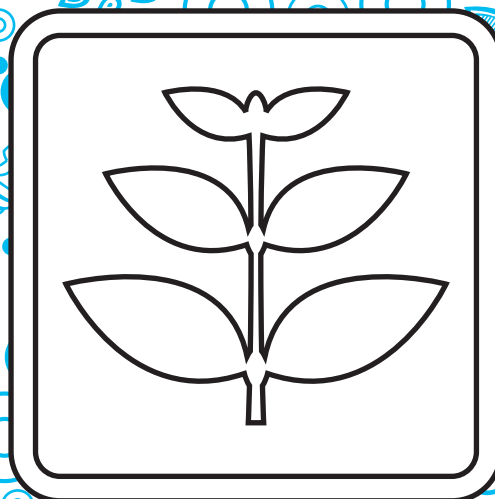
- 1. What percentage of a typical energy bill is due to lighting the home (plus or minus 3 percent)?**  
*5 percent (accept 2 to 8 percent)*
- 2. What is the most energy efficient light bulb type you can buy?**  
*LED, light emitting diode*
- 3. What is the unit for measuring light output from a light bulb?**  
*Lumens*

### ***Recycling***

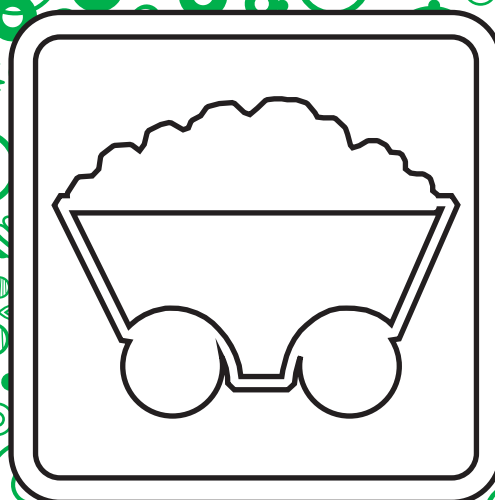
- 1. Name the four common types of recyclable materials most people recycle.**  
*Glass, plastic, metal, and paper*
- 2. Name one benefit to recycling.**  
*Saves natural resources, reduces air pollution, reduces water pollution, creates jobs, uses less energy*
- 3. What is the difference between open and closed loop recycling?**  
*Open loop recycling – recycled materials are made into something different than the original item*  
*Closed loop recycling – recycled materials are made into the same item again*

### ***Resources***

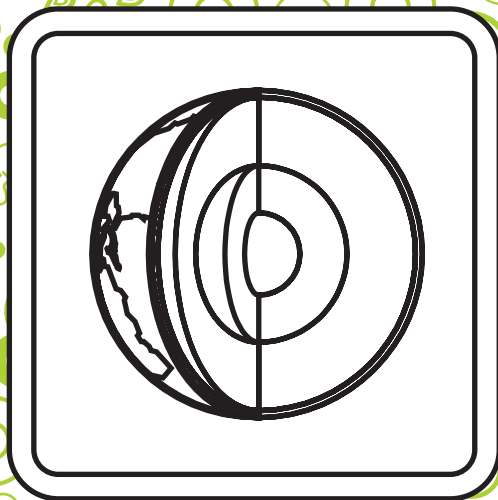
- 1. Name two renewable resources.**  
*Solar, wind, hydropower, geothermal, biomass*
- 2. Name two nonrenewable resources.**  
*Coal, petroleum, uranium, natural gas, propane*
- 3. What percentage of U.S. energy comes from renewable resources (plus or minus 3 percent)?**  
*9.6 percent (accept 6 – 12%)*



**BIOMASS**  
**ENERGY *Knockdown***



**COAL**  
**ENERGY *Knockdown***



## **GEOHERMAL**

### **ENERGY *Knockdown***



## **HYDROPOWER**

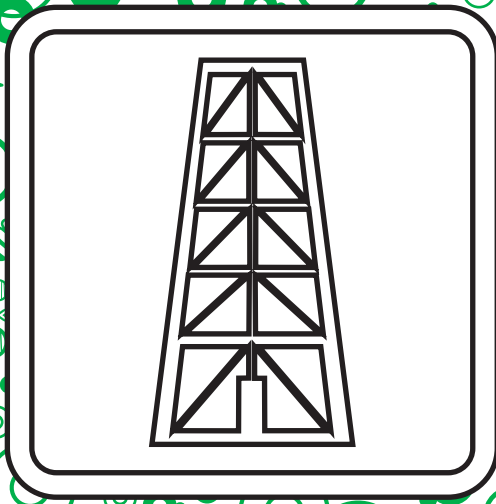
### **ENERGY *Knockdown***



**NATURAL GAS**  
**ENERGY *Knockdown***

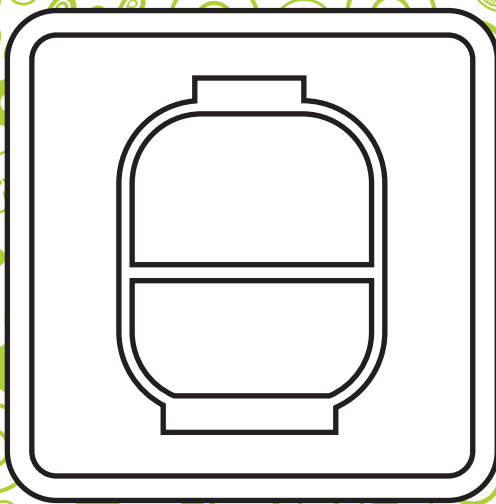


**URANIUM**  
**ENERGY *Knockdown***



# **PETROLEUM**

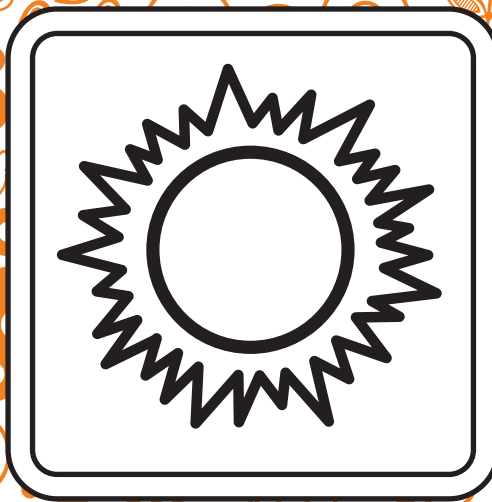
## **ENERGY *Knockdown***



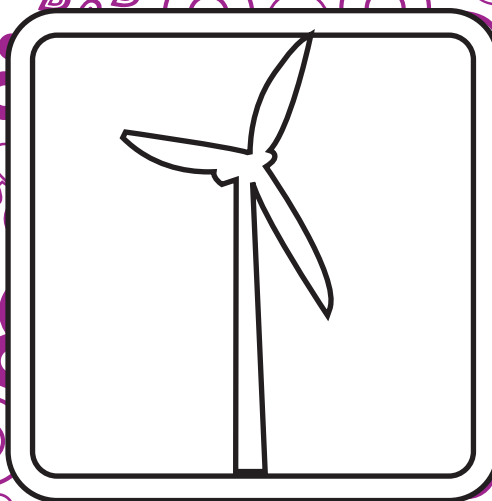
# **PROPANE**

## **ENERGY *Knockdown***

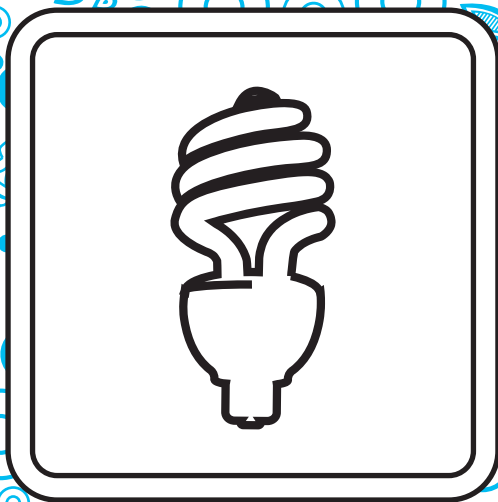




**SOLAR**  
**ENERGY *Knockdown***



**WIND**  
**ENERGY *Knockdown***



**CFL**  
**ENERGY EFFICIENCY *Knockdown***



**WATER HEATER**  
**ENERGY EFFICIENCY *Knockdown***

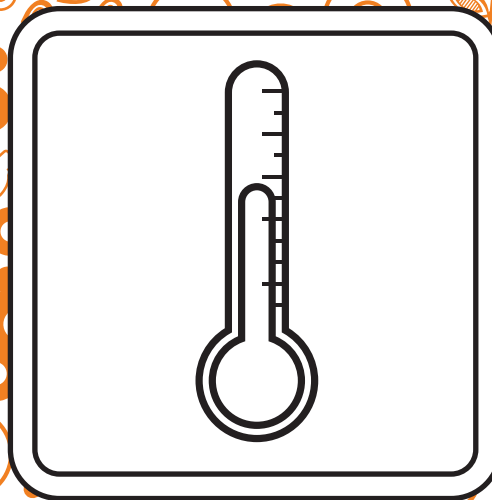




## **TRANSPORTATION**

### **ENERGY EFFICIENCY *Knockdown***

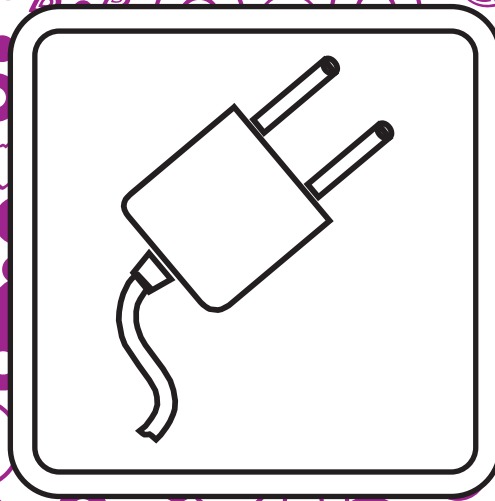
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## **THERMOSTAT**

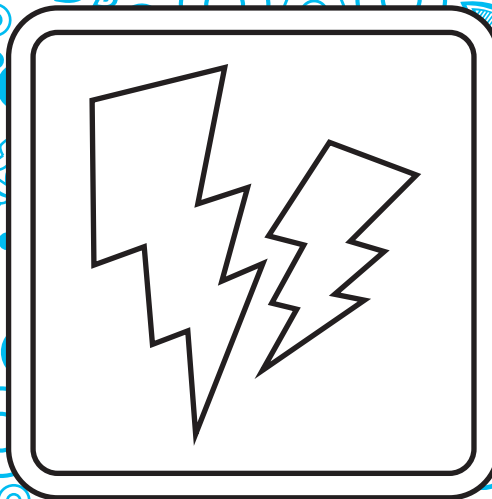
### **ENERGY EFFICIENCY *Knockdown***

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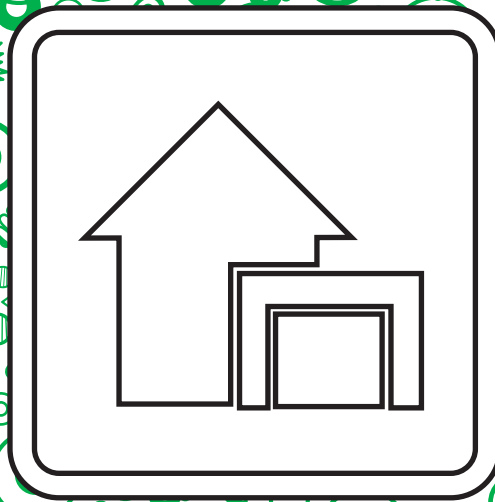
## **APPLIANCES AND MACHINES**

### **ENERGY EFFICIENCY *Knockdown***



## **ELECTRICITY**

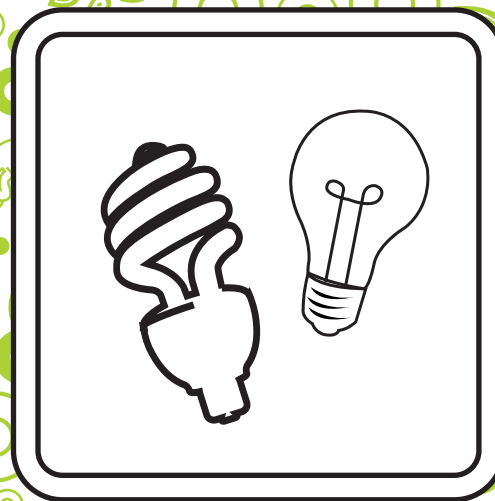
### **ENERGY EFFICIENCY *Knockdown***



## **BUILDING ENVELOPE**

### **ENERGY EFFICIENCY *Knockdown***

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## **LIGHTING**

### **ENERGY EFFICIENCY *Knockdown***

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# RECYCLING

## ENERGY EFFICIENCY *Knockdown*

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# RESOURCES

## ENERGY EFFICIENCY *Knockdown*

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# Source Separation

## Materials Needed

- Cardboard box
- Newspaper
- Aluminum foil
- Foam cup
- Soup can
- Masking tape
- Source questions

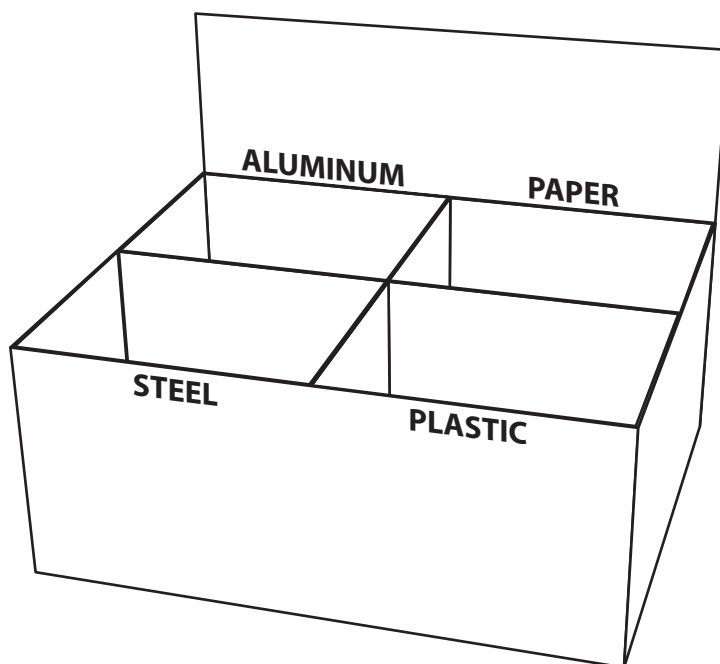
## Source Separation Team Play

Team members must toss a recyclable material into its appropriate compartment before answering five solid waste questions and earning one energy buck for each correct answer.

### Get Ready

1. Take a cardboard box and divide it into four compartments with pieces of cardboard (see diagram).
2. Write the words STEEL and PLASTIC on the front of the box as shown.
3. Attach a piece of cardboard to the back of the box to serve as a backboard.
4. Write the words ALUMINUM and PAPER on the backboard as shown.
5. Gather together a rolled up newspaper (paper), aluminum foil (aluminum), a cup or ball (plastic)—you may need to add some weight to it—and an empty vegetable or soup can (steel).
6. Select the five questions you are going to use (see page 67). The grade level of the students playing the game determines the difficulty of the questions you choose.

**NOTE:** You may also use four separate, labeled bins in place of the box set-up above.



### Get Set

Place the box at one end of an eight foot long table. The age level of the players will determine where the tosser should stand. Younger students should stand at the opposite end of the table. Older students should stand back about one or two feet from the opposite end of the table. Place a piece of masking tape on the floor to mark where you want the tosser to stand.

### Go!

Give these instructions to the carnival team:

1. At the end of the table is a box separated into four compartments. Each compartment represents a different recyclable material.
2. I will need one member of the carnival team to serve as the tosser. The tosser will have to throw each item into its appropriate compartment.
3. When you successfully toss an item into its correct compartment, I will give the team a solid waste question. Your team spokesperson will then give me an answer. If the answer is correct, your team will win one energy buck. If the tosser misses the compartment, he/she can try again. If the recyclable material goes into the wrong compartment, I will take it out and the tosser can try again. After all four items have been properly recycled, I will ask a fifth question to earn a total of five energy bucks.
4. Are there any questions? Who will be the spokesperson for your team? Who will be the tosser?



# Source Separation Individual Play

Follow the Team Play directions for GET READY and GET SET. Don't forget to collect each player's *Source Separation* coupon.

## Go!

Give these instructions to the player:

1. At the end of the table is a box separated into four compartments. Each compartment represents a different recyclable material.
2. You will have to throw each item into its appropriate compartment.
3. When you successfully toss an item into its correct compartment, I will give you a solid waste question and you will then give me an answer. If the answer is correct, you will win one energy buck. If you miss the compartment, you can try again. If the recyclable material goes into the wrong compartment, I will take it out and you can try again. After all four items have been properly recycled, I will ask a fifth question to earn a total of five energy bucks.
4. Are there any questions?

## Source Separation Questions

1. **Which of the following methods is the one most often chosen to dispose of the nation's solid waste—landfilling, incineration, composting, or recycling?**  
*Landfills (Fifty-three percent of the nation's waste is disposed of by this method.)*
2. **In a waste-to-energy plant, the energy released from burning solid waste is converted into usable forms of energy. One form is steam for heating buildings and other industrial uses. What is the other usable form of energy?**  
*Electricity*
3. **Making aluminum cans from recycled aluminum scrap takes what percentage of the energy required to make cans from all new materials—5, 25, 50, or 75?**  
*Five*
4. **Plus or minus one pound, the average American produces how many pounds of solid waste in one day?**  
*Four pounds (accept three to five)*
5. **What is the name of the gas formed in landfills that can be used as fuel?**  
*Methane*
6. **Pound for pound, which material provides the most amount of energy in a waste-to-energy plant—plastics, paper, yard wastes, or food wastes?**  
*Plastics*
7. **Which of the following four items makes up the largest segment of the nation's solid waste—glass, paper, metals, or yard wastes?**  
*Paper*
8. **Plus or minus five cubic yards, for every 100 cubic yards of solid waste burned in a waste-to-energy plant, how many cubic yards of ash will remain to be landfilled or processed?**  
*Fifteen cubic yards (accept ten to 20)*
9. **By weight, not volume, which of the following materials is recycled the most—glass, aluminum, steel, or plastic?**  
*Steel*
10. **Which of the following phrases best describes the degree to which solid waste biodegrades in a modern landfill after a 20 year period—very little, about 1/3, about 3/4, almost all biodegrades?**  
*Very little*
11. **Which material is the most valuable to recycle—aluminum, steel, or plastic?**  
*Steel*
12. **About how much of our trash do Americans recycle today—25, 35, 50, or 60 percent?**  
*About 35%*



# Top Five

## Materials Needed

---

- Top five board graphics
- Marker
- Dark paper
- Paper clips
- Top five category list and answers

## Top Five Team Play

In our version of Family Feud, teams give the top five answers to an energy question to win one energy buck.

## Get Ready

---

1. Make five copies of the board graphic (page 73). It is suggested that you use dark-colored paper so that the answers are not visible through the paper.
2. Cut out each of the *Top Five* graphics, giving you a total of six equal pieces—*Top Five*, *1*, *2*, *3*, *4*, and *5*—for each set of graphics.
3. Using five of the sample questions attached, or your own questions, write the energy topic on the reverse side of the *Top Five* section and its top five answers on the appropriate strips. Write the energy topic and answers upside down on the strips so that when the graphics are flipped over, they will appear right side up, facing the team. It is important to plan the spacing of your words prior to writing on the strip of paper. It may be helpful to use a fine-tip or medium-tip marker.
4. Laminate each strip, if possible, and repeat this process for each of the four remaining questions you have chosen. Clip or rubber band each group of strips together for storage purposes.

## Get Set

---

1. Arrange all five games on a long table facing the team. You can also “deal” and gather up each game separately. You will need a copy of each of the numbered *Top Five* questions and answers so you can read each question to the team and know in which positions the answers are located.
2. Turn over the *Top Five* strip first and read the entire question. Ask the team’s spokesperson for answers. Each time a correct answer is given, flip over the appropriate strip. If the team gives three incorrect answers, it is eliminated from the round and must move on to the next question.

## Go!

---

Give these instructions to the carnival team:

1. *Top Five* is similar to the Family Feud television game show. I will ask you a question and you will attempt to give me the top five correct answers. If your team gets all five answers before giving three incorrect answers, your team wins one energy buck.
2. Are there any questions? Who will be the spokesperson for your team? Here is your first *Top Five* question.

# Top Five Individual Play

In our version of Family Feud, the player must give the top five answers to an energy question within 90 seconds to win five energy bucks.

## Get Ready

---

1. Make five of copies of the game board graphic (page 73). It is suggested that you use dark-colored paper so that the answers are not visible through the paper.
2. Cut out each of the *Top Five* graphics, giving you a total of six equal pieces—*Top Five*, 1, 2, 3, 4, and 5—for each set of graphics.
3. Using five of the sample questions attached, or your own questions, write the energy topic on the reverse side of the *Top Five* section and its top five answers on the appropriate strips. Write the energy topic and answers upside down on the strips so that when the graphic is flipped over, it will appear right side up, facing the player. It is important to plan the spacing of your words prior to writing on the strip of paper. It may be helpful to use a fine-tip or medium-tip marker.
4. Laminate each strip if possible, and repeat this process for each of the four remaining *Top Five* questions. Clip or rubber band each group of strips together for storage purposes.
5. Collect each player's *Top Five* coupon.

## Get Set

---

1. Arrange all *Top Five* games on a long table facing the player. You can also “deal” and gather up each game separately. You will need a copy of each of the numbered *Top Five* questions and answers so you can read the appropriate question to the player and know in which positions the answers are located.
2. Give the player instructions. Have the player select a category to play. Once the category is selected, deal out the game strips face down, turn over the category card, and read the question slowly. Each time a correct answer is given, flip over the appropriate strip. The player earns one energy buck for each correct answer. If the player gives three incorrect answers, he/she is eliminated and the game is over. After the game ends, award the player his/her energy bucks, fold up the game, and send for the next player. It is suggested that individuals waiting to play stand a few feet from the game in progress, or have several categories available to alternate.

## Go!

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Give these instructions to the player:

1. Please pick a category.
2. *Top Five* is similar to the Family Feud television game show. I will ask you a question and you will attempt to give me the top five correct answers. For each correct answer you give, you will receive one energy buck. If you get all five answers correct before giving three incorrect answers, you win five energy bucks. If you give three incorrect answers, the game is over and I will reveal the correct answers.
3. Are there any questions? You have 90 seconds to give the top five answers.



# Top Five Questions and Answers

**1. The United States imports about half of the petroleum we use. Name the TOP FIVE nations that supply this energy source.**

***TOP FIVE—Petroleum Imports***

1. *Canada*
2. *Saudi Arabia*
3. *Mexico*
4. *Venezuela*
5. *Iraq*

**2. Just under forty percent of total U.S. energy consumption is used to generate electricity for homes, schools, businesses, and factories. Name the TOP FIVE energy sources that are used to generate this electricity.**

***TOP FIVE—Generating Sources***

1. *Coal—39%*
2. *Natural Gas —28%*
3. *Uranium—19%*
4. *Hydropower—6%*
5. *Wind—4%*

**3. Renewable energy sources provide the U.S. with between nine and ten percent of its annual energy demand. Name these TOP FIVE renewable sources.**

***TOP FIVE—Renewable Sources***

1. *Biomass—4.8%*
2. *Hydropower—2.5%*
3. *Wind—1.7%*
4. *Solar—0.4%*
5. *Geothermal—0.2%*

**4. Coal provides the greatest amount of U.S. electricity. Name the TOP FIVE states that produce that coal.**

***TOP FIVE—Coal Producers in 2014***

1. *Wyoming*
2. *West Virginia*
3. *Kentucky*
4. *Pennsylvania*
5. *Illinois*

**5. Domestic petroleum production provides the U.S. with about 64 percent of the nation's oil. Name the TOP FIVE states that produce that petroleum.**

***TOP FIVE—Petroleum Producers in 2014***

1. *Texas*
2. *North Dakota*
3. *Alaska*
4. *California*
5. *Oklahoma*

**6. One hundred people were surveyed. What were their TOP FIVE responses to this statement: “Name a device in your home that uses energy.”**

***TOP FIVE—Energy Users***

1. Furnace
2. Water heater
3. Air Conditioner
4. Lights
5. Computers/electronics

**7. Name the TOP FIVE countries that produce petroleum.**

***TOP FIVE—Oil Producing Countries in 2014***

1. United States
2. Saudi Arabia
3. Russia
4. China
5. Canada

**8. Recycling aluminum saves 95 percent of the energy required when compared to producing aluminum from bauxite, aluminum ore. Name the TOP FIVE items made of aluminum that can be recycled.**

***TOP FIVE—Aluminum Recycling***

1. Beverage cans
2. Lawn furniture
3. Foil wrapping and containers
4. Storm windows and doors
5. House siding

**9. Name the TOP FIVE home energy conservation measures that are recommended to help use energy wisely in the home. (The game moderator may have to ask for more specific information, and/or decide if the answer is close enough to the given answer.)**

***TOP FIVE—Home Energy Management***

1. Install compact fluorescent or LED light bulbs
2. Use programmable thermostat
3. Insulate walls and attic
4. Use hot water wisely
5. Turn off computer/lights/video games

**10. One hundred students were surveyed. What were the TOP FIVE responses to the following survey question: “Name a driving habit or auto maintenance measure that increases automobile efficiency and conservation.”**

***TOP FIVE—Increasing Automobile Efficiency and Conservation***

1. Carpool
2. Avoid aggressive driving (speeding, rapid starts/stops)
3. Tune-up engine
4. Correct tire pressure
5. Plan trips/combine errands

**11. Appliances can account for a fair amount of a home's energy use. Name the TOP FIVE Appliance Energy Saving tips.**

**TOP FIVE—Appliance Energy Saving Tips**

1. Use the dishwasher *ONLY* when it is full
2. Use the energy saver feature on the dishwasher, without the heat dry setting
3. Keep the refrigerator and freezer at the correct temp – not *TOO* cold
4. Wash your clothes in cold water
5. Make certain your refrigerator door seals are tight

**12. Water heating makes up about 1/5th of a home's energy bill. Name the TOP FIVE tips for lowering water heating costs.**

**TOP FIVE—Home Water Heating Tips**

1. Lower water heater temperature to 120° F
2. Take short showers
3. Install low-flow faucets and showerheads
4. Repair leaky faucets promptly
5. Insulate your water heater tank

**13. One hundred people were surveyed. What were the TOP FIVE responses to this statement: "Name something you can do to reduce home heating and cooling costs?"**

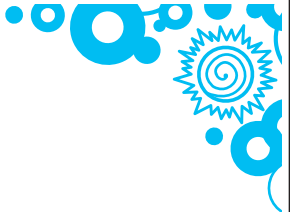
**TOP FIVE—Home Heating and Cooling Tips**

1. Install a programmable thermostat
2. Set your thermostat to the appropriate setting for night and day *AND* the season
3. Use drapes and shades as insulators – open in the winter, closed in the summer
4. Check your windows and doors for air leaks
5. Clean or replace air filters once a month or as needed

**14. Name the TOP FIVE tips for saving energy with home electronics.**

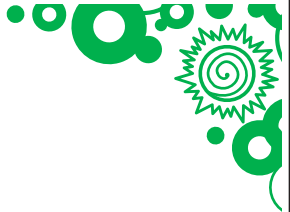
**TOP FIVE—Energy Saving Tips for Home Electronics**

1. Turn off electronics when not in use
2. Shop for ENERGY STAR® products
3. Unplug phantom Loads *OR* use power strips
4. Turn off computers and monitors or put them in sleep mode
5. Use rechargeable batteries rather than disposable batteries



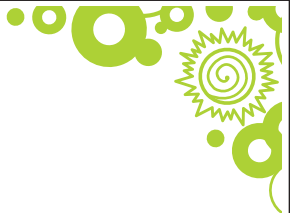
# Top Five

CATEGORY \_\_\_\_\_



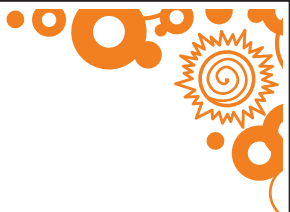
## Top Five

1



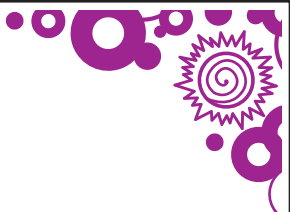
## Top Five

2



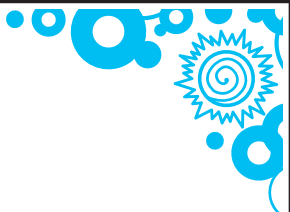
## Top Five

3



## Top Five

4



## Top Five

5



# Wheel of Energy

## *or Wheel of Energy Efficiency*

### Materials Needed

- *Wheel of Energy* or *Wheel of Energy Efficiency* graphics
- Paper fastener
- Cardboard or cardstock
- Paper clips
- Envelopes

## Wheel of Energy Team Play

Each team tries to guess three energy phrases using letters it earns from answering questions.

### Get Ready

1. Decide which version of the wheel and questions fit your group's needs. Make a copy of the enclosed *Wheel of Energy* graphic (page 79) or the *Wheel of Energy Efficiency* graphic (page 83), and one copy of each of the energy phrases (page 84). Save the originals.
2. Cut out the arrow on top of the wheel graphic you have chosen, and mount the wheel, the title, and the arrow on separate pieces of cardstock (cut cardstock to match arrow).
3. Punch a hole in the center of the wheel. With a fastener, attach the arrow to the wheel loosely enough so that it can spin freely.
4. Cut approximately 150 one-inch squares of cardstock. Cut out the letters from one phrase at a time and mount them (or just write them) on the cardstock squares. On the reverse side of the square, write the number that corresponds to the order in which the letter appears in the word. For example, for the word FOSSIL, F = 1, O = 2, S = 3, etc. Repeat the same procedure for the next word in the phrase. Once you have finished a phrase, clip or rubber band each word together, place all the squares in a small envelope, and label it with the phrase on the outside. Repeat the process for all of the phrases you will be using.

### Get Set

1. To play *Wheel of Energy*, select three energy phrases. One should be an easy phrase, and the other two more difficult. Arrange all three phrases with the letters face down, and the numbers face up and toward the team.
2. Have the phrases you've selected on a separate piece of paper for your reference in the same order as they are placed on the table. It would be helpful to have each letter numbered on your copy for easy identification. You should also have a copy of the *Wheel of Energy Questions and Answers* pages (76-78) or *Wheel of Energy Efficiency Questions and Answers* (pages 80-82), depending on which wheel you've assembled.

### Go!

Give these instructions to the carnival team:

1. *Wheel of Energy* is a take-off of the TV game show *Wheel of Fortune*. In front of you are three energy phrases. The first one is worth one energy buck if solved; the other two are each worth two energy bucks.
2. First, a member of your team spins the arrow. If it stops on one of the seven energy categories, I will ask the team a question from that category. If your answer is correct, you may ask for a consonant. I will turn over that consonant on ALL of the three phrases. If the arrow lands on Free Vowel, your team automatically gets to choose a vowel, and I will turn it over in any of the words on the table. At any time, the spokesperson for your team may guess the phrase. You will continue to spin the arrow until all three phrases are solved or until your five minutes are up.
3. Are there any questions? Who will be the spokesperson for your team?

# Wheel of Energy Individual Play

Each player tries to guess an energy phrase using letters he or she earns from answering questions.

## Get Ready

1. Decide which version of the wheel and questions fit your group's needs. Make a copy of the enclosed *Wheel of Energy* graphic (page 79), or the *Wheel of Energy Efficiency* graphic (page 83), and one copy of each of the energy phrases (page 84). Save the originals.
2. Cut out the arrow on top of the wheel graphic you have chosen, and mount the wheel, the title, and the arrow on separate pieces of poster board (cut poster board to match arrow).
3. Punch a hole in the center of the wheel. With a fastener, attach the arrow to the wheel loosely enough so that it can spin freely.
4. Cut approximately 150 one-inch squares of poster board. Cut out the letters from one phrase at a time and mount them (or just write them) on the poster board squares. On the reverse side of the square, write the number that corresponds to the order which the letter appears in the word. For example, for the word FOSSIL, F = 1, O = 2, S = 3, etc. Repeat the same procedure for the next word in the phrase. Once you have finished a phrase, clip or rubber band each word together, place all the squares in a small envelope, and label it with the phrase on the outside. Repeat the process for all of the phrases you will be using. Group the phrase envelopes by level of difficulty into 3 stacks.
5. Collect each player's *Wheel of Energy* coupon.

## Get Set

1. To play *Wheel of Energy*, you must first place the phrases into three levels of difficulty. When a player approaches your game table, ask him/her if he/she wishes to try for an energy phrase worth three, four, or five energy bucks. When he/she makes his/her selection, pick one of the envelopes from that level. Take out the pre-grouped letters for each word in the phrase, arranging the letters face down, and the numbers face up and towards the player.
2. Have the phrases you've selected on a separate piece of paper for your reference. It would be helpful to have each letter numbered on your copy for easy identification. You should also have a copy of the *Wheel of Energy Questions and Answers* (pages 76-78) or *Wheel of Energy Efficiency Questions and Answers* (pages 80-82), depending on which wheel you've assembled.

## Go!

Give these instructions to the player:

1. *Wheel of Energy* is a take-off of the TV game show *Wheel of Fortune*. In front of you are three sets of envelopes containing energy phrases. The first set contains easier phrases that are worth three energy bucks if solved; the second set is worth four energy bucks if solved; the third set contains the most difficult phrases that are worth five energy bucks if solved. Which level of difficulty would you like to try to solve?
2. First, you must spin the arrow. If it stops on one of the seven energy categories, I will ask you a question from that category. If your answer is correct, you may ask for a consonant. I will turn over that consonant on all of the words in the phrase. If the arrow lands on Free Vowel, you automatically get to choose a vowel, and I will turn it over in any of the words on the table. You will continue to spin the arrow until the phrase is solved or until your 90 seconds are up. Are there any questions?

# Wheel of Energy Questions and Answers

## Electricity

1. Who invented the light bulb?

*Thomas Edison*

2. Name two sources of energy that are used to make electricity.

*Coal, uranium, natural gas, hydropower, biomass, petroleum, geothermal, wind, solar*

3. Plus or minus three cents, what is the average price of a kilowatt-hour of electricity for residential customers?

*12.5 cents (Accept 9 to 15 cents)*

4. What unit is electricity use measured and sold in?

*Kilowatt-hour*

5. In what year was the first electric power plant built (plus or minus ten years)?

*1882 (Accept 1872 to 1892)*

6. Which source of energy is responsible for generating the largest amount of the nation's electricity?

*Coal (39 percent)*

7. Which energy source, over the past 25 years, has experienced the largest increase in electricity generation?

*Natural gas*

8. During which hours does electricity use peak during the summer?

*Between 12 noon to 6 p.m. (Within range)*

9. What percent of total U.S. energy is used to generate the nation's electricity, plus or minus five percent?

*39 percent (Accept 34 to 44 percent)*

10. What percent of the energy used to generate electricity in a thermal power plant is wasted in the form of heat, plus or minus seven percent?

*Sixty-five percent (Accept 58 to 72 percent)*

## Renewables

1. Which energy source gets its energy from crops, garbage, and agricultural wastes?

*Biomass*

2. What percent of the nation's energy is supplied by renewables today, plus or minus three percent?

*9.6 percent (Accept 6 to 12 percent)*

3. What is used to convert moving air into electricity?

*Wind turbine (wind machine)*

4. In times of drought, which energy source experiences a drop in production?

*Hydropower*

5. Which renewable source of energy generates five to ten percent of the nation's electricity, depending on rainfall?

*Hydropower (6.2 percent)*

6. Which renewable energy source is a good source for heating water?

*Solar, Geothermal*

7. Which source of energy is a result of uneven heating of the Earth's surface?

*Wind*

8. Name the device that converts solar energy directly into electricity.

*Photovoltaic cell or solar cell*

9. Which source of energy is a result of radioactive decay of elements inside the Earth's core?

*Geothermal*

## Coal

1. What is the major use of coal?

*Generating electricity*

2. What is the major method for transporting coal?

*Trains*

3. Name one of the top five coal producing states.

*Wyoming, West Virginia, Kentucky, Pennsylvania, Illinois*

4. Name one of the chemical elements that gives coal its energy.

*Carbon or hydrogen*

5. Which type of coal has the highest energy content—anthracite, bituminous, or lignite?

*Anthracite*

6. Is most of the nation's coal obtained through surface mining or underground mining?

*Surface mining*

7. What percent of the nation's coal is obtained by surface mining, plus or minus five percent?

*64 percent (Accept 59 to 69 percent)*

8. What chemical element in coal may contribute to acid rain?

*Sulfur*

9. At a preparation plant, coal is \_\_\_\_\_.

*Cleaned and sorted*

## Petroleum

- 1. The major product produced during petroleum refining is what?**  
*Gasoline*
- 2. What is the major use for petroleum?**  
*Transportation fuel (gasoline)*
- 3. Name a product made from petroleum other than gasoline.**  
*Kerosene, heating oil, diesel fuel, jet fuel, asphalt, and other acceptable answers*
- 4. What nation produces the largest amount of petroleum?**  
*United States*
- 5. Name one of the top five petroleum-producing states.**  
*Texas, North Dakota, Alaska, California, Oklahoma*
- 6. What percent of the nation's energy is supplied by petroleum, plus or minus five percent?**  
*Thirty-five percent (Accept 30 to 40 percent)*
- 7. What percent of the nation's petroleum is imported from other nations today, plus or minus five percent?**  
*48 percent (Accept 43 to 53 percent)*
- 8. What two chemical elements make up petroleum?**  
*Hydrogen and carbon*

## Uranium

- 1. What is the only use of uranium in the energy production field?**  
*Generating electricity*
- 2. How does uranium give off its energy in a power plant?**  
*By fission or by splitting (and giving off heat)*
- 3. What isotope of uranium splits when hit by a neutron?**  
*U-235*
- 4. What year did America's first nuclear power plant go into use, plus or minus ten years?**  
*1957 (Accept 1947 to 1967)*
- 5. How many nuclear power plants are in operation in the U.S., plus or minus ten?**  
*99 (Accept 89 to 109)*
- 6. What percent of the nation's electricity is supplied by uranium in a nuclear power plant, plus or minus five percent?**  
*Nineteen percent (Accept 14 to 24 percent)*

- 7. Where is high-level nuclear waste permanently stored?**  
*On site at nuclear power plants*
- 8. TMI are the initials of the nuclear power plant in Pennsylvania where the nation's worst nuclear accident occurred. What do the initials stand for?**  
*Three Mile Island*
- 9. Which isotope of uranium is most abundant?**  
*U-238*

## Natural Gas

- 1. How is natural gas transported?**  
*By pipeline*
- 2. What's the major use of natural gas in homes?**  
*Home heating*
- 3. True or false—Natural gas is the cleanest burning fossil fuel.**  
*True*
- 4. What color is natural gas?**  
*Colorless*
- 5. Which one of the four sectors of the economy—industry, residential, transportation, or commercial—is the major user of natural gas?**  
*Industry*
- 6. True or false, natural gas can be made from renewable sources such as garbage, manure, and agricultural waste?**  
*True (biogas)*
- 7. What is the major gas in raw natural gas?**  
*Methane*
- 8. In areas where natural gas pipelines do not reach, what gas is often used in its place?**  
*Propane*
- 9. True or false, natural gas is odorless?**  
*True (Gas companies add an odorant so leaking gas can be detected)*
- 10. Natural gas is measured by the \_\_\_\_\_.**  
*Cubic foot (measured)*



## Energy Management

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- 1. True or false—heating and cooling rooms uses most of the energy in American homes.**

*True*

- 2. Name one way to save energy in your house.**

*Turn off lights and appliances*

*Insulate*

*Use hot water wisely*

*Caulk and weather-strip around windows and doors*

*Other acceptable answers*

- 3. Name one way to conserve energy in your automobile through proper maintenance.**

*Tune-up engine*

*Keep tires properly inflated*

*Regular oil changes*

- 4. What type of light bulb provides the same amount of light as an incandescent bulb for one-fourth the energy?**

*Fluorescent (or compact fluorescent)*

- 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*

- 6. What letter of the alphabet is used to measure the value of insulation?**

*R (R-value)*

- 7. Name one way to conserve energy in your car through proper driving habits.**

*Drive the speed limit*

*Avoid jack rabbit starts and stops*

*If you'll be sitting idle for more than a minute, shut off your engine*

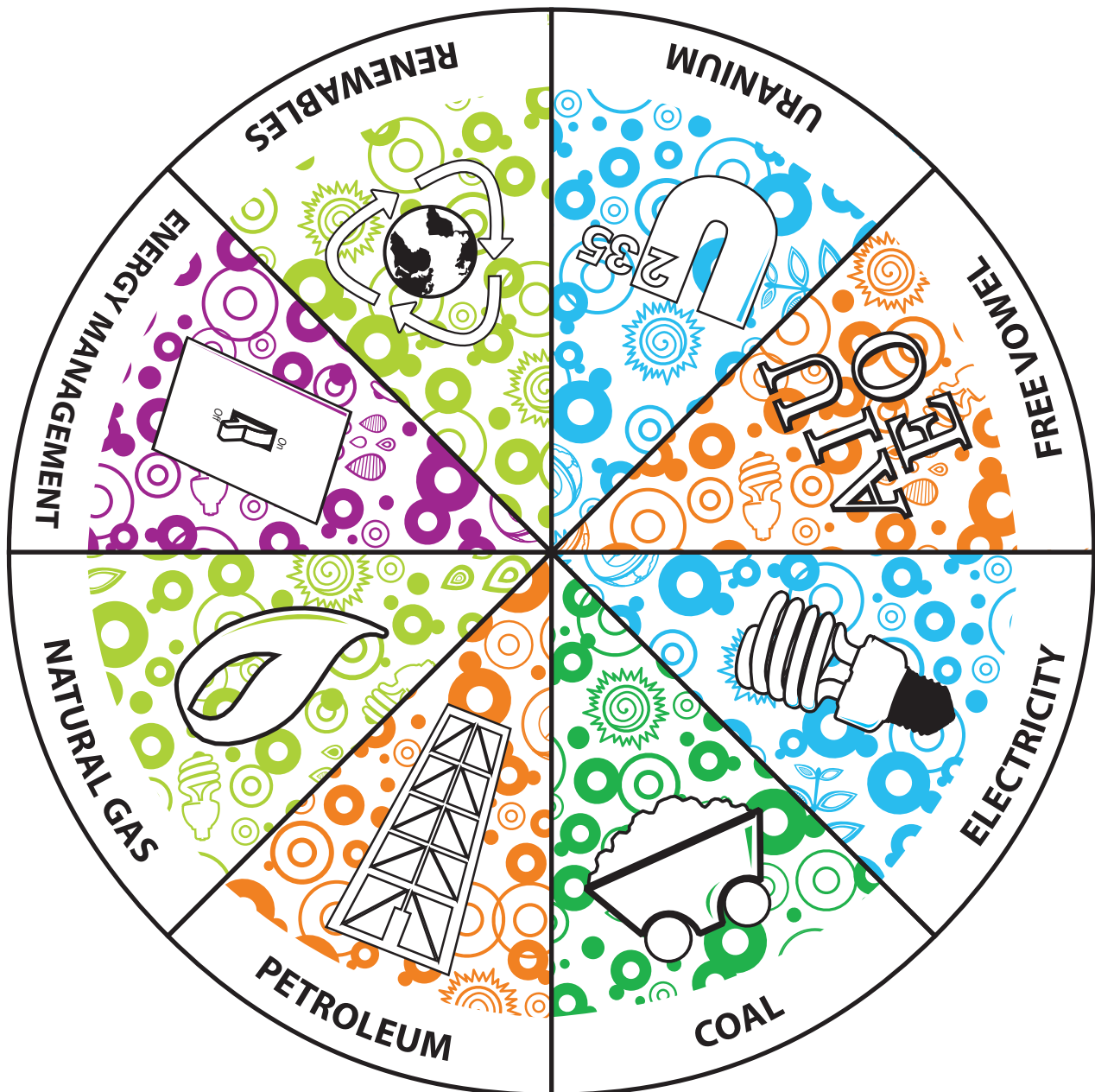
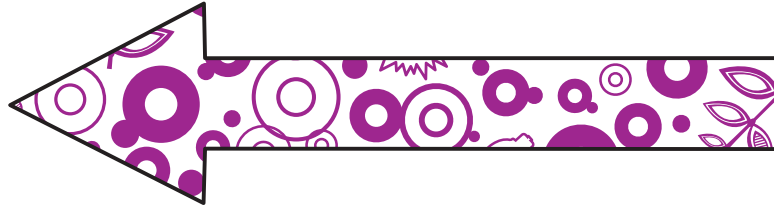
*Remove excess weight—items stored in trunk*

*Other acceptable answers*

- 8. What two items are used to seal cracks around windows and doors?**

*Caulking and weather-stripping*

# Wheel of Energy



# Wheel of Energy Efficiency Questions and Answers

## Recycling

1. **What percentage of energy does recycling aluminum save?**

95%

2. **What percentage of energy does recycling steel save?**

75%

3. **Name two benefits of recycling.**

*Saves energy; saves transportation costs and energy; saves raw materials for other uses; keeps materials out of landfills*

4. **True or false: Only plastics "1" and "2" can be recycled.**

*False. All plastics with the symbol can be recycled if the local area supports it.*

5. **True or false: Aluminum can only be recycled once.**

*False. Aluminum can be recycled over and over and over again.*

6. **True or false: Recycled steel is weaker than new steel.**

*False. Recycling steel does not change the strength of the steel.*

7. **What percentage of corrugated cardboard boxes are recycled?**

90%

8. **How many trees are saved when one ton of paper is recycled?**

15-17 trees

9. **What fraction of trash is recycled?**

About 1/3

5. **What is one thing you can do to stay warm without turning up the heat?**

*Put on a sweater, drink a cup of hot tea or cocoa, get up and move around, pull a blanket over your lap*

6. **What are some things you can do to stay cool without lowering the air conditioning setting?**

*Run a small fan, drink a cool drink, wear shorts and sleeveless shirts, stay out of the sun, close the blinds to the sunlight, take a cool bath*

7. **True or false: Insulation is important only when it's cold outside.**

*False. A properly insulated home will also prevent outside air from heating the inside of the house in the summer.*

8. **True or false: The moisture level in the house has nothing to do with heating or cooling.**

*False. Too much moisture in the summer feels warmer, and too little moisture in the winter feels cooler.*

9. **How can running a humidifier in the winter help your heating costs?**

*Moist air holds more heat, so properly humidifying the air will help it stay warmer longer.*

10. **How can running a dehumidifier in the summer help your cooling costs?**

*Warm air holds more heat, so removing excess moisture from the air will help it cool down faster.*

## Heating and Cooling

1. **What does a programmable thermostat do?**

*Automatically adjusts the temperature according to the time of day; reduces the amount of energy used to heat or cool a home when no one is there*

2. **What wintertime thermostat setting is the best balance between saving energy and being comfortable?**

68 degrees Fahrenheit

3. **What summertime thermostat setting is the best balance between saving energy and being comfortable?**

75-78 degrees Fahrenheit

4. **How can window blinds and curtains play a role in keeping your home warm or cool?**

*Open them to the sun during cold months, and close them against the sun in the hot months.*

## Trash and Energy

1. **True or false: Trash can be burned to generate electricity.**

*True, but not all trash should be burned.*

2. **How many pounds of garbage have the same energy as in 500 lbs. of coal?**

2,000 lbs.

3. **Every day, how many pounds of trash does each American produce?**

About 4.5 lbs

4. **What percentage of American trash is burned for its energy?**

12.9% (accept 8-16)

5. **True or false: Everything we throw away should be burned to generate electricity.**

*False. Glass, steel, and aluminum do not burn well and should be recycled.*

6. **Compared to coal, how much carbon dioxide is produced when trash is burned to generate electricity?**

*Less than half*

## Renewable Energy

1. **What is the most common use of wind power?**

*Generating electricity*

2. **Besides generating electricity, name a use of solar power.**

*Heating interior spaces; heating water*

3. **What are two advantages to using wind power?**

*Clean, free to use, renewable, often available – especially in the Midwest*

4. **Why can't everything be powered with solar power?**

*Solar power is not available all day long, and is not intense enough in winter months or on cloudy days.*

5. **What are two advantages to using hydropower?**

*Clean, free, easy to use, available day or night*

6. **What are two advantages to using solar power?**

*Clean, plentiful, free, renewable, often available – especially in the summer*

7. **What are two disadvantages to using wind power?**

*Wind speeds are variable; the best areas are not near cities; wind farms require a lot of land; many, many wind turbines are needed to equal one coal, natural gas, or nuclear power plant*

8. **What are two disadvantages to using solar power?**

*Relatively few areas of the U.S. have enough sunlight for it to be practical; the equipment is expensive and fragile; solar farms require a lot of land*

9. **What are two disadvantages to using hydropower?**

*In times of drought, water flow is reduced; damming a river disrupts natural environments and can displace people from their homes*

10. **Which renewable energy source provides the most energy to the U.S.?**

*Biomass (4.8%)*

11. **Which renewable energy source provides the most electricity to the U.S.?**

*Hydropower (6.2%)*

## Saving Energy at Home

1. **What are two things you can do to save energy that require no special equipment?**

*Turn lights off when leaving a room; turn off the TV and other electronics when not in use; unplug appliances with phantom loads when not being used; open or close the blinds to control the sunlight entering a room; use light from the window instead of turning on a light*

2. **What does the ENERGY STAR® rating mean?**

*The device has met minimum requirements of energy efficiency as set out by the U.S. Department of Energy – it's a very efficient device or appliance*

3. **Which light bulb type is least efficient – incandescent, CFL, or LED?**

*Incandescent*

4. **Which type of light bulb saves the most money when producing 25,000 hours of light?**

*LED*

5. **True or false: CFL bulbs are not dimmable.**

*False. Special CFL bulbs are manufactured that are ok to use with a dimmer switch.*

6. **True or false: When factoring purchase price and energy use, LED bulbs are more expensive than incandescent bulbs.**

*False. While LED bulbs are more expensive to purchase, they use less than ¼ the energy of an incandescent bulb in producing the same amount of light.*

7. **Which uses less energy, warming a slice of pizza in the microwave or in the oven?**

*Microwave*

8. **What is a programmable thermostat and how can it help save energy?**

*A thermostat that automatically adjusts the thermostat setting according to the day and time to avoid unnecessarily heating or cooling the house when no one is home.*

9. **Name two devices that probably have phantom loads.**

*Microwave, coffee maker, TV, stereo, anything with a remote control, computer, cell phone charging cord*

## Transportation

**1. Name two ways to maximize the fuel efficiency of your car.**

*Keep tires properly inflated; replace the oil and air filter regularly; avoid jackrabbit stops and starts; do not idle (drive-up lanes, waiting for friends); combine errands into single trips rather than leaving and going back home multiple times in a day*

**2. What is biodiesel?**

*Diesel fuel produced from vegetable oil, such as soybean oil or canola oil*

**3. What is a limitation of using a plug-in electric car?**

*Most plug-in electric cars cannot travel more than 50-100 miles without needing to be recharged*

**4. What is an advantage of using a plug-in electric car?**

*Plug-in electric cars are very quiet and use much less energy to operate them.*

**5. What energy source is used mostly for transportation?**

*Petroleum in the form of gasoline, diesel fuel, or jet fuel*

**6. Name a fossil fuel that can be used for transportation and is cleaner than petroleum-based fuels.**

*Natural gas*

**7. What is a major drawback to the development of hydrogen fuel cell automobiles?**

*Finding hydrogen refueling options; fuel cell components are expensive; hydrogen fuel cell automobiles have less range than gasoline vehicles; hydrogen needs a larger tank than gasoline*

**8. What is an advantage to developing hydrogen fuel cell automobiles?**

*The only byproduct of hydrogen fuel cells is water; hydrogen can be produced from a variety of sources, all of which are available domestically*

**9. What two technologies are used in a hybrid vehicle?**

*Electric motors and internal combustion engines*

## How We Use Energy in the USA

**1. Which sector of the economy uses the most energy?**

*Electric Power Generation*

**2. Which energy source provides the most energy?**

*Petroleum*

**3. What do we do to most energy sources to get the energy from them?**

*Burn them (combustion)*

**4. What fraction of energy in the U.S. is used by homes?**

*About 22%*

**5. Which energy source provides the most electricity in the U.S.?**

*Coal*

**6. Which country provides most of our imported petroleum?**

*Canada*

**7. What percentage of our total energy is provided by nonrenewable resources?**

*About 90%*

**8. Name two fossil fuels.**

*Coal, petroleum, natural gas, propane*

**9. Why is a fossil fuel called a fossil fuel?**

*It was formed from the remains of plants and animals that lived millions of years ago*

## Lighting

**1. Who perfected the incandescent bulb?**

*Thomas Edison*

**2. How does an incandescent bulb produce light?**

*The filament gets so hot that it glows white hot, or incandesces.*

**3. What is the efficiency of an incandescent bulb at producing light?**

*10%; the other 90% is lost as heat*

**4. How does a fluorescent bulb produce light?**

*The mercury vapor inside gets energized and releases ultra-violet light. The phosphor coating inside the tube absorbs the ultra-violet light and releases it as visible light; this is called fluorescence.*

**5. How much more efficient than incandescent bulbs is a CFL?**

*CFL bulbs use up to 75% less energy than an incandescent bulb to produce the same amount of light*

**6. Which is more efficient, a CFL bulb or an LED bulb?**

*LED bulbs are more efficient*

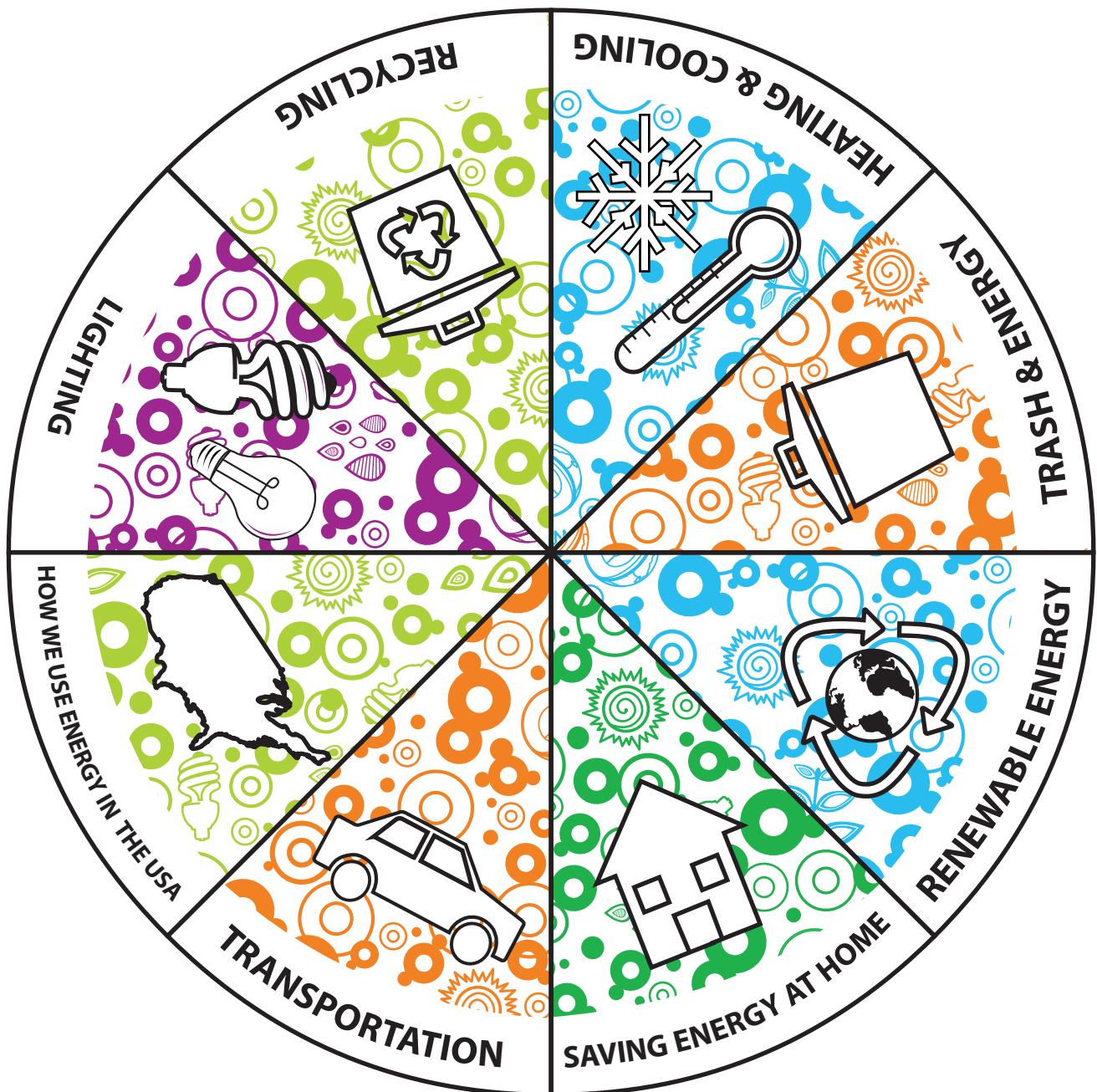
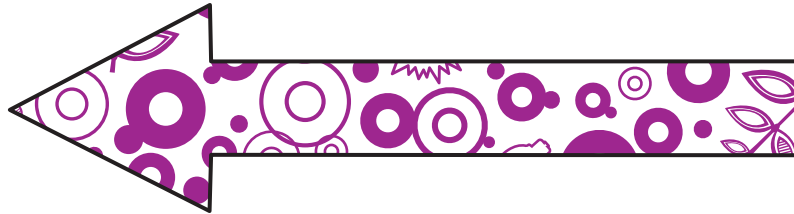
**7. What portion of a home's energy costs goes to lighting?**

*About 5%*

**8. What portion of a home's electricity costs goes to lighting?**

*About 14%*

# Wheel of Energy Efficiency





**MILES PER GALLON  
PIPELINE  
RECYCLE  
ENERGY EFFICIENCY  
IMPORTED OIL  
OFFSHORE DRILLING  
SOLAR PANEL  
PEAK DEMAND  
FOSSIL FUEL  
HOME HEATING  
NUCLEAR REACTOR  
SUSTAINABILITY  
WIND TURBINE**



# Lights Out!

## Materials Needed:

- *Lights Out!* graphics
- Cardboard or cardstock
- Colored paper
- Paper clips
- Envelopes

## Lights Out! Team Play

Each team tries to solve energy words without “draining the battery.” If a team runs out of battery power it’s Lights Out! Teams must answer energy related questions in order to guess letters in the word puzzle.

## Get Ready

1. Make one copy of the battery graphic (page 88) and mount onto cardboard or cardstock.
2. Make another copy of the battery onto colored paper, or color it with one color. Cut this colored battery into its individual pieces and clip together.
3. Select the energy words you will use from the word bank on page 86 or create your own. Cut out squares of cardstock. Write a letter from each energy word onto the squares. On the reverse side of the square write the number that corresponds to the order in which the letter appears in the word. For example, for the word FOSSIL, F=1, O=2, etc. Clip the squares together and place them in an envelope. Label the envelope with the word or phrase. Repeat the same process for all the words you will use.

## Get Set

1. To play *Lights Out!*, select three energy words or phrases. One should be an easier phrase and the other two can be more difficult. Arrange all three phrases with the letters face down, and the numbers face up toward the team.
2. Have the words or phrases you’ve selected on a separate piece of paper for your reference, with the letters numbered for easy identification. You should also have a copy of the *Lights Out! Question Bank* (page 87).

## Go!

Give these instructions to the carnival team:

1. I have three energy words for your team to solve before your energy battery drains. In front of you are the three words or phrases. The first word is worth one buck if solved, the other two are each worth two energy bucks.
2. Before your team can guess a letter, your team must answer an energy related question correctly. If the letter is there, I will flip over and reveal the letter. If the letter is not there, one segment of your battery will “drain” and I will cover part of your battery. Your team may guess the word or letters at any time but will continue to drain the battery with each incorrect guess. You must try and solve all three words without draining your battery.
3. Are there any questions? Who will be the spokesperson for the team?
4. Your first word has \_\_\_\_\_ letters. Here is your first question.



# Lights Out! Individual Play

The player tries to solve energy words without “draining the battery.” If the player runs out of battery power it’s Lights Out! He/she must answer energy related questions in order to guess letters in the word puzzle.

## Get Ready

1. Make one copy of the battery graphic (page 88) and mount onto cardboard or cardstock.
2. Make another copy of the battery onto colored paper, or color it with one color. Cut this colored battery into its individual pieces and clip together.
3. Select the energy words you will use from the word bank below or create your own. Cut out squares of cardstock. Write a letter from each energy word onto the squares. On the reverse side of the square write the number that corresponds to the order in which the letter appears in the word. For example, for the word FOSSIL, F=1, O=2, etc. Clip the squares together and place them in an envelope. Label the envelope with the word or phrase. Repeat the same process for all the words you will use.
4. Collect each player’s *Lights Out!* coupon.

## Get Set

1. To play *Lights Out!*, group the energy words by difficulty levels. When a player approaches your table, ask him/her if he/she wishes to solve a word worth three, four, or five energy bucks. When the selection is made, pick an envelope from that level. Take out the word or phrase from that envelope, arranging the letters face down and the numbers face up, toward the player.
2. Have the words or phrases you’ve selected on a separate piece of paper for your reference, with the letters numbered for easy identification. You should also have a copy of the *Lights Out! Question Bank* (page 87).

## Go!

Give these instructions to the player:

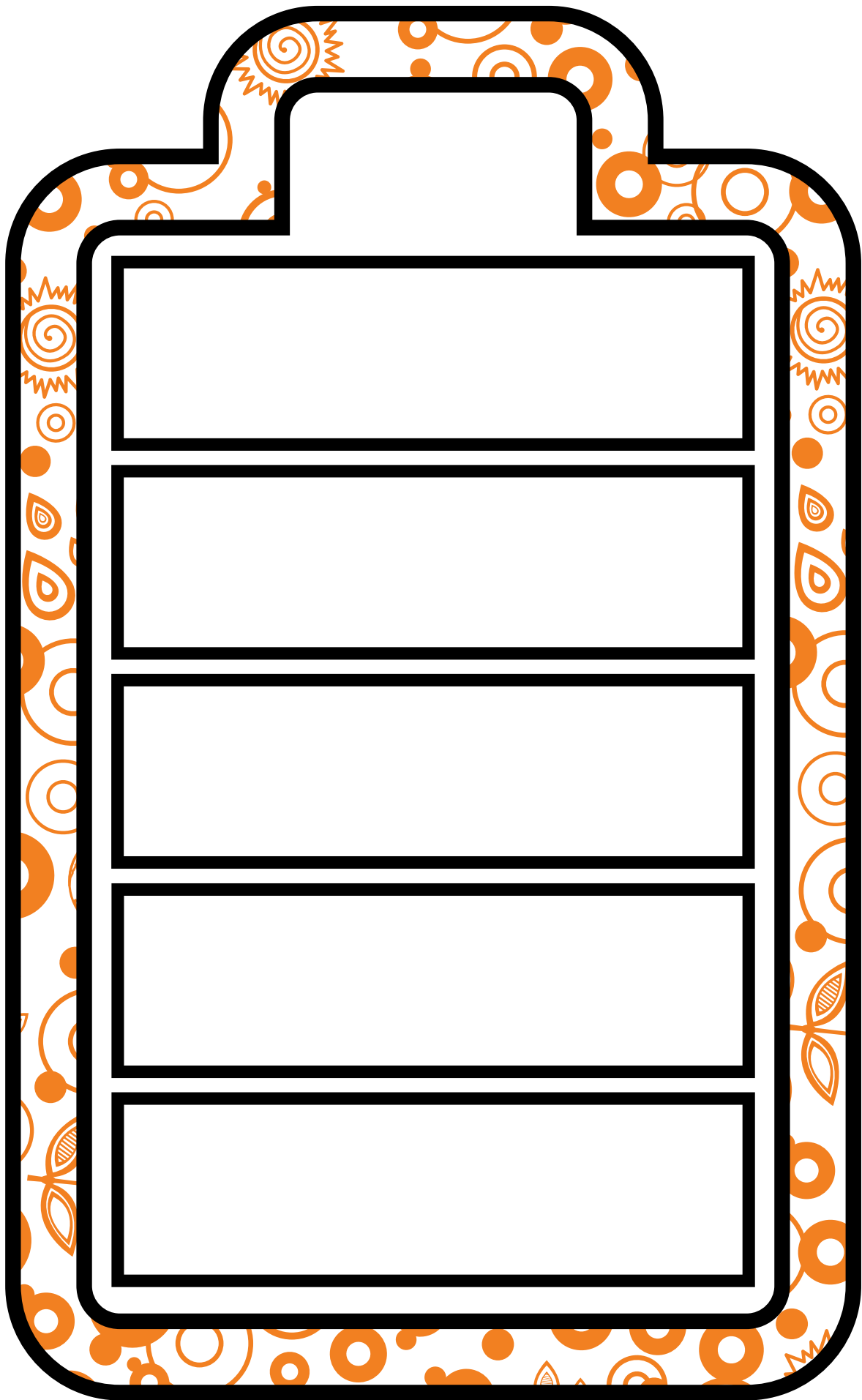
1. I have an energy word for you to solve before your energy battery drains. In front of you are three sets of words or phrases. The first set contains easier words that are worth three energy bucks if solved; the second set is worth four energy bucks if solved; the third set contains the most difficult items to solve that are worth five energy bucks. Which level of difficulty would you like to try to solve?
2. Before you can guess a letter, you must answer an energy related question correctly. If the letter is there, I will flip over and reveal the letter. If the letter is not there, one segment of your battery will “drain” and I will cover part of your battery. You may continue to guess letters or the word at any time but will continue to drain the battery with each incorrect guess. You must try and solve the word without draining your battery. Are there any questions?

## Lights Out! Word Bank

- |                |                         |                             |                        |
|----------------|-------------------------|-----------------------------|------------------------|
| ▪ Insulation   | ▪ Landscaping           | ▪ EnergyGuide Label         | ▪ Plug load            |
| ▪ Gasket       | ▪ Incandescent          | ▪ Conservation              | ▪ Power strip          |
| ▪ Thermostat   | ▪ Compact fluorescent   | ▪ Efficiency                | ▪ Ballast              |
| ▪ ENERGY STAR® | ▪ Solar tubing          | ▪ Appliances                | ▪ Energy consumption   |
| ▪ Recycle      | ▪ Light emitting diode  | ▪ Smart meters              | ▪ Relative humidity    |
| ▪ Air filter   | ▪ Energy sustainability | ▪ Kilowatt-hours            | ▪ Environmental impact |
| ▪ Water heater | ▪ Electricity           | ▪ Vampire load/Phantom load | ▪ Renewable energy     |

# Lights Out! Question Bank

1. **Give an example of something that is energy conservation.**  
*Sealing your windows, turning of the lights when you leave a room, recycling, unplugging/turning off devices that are not in use*
2. **Give an example of energy efficiency.**  
*Installing LED or CFL bulbs, switching to a low-flow showerhead, buying ENERGY STAR® appliances*
3. **How can landscape help with reducing energy usage in a building?**  
*Trees can add shade on the sunny side of a home, reducing cooling costs; trees can block winds and weather that might cool a home in heating seasons*
4. **Why should consumers look for yellow and black labels on appliances when purchasing them?**  
*To help estimate and compare energy costs of appliances*
5. **Name the 4 Rs to energy conservation.**  
*reduce, reuse, recycle, repair*
6. **Describe a way your family can save energy at home.**  
*Turn lights off when leaving a room; turn off the TV and other electronics when not in use; unplug appliances with phantom loads when not being used; open or close the blinds to control the sunlight entering a room; use light from the window instead of turning on a light*
7. **What letter is used to indicate the resistance of the material to heat flow used with insulation?**  
*R-value*
8. **Give an example of how to lower your water heater energy usage.**  
*Turn the thermostat down to 120°F, take shorter showers, wash clothes in cold water, use the dishwasher only when full*
9. **Name a way that a programmable thermostat benefits a homeowner.**  
*Homeowners can set the temperature to adjust when they are not home, homeowners can automatically adjust the temperature at different times of the day or in different seasons*
10. **Describe a simple test that can be done to see if there are air leaks around windows or doors.**  
*Tape toilet or crepe paper to the end of a pencil and hold it up against a crack or joint; if the paper moves, air is leaking or escaping*
11. **Name a way that you can save energy when you are cooking.**  
*Use the microwave for smaller items, decide what you want before you open the refrigerator*
12. **About how much energy is given off as wasted heat by an incandescent bulb?**  
*90%*
13. **Name 1 renewable energy source.**  
*Biomass, wind, solar, geothermal, hydropower*
14. **Name 1 nonrenewable energy source.**  
*Coal, natural gas, petroleum, propane, uranium*
15. **Name a fuel that is used to heat homes or schools.**  
*Electricity, natural gas, propane, heating oil*
16. **Name two energy sources that generate electricity.**  
*Hydropower, solar, wind, uranium, coal, natural gas*
17. **Besides driving habits, name one way a driver can decrease his fuel usage.**  
*Carpool, walk/bike, reduce junk in the trunk, get regular tune-ups*
18. **On fuel economy labels, what does MPG indicate?**  
*Miles traveled per gallon*
19. **Name one type of insulation.**  
*Fiberglass, cellulose, spray-in, Styrofoam, weatherstripping, caulk*
20. **What task in the home uses the most energy?**  
*Heating and cooling*
21. **How much of home energy use is attributed to appliances and machines?**  
*25% (accept 20-30%)*
22. **What is the average cost of a kilowatt-hour of electricity for residential customers in the United States?**  
*12.5 cents*
23. **What is the term for the time of day when electricity is used most and costs the most?**  
*Peak demand*
24. **What does a payback period for an appliance describe?**  
*The amount of time it will take for a more expensive and efficient model to begin saving you money over the less expensive, less efficient model*
25. **Which greenhouse gas do we emit in the generation of most of our electricity, and the operation of most of our cars?**  
*Carbon dioxide*





## Youth Awards Program for Energy Achievement

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

This program combines academic competition with recognition to acknowledge everyone involved in NEED during the year—and to recognize those who achieve excellence in energy education in their schools and communities.

### **What's involved?**

Students and teachers set goals and objectives, and keep a record of their activities. Students create a digital project to submit for judging. In April, digital projects should be uploaded to the online submission site.

Want more info? Check out **[www.NEED.org/Youth-Awards](http://www.NEED.org/Youth-Awards)** for more application and program information, previous winners, and photos of past events.

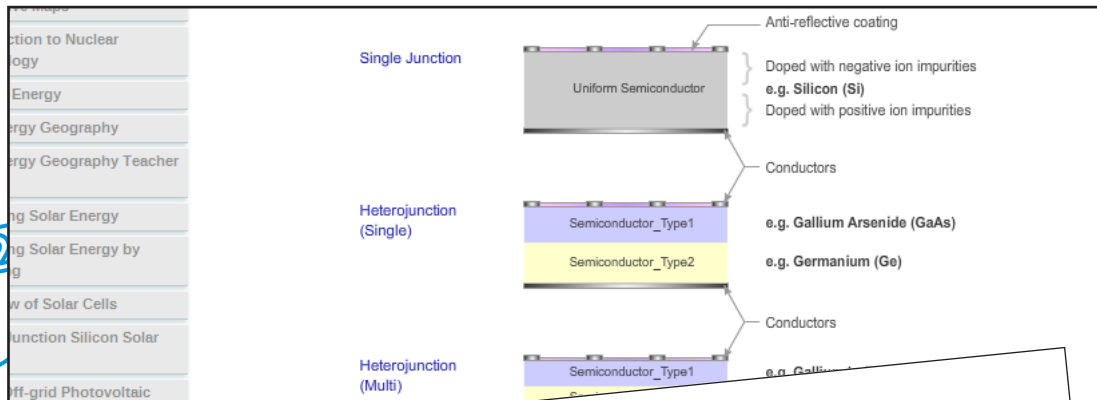




## Looking For More Resources?

Our supplemental materials page contains PowerPoints, animations, and other great resources to compliment what you are teaching!

This page is available at [www.NEED.org/educators](http://www.NEED.org/educators).



## SOLAR AT A GLANCE

### WHAT IS SOLAR?

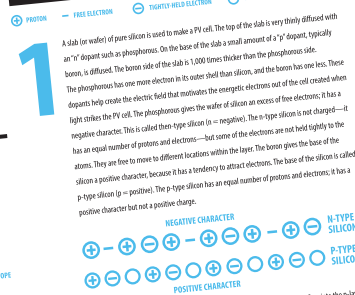
Solar energy is radiant energy that is produced by the sun. Every day the sun radiates, or sends out, an enormous amount of energy. The sun radiates more energy in one second than people have used since the beginning of time!

### NUCLEAR FUSION

The process of fusion most commonly involves hydrogen isotopes combining to form a helium atom with a transformation of matter. This matter is emitted as radiant energy.

### PHOTOVOLTAIC CELLS

Photovoltaic comes from the words photo meaning "light" and volt, a measurement of electricity. Sometimes photovoltaic cells are called PV cells or solar cells for short. These are the four steps that show how a PV cell is made and how it produces electricity.



### TOP SOLAR STATES



## CANADA ENERGY FACTS

### WORLD RANKING OF ENERGY PRODUCTION

Canada ranks fifth in the world in total energy production, fifth in annual petroleum production, third in natural gas production, second in uranium production, and fifth in electricity produced by hydropower.



### WORLD RANKING OF ENERGY CONSUMPTION



# Energy Carnival Evaluation Form

State: \_\_\_\_\_ Grade Level: \_\_\_\_\_ Number of Students: \_\_\_\_\_

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

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Other Comments:

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Please fax or mail to: **The NEED Project**

8408 Kao Circle  
Manassas, VA 20110  
FAX: 1-800-847-1820



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