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. $\frac{\$6.50}{\$0.40/lb.}$ = 16.25 x 32can/lb. = 520 cans

2. 1998, accept 1997-1999

3. 4,020 billion kilowatt-hours

4. 6 domestic + 4 foreign = 10 total usage
   4 foreign/10 total = 0.4 x 100 = 40%

5. 100 miles/ 5 miles per gallon = 20 gallons of fuel;
   20 gallons x $2.50/gallon = $50.00

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. ⅔ x 1,266 therms = 844 therms

9. Total production = 4,020 billion kWh
   Uranium = 805 billion kWh
   805/4,020 = 0.2002 = 20.0%, round
   = 20%

10. 16 cups to a gallon
    (1/16) x (91,500) = 5,718.75 = 5,719 Btu

11. United States = 15.6 MBD
    Canada = 5.0 MBD
    Brazil= 3.4 MBD
    Total = 24.0 MBD

12. Total of fossil fuels:
    14.1% (coal) + 28.7% (natural gas) +
    37.0% (petroleum) = 79.8%
    98 quads x 0.798 = 78.2 = 78.2 quads

13. $A = P (1.0 + R)^T$
    A = Final Amount
    P = Principle
    R = Rate of Increase
    T = Number of Years

    $A = 37 (1.0 + .02)^{10}$
    $A = 37 (1.02)^{10}$
    A = 37 (1.219) = 45.1
    A = 45.1 quads

14. A = 1.4B C = 360 gallons C = 1.2B
    360 gallons
    B = 1.2
    B = 300 gallons
    A = 1.4 (300 gallons) = 420 gallons

15. 24 kWh x 3.5 miles/kWh = 84 miles

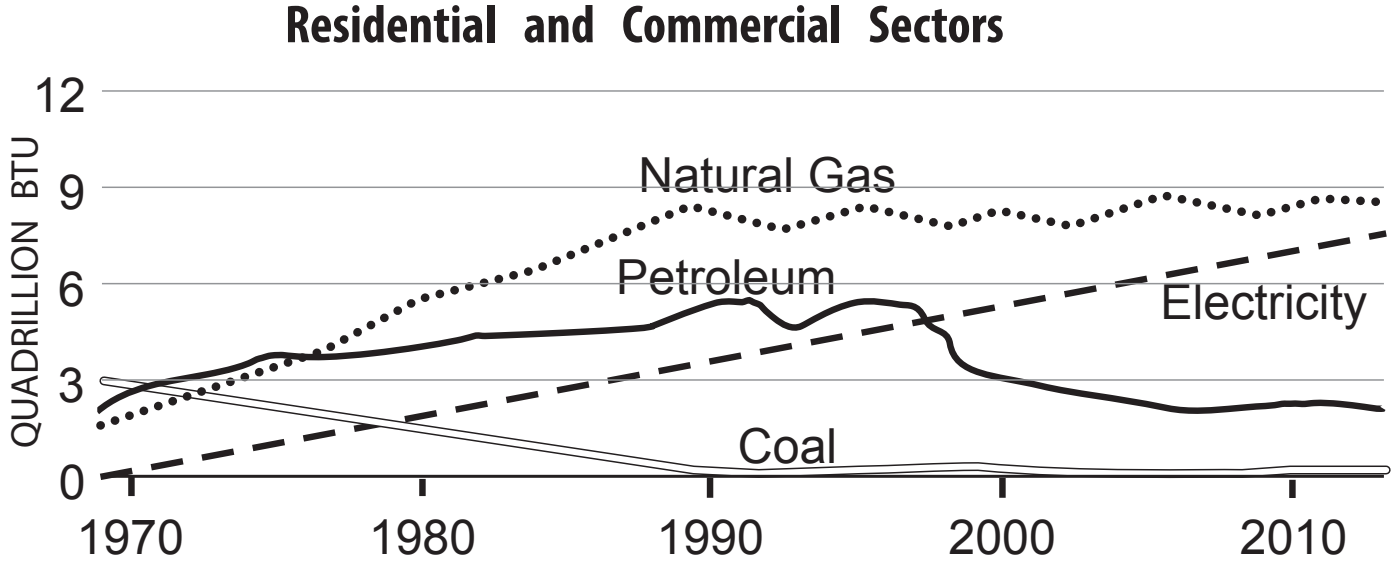
16. 6,000 gallons

Question 1

x 32 = 1 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?

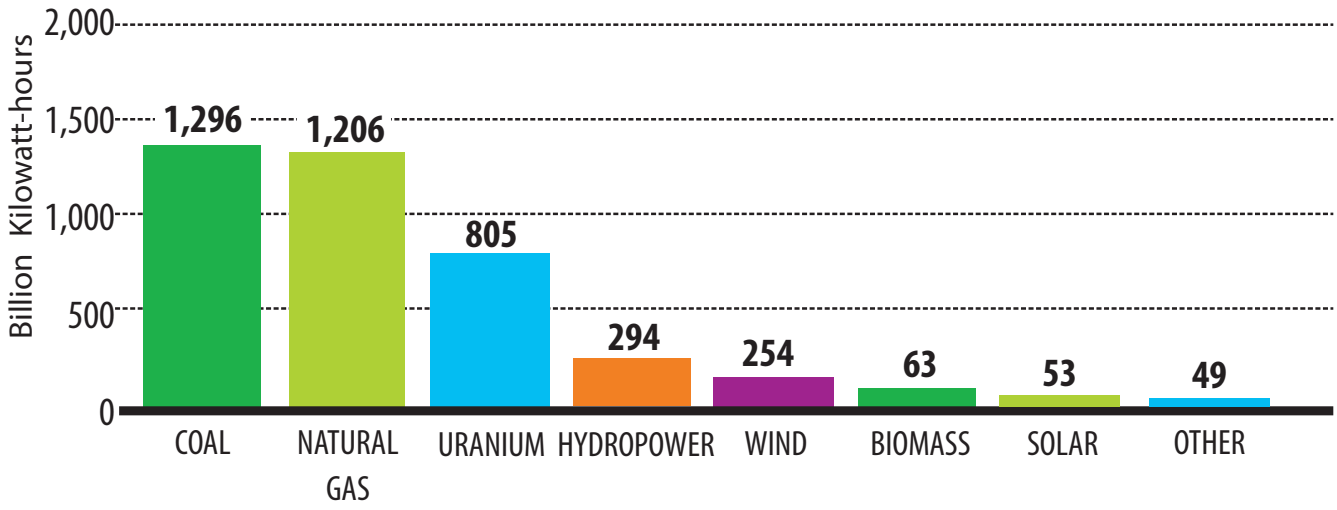
Question 2



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

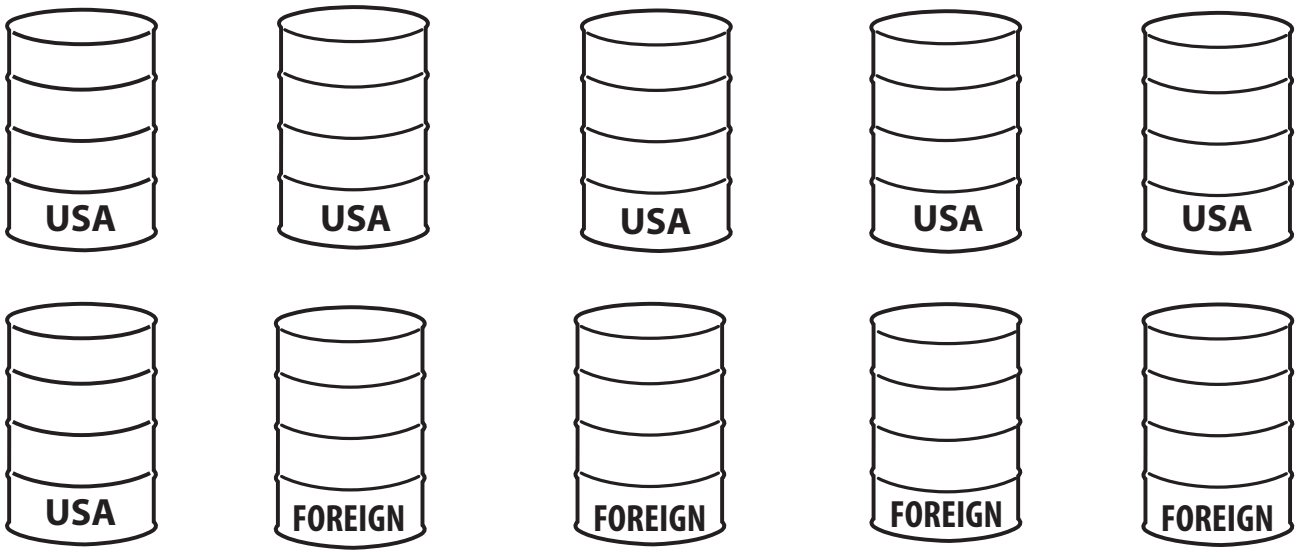
Question 3

Electricity Generation, 2017



How many billion kilowatt-hours of electricity were generated in the United States in 2017?

Question 4

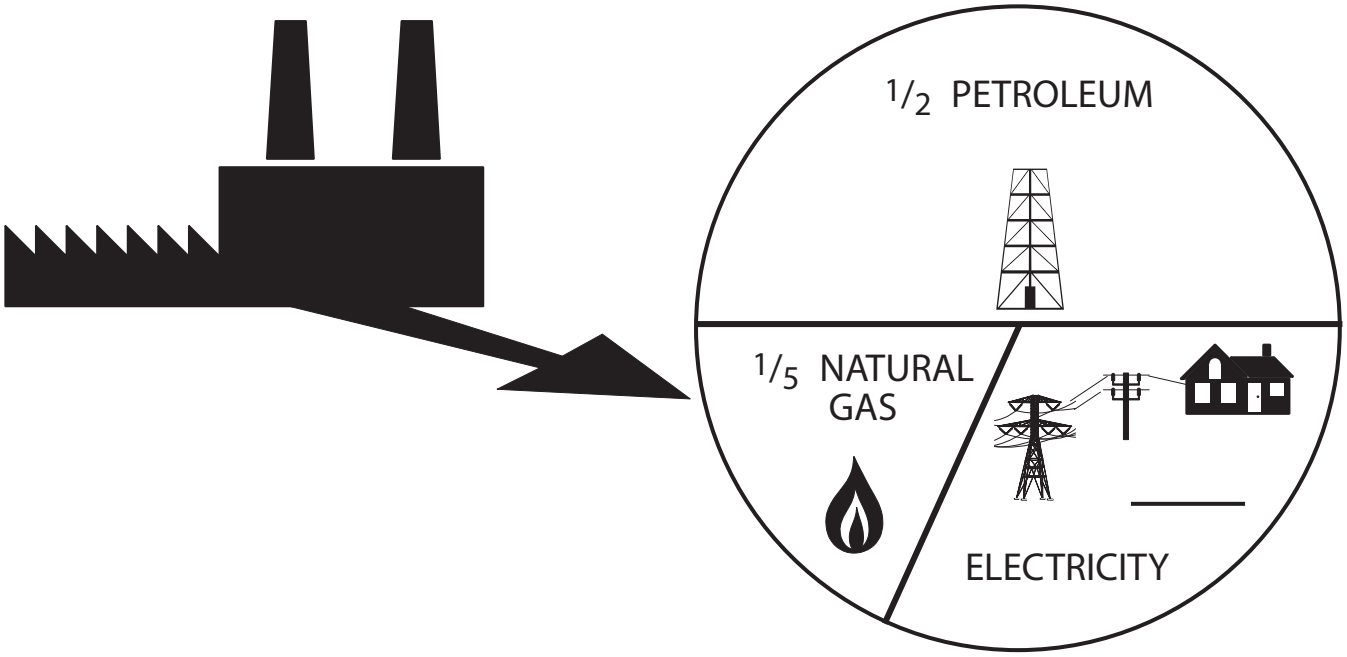


The ten barrels represent all of the petroleum consumed in the U.S. in 2017. What percentage of that petroleum had to be imported from other nations?

Question 5

A semi-truck gets 5 miles per gallon. If the diesel fuel it uses costs $2.50 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?

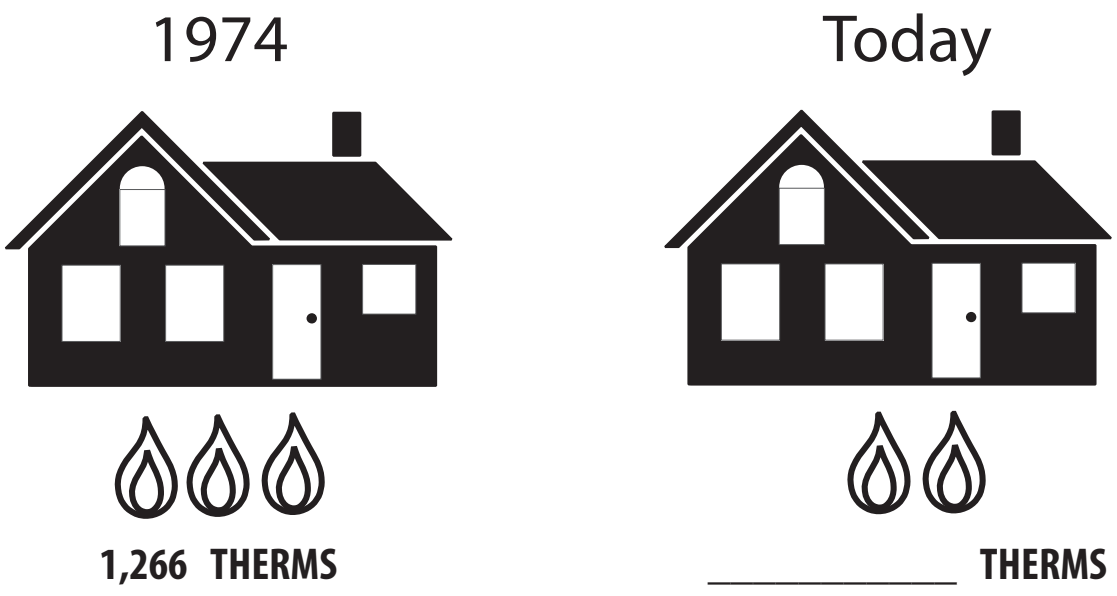
Question 7

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 - ENERGY STAR® MODEL	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?

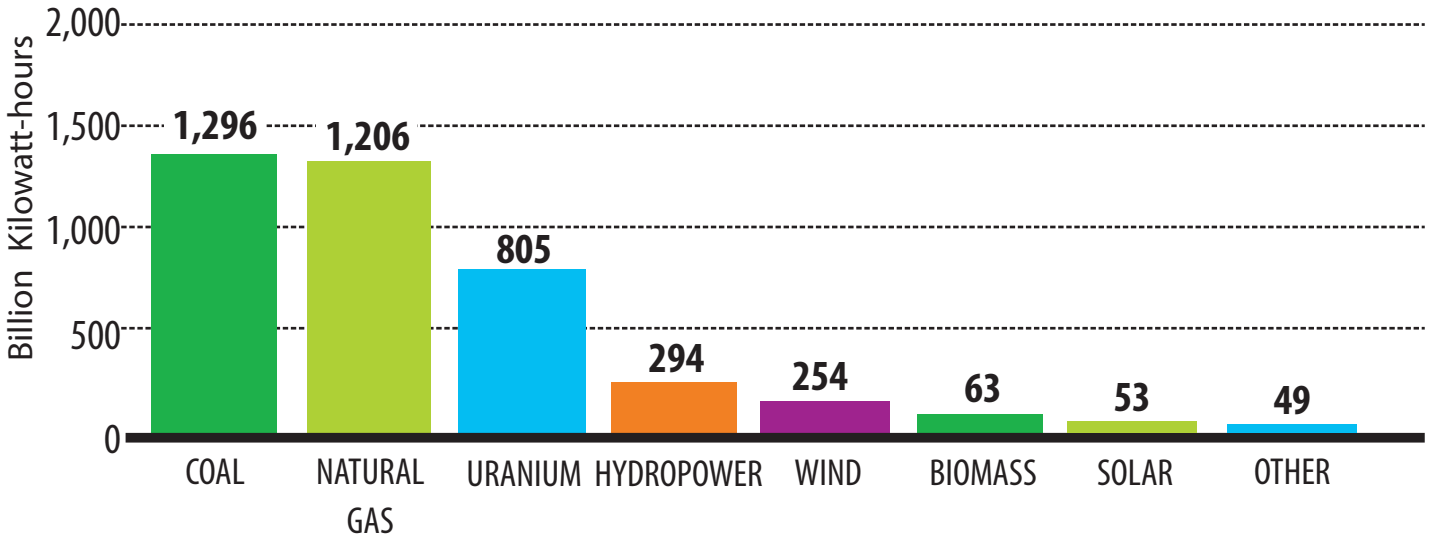
Question 8



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, 2017

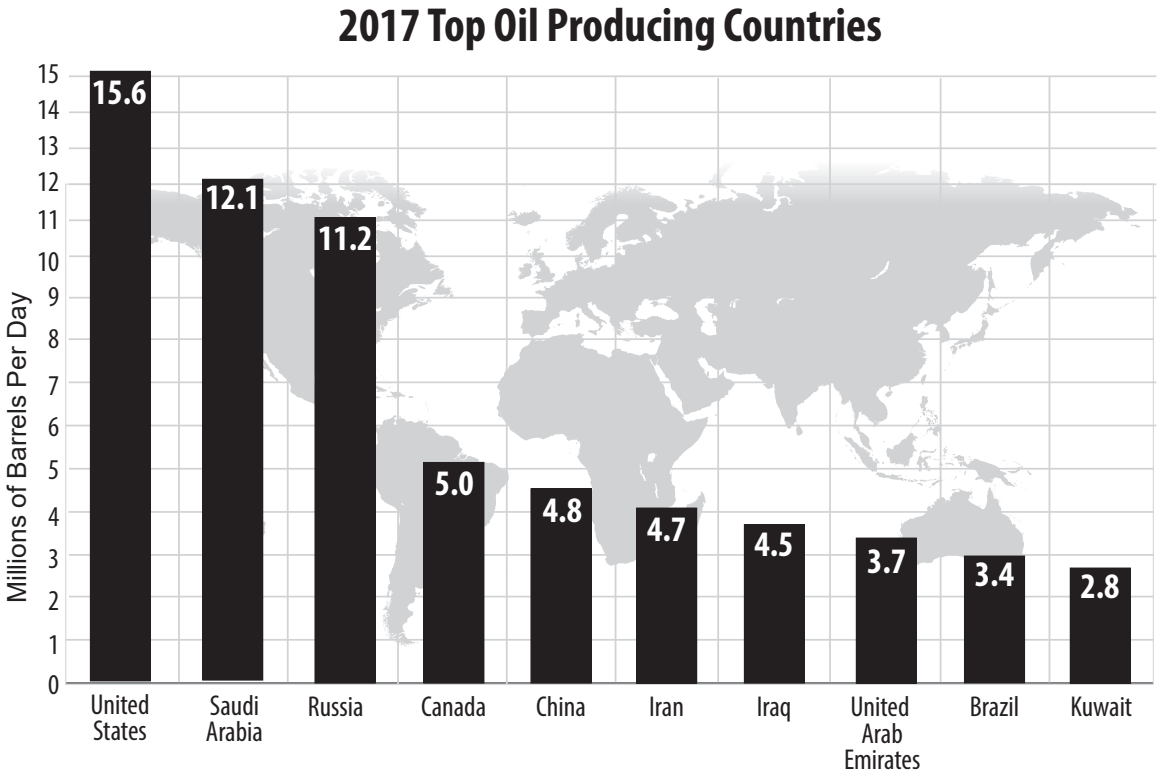


How many billion kilowatt-hours of electricity were generated in the United States in 2017?

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



Of the top oil producing countries, how many millions of barrels per day (mbd) did countries in the Western Hemisphere produce in 2017?

Question 12

U.S. Energy Consumption by Source, 2017

NONRENEWABLE

PETROLEUM 37.0% *
Uses: transportation, manufacturing - includes propane

NATURAL GAS 28.7% *
Uses: heating, manufacturing, electricity - includes propane

COAL 14.1%
Uses: electricity, manufacturing

URANIUM 8.6%
Uses: electricity

PROPANE
Uses: heating, manufacturing

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

RENEWABLE

BIOMASS 5.2%
Uses: heating, electricity, transportation

HYDROPOWER 2.8%
Uses: electricity

WIND 2.4%
Uses: electricity

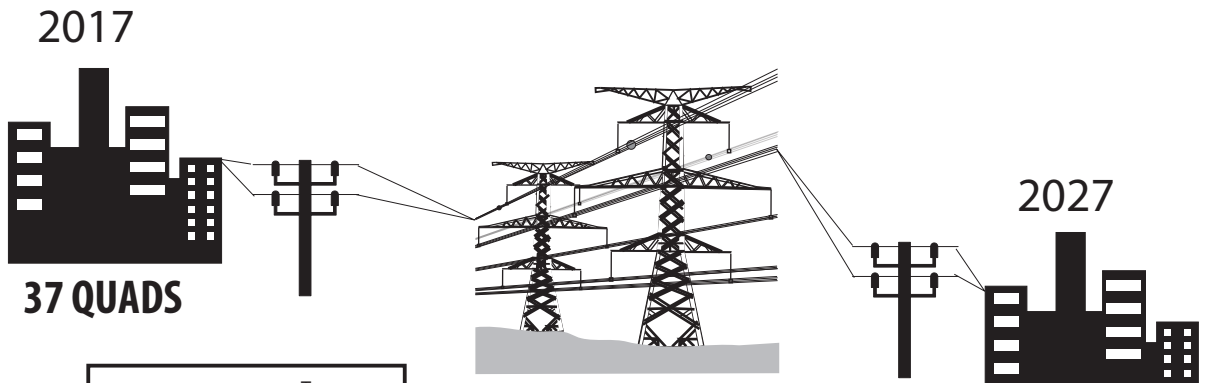
SOLAR 0.8%
Uses: heating, electricity

GEOTHERMAL 0.2%
Uses: heating, electricity

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

If the nation consumed 98 quads of energy in 2017, how many quads were provided by fossil fuels, to the nearest tenth of a quad?

Question 13



$A = P\ (1.0 + R)^T$

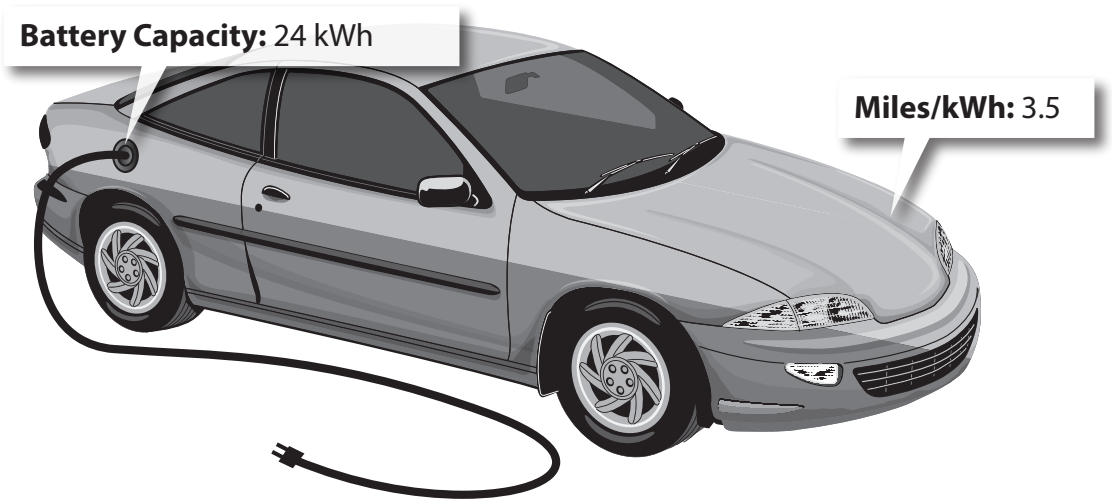
A = Final Amount
P = Principle
R = Rate of Increase
T = Number of Years

In 2017, the nation consumed about 37 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 2027?

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

ENERGY STAR

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

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

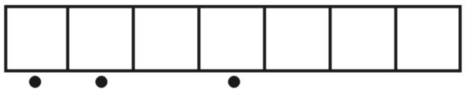
ENERGY JUMBLE 8

BULB
MAGNET
PLUG
KINETIC

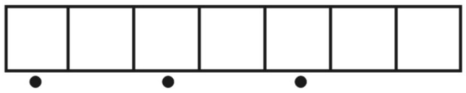
I'm a unit of light output; I'm pretty bright.
LUMEN

ENERGY JUMBLE 1

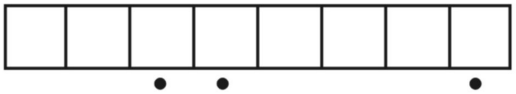
MELTRHA



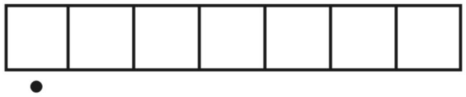
TNMEHEA



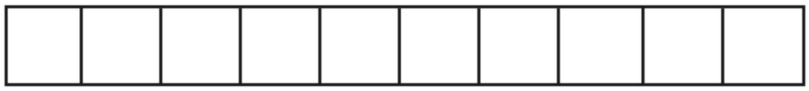
ANOIGELS



UBNTERI

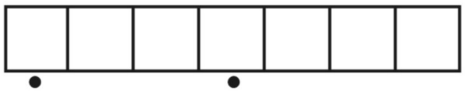


I save energy when I'm properly set.

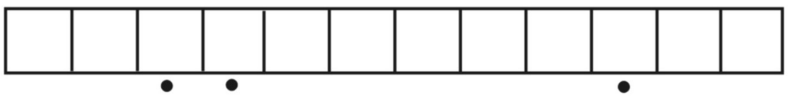


ENERGY JUMBLE 2

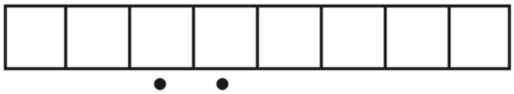
AIUURMN



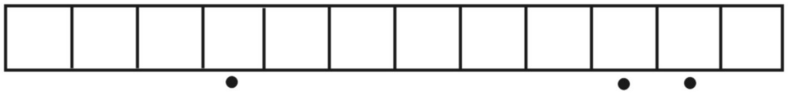
ANITREVOSNOC



TOWITALK



TCAOIVOOTHPL



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

ENERGY JUMBLE 3

A P E O N R P

A S O B M I S

M N U I R U A

I T G L H

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

ENERGY JUMBLE 4

A D M

E E P I N I P L

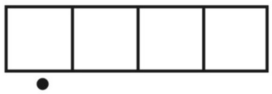
N S U

R O W P E

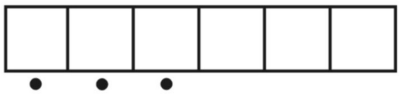
When the sun heats the Earth unevenly, I am created.

ENERGY JUMBLE 5

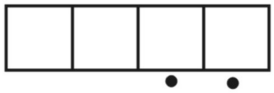
D O W O



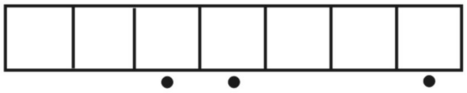
Y E R G E N



L O C A



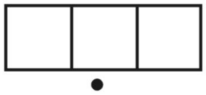
B R A G G E A



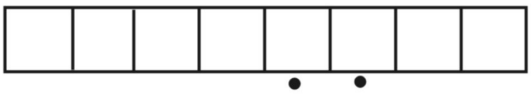
Use my energy once, I'll still be around, because I'm...

ENERGY JUMBLE 6

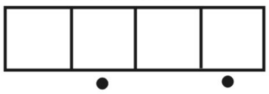
S G A



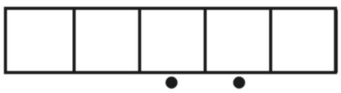
C L C I R E E T



N R U B



O R S A L

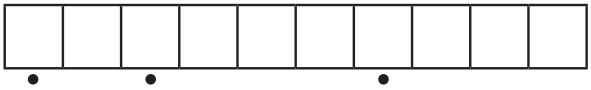


Being a gas is easy, because I'm a …

ENERGY JUMBLE 7

NETRINVOMNE

RETOMEGLAH



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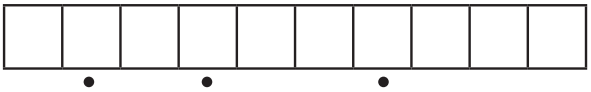
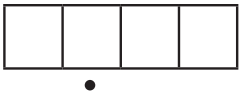


RETNSAGREY

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

ENERGY JUMBLE 8

BLBU



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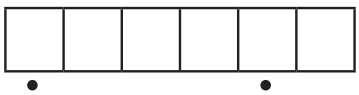

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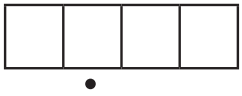

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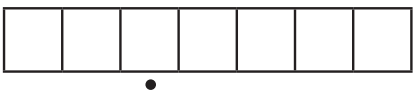


I'm a unit of light output; I'm pretty bright.

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, fluorescent, or LED?**

   LED

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?**

   11.4 percent (accept 8 to 14 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 a small amount 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 37 percent of the total?**

   Petroleum

4. **Which fossil fuel is used to generate approximately 32 percent of the United States' electricity?**

   Natural Gas

5. **What is the cleanest burning fossil fuel?**

   Natural gas/propane

6. **Which fossil fuel is transported mostly by barge or train?**

   Coal

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 produces the greatest amount of energy today?**

   Texas

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

   12.9 cents per kWh (accept 13 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?**

   38 percent (accept 33 to 43 percent)

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

   Natural gas (32 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-one percent (accept 86 to 96%)

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

   George Westinghouse and Nikola Tesla (accept either)

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

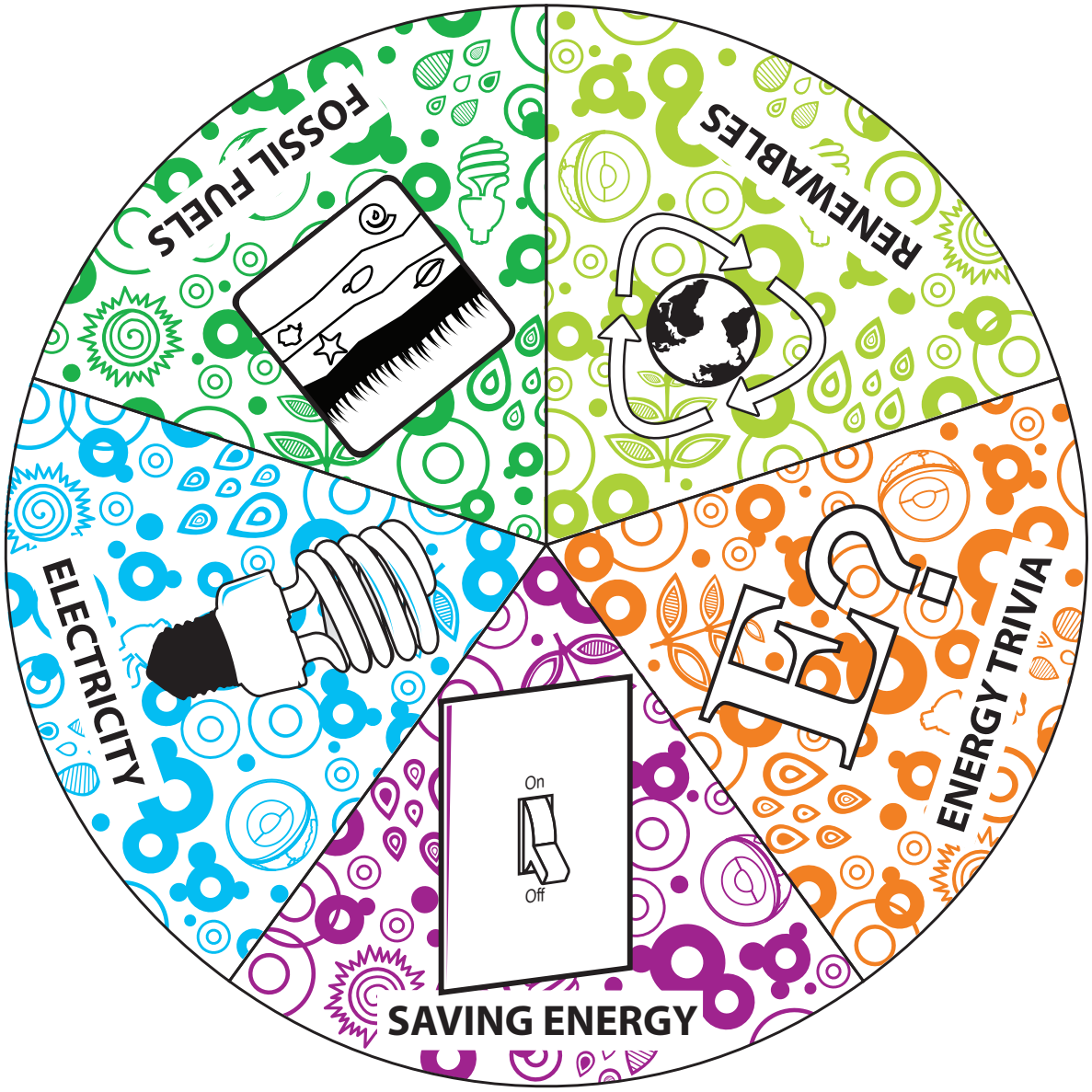
   Biomass

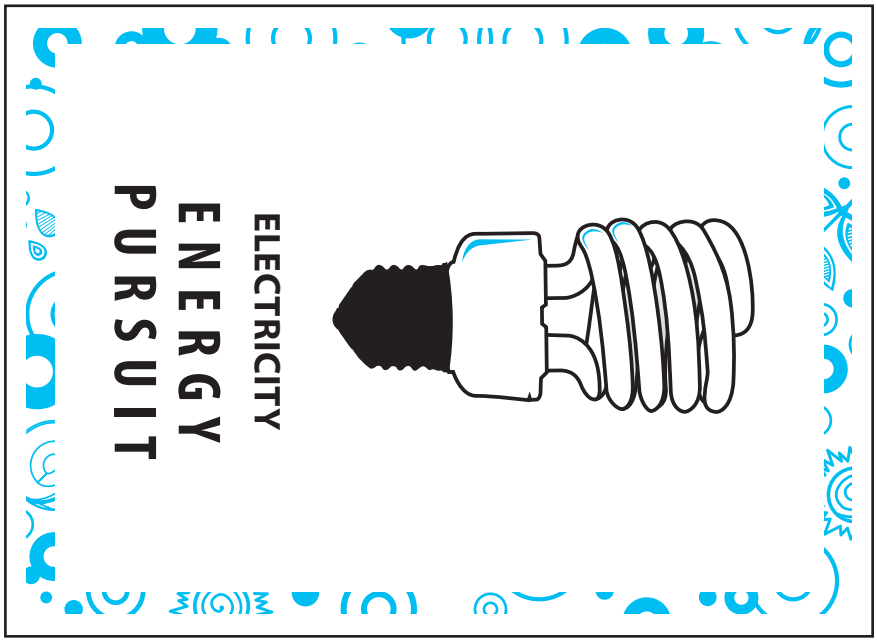
   Petroleum

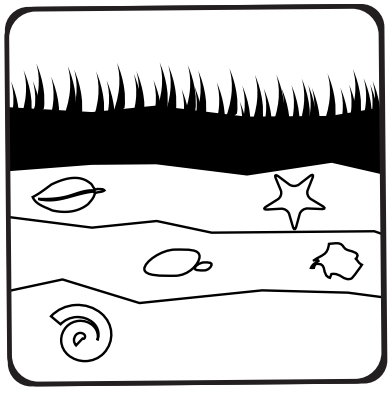
   Wind

   Solar

   Geothermal

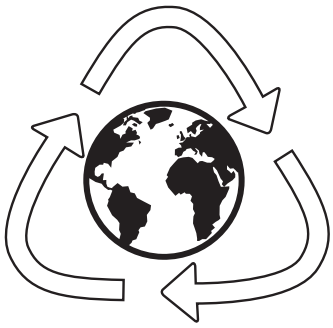






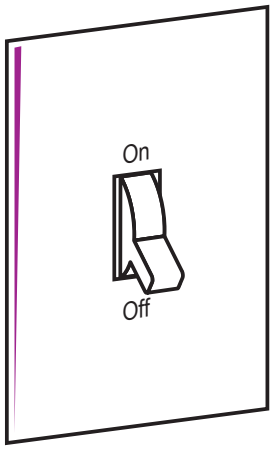
FOSSIL FUELS

ENERGY PURSUIT



RENEWABLES

ENERGY PURSUIT



SAVING ENERGY

ENERGY PURSUIT

E?

ENERGY TRIVIA

ENERGY PURSUIT

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 (Twenty to twenty-five 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)?**
   11.4 percent (accept 8 to 14 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?**
   40 percent (accept 30 to 50 percent)
5. **Plus or minus five percent, what percentage of energy consumed in the United States is supplied by nonrenewable sources?**
   88.4 percent (accept 83 to 93 percent)
6. **Ninety percent of raw natural gas is composed of what gas?**
   Methane (One carbon and four hydrogen atoms—CH_4)
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 (91 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

LED

1. **What does LED Stand for?**
   Light-emitting Diode
2. **How much energy can an LED save compared to an incandescent bulb (plus or minus 5%)?**
   80% (accept 75 to 85%)
3. **How much longer can LED bulbs last compared to an incandescent light bulb?**
   25 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?**
   12.9 (13) cents
2. **Name a time during the day that energy use is in its peak.**
   Afternoon (12-6 PM)
3. **Name one of the top three resources used to generate U.S. electricity.**
   Natural gas, coal, 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)?**
   8 percent (accept 5 to 11 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

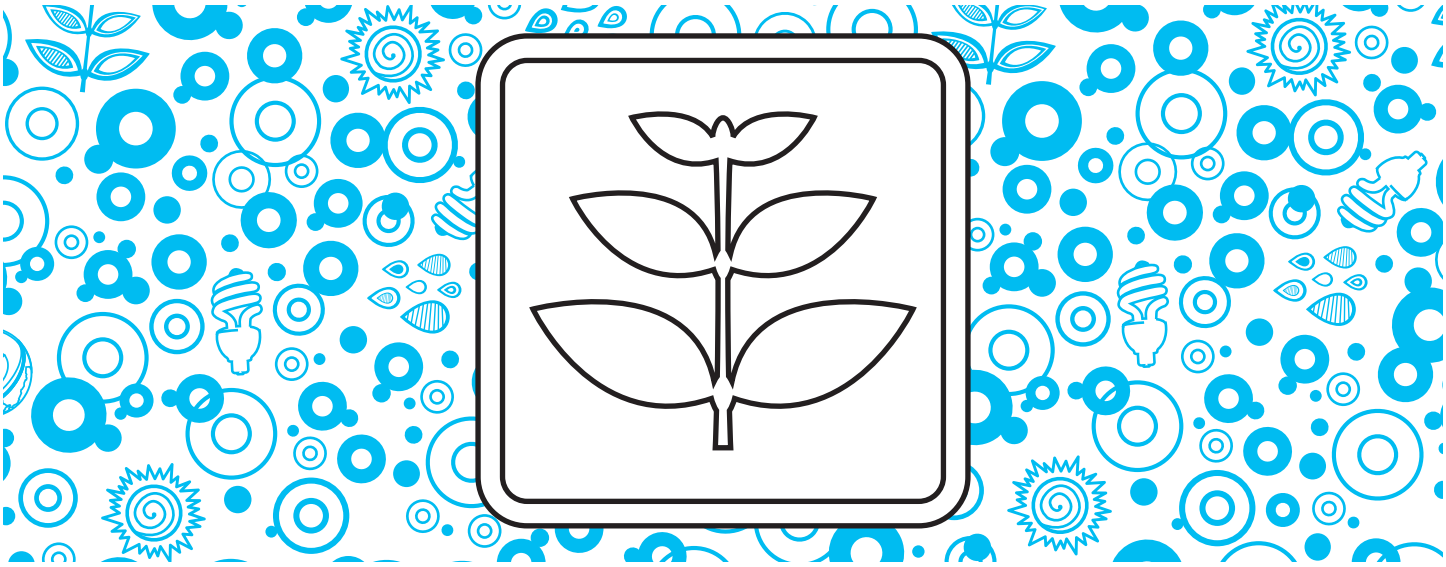
Recycling

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

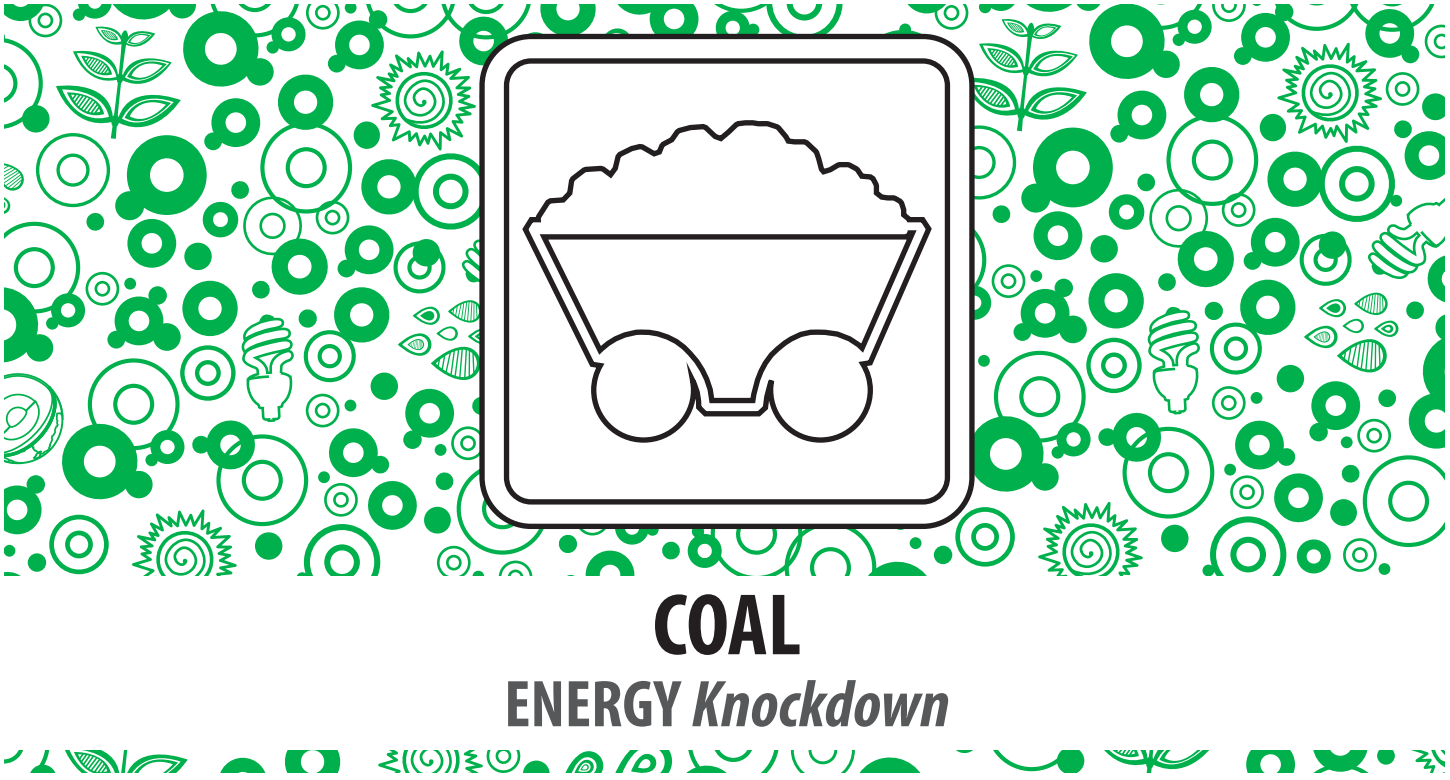
Resources

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)?**
   11.4 percent (accept 8 to 14%)



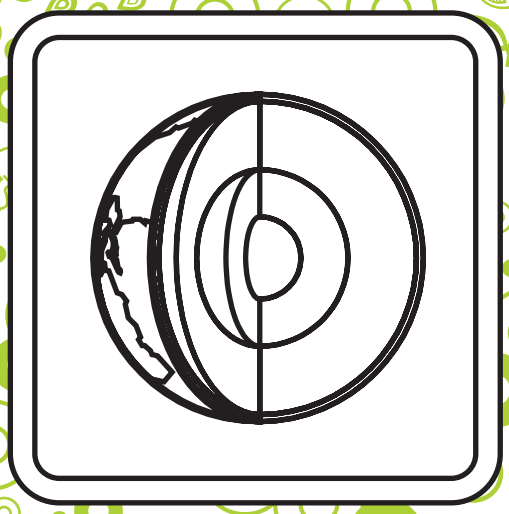
BIOMASS

ENERGY *Knockdown*



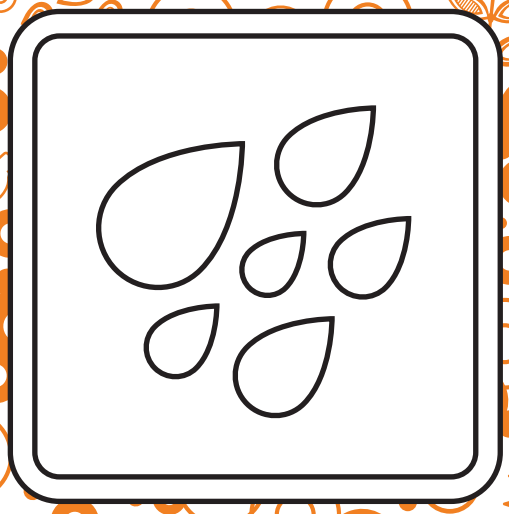
COAL

ENERGY *Knockdown*



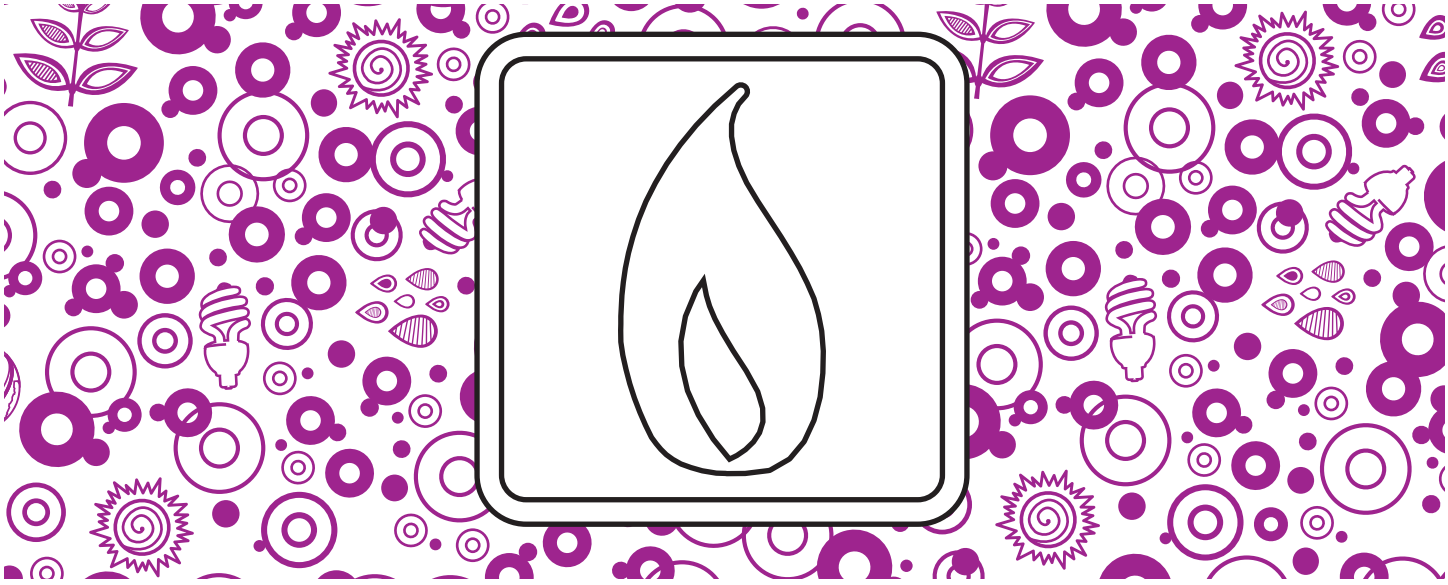
GEOTHERMAL

ENERGY *Knockdown*



HYDROPOWER

ENERGY *Knockdown*

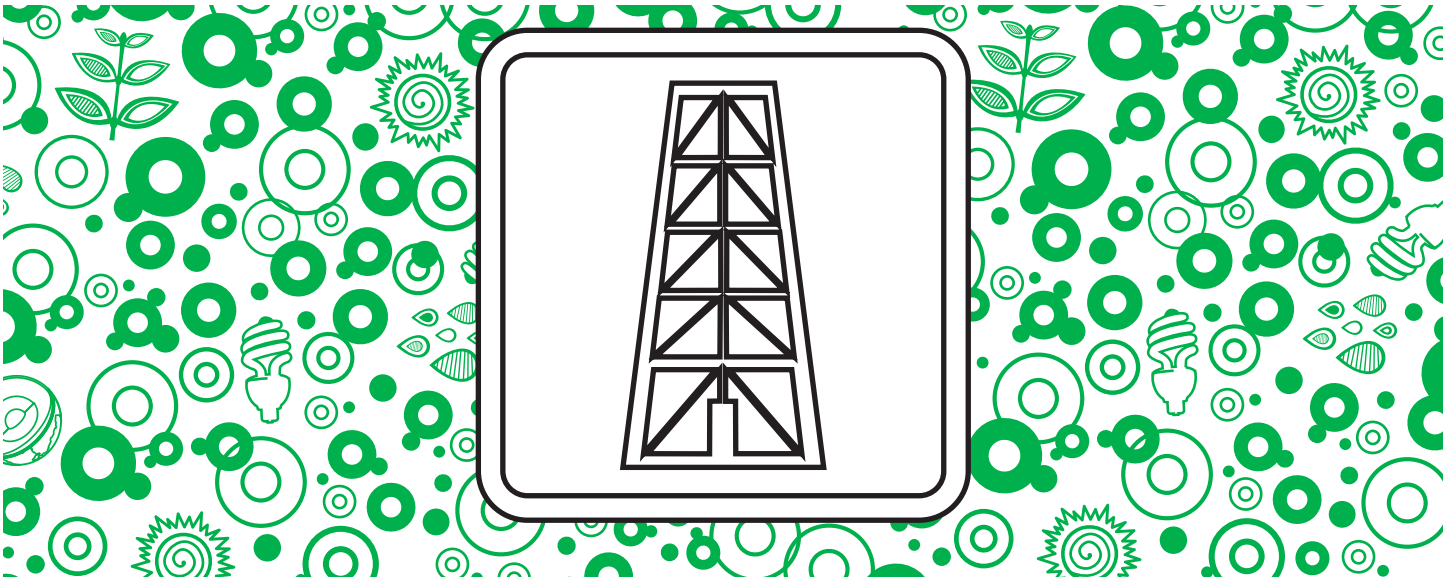


NATURAL GAS

ENERGY *Knockdown*

URANIUM

ENERGY *Knockdown*

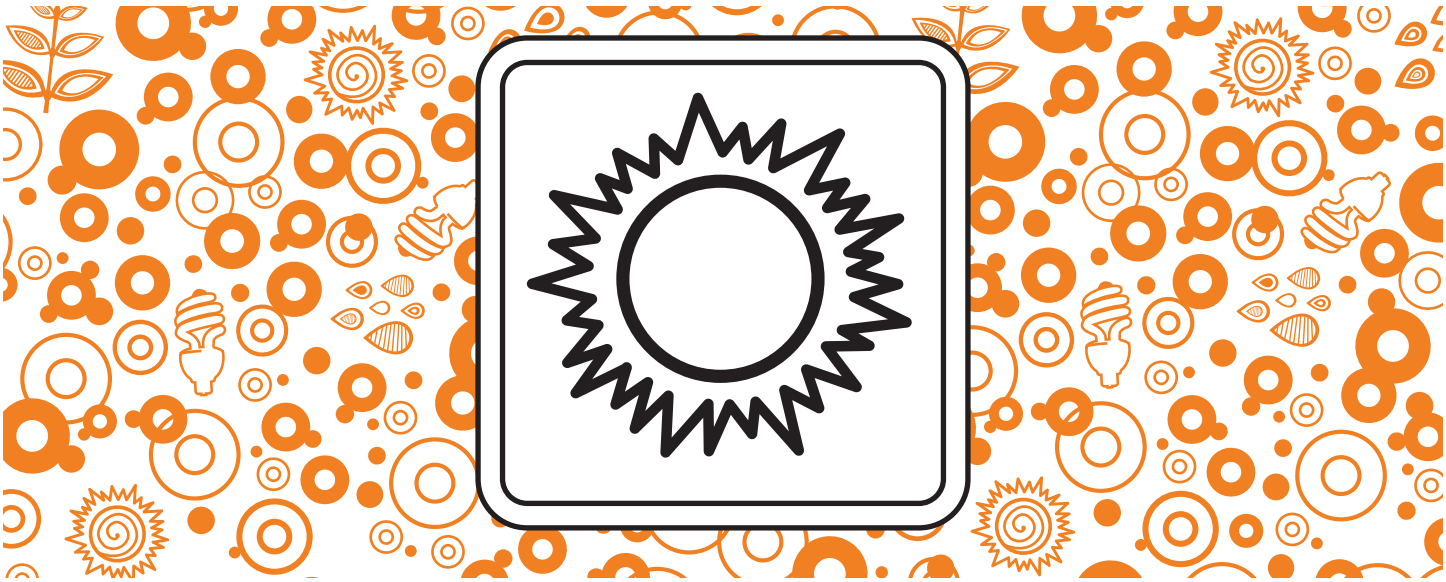


PETROLEUM

ENERGY *Knockdown*

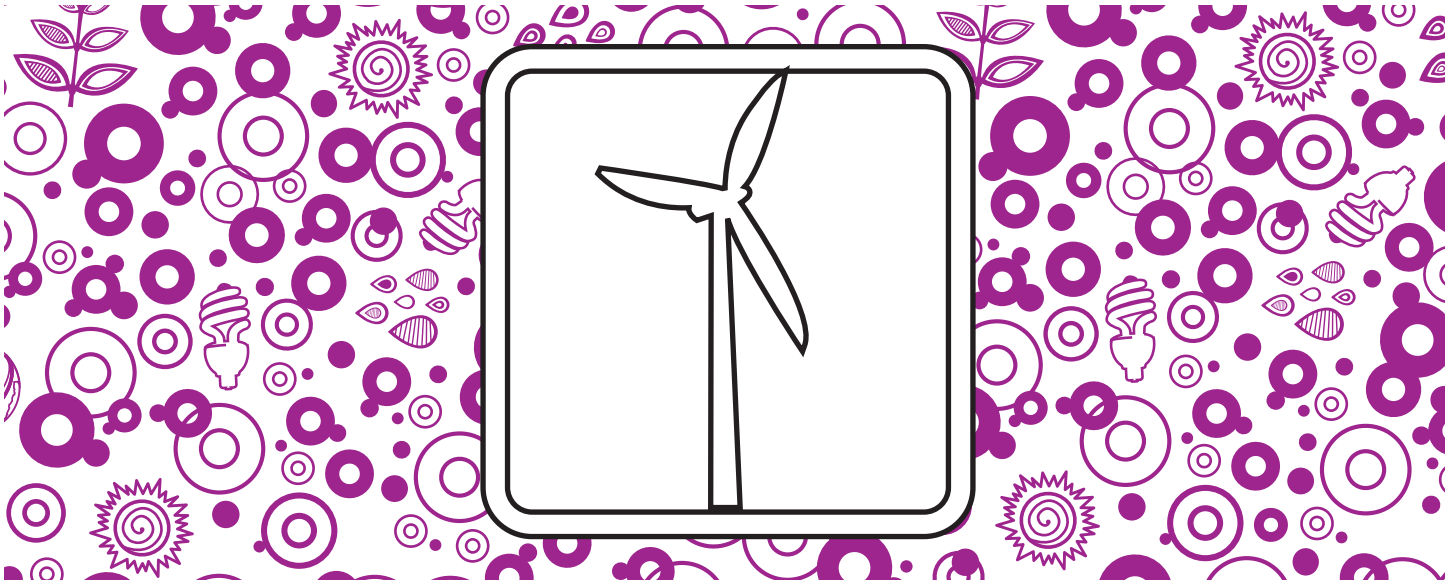
PROPANE

ENERGY *Knockdown*



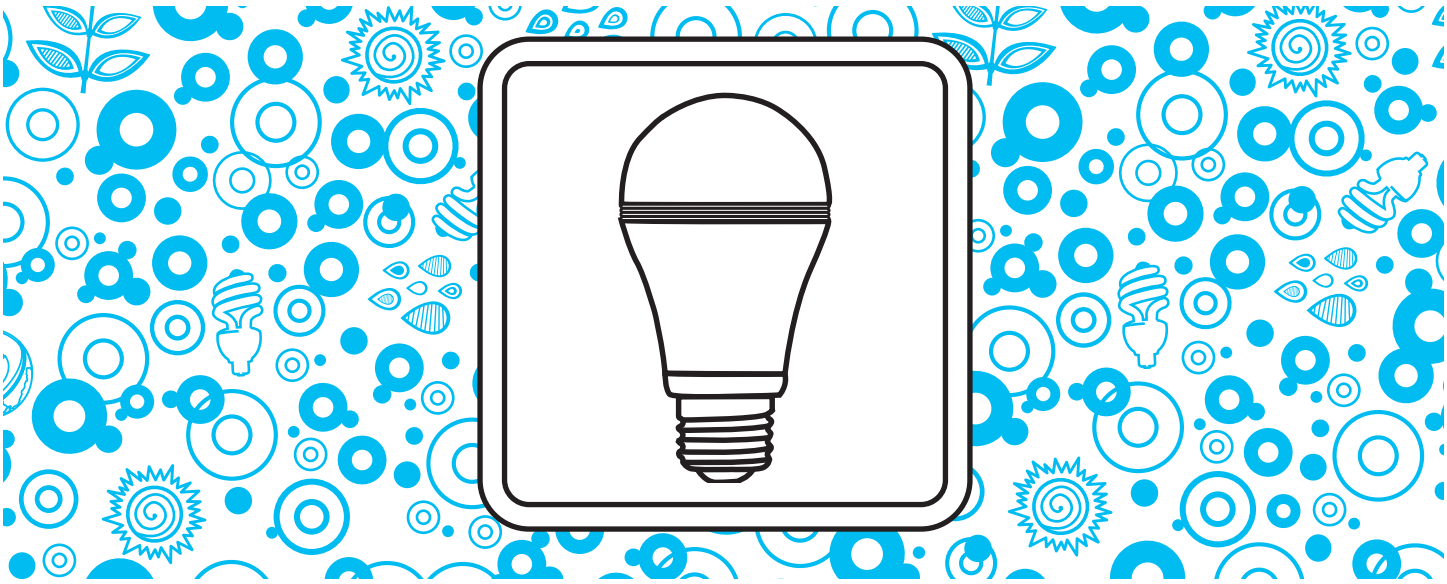
SOLAR

ENERGY *Knockdown*



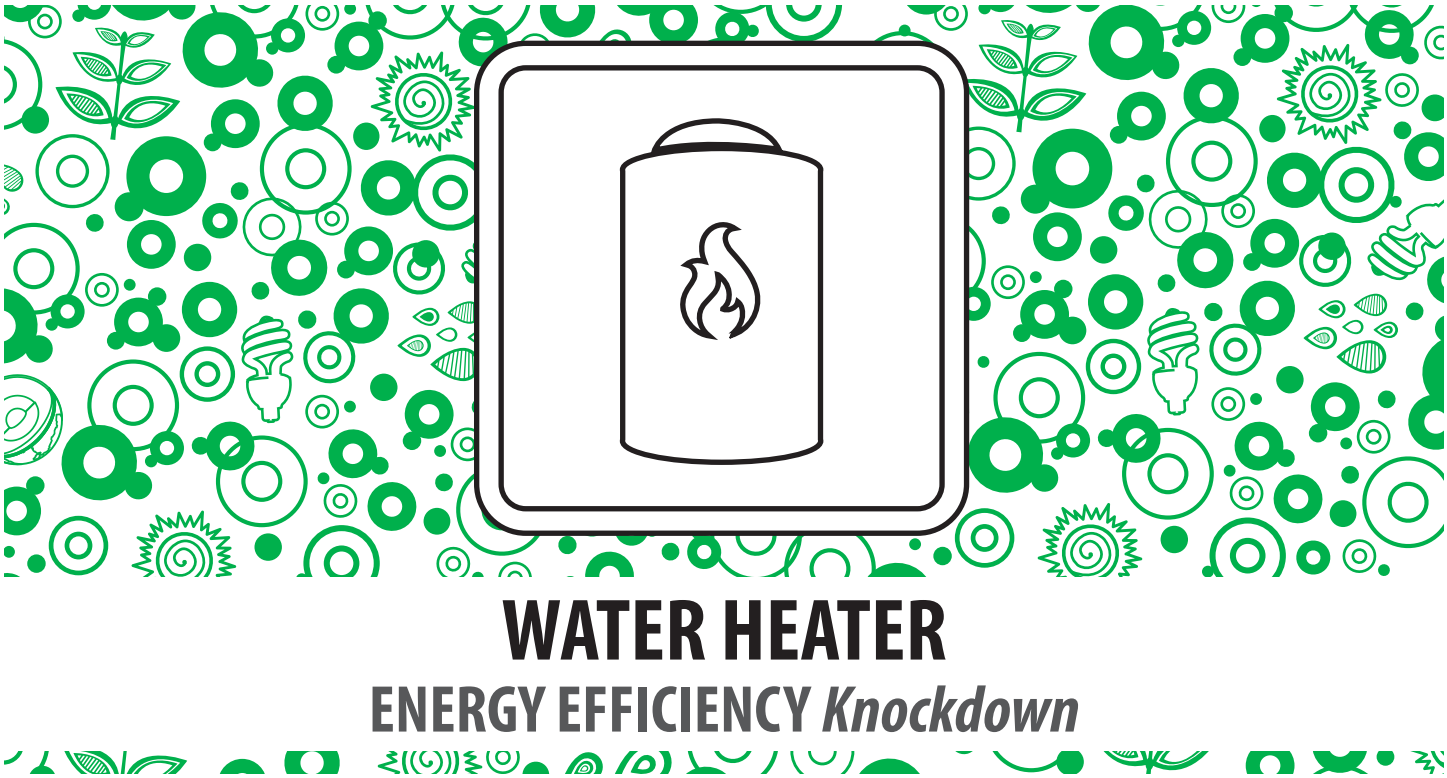
WIND

ENERGY *Knockdown*



LED

ENERGY EFFICIENCY *Knockdown*

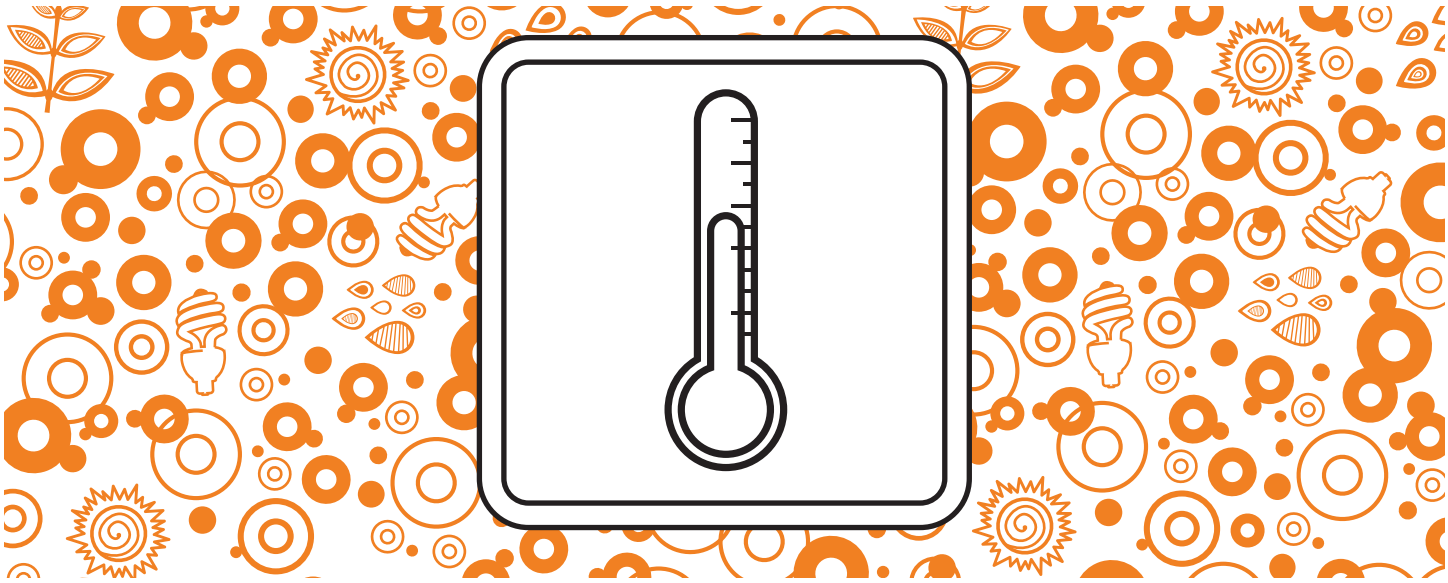


WATER HEATER

ENERGY EFFICIENCY *Knockdown*

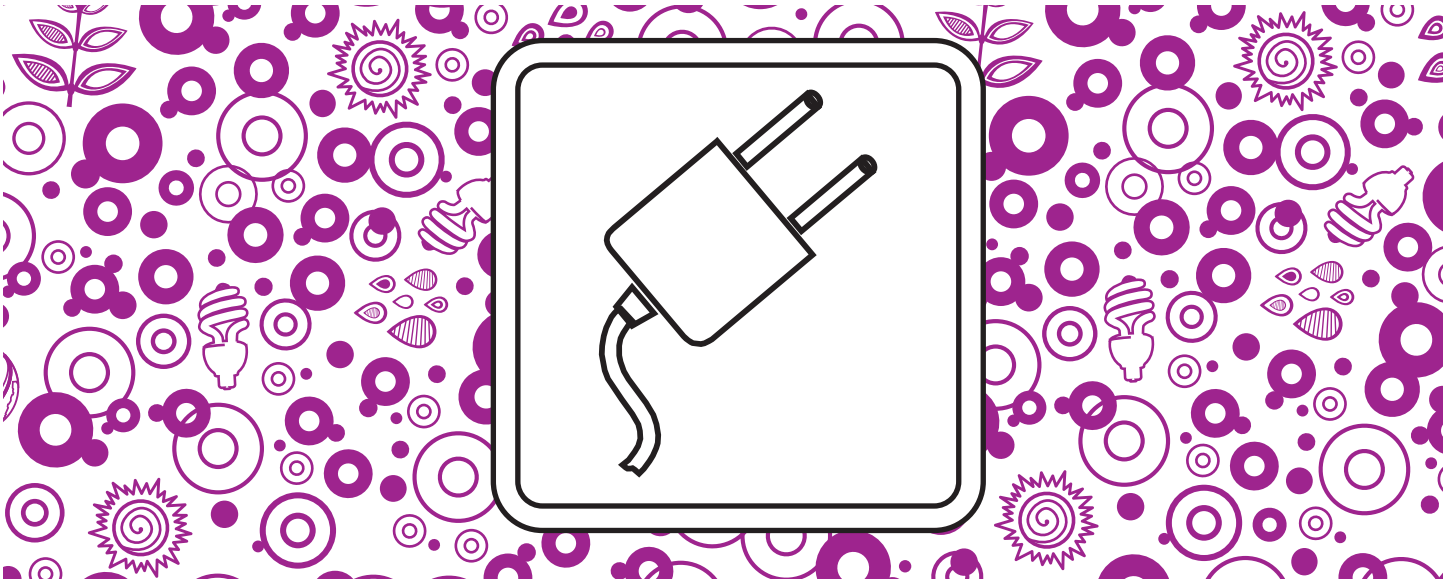
TRANSPORTATION

ENERGY EFFICIENCY *Knockdown*



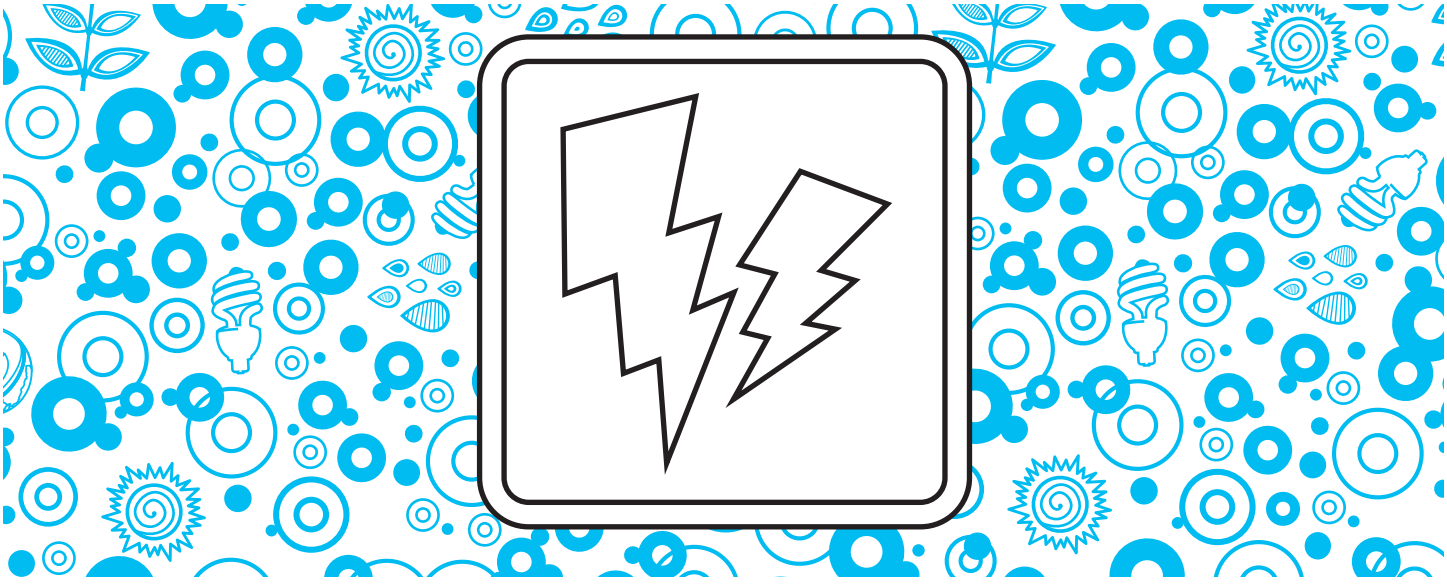
THERMOSTAT

ENERGY EFFICIENCY *Knockdown*



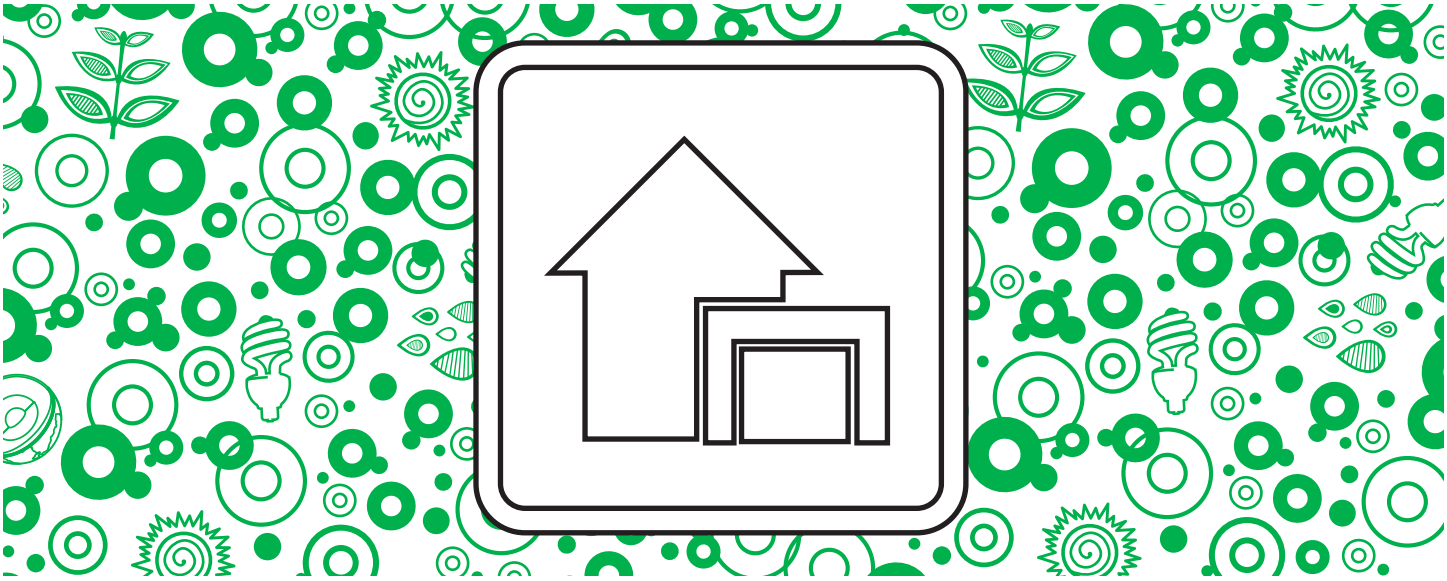
APPLIANCES AND MACHINES

ENERGY EFFICIENCY *Knockdown*



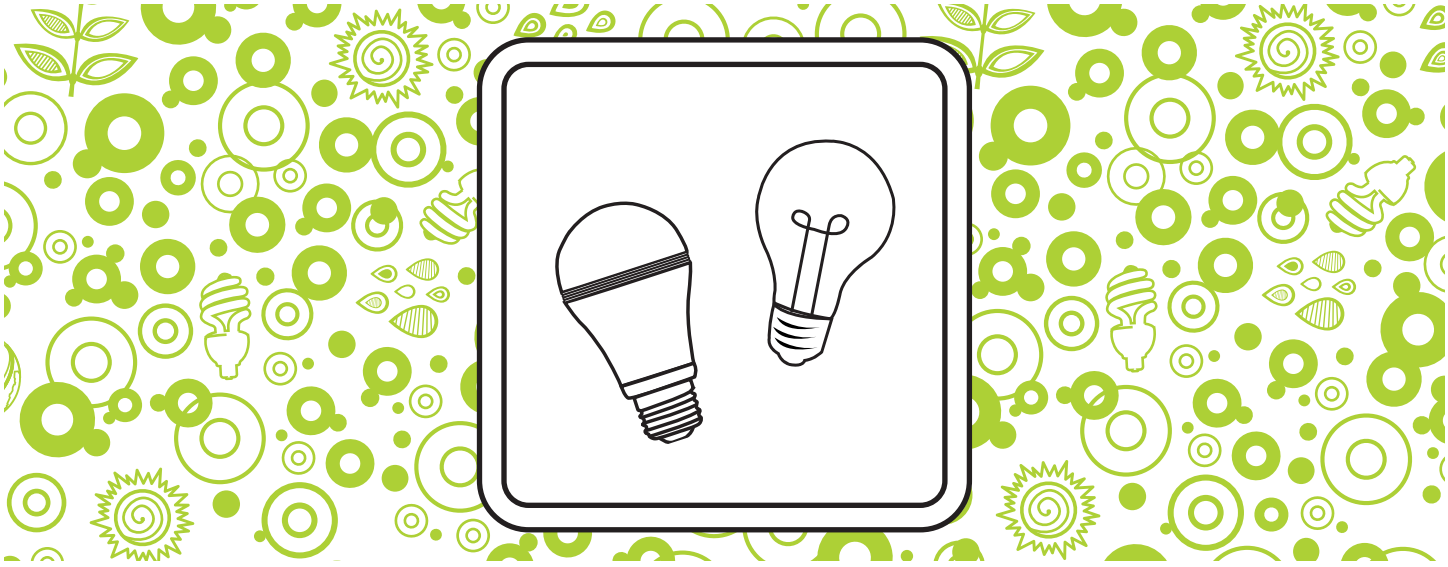
ELECTRICITY

ENERGY EFFICIENCY *Knockdown*



BUILDING ENVELOPE

ENERGY EFFICIENCY *Knockdown*



LIGHTING

ENERGY EFFICIENCY *Knockdown*

RECYCLING

ENERGY EFFICIENCY *Knockdown*

RESOURCES

ENERGY EFFICIENCY *Knockdown*

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 spokeperson 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 perfected 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?**
   12.9 cents (accept 10 to 16 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?**
   Natural Gas (32 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 often 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?**
   38 percent (accept 33 to 43 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?**
   11.4 percent (accept 8 to 14 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 (7.3 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, Pennsylvania, Illinois, Kentucky
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?**
   65 percent (accept 60 to 70 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, New Mexico
6. **What percent of the nation's energy is supplied by petroleum, plus or minus five percent?**
   Thirty-seven percent (accept 32 to 42 percent)
7. **What percent of the nation's petroleum is imported from other nations today, plus or minus five percent?**
   40 percent (accept 35 to 45 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 reactors are in operation in the U.S., plus or minus ten?**
   99 (accept 88 to 108)
6. **What percent of the nation's electricity is supplied by uranium in a nuclear power plant, plus or minus five percent?**
   20.0 percent (accept 15 to 25 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 (accept Ccf)

Energy Management

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?**
   CFL or LED

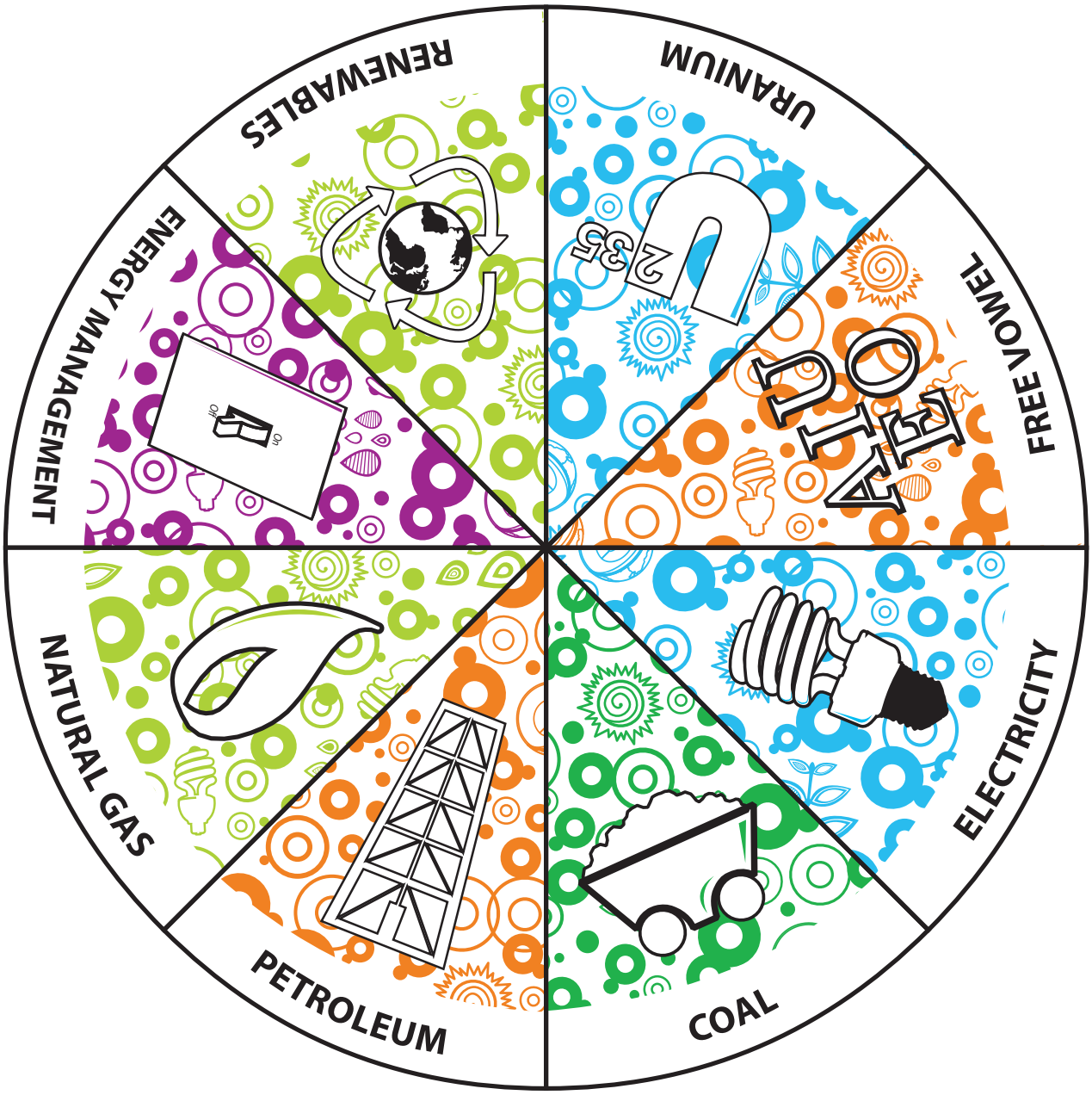
5. **As the energy efficiency rating of an appliance increases, the amount of energy it requires to operate: increases, decreases, or remains the same?**
   Decreases

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?**
   92.3% (accept 87 to 95%)
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

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.
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.

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?**
   12.8% (accept 8 to 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 (5.2%)
11. **Which renewable energy source provides the most electricity to the U.S.?**
    Hydropower (7.3%)

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. The price of LED bulbs is about the same as other bulbs, and 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

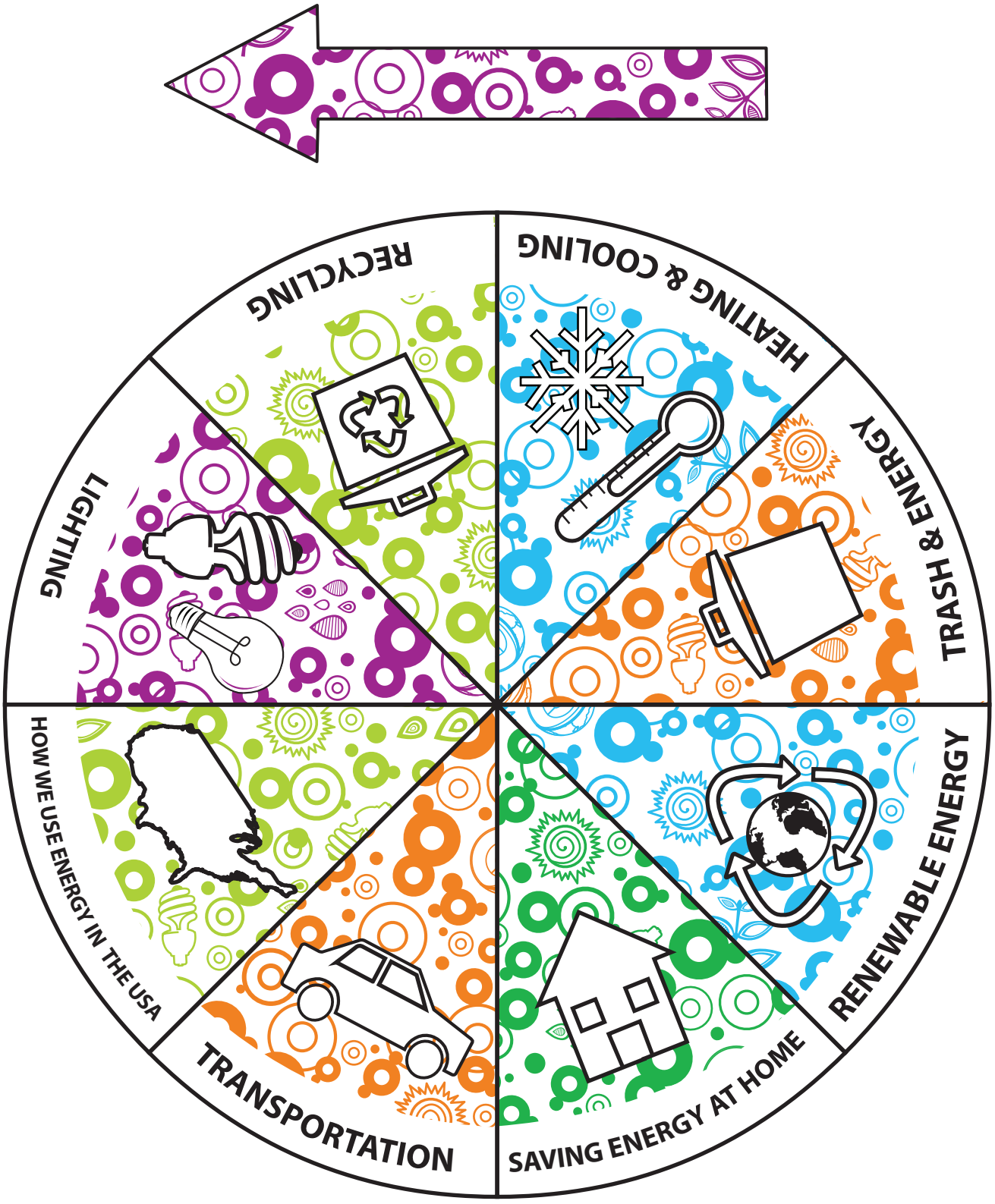
How We Use Energy in the USA

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?**
   One-fifth (about 20%)
5. **Which energy source provides the most electricity in the U.S.?**
   Natural Gas
6. **Which country provides most of our imported petroleum?**
   Canada
7. **What percentage of our total energy is provided by nonrenewable resources?**
   About 88% (88.4%)
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 8%
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

Top Three

Each team works together to give the top three answers to several energy questions.

Materials Needed

- Question and answer sheet, page 38
- Four sets of *Top Three* cards, pages 39-40
- Colored paper

Get Ready

1. Using the sample questions, or your own questions, assemble four sets of *Top Three* cards on different colored paper. You may wish to copy the cards onto darker paper so the answers cannot be seen through the cards.
2. Write the energy questions on the reverse side of the *Top Three* cards.
3. Write the answers on the reverse side of the appropriate number cards.

Get Set

Place the cards on the table with the questions and answers facing down.

Go!

Give these instructions to the carnival team:

1. You have five minutes to give me the top three answers for each of the questions.
2. This game is like Family Feud®. I'll ask you an energy question, and your team must give me the top three answers. You can give me the answers in any order.
3. When your team gives me a correct answer, I'll turn the card over. You are only allowed one wrong answer in each category. If you answer incorrectly more than once, we will move on to the next category. You will receive two energy bucks for each category in which you get all three correct answers.

Give these instructions to the individual(s):

1. You have five minutes to give me the top three answers for each of the questions.
2. This game is like Family Feud®. I'll ask you an energy question, and you must give me the top three answers. You can give me the answers in any order.
3. When you give me a correct answer, I'll turn the card over. You are only allowed one wrong answer in each category. If you answer incorrectly more than once, we will move on to the next category. You will receive two energy bucks for each category in which you get all three correct answers.

Top Three Questions and Answers

1. **Name the top three things kids should recycle to save energy.**
   1. *aluminum or metal cans*
   2. *paper or cardboard*
   3. *glass*

2. **Name the top three fossil fuels.**
   1. *petroleum or oil*
   2. *natural gas*
   3. *coal*

3. **Name the top three renewable energy sources you find at the beach.**
   1. *solar (sun)*
   2. *hydropower (water, tidal, or wave)*
   3. *wind*

4. **Name the top three ways kids can save energy at home.**
   1. *turn off the lights*
   2. *turn off the TV, video games, computer, etc.*
   3. *save hot water*

5. **Name the top three ways energy from the sun helps us.**
   1. *energy to see things (light)*
   2. *energy to heat things*
   3. *energy to grow plants*


TOP THREE


ONE

TWO

THREE

Energy Source Match Game

Each team works together to match the energy source name, symbol, and definition cards.

Materials Needed

- Cardstock
- *Energy Source Match Game* name cards, page 45
- *Energy Source Match Game* symbol cards, page 46
- *Energy Source Match Game* definition cards, page 47

Get Ready

1. Copy each sheet of *Energy Source Match Game* cards onto cardstock.

NOTE: For younger students, you may want to use only the name and symbol cards. For older students, use the name, symbol, and definition cards.

Get Set

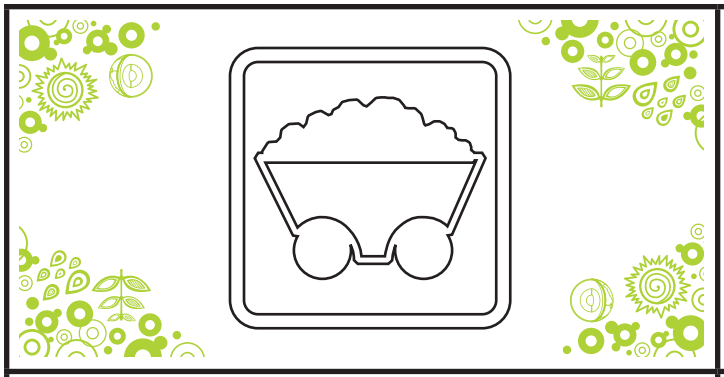
Arrange the cards in random order face down on the playing table.

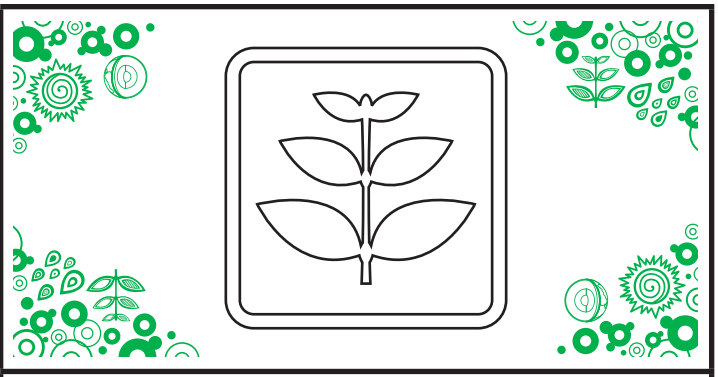
Go!

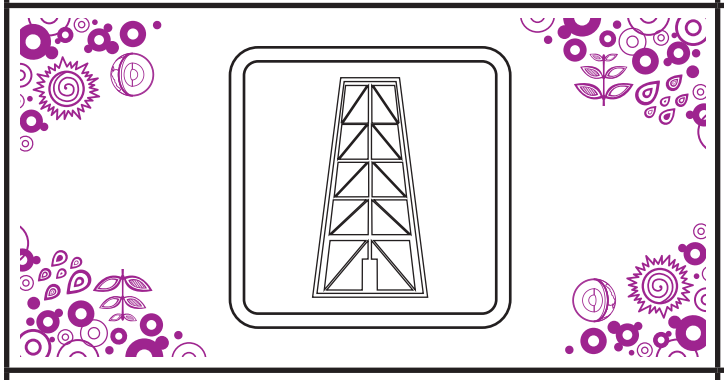
Give these instructions to the carnival team or individual(s):

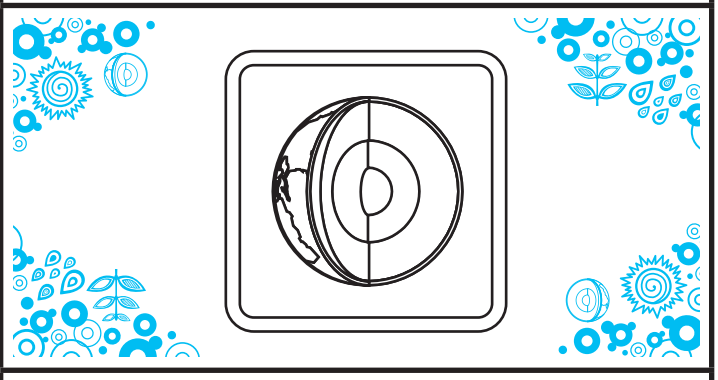
1. You have five minutes to match the ten energy source symbols with their names and definitions.
2. You will receive two energy bucks for five matches, and five energy bucks for ten matches.

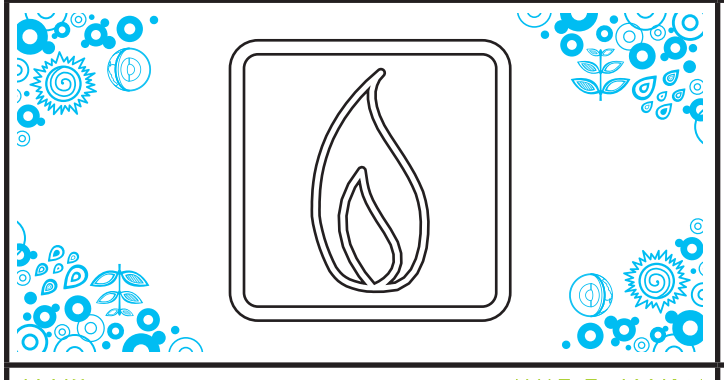
Coal	Biomass
Petroleum	Geothermal
Natural Gas	Hydropower
Propane	Solar
Uranium	Wind

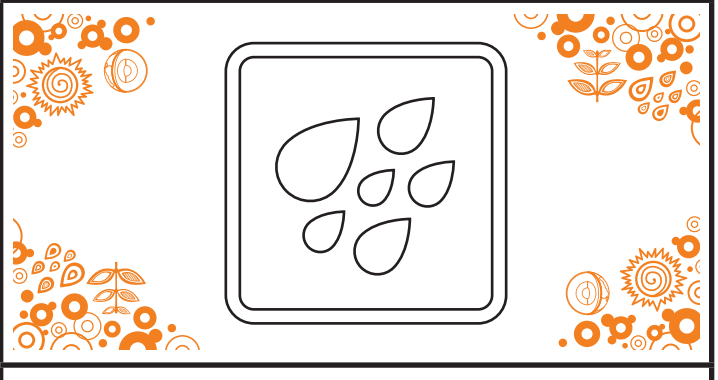


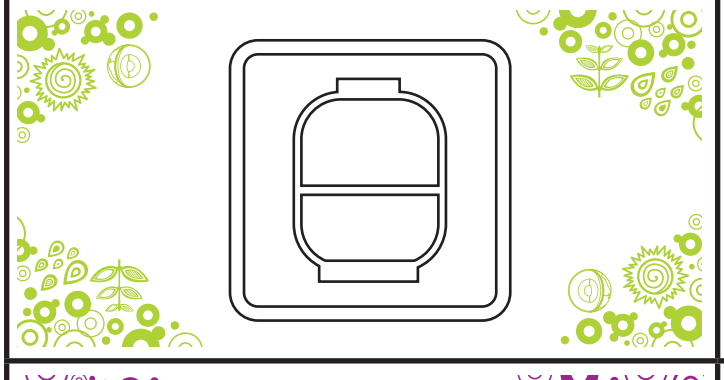


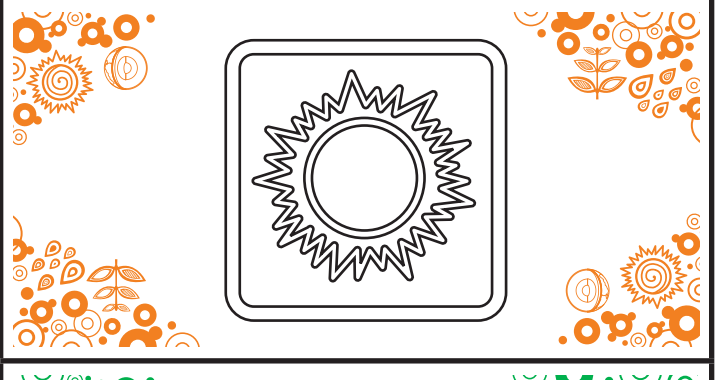


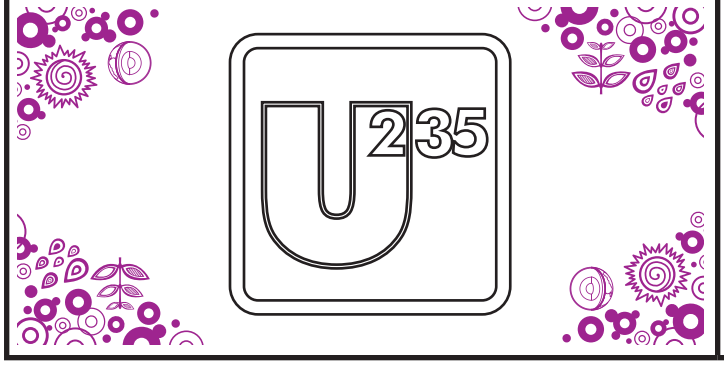


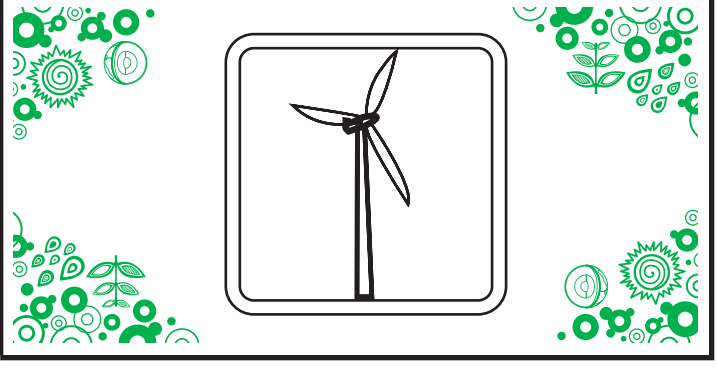












Black rock that is burned to make electricity.	**Energy from wood, waste, and garbage.**
Fuel that provides energy for cars, trucks, and jets.	**Energy from heat inside the Earth.**
The fossil fuel that heats most homes.	**Energy from flowing water.**
The portable fuel - under pressure, it's a liquid.	**There is a lot of energy in its rays.**
Energy from splitting the atoms of this element.	**Energy from moving air.**

Facts of Light

How much does it cost to create 25,000 hours of light from each bulb?

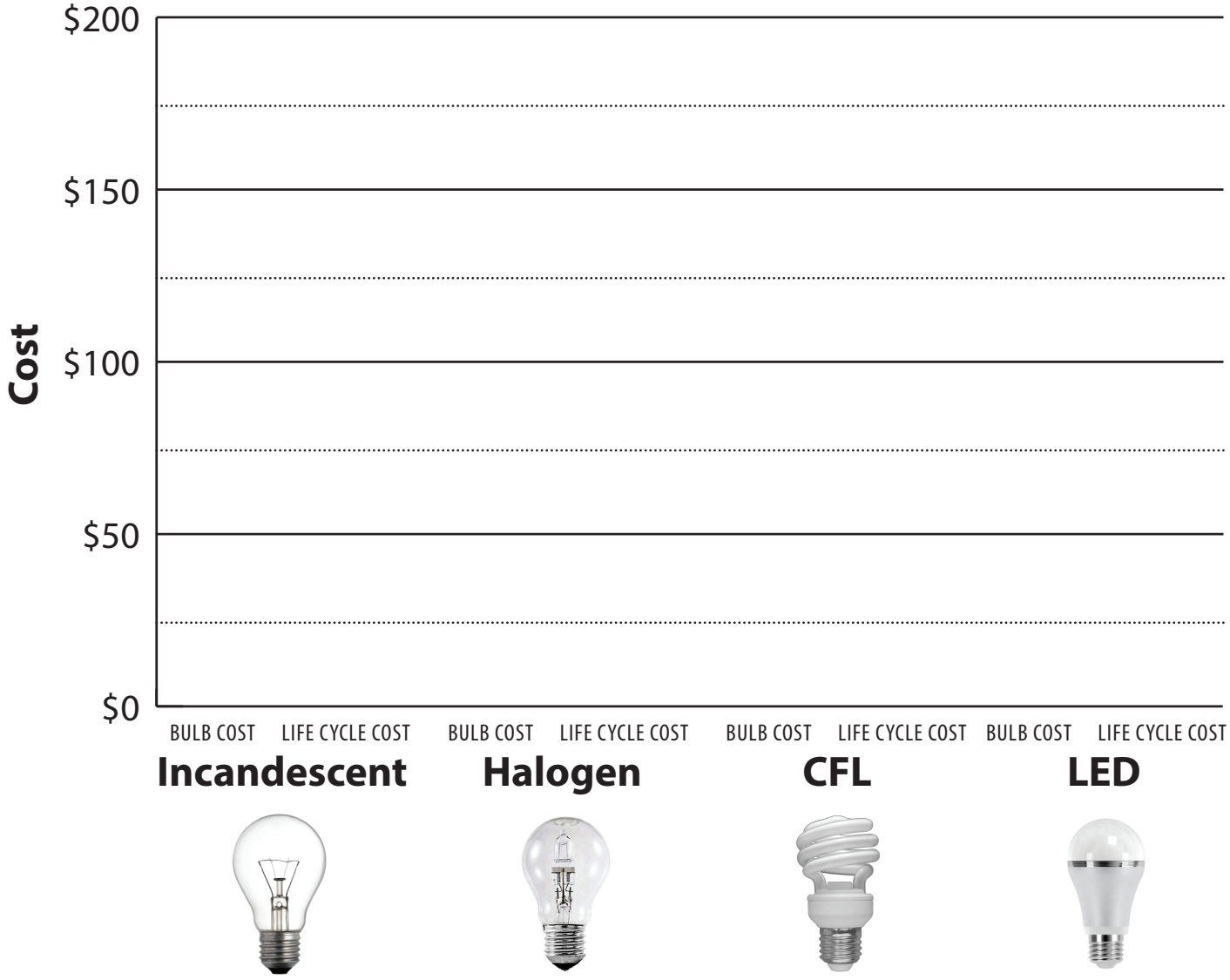



All bulbs provide about 850 lumens of light.

	COST OF BULB	INCANDESCENT BULB	HALOGEN	COMPACT FLUORESCENT (CFL)	LIGHT EMITTING DIODE (LED)
	Life of bulb (how long it will light)	1,000 hours	3,000 hours	10,000 hours	25,000 hours
(1)	How many bulbs do you need to get 25,000 hours?				
x	Price per bulb	$0.50	$1.50	$1.50	$1.33
(2) =	**Cost of bulbs for 25,000 hours of light**				
	COST OF ELECTRICITY	**INCANDESCENT BULB**	**HALOGEN**	**COMPACT FLUORESCENT (CFL)**	**LIGHT EMITTING DIODE (LED)**
	Total Hours	25,000 hours	25,000 hours	25,000 hours	25,000 hours
x	Wattage	60 watts = 0.060 kW	43 watts = 0.043 kW	13 watts = 0.013 kW	12 watts = 0.012 kW
(3) =	Total kWh consumption				
x	Price of electricity per kWh	$0.129	$0.129	$0.129	$0.129
(4) =	**Cost of Electricity**				
	LIFE CYCLE COST	**INCANDESCENT BULB**	**HALOGEN**	**COMPACT FLUORESCENT (CFL)**	**LIGHT EMITTING DIODE (LED)**
(5)	Cost of bulbs				
(6) +	Cost of electricity				
(7) =	**Life cycle cost**				

Facts of Light

Comparing Light Bulbs



	Incandescent	Halogen Incandescent	CFL	LED
Bulb Cost	$12.50	$12.45	$3.75	$1.33
Electricity Cost				
Life Cycle Cost				

NOTE: Bulb cost reflects the number of bulbs needed to produce 25,000 hours of light, which is the lifespan of one LED bulb. To produce the same amount of light, it would take 25 incandescent bulbs and 2.5 CFL bulbs.

Answer the following questions in your science notebook.

1. Draw the Comparing Light Bulbs graph in your science notebook. Use the data provided to create a bar graph.
2. Looking at the graph and the data table, what conclusions can you draw about the cost of each type of bulb?
3. If you were going to change all of the light bulbs in your home, which bulbs would you use and why?

Facts of Light Summary

Use the *Facts of Light* data to show the life cycle cost of each bulb when used for 25,000 hours.

INCANDESCENT

COST OF INCANDESCENT BULBS + COST OF ELECTRICITY = INCANDESCENT LIFE CYCLE COST

HALOGEN

COST OF HALOGEN BULBS + COST OF ELECTRICITY = HALOGEN LIFE CYCLE COST

CFL

COST OF CFL BULBS + COST OF ELECTRICITY = CFL LIFE CYCLE COST

LED

COST OF LED BULBS + COST OF ELECTRICITY = LED LIFE CYCLE COST

Energy House

Students learn about efficiency, conservation, and economic returns by using various materials to insulate a cardboard house and then test its efficiency.

Grade Levels:

Elem Elementary

Int Intermediate

Sec Secondary

Subject Areas:

Science

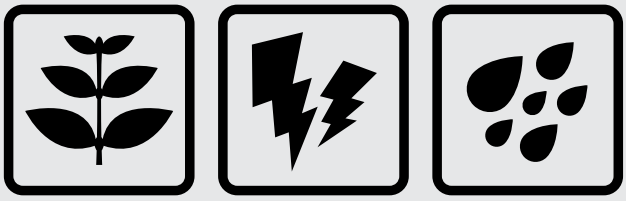
Technology

Math

Engineering

NEED

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.

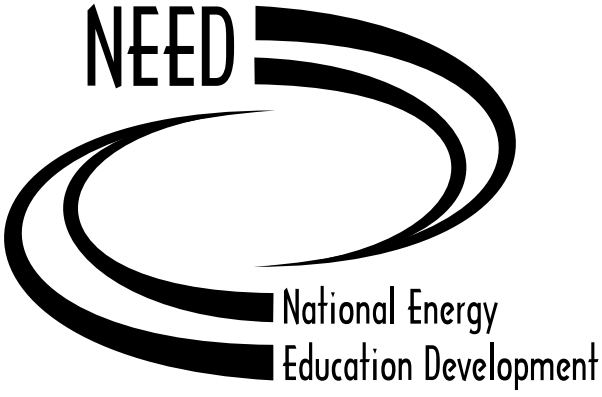
Permission to Copy

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.



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Energy House

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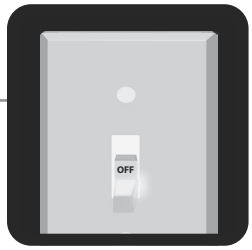


Standards Correlation Information

https://www.need.org/educators/curriculum-correlations/

Next Generation Science Standards

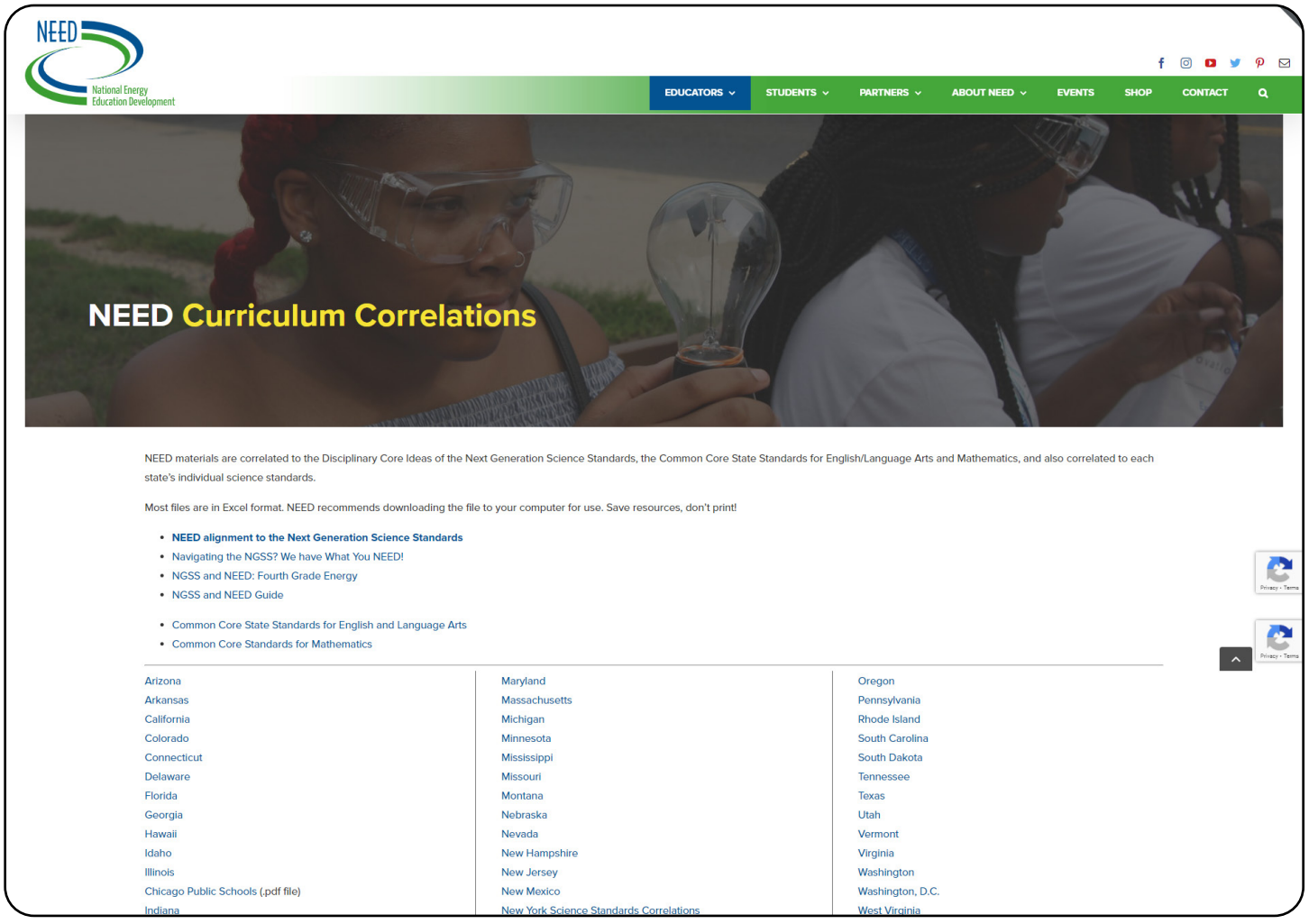
- This guide effectively supports many Next Generation Science Standards. This material can satisfy performance expectations, science and engineering practices, disciplinary core ideas, and cross cutting concepts within your required curriculum. For more details on these correlations, please visit NEED's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



Teacher Guide

Background

Insulation is a material used to limit the movement of thermal energy or heat. Students will be challenged to build a model home out of cardboard that 1) meets the required building code rules outlined below and 2) uses insulation to slow or stop the movement of thermal energy (heat) into and out of the home.

Objectives

- Students will be able to describe efficiency and conservation measures for the home.
- Students will be able to justify and explain why efficiency and conservation measures make sense economically.

Concepts

- Heating and cooling uses more energy than any other energy task in the home.
- Insulators are materials that do not conduct (or move) heat well.
- Many materials can be used to reduce the energy needed to keep houses at comfortable temperatures.

Materials

MATERIALS NEEDED FOR THE CLASS	MATERIALS NEEDED PER GROUP
▪1 Roll of aluminum foil ▪Scissors ▪1 Package or roll of small bead caulking ▪Rulers ▪1 Package of small self-stick weatherstripping ▪1 Roll of bubble wrap ▪1 Roll of cotton batting ▪Ice cubes ▪1 Roll of padded mailing paper	▪Thermometers ▪Meter stick ▪Pencils ▪Cardboard boxes ▪Sheets of heavy transparency film ▪Poster boards ▪Resealable quart-sized plastic bags ▪Rolls of mailing tape *Most materials listed above can be bought at an office supply store or hardware store.*

Preparation

- Familiarize yourself with the *Teacher* and *Student Guides*. Preview the extensions and full instructions to develop a good implementation plan that fits your students and the time available.
- Make one copy of the *Student Guide* for each student. If desired, make a copy of the optional *Cost Sheet* for each student.
- Procure the materials needed from the list above and set up a Construction Center for the students.
- Make a master or digital projection of the master on page 10 to share with the class.
- Pre-determine student groups of three.
- Gather play money and divide it up for groups to use if opting to incorporate a budget. (optional)

Procedure

1. Introduce the activity to the class using the *Insulators and Conductors* master. Discuss the materials in the pictures that are conductors and insulators (see the answer key starting on page 7 for suggestions). Explain to the class that conductors are materials such as metals that move thermal energy easily; insulators are materials that do not move thermal energy well. Have students discuss what they know about common materials (wood, plastic, glass, metal, leather, water, cement, fabric) and categorize them as conductors or insulators.

Grade Levels

- Elementary, grades 3-5
- Intermediate, grades 6-8
- Secondary, grades 9-12

Time

- 1.5-2.5 hours

Additional Resources

Check out NEED's *Building Science* module on our website, shop.NEED.org, to explore the science and energy behind keeping buildings comfortable and functional. This unit also includes a house design project with additional challenges built in, and could serve as an amplified challenge for students after this unit.

Materials Note

Students can use uniformly sized boxes or provide their own cardboard. NEED often uses 9x9x9 boxes in workshops.

2. A good way for students to think more clearly about objects as conductors or insulators is to consider that all the materials in the room are at the same temperature. The students' hands are warmer than the room. Do the objects feel warm or cool when they are touched? Conductors move heat away from the students' hands, making the objects feel cooler. Insulators do not move heat well, so the objects feel warm. Have the students think about stepping from the shower with one foot on a rug and one on a tile floor. Both the rug and the tile are at the same temperature. How do they feel? Which is the conductor and which is the insulator?
3. Distribute the *Student Guide* to the students and place them into the groups you have set up. Review the procedure for the activity with the class, making sure to expressly outline the building code. If necessary, make sure the building code is visible on the board or screen as well. Be sure to highlight any group work and lab safety rules you may have and remind students safe procedures for cutting with cardboard.
4. Show the class the materials in the Construction Center. If you are incorporating the optional *Cost Sheet* and budgeting, make sure to discuss costs of the materials and how this will factor into the testing at the end. It may be helpful for groups to pre-determine the supplies they will use (and prepare a preliminary budget, if applicable) before visiting the Construction Center. Show the class the materials in the Construction Center.
5. Clearly define how much time groups will have for construction. Remind them that their goal is to use insulation to slow or stop the movement of thermal energy. They will test for this at the end by cooling the inside of their home with ice to see how well it stays cool when warm air/lamps are placed outside. A sample rubric is provided on page 7. Discuss the rubric if desired.
6. Distribute boxes/cardboard if you are providing them to students. If students are providing their own cardboard, make sure to identify any size parameters and limitations you wish to incorporate outside of the building code.
7. Allow groups to begin planning, acquiring materials from the Construction Center, and construct their homes. Monitor group work, enforcing the building code and any safety measures necessary. Give time check-ins regularly so groups are aware of the remaining time for work.
8. When groups are finished, decide if you will inspect homes for building code violations. Provide each group with a thermometer. Take the houses to the place where testing will occur. If it is a warm day, take the houses outside. If conducting indoor tests, set up the houses so that incandescent or heat lamps will be equally trained on each home. Ask each group to insert the thermometer into their home in the top of the door (with the door closed). They should allow their thermometers to normalize for a minute and record the temperature as a baseline temperature.
9. Distribute plastic bags to each group, each filled with 8 ice cubes (or a similar mass of ice). Instruct groups to open their doors and place the ice inside the center of the home and close the door. If indoors, turn on any lamps that are providing heat and allow them to remain on.
10. Record the temperature after 10-15 minutes. Students will slide the thermometers back into the closed door, and allow them to normalize and record the final temperature.
11. Ask students to review their data as a group and identify design elements that might have improved their results or contributed to their results.
12. Discuss that insulation works both ways. While we often think of insulation keeping something hot, it can also help to keep an air-conditioned home cool, or a warmed home warm. Discuss the energy savings that insulation can produce, related to cost—the more insulation you use, the more energy savings. At some point, however, the increase in cost is not economically worthwhile. The cost up-front may outweigh the energy saved, or you may reduce the amount of usable space too much. Materials that are really good insulators usually cost more than less-efficient insulators, so you need to consider the trade-offs and balance the energy saved with the cost. While the energy savings may not be obvious in this activity, homeowners can look at their bills to calculate savings. Discuss why homes in warmer climates might choose to opt out of insulation.
13. Discuss other materials the groups could have used as insulation, such as foam board. Discuss what each group would change if they could do the activity again with additional materials. Ask students why they think building codes are necessary and discuss how the building code can have benefits and limitations.
14. Evaluate the activity with the class using the Evaluation Form on page 15.

Extension Activities

- Substitute a handwarmer in place of ice cubes to represent heating in colder climates.
- Have students draw blueprints of their houses to scale and devise written plans to insulate their houses before they begin the activity.

- Have students devise an experiment to test and determine the insulating qualities of the insulating materials prior to insulating the houses. One simple experiment is to insulate cold drink cans with various materials to see which material keeps the liquid the coldest.
- Give students two boxes. One will be fully insulated, and one will be designed identically without any insulation, to act as an experimental control.
- Have students devise an experiment to explore the insulating qualities of materials with which houses are made, such as wood, brick, stucco, cinder block, etc.
- For an added challenge, assign the groups a maximum budget for construction. They must provide the best insulation without exceeding the homeowner's budget.
- Ask one member of each group to join a team of "Building Inspectors" who look for building code compliance errors.
- Have a building contractor or certified energy manager visit the class to discuss energy-saving materials and techniques in the building industry.
- Have students survey their own homes to determine how well their homes are insulated and what measures could be undertaken to make their homes more energy efficient. See *Energy Conservation Contract,* available for free download at shop.NEED.org, to teach students how to save energy at home with their families.
- Have students survey the school to determine how well the building is insulated and what measures could be undertaken to make the school more energy efficient. See *School Energy Experts,* available for free download at shop.NEED.org, to teach students how to survey buildings and learn about conservation and efficiency measures at school.

☑Answer Key For Insulators and Conductors Master

- **Metal Pan with Plastic Handle:** Metal is a conductor—it conducts heat to the food inside to cook it efficiently. Plastic is an insulator—it does not conduct heat from the pan to a person's hands.
- **Metal Kettle with Wooden Handle:** Metal is a conductor—it conducts heat to the water inside to warm it efficiently. Wood is an insulator—it does not conduct heat from the kettle to a person's hands.
- **Metal Spoon with Plastic Handle:** Metal is a conductor—it conducts heat. Plastic is an insulator—it does not conduct heat from the spoon to a person's hands.
- **Fabric Oven Mitt:** Fabric is an insulator—it does not conduct heat from hot pans to a person's hands. Discuss blankets and clothes as insulators. What would happen if the fabric mitt got wet? Is water a conductor or insulator? (conductor)
- **Thermos (Vacuum) Bottle:** There is a space between the inside liner and the outside material of a vacuum bottle in which most of the air has been removed. Since heat travels from molecule to molecule, a space with few molecules is a good insulator. Double pane windows work on the same principle.
- **Ceramic or Plastic Cup:** Ask the students whether the cup would be hotter if made of ceramic or plastic. (ceramic) Which is the better insulator? (plastic)

☑Sample Rubric For Evaluating Homes

- Follows building code _____ / 15 points
- Budget (lowest = 10 points / highest = 0 points) _____ / 10 points
- Insulation Effectiveness ($\Delta T°$)
  (greatest ΔT = highest score, lowest ΔT = lowest score) _____ / 20 points
- Aesthetics _____ / 5 points

*Assess budget and insulation effectiveness on a sliding scale. If, for example, you have 10 groups, the group that measures the greatest temperature drop will receive 10 points. The next best temperature will be awarded a 9 out of 10, and so forth.

Student Guide

✪ Challenge

You have been chosen to build a house that meets the local building code, while efficiently insulating the home in order to save the homeowners energy costs for years to come. A well insulated home will be able to maintain a different temperature than outside conditions.

❓ Question

What materials will most efficiently insulate your energy house?

Building Code

- ✓ You must have at least 1 door, at least 10 cm x 6 cm. The door must open and close.
- ✓ You must have at least 2 windows, each at least 5 cm x 5 cm. The windows must be transparent (you can see through them).
- ✓ The ceiling must be at least 5 cm above the top of the door.
- ✓ Insulation on the floor and walls cannot exceed 1 cm in thickness.
- ✓ No insulation can be exposed. All insulation must be covered by a ceiling, wall, or floor (poster board).

✔ Procedure

1. Assemble your box home so it stands up, but do not apply tape to all sides yet, as you will need to be able to install insulation. You will seal your home as the last step before you test!
2. Draw your windows and door to fit the building code requirements. These can be located on any side or face of your house.
3. Carefully cut out the windows and the door, leaving one side of the door attached. The door should remain open and unsealed. Windows will be covered with transparency paper and sealed closed. Additional doors and windows are allowed, but all must fit within the building code requirements. If you add a storm door, it also must open and close.
4. Examine your home to determine its insulation needs. Look at the materials available and read the building code thoroughly. Decide which materials you want to use and the amount you will need of each. Follow the Building Code and place the desired insulation materials in your home. Use the mailing tape as the method to secure and affix your insulation and attach wall coverings. Remember, no insulation can be exposed.
5. Seal the home with tape and utilize weather stripping as needed. You may make your roof flat or pitched, based on your desired architectural design.
6. Take your home to the desired testing area (as outlined by your teacher). Place your home so it receives equal amounts of direct light or shade. All houses tested should be in similar conditions, where possible.
7. Measure and record the temperature of your home to start. Inserting the thermometer into the home through the top of the door. Wedge the door closed so the thermometer stays inside but the door is mostly closed. Turn the thermometer on and wait 30 seconds to allow the thermometer to adjust. Record this as your starting temperature.
8. Gather the bag of ice from your teacher. Make sure the bag is sealed and place the bag flat on the floor in the center of your home. Close the door. Allow your home to stay outside for the time prescribed by your teacher. This ice will act as a "cooling unit" for your home, creating a temperature difference outside versus inside. This "cooling unit" will also help you demonstrate how well the insulation you designed does its job to hold the temperature inside. Warmer air will want to come inside and cooler air will want to escape - insulation acts like a security guard to stop this from happening. If your insulation does its job, your home will be cooler at the end of the test than the outside air when you started.
9. After the time has passed, record the temperature of your home by inserting the thermometer into the home through the top of the door. Wedge the door closed so the thermometer stays inside but the door is mostly closed. Turn the thermometer on and wait 30 seconds to allow the thermometer to adjust. Record this temperature as the final temperature.
10. Calculate the total temperature change for each home. Record observations about the ice cubes after taking your measurements. How much has melted? How much longer do you think the ice would take to melt completely? Why?

Student Guide

Data & Observations

1. Room temperature (°C): _____

2. House temperature (°C): _____

3. Difference (Δ) in temperature (°C): _____

4. If I did the activity again, I would change_____ about my house:

Conclusion

1. Analyze your home design, the insulating materials you used, and your budget. How efficient was your home at maintaining its temperature? How did your cost for materials compare to the temperature change? What would you do differently if you could design your house again? Cite evidence from your trial in your response.

2. Compare your results with other groups. What did other groups do differently and why?

Cost Sheet

AMOUNT				TOTAL COST
_____	Mailing Tape	@	$0.50 roll	_____
_____	Plastic Film	@	$0.25 each	_____
_____	Aluminum Foil	@	$0.20/meter	_____
_____	Poster Board	@	$0.50 each	_____
_____	Bubble Wrap	@	$1.00/meter	_____
_____	Cotton Batting	@	$0.75/meter	_____
_____	Padded Paper	@	$0.50/meter	_____
_____	Caulking	@	$0.01/cm	_____
_____	Weatherstripping	@	$0.01/cm	_____

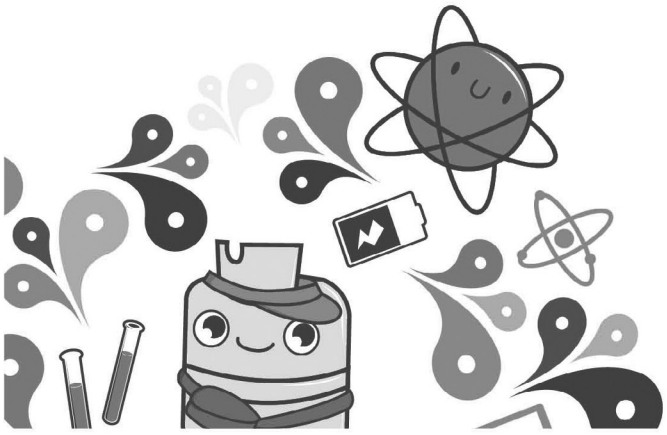
Total Cost for Materials: _____

Insulators and Conductors

YOUTH ENERGY CONFERENCE AND AWARDS

The NEED Youth Energy Conference and Awards gives students more oportunities to learn about energy and to explore energy in STEM (science, technology, engineering, and math). The annual June conference has students from across the country working in groups on an Energy Challenge designed to stretch their minds and energy knowledge. The conference culminates with the Youth Awards Ceremony recognizing student work throughout the year and during the conference.

For More Info: www.youthenergyconference.org



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.

Share Your Energy Outreach with The NEED Network!
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 are uploaded to the online submission site.

Want more info?

Check out **www.NEED.org/need-students/youth-awards/** for more application and program information, previous winners, and photos of past events.

AWESOME EXTRAS!

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

www.NEED.org/educators/awesome-extras/

Energy House Evaluation Form

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

1. Did you conduct the entire activity?	❑ Yes	❑ No
2. Were the instructions clear and easy to follow?	❑ Yes	❑ No
3. Did the activity meet your academic objectives?	❑ Yes	❑ No
4. Was the activity age appropriate?	❑ Yes	❑ No
5. Was the allotted times sufficient to conduct the activity?	❑ Yes	❑ No
6. Was the activity easy to use?	❑ Yes	❑ No
7. Was the preparation required acceptable for the activity?	❑ Yes	❑ No
8. Were the students interested and motivated?	❑ Yes	❑ No
9. Was the energy knowledge content age appropriate?	❑ Yes	❑ No
10. Would you use this activity again?	❑ Yes	❑ No

Please explain any 'no' statement below.

How would you rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor
How would your students rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor

What would make the activity more useful to you?

Other Comments:

Please fax or mail to: **The NEED Project**
8408 Kao Circle
Manassas, VA 20110
FAX: 1-800-847-1820

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NC Green Power
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Current

Past

Education

Summary

Specialties

-
-
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Education

Experience

-
-
-
-

Energy Safety

We use energy every day—many kinds of energy. Sometimes, energy can be dangerous. It is important to know the dangers and how to be safe. Here are some ways to stay safe when you are using energy.

Natural Gas Safety

We use **natural gas** to warm our homes, cook our food, and heat our water. Natural gas is burned to make heat. That means there is fire in the furnace and in the water heater. There is fire on the stove.

Fires are always dangerous. Do not play near the furnace, water heater, or stove. Never touch them unless an adult is with you.

Natural gas can also be dangerous if there is a leak. The gas company puts a special chemical odor in natural gas. It smells like rotten eggs. That smell lets you know if there is a gas leak. Your parents or your teacher can show you how it smells.

If you ever smell natural gas, tell an adult. Don't use the phone or turn on the lights. Leave your house right away. Never light a match or start a fire if there is a gas leak.

Petroleum Safety

We use **petroleum** for lots of jobs. Gasoline runs our cars and our lawn mowers. Sometimes we burn oil in our furnaces for heat. We burn kerosene in lanterns.

All of these fuels can be dangerous. You should never put them in your mouth or breathe their fumes. They also burn easily and can cause fires. Tell an adult if there is a spill and stay away from it. Don't try to clean it up yourself.

Propane Safety

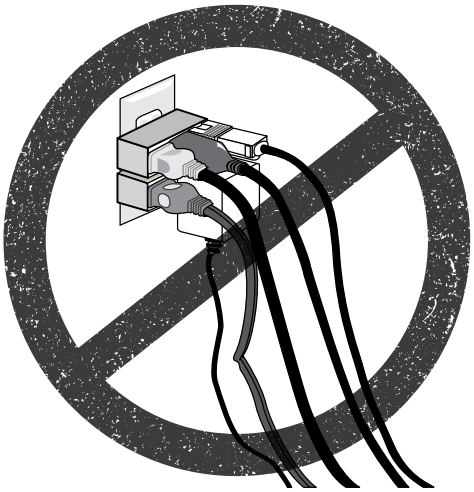
Propane is used in gas grills and on farms for heat. Propane is stored in tanks. It can be dangerous. Never touch a propane tank. If you hear propane leaking from a tank or smell gas, tell an adult and stay away. Companies add the same rotten egg odor to propane that they do to natural gas.

Electrical Safety

Electricity is amazing. It gives us heat and light, and runs **appliances**—our TVs, computers, refrigerators, hair dryers, gaming systems, and washers. Electricity can also be dangerous. It can cause fires and injuries, even death.

Here are some rules for using electricity safely:

- Don't insert anything into an outlet except a plug.
- Don't pull on the cord to unplug an appliance, hold the plug and pull.
- Dry your hands before you plug in or unplug a cord.
- If a plug is broken or a cord is cut or worn, don't use it.
- Don't plug too many cords into one outlet.
- Turn off a light or unplug it before changing a light bulb.
- Never touch the inside of an appliance while it's plugged in.



- Keep appliances away from water. Don't use a hair dryer if there's water in the sink nearby.
- If there's a big storm, turn off the TV and computer.
- Don't touch any power lines outside.
- Some power lines are buried underground. Call 811 before you dig. If you are digging and find a wire, don't touch it.
- Don't fly a kite or climb a tree near a power line.

Energy Conservation Contract

Students learn about saving energy and encourage their families to conserve in this outreach activity.

Grade Levels:

- Elem Elementary
- Int Intermediate
- Sec Secondary

Subject Areas:

- Science
- Social Studies
- Math
- Language Arts

NEED
National Energy Education Development Project

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NEED Mission Statement

The mission of The NEED Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs.

Teacher Advisory Board Statement

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

Permission to Copy

Energy Data Used in NEED Materials

NEED believes in providing the most recently reported energy data available to our teachers and students. Most statistics and data are derived from the U.S. Energy Information Administration's Annual Energy Review that is published yearly. Working in partnership with EIA, NEED includes easy to understand data in our curriculum materials. To do further research, visit the EIA website at www.eia.gov. EIA's Energy Kids site has great lessons and activities for students at www.eia.gov/kids.

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National Energy Education Development

1.800.875.5029
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Energy Conservation Contract

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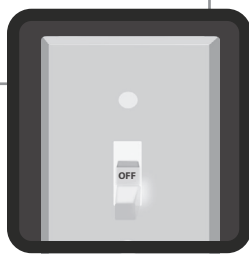


Standards Correlation Information

www.NEED.org/curriculumcorrelations

Next Generation Science Standards

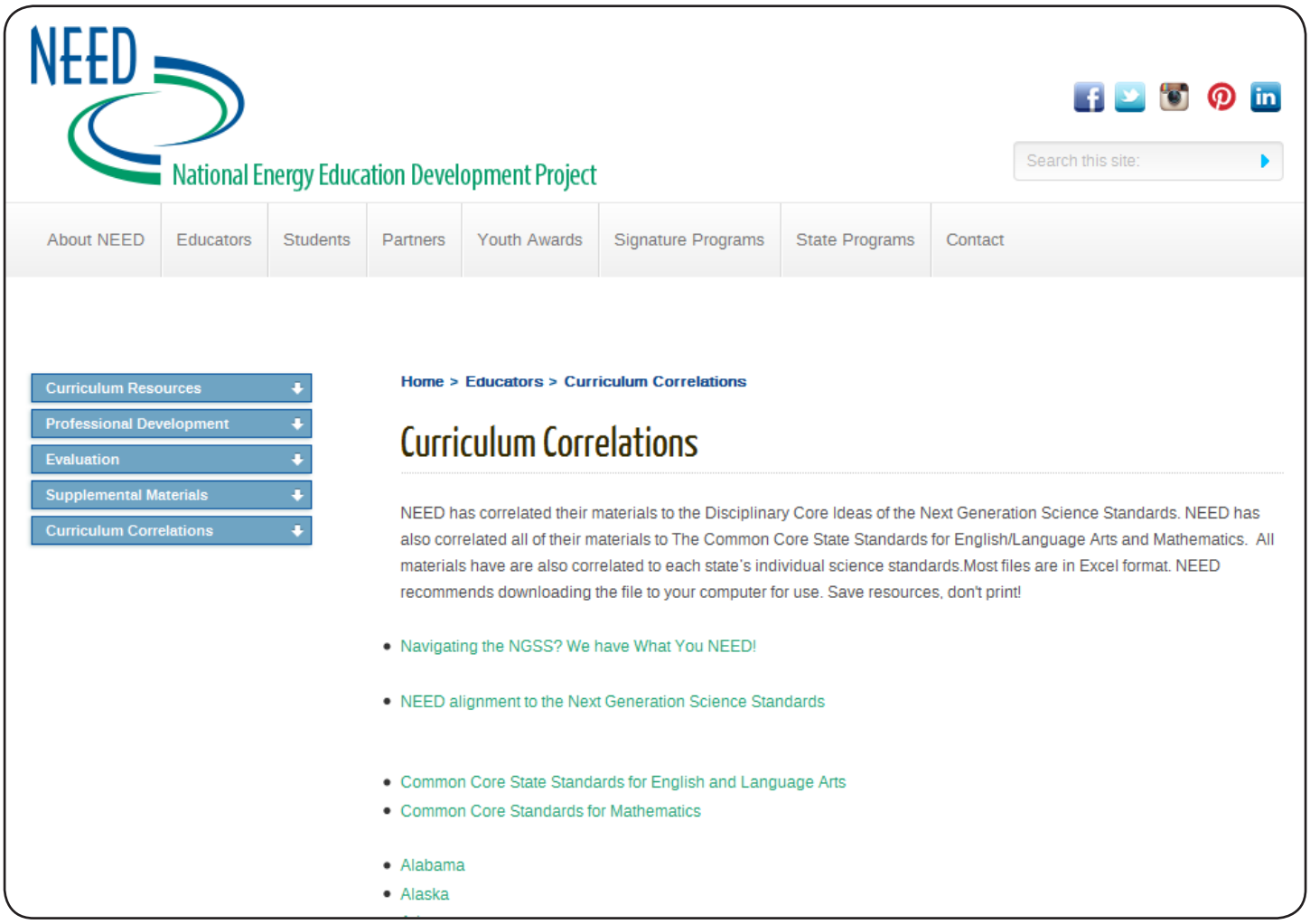
- This guide effectively supports many Next Generation Science Standards. This material can satisfy performance expectations, science and engineering practices, disciplinary core ideas, and cross cutting concepts within your required curriculum. For more details on these correlations, please visit NEED's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

Common Core State Standards

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

Individual State Science Standards

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



Teacher Guide

Background

Students discuss their energy use for daily activities with their families and educate them about energy-saving behaviors and methods, using the *Household Rating Guide*. For one month, family members are asked to make a conscious effort to reduce their energy use. When the one-month period is over, students and their families will again use the *Household Rating Guide* to estimate how much energy they saved. Students are encouraged to ask family members to sign another contract for 12 months and display the contract at home as a reminder.

Preparation

1. Prepare copies of *Energy Conservation Contract*, *Calculating Your Average Savings*, and *How Much Energy Did We Save?* to project in order to demonstrate how to enter scores and complete required calculations.
2. Make copies of the *Student Guide*, *Household Rating Guide*, *Energy Conservation Contract*, *Calculating Your Average Savings*, and *Change a Light Bingo* for each student.

Procedure

3. Introduce the concepts of efficiency and conservation by playing a quick game of *Change a Light Bingo* with your students.
4. Give each student a copy of the *Student Guide*, *Household Rating Guide*, *Energy Conservation Contract*, and *Calculating Your Energy Savings* and explain that they will use this set of worksheets to help determine their energy use and make reductions as a family.
5. Explain to students how to conduct the first discussion with their family members.
6. Fill in a sample contract with the class, making sure students know how to calculate and enter scores.
7. Give the students a set time frame, perhaps three days, in which to conduct their discussions at home. Students may leave the rating guide with their families, but must return the other forms to class. Emphasize to students that they will need to use the other forms again at the end of the month. Collect the forms after the allotted time.
8. At the end of the one-month contract period, distribute the forms again so that students can lead their families in the post-activity discussion and rating. Review the rating process and tips for holding discussions, if necessary. Again, give the student a time frame in which to complete their interviews and return the completed forms.
9. When all the reporting forms are in, calculate how much energy each participating household saved during the one-month period using the *How Much Energy Did We Save?* form.
10. Ask students to encourage their families to sign the contracts for an additional 12-month period and display the contract prominently at home to encourage energy-saving behaviors.

Assessment

- Play *Change a Light Bingo* as an assessment to close the activity.
- Assess student knowledge gain based on participation in contract activities and reductions.
- Evaluate the activity with your students using the evaluation form on page 19, and return it to NEED.

Grade Levels

- Elementary, grades 4-5
- Intermediate, grades 6-8
- Secondary, grades 9-12

Time

Two to three 45-minute class periods over a one-month period, plus homework.

Additional Resources

This contract activity is a wonderful companion piece to many of NEED's efficiency and conservation titles. These titles contain student informational text and hands-on explorations that provide the necessary background to enhance this contract activity. Download these titles from www.NEED.org to enhance your conservation activities:

- *Building Buddies*
- *Monitoring and Mentoring*
- *Saving Energy at Home and School*
- *Learning and Conserving*

Extension Activities

Be sure to let everyone know how much energy your contract projects saved! Make a chart and publicize the results in the local newspaper, your school paper, and/or a PTA bulletin. Figure out how much energy the participating households would save in one year if they continue their energy-saving behaviors. Or figure out how much energy would be saved if two or three times as many households implemented the energy-saving behaviors.

Do you want to do a super project? You can use the activities below to build students' communication, writing, geography, or math skills. Examine the activities given and pick one or more that fit your needs.

- **Press Conference** *(Skills: communication, writing)*
Involve the entire school in your contract project. Consider holding a press conference to let everyone know what the project is all about.

- **Have a VIP (principal, mayor, or congressman) sign an Energy Conservation Contract**
Brainstorm VIPs the class might be able to enlist in your efforts by signing a contract.

- **Letters to VIPs** *(Skills: writing)*
Write a letter to your congressman, the President, or someone locally. Explain what your class is doing to raise energy awareness in your community. Enclose the results of your efforts.

- **50 States Campaign** *(Skills: writing, geography)*
An interesting twist to this activity is getting contracts signed in all 50 states. Begin a long-distance learning campaign with students and teachers from across the country. Ask students to start with those they know in other states like family, friends, summer camp buddies, and pen pals.

Change a Light BINGO Instructions

Get Ready

Duplicate as many *Change a Light Bingo* sheets (found on page 17) as needed for each person in your group. In addition, decide now if you want to give the winner of your game a prize and what the prize will be.

Get Set

Pass out one *Change a Light Bingo* sheet to each member of the group.

Go

PART ONE: FILLING IN THE BINGO SHEETS

Give the group the following instructions to create bingo cards:

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

PART TWO: PLAYING BINGO

Give the class the following instructions to play the game:

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

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

Preparation

- 5 minutes

Time

- 45 minutes

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

- Biomass Bingo—*Energy Stories and More*
- Energy Bingo—*Energy Games and Icebreakers*
- Hydropower Bingo—Hydropower guides
- Hydrogen Bingo—*H_2 Educate*
- Marine Renewable Energy Bingo—*Ocean Energy*
- Nuclear Energy Bingo—Nuclear guides
- Offshore Oil and Gas Bingo—*Ocean Energy*
- Oil and Gas Bingo—Oil and Gas guides
- Science of Energy Bingo—*Science of Energy* guides
- Solar Bingo—Solar guides
- Transportation Bingo—*Transportation Fuels Infobooks*
- Wind Energy Bingo—Wind guides

▪Now you need to verify the bingo winner's results. Ask the bingo winner to call out the first person's name on his bingo run. That player then stands and the bingo winner asks him the question which he previously answered during the 20-minute session. For example, if the statement was "can name two renewable sources of energy," the player must now name two sources. If he can answer the question correctly, the bingo winner calls out the next person's name on his bingo run. However, if he does not answer the question correctly, the bingo winner does not have bingo after all and must sit down with the rest of the players. You should continue to point to players until another person yells "Bingo."

CHANGE A LIGHT BINGO ANSWERS

A. Knows the average cost per kilowatt-hour of electricity for residential customers

B. Can name two renewable energy sources

C. Has an ENERGY STAR® appliance at home

D. Knows which energy source generates the most electricity in the U.S.

E. Can name two ways to save energy at home

F. Has taken the ENERGY STAR® change a light pledge

G. Knows the perfector/patent holder of the incandescent light bulb

H. Knows how electricity is generated

I. Can explain the concept of energy efficiency

J. Uses two CFLs at home

K. Can name two reasons to use an ENERGY STAR® CFL or LED

L. Knows the significance of the ENERGY STAR® rating on appliances

M. Knows what a lumen is

N. Knows how much energy an incandescent bulb converts to wasted heat

O. Knows a greenhouse gas produced by the burning of fossil fuels

P. Knows what CFL stands for

A $0.12 national average for residential customers	**B** biomass geothermal hydropower solar wind	**C** ask for description	**D** coal
E use a programmable thermostat, use CFLs or LEDs, adjust water temperature, winterization measures, etc.	**F** ask for when/results	**G** Thomas Edison	**H** Steam, water, or wind spins a turbine, spinning a generator, producing electricity, or through PV cells
I Energy efficiency reduces overall electricity consumption by using more efficient devices	**J** ask for location in home	**K** Reduce electricity consumption (save money), lasts longer, produces less heat	**L** Shows that the appliance meets energy efficiency guidelines
M indicates the amount of light emitted by a lamp	**N** 90%	**O** carbon dioxide	**P** Compact fluorescent light bulb

Student Guide

Your task is to help your family learn how to save energy at home. You will discuss how families use energy at home, and teach them about energy conservation and efficiency technologies, techniques, and behaviors. Using the *Household Rating Guide*, you will survey your family's current energy use. You will discuss the ratings in each category, commending them on scores of 4 or 5. Scores of 3 or below indicate areas where improvements can easily be made. Ask them to make a conscious effort to save energy for the next month by signing the *Energy Conservation Contract*.

When the one-month contract period is over, you will meet with your family and conduct a second survey to determine their new Energy Conservation Rating and calculate the amount of energy saved during the contract period. Encourage family members to continue energy-saving behaviors after the project is finished.

Your class will then tally the energy saved by all participating families during the period.

Discussion #1

1. Gather your family members together and explain the goal of the project. Explain to them the importance of conserving energy and how most energy-saving changes are simple, easy to do, and save money.

2. Show your family the *Household Rating Guide* and explain the rating levels of 0 to 5 on the first five sections. Ask them to rate their household energy use honestly as you go through each section. Explain that most households have low ratings (0, 1, or 2), so there is no need to be embarrassed. If different family members have different answers, agree on an average figure for each activity. Underline or circle the family's ratings.

3. After you have finished the first five sections, explain that the last section (Living Efficiently) is a little different. It contains one-time or long-term actions that save energy and are rated with simple yes or no answers. The energy saved by each of these measures is significant.

4. At the end of the discussion, thank your family for participating and ask them to sign the Energy Conservation Pledge in the box on the bottom of the contract. Leave the *Household Rating Guide* in a convenient place so that family members can review it.

5. Calculate the average score for each section on the *Calculating Your Average Savings* worksheet and enter it in the "Rating Before" column on the *Energy Conservation Contract*.

Discussion #2 *(ONE MONTH LATER)*

1. Once again, go through the *Household Rating Guide* with your family to determine the new ratings in each section. Underline or circle the family's ratings in a different color.

NOTE: Since your family may not remember the rating from the first interview, they may give themselves a lower rating. In this case, tell them the first rating and ask if they have gotten better, worse, or are behaving the same in that category. If your family really believes they are doing less to save energy than before, record that number.

2. Calculate the average score for each section on the *Calculating Your Average Savings* worksheet and enter it in the "Rating After" column of the *Energy Conservation Contract*.

3. Calculate the Energy Conservation Units (ECUs) saved in each category and add them to find the Total Monthly Savings. Calculate the Energy Equivalents in the second chart to show your family the equivalent savings. Congratulate your family on the energy they have saved! Ask your family to keep the *Household Rating Guide* with its energy-saving tips in a prominent place, but you must keep the *Energy Conservation Contract* so that your class can make a final report. Take it back to class with you.

4. Encourage your family members to keep up their energy-saving behaviors and to implement any recommendations in the Living Efficiently section to which the answer was no. Invite them to any follow-up activities planned at your school.

Household Rating Guide

How to Rate Your Family's Energy Use

How much energy does your family use every month? Are your family members aware of the energy they use? Do they know about ways to save energy at home by changing their actions and taking simple steps to make the house more energy efficient?

This guide can help your family save energy in six energy areas:

- Home Heating and Cooling
- Water Heating
- Household Appliances and Electronics
- Lighting
- Transportation
- Living Efficiently

Start by finding your family's Household Energy Conservation Rating. First, read the statements in each energy section carefully. Decide how much or how little your family's energy use fits the statements and then rate your family's energy use by choosing a number from 0 to 5 for each statement in the first five categories.

For example, if your family never makes an effort to save energy in a category, choose 0. But if your family always makes an effort, choose 5. (If some members of your household are more energy conscious than others, choose the number you feel represents the average for your family.)

Please be honest with your responses. Do not be embarrassed if you give your family low ratings; most American households would receive ratings of 0, 1, or 2. The important thing is to honestly evaluate your current energy consumption and work to reduce it.

The Living Efficiently section deals with one time or long-term actions. Those statements are rated with simple "yes" or "no" answers. The actions listed in this section reduce energy consumption significantly and are given more weight.

At the end of the contract period, you will be rated again on your family's energy use and any energy-saving improvements your household has made.

You should know the contract rating system gives some energy conservation behaviors more weight than others. Turning down the thermostat, for example, saves more energy than turning off a light.

Household Rating Guide

Home Heating and Cooling

1. We inspect windows and doors, and make repairs as necessary, to make sure they are airtight.
Caulking and weatherstripping can deteriorate over time. 25% of home heat loss is around windows and doors.

Never 0 1 2 3 4 5 Always

2. We inspect the ductwork to make sure there are no cracks or openings.
Openings or cracks in the ducts can allow conditioned (heated or cooled) air to escape into the attic and crawl spaces.

Never 0 1 2 3 4 5 Always

3. We clean or replace system filters as recommended.
Keeping filters clean will provide more efficient heating and cooling.

Never 0 1 2 3 4 5 Always

4. In winter, we dress warmly and set the thermostat at 68 degrees or lower during the day and 60 degrees or lower at night. *Setting the thermostat back for 8 hours a day can save 10%.*

Never 0 1 2 3 4 5 Always

5. In the summer, we dress lightly and set the thermostat at 78 degrees or higher.
This temperature is considered the most comfortable for humans if fans are used to circulate the air.

Never 0 1 2 3 4 5 Always

6. We keep windows and doors closed when the heating or air conditioning system is operating.
Having windows and doors open makes your heating or air conditioning system work harder.

Never 0 1 2 3 4 5 Always

Water Heating

1. The water heater thermostat is always set at 120 degrees.
Most hot water heaters are set much higher than necessary. You can save up to 10 percent on your energy bill by setting the temperature at 120 degrees.

Never 0 1 2 3 4 5 Always

2. We inspect the insulation on our hot water tank and piping, and make repairs as necessary.
Insulation can come loose or deteriorate over time.

Never 0 1 2 3 4 5 Always

3. We use cold water whenever hot water is not necessary (e.g., washing clothes, rinsing dishes, running disposal). *Using cold water saves energy and most tasks do not require hot water.*

Never 0 1 2 3 4 5 Always

4. We take short showers and fill the tub with only the water we need.
Short showers use less energy than baths.

Never 0 1 2 3 4 5 Always

5. We fill the sink to wash dishes rather than running the water, and use the short cycle on the dishwasher.
Running water to wash dishes and long dishwasher cycles use a lot of water and energy.

Never 0 1 2 3 4 5 Always

Household Rating Guide

Household Appliances and Electronics

1. We turn off appliances and electronics, such as televisions, when not in use.
Many appliances continue to draw energy when they are in the off position.

Never 0 1 2 3 4 5 Always

2. We preheat the oven for only five minutes or not at all.
It also saves energy to cook several dishes at once to make maximum use of this concentrated heat.

Never 0 1 2 3 4 5 Always

3. When baking, we keep the oven door closed rather than opening it often to look inside and use a timer. *An open oven door lets valuable heat escape.*

Never 0 1 2 3 4 5 Always

4. Whenever possible, we use a toaster oven or microwave instead of a regular oven.
These smaller appliances save energy for most cooking jobs.

Never 0 1 2 3 4 5 Always

5. We inspect refrigerator and freezer door seals often to make sure they are airtight.
Insert a piece of paper halfway in the door. If you can pull the paper out easily, the seal is not airtight.

Never 0 1 2 3 4 5 Always

6. We use the energy-saver feature on the dishwasher, allowing the dishes to air dry.
Producing heat to dry dishes uses a lot of energy.

Never 0 1 2 3 4 5 Always

Lighting

1. We turn off indoor and outdoor lights when they are not needed.
Many people leave lights on without thinking—wasting energy.

Never 0 1 2 3 4 5 Always

2. We use natural lighting whenever we can by opening blinds/shades.
Natural lighting is free to use.

Never 0 1 2 3 4 5 Always

3. We use energy-efficient lights in garages and work areas that need lots of light.
A 40-watt fluorescent lamp provides 50-80 lumens per watt, while a 60-watt incandescent provides only 13-15 lumens per watt. You save energy and get more light from fluorescents.

Never 0 1 2 3 4 5 Always

4. We replace burned-out incandescent light bulbs with compact fluorescent (CFL) bulbs or light emitting diodes (LED).
New CFLs and LEDs fit conventional light fixtures. They are more expensive to buy, but last ten times longer and use one-fourth or less of the energy of incandescent bulbs, saving you money and energy in the long run.

Never 0 1 2 3 4 5 Always

5. We keep lamps and light fixtures clean because dirt absorbs light.
Get the best use of lighting by dusting regularly.

Never 0 1 2 3 4 5 Always

Household Rating Guide

Transportation

1. We check tire pressure regularly and keep oil and air filters clean.
Under-inflated tires decrease fuel economy by as much as one mile per gallon. Clogged filters waste gasoline.

Never 0 1 2 3 4 5 Always

2. We have the car's engine tuned regularly.
A well-tuned engine can improve gas mileage by as much as 10 percent.

Never 0 1 2 3 4 5 Always

3. We use public transportation or carpool whenever we can.
Using public transportation and carpooling saves on transportation fuel.

Never 0 1 2 3 4 5 Always

4. We avoid unnecessary trips by planning carefully.
The fewer trips you make, the less fuel you use.

Never 0 1 2 3 4 5 Always

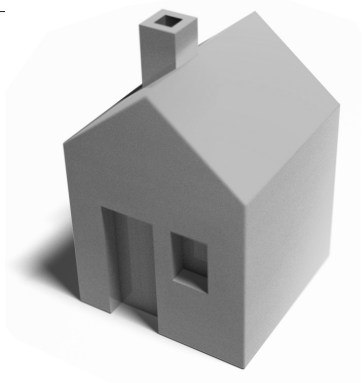
5. We do not exceed the speed limit and maintain a steady speed when driving.
Driving faster than the speed limit uses more fuel. It is more efficient to keep an even speed.

Never 0 1 2 3 4 5 Always

6. We do not let an automobile idle for more than one minute.
Less gas is used to restart an engine than to idle for more than one minute.

Never 0 1 2 3 4 5 Always

Living Efficiently



1. We have had an energy audit of our house.
Your local utility will send someone to your house to perform an audit and show you where your house is wasting energy and what you can do to correct it.

Yes No

2. We have eliminated drafts around windows and doors with caulking and weatherstripping.
Proper caulking and weatherstripping can cut fuel costs by up to 10 percent.

Yes No

3. We have the proper amount of insulation in the attic and walls.
If you need to add insulation, the cost will be returned to you in lower utility bills.

Yes No

4. We have insulated our hot water tank and piping.
A well-insulated tank can save $10-20 in energy costs over a 12-month period.

Yes No

5. We have low-flow shower heads.
These easy-to-install devices save energy and provide adequate shower pressure.

Yes No

6. When buying new appliances, we compare EnergyGuide labels and buy energy efficient models.
The most energy efficient new appliances cost a little more, but save money and energy over their operating life.

Yes No

7. When purchasing vehicles, fuel mileage is one of our most important considerations.
A fuel efficient vehicle can save thousands of dollars in fuel costs over the life of the vehicle.

Yes No

Energy Conservation Contract

Number in Household: _____

Household Energy Conservation Rating

Energy Saving Measure	Rating After	– Rating Before	= Change	X ECU* Factor	= ECUs Saved
Heating and Cooling				X 10 ECU	=
Water Heating				X 5 ECU	=
Household Appliances				X 3 ECU	=
Lighting				X 2 ECU	=
Transportation				X 10 ECU	=
Living Efficiently				X 50 ECU	=
Total Monthly Savings = Total ECUs Saved				TOTAL	

*ECU= Energy Conservation Unit - an average energy-saving unit calculated by considering the many different appliances and fuels used by homes to accomplish the tasks. The actual amount of energy saved by an individual household is difficult to measure precisely, because it depends upon the age of the house, furnace, air conditioner, appliances, and many other factors. Long-term monitoring of weather conditions and energy meters is the only method of determining actual energy savings in an individual residence.

Total ECUs Saved	Conversion	Energy Equivalent
	ECU X 100,000 BTUs	Btu
	ECU X 0.8 gallons of gas	gallon
	ECU X 1.0 Ccf natural gas	Ccf
	ECU X 10 kWh electricity	kWh

ENERGY CONSERVATION PLEDGE

We, the members of this household, agree to make a sincere effort to save energy and to learn more about energy conservation and efficiency.

_____ _____

_____ _____

_____ _____

Calculating Your Average Savings

Rating Before

HEATING/COOLING: Add the scores you circled and divide the total by six. _____

WATER HEATING: Add the scores you circled and divide the total by five. _____

APPLIANCES: Add the scores you circled and divide the total by six. _____

LIGHTING: Add the scores you circled and divide the total by five. _____

TRANSPORTATION: Add the scores you circled and divide the total by six. _____

LIVING EFFICIENTLY: Add the number of yes answers. _____

Record these average ratings on the **Energy Conservation Contract** *in the* **Rating Before** *column.*

Rating After

HEATING/COOLING: Add the scores you circled and divide the total by six. _____

WATER HEATING: Add the scores you circled and divide the total by five. _____

APPLIANCES: Add the scores you circled and divide the total by six. _____

LIGHTING: Add the scores you circled and divide the total by five. _____

TRANSPORTATION: Add the scores you circled and divide the total by six. _____

LIVING EFFICIENTLY: Add the number of yes answers. _____

Record these average ratings on the **Energy Conservation Contract** *in the* **Rating After** *column.*

How Much Energy Did We Save?

How many families signed Energy Conservation Contracts? _____

Indicate the total number of ECUs saved in each of the following categories:

Heating/Cooling _____

Water Heating _____

Appliance Use _____

Lighting _____

Transportation _____

Living Efficiently _____

Total ECUs saved in all categories (add above numbers for total) _____

Energy Projections

How much energy would the families save if they continue the energy-saving measures for one year?

_____

How much energy would your community save if the following number of homes practiced the measures outlined in the *Household Rating Guide*?

500 _____

1,000 _____

5,000 _____

CHANGE A LIGHT BINGO

A. Knows the average cost per kilowatt-hour of electricity for residential customers

B. Can name two renewable energy sources

C. Has an ENERGY STAR® appliance at home

D. Knows which energy source generates the most electricity in the U.S.

E. Can name two ways to save energy at home

F. Has taken the ENERGY STAR® change a light pledge

G. Knows the perfector/patent holder of the incandescent light bulb

H. Knows how electricity is generated

I. Can explain the concept of energy efficiency

J. Uses two CFLs at home

K. Can name two reasons to use an ENERGY STAR® CFL or LED

L. Knows the significance of the ENERGY STAR® rating on appliances

M. Knows what a lumen is

N. Knows how much energy an incandescent bulb converts to wasted heat

O. Knows a greenhouse gas produced by the burning of fossil fuels

P. Knows what CFL stands for

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

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** for more application and program information, previous winners, and photos of past events.

Energy Conservation Contract Evaluation Form

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

1. Did you conduct the entire activity?	❑ Yes	❑ No
2. Were the instructions clear and easy to follow?	❑ Yes	❑ No
3. Did the activity meet your academic objectives?	❑ Yes	❑ No
4. Was the activity age appropriate?	❑ Yes	❑ No
5. Was the allotted time sufficient to conduct the activity?	❑ Yes	❑ No
6. Was the activity easy to use?	❑ Yes	❑ No
7. Was the preparation required acceptable for the activity?	❑ Yes	❑ No
8. Were the students interested and motivated?	❑ Yes	❑ No
9. Was the energy knowledge content age appropriate?	❑ Yes	❑ No
10. Would you teach this activity again? *Please explain any 'no' statement below*	❑ Yes	❑ No

How would you rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor
How would your students rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor

What would make the activity more useful to you?

Other Comments:

Please fax or mail to: **The NEED Project**
8408 Kao Circle
Manassas, VA 20110
FAX: 1-800-847-1820

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Harvard Petroleum
Hawaii Energy
Houston Museum of Natural Science
Idaho Power
Idaho National Laboratory
Illinois Clean Energy Community Foundation
Independent Petroleum Association of America
Independent Petroleum Association of New Mexico
Indiana Michigan Power – An AEP Company
Interstate Renewable Energy Council
James Madison University
Kentucky Clean Fuels Coalition
Kentucky Department of Education
Kentucky Department of Energy Development and Independence
Kentucky Power – An AEP Company
Kentucky River Properties LLC
Kentucky Utilities Company
Kinder Morgan
Leidos
Linn County Rural Electric Cooperative
Llano Land and Exploration
Louisiana State University Cooperative Extension
Louisville Gas and Electric Company
Maine Energy Education Project
Massachusetts Division of Energy Resources
Michigan Oil and Gas Producers Education Foundation
Miller Energy
Mississippi Development Authority–Energy Division
Mojave Environmental Education Consortium
Mojave Unified School District
Montana Energy Education Council
NASA
National Association of State Energy Officials
National Fuel
National Grid
National Hydropower Association
National Ocean Industries Association
National Renewable Energy Laboratory
Nebraska Public Power District
New Mexico Oil Corporation
New Mexico Landman's Association
Nicor Gas – An AGL Resources Company
Northern Rivers Family Services
North Shore Gas
NRG Energy, Inc.
Offshore Energy Center
Offshore Technology Conference
Ohio Energy Project
Opterra Energy
Oxnard School District
Pacific Gas and Electric Company
Paxton Resources
PECO
Pecos Valley Energy Committee
Peoples Gas
Petroleum Equipment and Services Association
Phillips 66
PNM
Providence Public Schools
Read & Stevens, Inc.
Renewable Energy Alaska Project
Rhode Island Office of Energy Resources
River Parishes Community College
RiverQuest
Robert Armstrong
Roswell Geological Society
Salt River Project
Sandia National Laboratory
Saudi Aramco
Science Museum of Virginia
C.T. Seaver Trust
Shell
Shell Chemicals
Society of Petroleum Engineers
Society of Petroleum Engineers – Middle East, North Africa and South Asia
David Sorenson
Southern Company
Space Sciences Laboratory of the University of California Berkeley
Tennessee Department of Economic and Community Development–Energy Division
Tioga Energy
Toyota
Tri-State Generation and Transmission
TXU Energy
United States Energy Association
University of Georgia
United Way of Greater Philadelphia and Southern New Jersey
University of Nevada–Las Vegas, NV
University of North Carolina
University of Tennessee
University of Texas - Austin
University of Texas - Tyler
U.S. Department of Energy
U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy–Wind for Schools
U.S. Department of the Interior–Bureau of Land Management
U.S. Energy Information Administration
West Bay Exploration
West Virginia State University
Yates Petroleum Corporation

Energy Expos

Students work in groups to develop hands-on exhibits and make presentations to teach others about energy sources, energy conservation, and transportation fuels.

Grade Levels:

- Elem Elementary
- Int Intermediate
- Sec Secondary

Subject Areas:

- Science
- Social Studies
- Language Arts
- Technology
- Public Speaking

NEED
National Energy Education Development Project

Teacher Advisory Board

NEED Mission Statement

The mission of The NEED Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs.

Permission to Copy

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.

National Energy Education Development

1.800.875.5029
www.NEED.org

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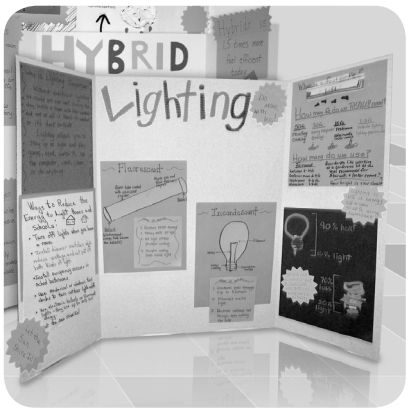


Energy Expos

Table of Contents

Standards Correlation Information

www.NEED.org/curriculumcorrelations

Next Generation Science Standards

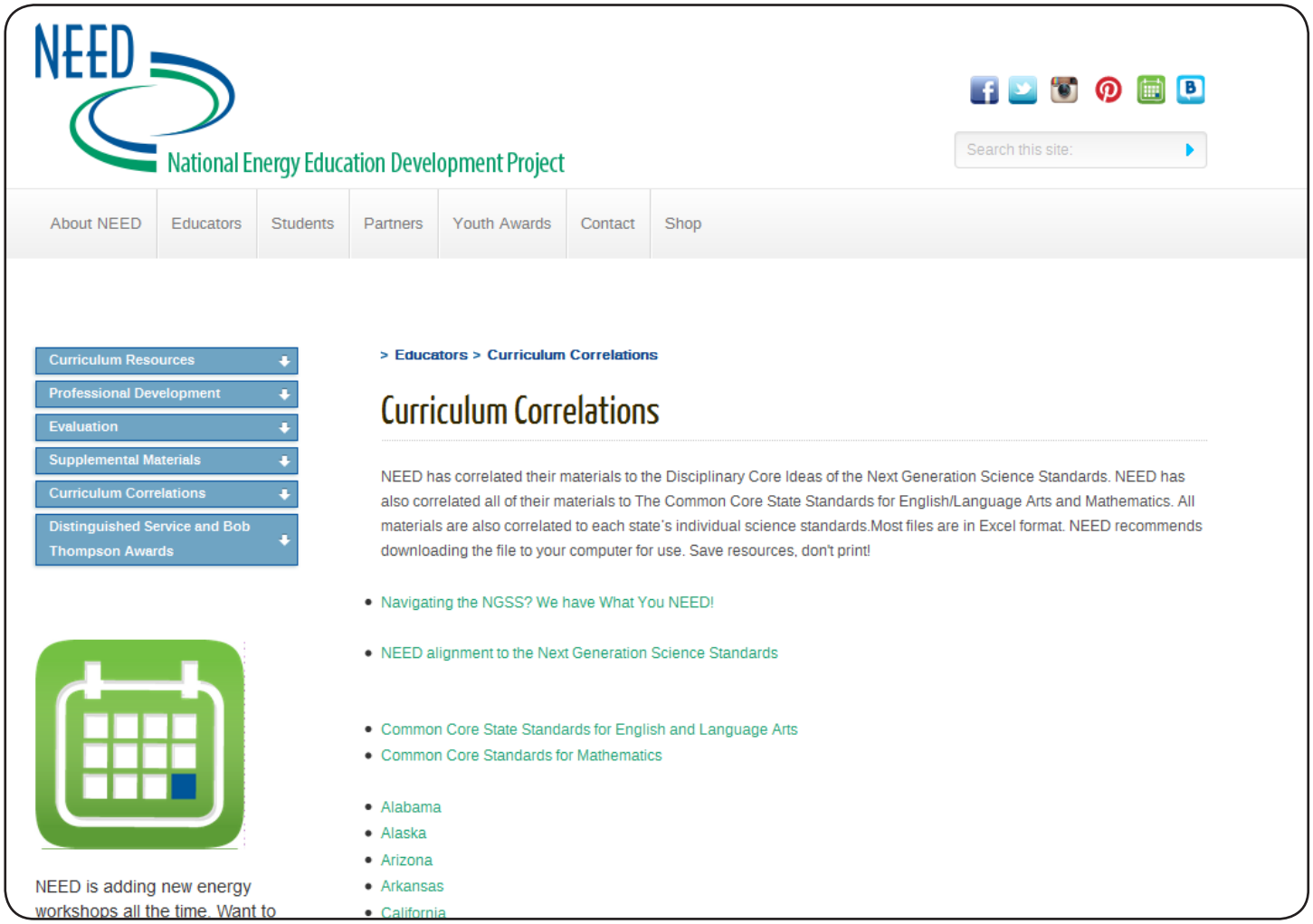
- This guide effectively supports many Next Generation Science Standards. This material can satisfy performance expectations, science and engineering practices, disciplinary core ideas, and cross cutting concepts within your required curriculum. For more details on these correlations, please visit NEED's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

Common Core State Standards

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

Individual State Science Standards

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



Teacher Guide

Background

Energy Expos is a cooperative learning activity designed to complement The National Energy Education Development (NEED) Project's existing curricula, *Energy Infobooks, Transportation Fuels Infobooks, Monitoring and Mentoring,* and *Learning and Conserving*. Using information from these resources, students will create exhibits to teach others about their energy topic.

Objectives

- Students will work in groups to create and present exhibits on energy sources, saving energy, or transportation fuels.
- Students will use reading, writing, researching, public speaking, art, technology, and critical thinking skills to create projects.
- Students will be able to list and describe key information about each topic.

Materials

- Art supplies
- Exhibit boards (optional)
- Internet access (optional)

Exhibit Topic

Energy Expos are divided into three topics: Energy Sources, Saving Energy, and Transportation Fuels. Use the guide below to determine which exhibits you would like your students to create.

ENERGY SOURCE EXHIBIT	SAVING ENERGY EXHIBIT	TRANSPORTATION FUELS EXHIBIT
Introduction to Energy, page 11	Energy Consumption in the U.S., page 23	Petroleum Fuels—Gasoline and Diesel, page 32
Petroleum, page 12	Why Saving Energy is Important, page 24	Biodiesel, page 33
Natural Gas, page 13	Heating, page 25	Ethanol, page 34
Coal, page 14	Cooling, page 26	Hydrogen, page 35
Propane, page 15	Lighting, page 27	Electricity, page 36
Uranium, page 16	Water Heating, page 28	Hybrid Electric, page 37
Hydropower, page 17	Electrical Devices and Appliances, page 29	Propane, page 38
Biomass, page 18	Taking Care of Trash, page 30	CNG/LNG, page 39
Solar, page 19		
Wind , page 20		
Geothermal, page 21		

Grade Levels

This activity is designed for students in grades 4-12.

Time

4-10 hours

Technology Integration

In addition to, or instead of, having students produce physical exhibits, have students create multimedia presentations using the technology available in your school.

For electronic images from NEED's materials, visit www.NEED.org.

Preparation

1. Divide students into groups of 2-4. Assign students to groups based on the exhibit topics you are focusing on, as listed on page 5.
2. Make an informational packet for each exhibit. Put all of the materials in a folder and label it with the exhibit's topic. Each folder should include relevant items from the chart below. However, students may also be required to research their own information. A list of online resources can be found on pages 8-9 to supplement informational packets, or to direct your students to further their research.

	ENERGY SOURCES	SAVING ENERGY	TRANSPORTATION FUELS
Grades 4-5 (one copy per student)	*Elementary Energy Infobook*	*Elementary Energy Infobook* *Monitoring and Mentoring*	*Elementary Transportation Fuels Infobook*
Grades 6-8 (one copy per student)	*Intermediate Energy Infobook*	*Intermediate Energy Infobook* *Monitoring and Mentoring*	*Transportation Fuels Infobook*
Grades 9-12 (one copy per student)	*Secondary Energy Infobook*	*Secondary Energy Infobook* *Learning and Conserving*	*Transportation Fuels Infobook*
All Grades	Exhibit Student Guide (one copy per student per group) Any special materials and/or resources you have on the topic/ source		

3. Depending on the level of your students, guided exhibit questions can be downloaded from www.NEED.org. These questions may help your students maintain focus during their work. These question sheets can make excellent additions to each group's informational packet.
4. Collect supplies and other materials, including the following:
   - one exhibit board for each group (optional);
   - contruction paper and posterboard; and
   - colored markers, crayons, paints, etc.

Day 1

1. Introduce the activity to the students. Reference NEED's *Energy Infobooks*, as needed, to enhance introductory discussion. Topics to cover in your introduction include:
   - A general overview of the role of energy in our lives and the importance of using many energy sources to meet our energy needs.
   - The concept that all energy sources have advantages and disadvantages.
   - A review of how students should work together in small groups and a timetable for working on the exhibits.
2. Divide the students into their groups and assign their topics. Hand out the folders.
3. Review the Student Guide format and the information in the folders with the students.

   Explain the grading rubric with a total of 40 possible points as follows:

5 = Excellent	Total points 36-40 Excellent (A)
4 = Very Good	Total points 31-35 Very Good (B)
3 = Satisfactory	Total points 24-30 Satisfactory (C)
2 = Fair	Total points 20-23 Fair (D)
1 = Poor	Total points < 20 Poor (F)

4. Have students begin working on their assignments. Remind students that they will present their topic to the whole group. Have the groups obtain teacher approval of their lists and scripts before they proceed to the next step.

Day 2

1. Monitor group work. Students should complete Steps 2 and 3 on their Student Guide and begin working on Step 4.
2. Check work product. At the end of the assigned time, check each group's script.
3. Take a few minutes to review the schedule of presentations for Day 4 (and/or Day 5, if you determine that the students need more time).

Day 3

1. Monitor group work. Students complete Step 4 on the Student Guide.
2. Check work product. Make sure that students are ready to make presentations on Day 4 (and/or Day 5, if you determine that the students need more time).

Day 4 (and 5 if necessary)

1. Set up exhibits.
2. Students give presentations.
3. Evaluate student performance using the rubric above, or create your own.

Extension/Outreach

1. Invite other classes in to visit your expo or take your expo to other schools.
2. Put on a presentation for the PTA.
3. **To encourage student engagement, give students the opportunity to act as judges for the expo. Provide students with a rubric, or create one as a class. Set up the classroom as a museum walk.**

Language Arts Extension

The NEED web site has links to many different energy organizations, including the ones listed on the following pages. These organizations can provide supplemental resource materials on energy or a specific energy source. As a language arts activity, consider having your students write to these organizations for additional information a few weeks before you begin the activity.

Internet Resources

Alliance to Save Energy
http://ase.org

American Coal Foundation
http://teachcoal.org

American Electric Power
www.aep.com

American Geological Institute (AGI)
www.americangeosciences.org

American Solar Energy Society
www.ases.org

American Wind Energy Association
www.awea.org

BP
www.bp.com

Bureau of Ocean Energy Management
www.boem.gov

California Energy Commission
www.energy.ca.gov

California Energy Commission Energy Quest Student Website
www.energyquest.ca.gov

Columbia Par Car
www.parcar.com

DaimlerChrysler
www.fleet.chrysler.com

Diesel Technology Forum
www.dieselforum.org

Electric Drive Transportation Association
www.electricdrive.org

Energy Hog Campaign
www.energyhog.org

Florida Solar Energy Center (FSEC)
www.fsec.ucf.edu/en

Ford
www.fleet.ford.com

General Motors
www.gmfleet.com/overview/fuel-efficiency.html

Geothermal Education Office
http://geothermal.marin.org

Governors' Biofuels Coalition
www.governorsbiofuelscoalition.org

Griffin Industries
www.biog3000.com

Honda
www.honda.com

Independent Petroleum Association of America
www.ipaa.org

International Research Center for Energy and Economic Development
www.iceed.org

Jefferson County Air Pollution Control District
www.louisvilleky.gov/APCD

Kentucky Clean Fuels Coalition
www.kentuckycleanfuels.org

Kentucky Department for Energy Development and Independence
www.energy.ky.gov

Kentucky Propane Gas Association
www.kypropane.org

Kentucky Soybean Board
www.kysoy.org

Kentucky Transportation Cabinet
http://transportation.ky.gov

Mineral Education Coalition
www.mineraleducationcoalition.org

Continued on next page >

Internet Resources (cont'd)

National Biodiesel Board
www.biodiesel.org

National Hydropower Association
www.hydro.org

National Ocean Industries Association
www.noia.org

Northeast Sustainable Energy Association
www.NESEA.org

Nuclear Energy Institute
www.nei.org

Regional Clean Air Program
www.doyourshare.org

Renewable Fuels Association
www.ethanolrfa.org

Shell Oil Company
www.shell.us

Suburban Propane
www.suburbanpropane.com

Toyota
www.toyota.com

Transit Authority of River City
www.ridetarc.org

U.S. Department of Energy
http://energy.gov

U.S. Department of Energy
Alternative Fuels Data Center
www.afdc.energy.gov

U.S. Department of Energy
Vehicles Program
http://energy.gov/public-services/vehicles/

U.S. Department of Energy
Energy Efficiency and Renewable Energy
www.eere.energy.gov

U.S. Department of Energy
Energy Savers
http://energy.gov/energysaver/energy-saver

U.S. Department of Energy
Fuel Cell Technologies Office
www1.eere.energy.gov/hydrogenandfuelcells

U.S. Department of Energy
National Renewable Energy Laboratory
www.nrel.gov

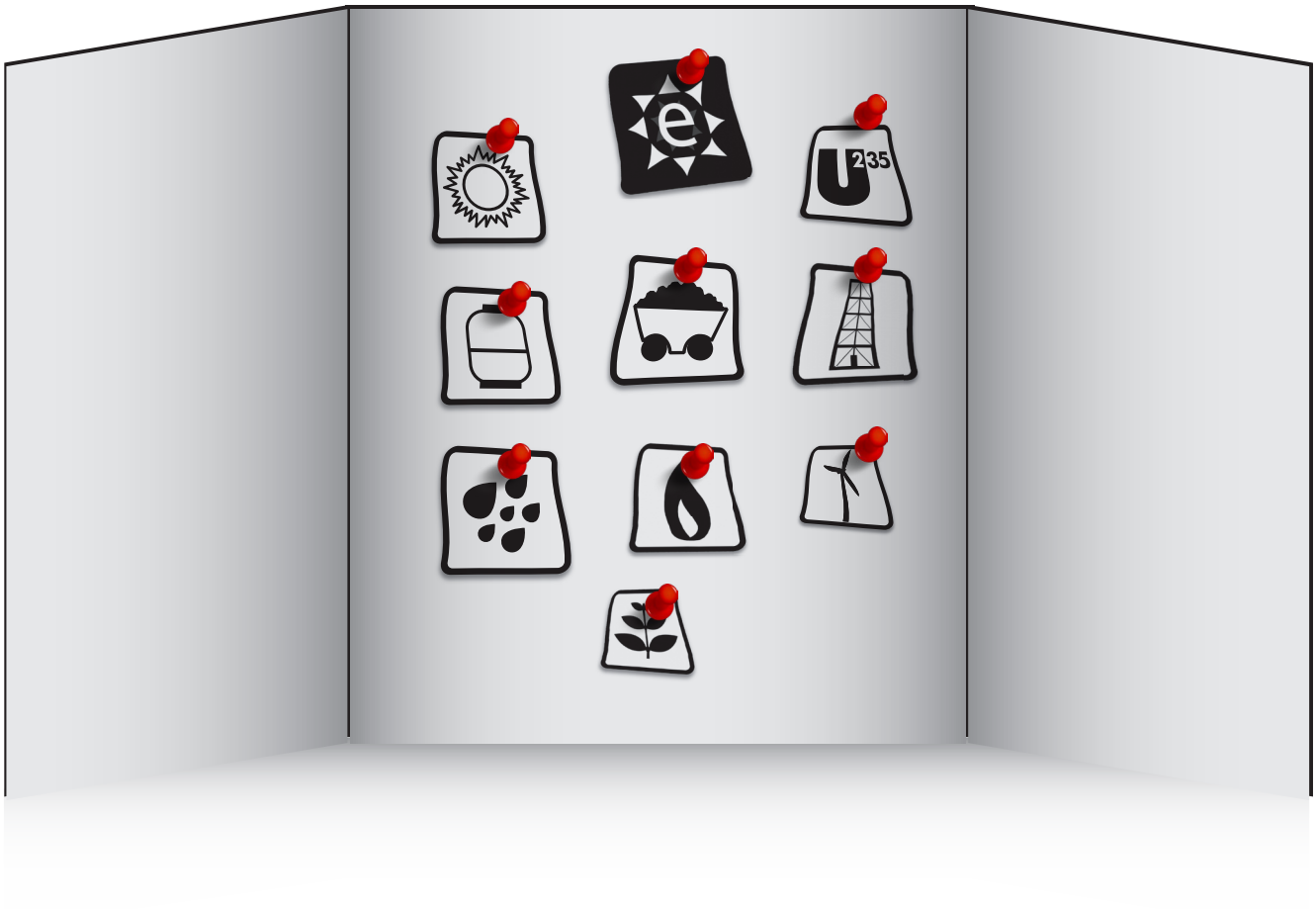
U.S. Department of Energy
U.S. Energy Information Administration
www.eia.gov

U.S. Department of Energy
U.S. Energy Information Administration, Energy Kids
www.eia.gov/kids

U.S. Department of Energy and
U.S. Environmental Protection Agency
ENERGY STAR
www.energystar.gov

U.S. Department of Energy and
U.S. Environmental Protection Agency
Fuel Economy
www.fueleconomy.gov

U.S. Environmental Protection Agency
www.epa.gov



STUDENT GUIDE TO CREATING AN ENERGY EXHIBIT

Energy Source Exhibits

Introduction to Energy
Energy Source Exhibit 1

Step 1: Learn About Energy

1. Read about your topic in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is energy?
- What does energy do?
- What do we use energy for in the United States?
- What energy sources do we use in the United States?
- What do renewable and nonrenewable mean?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display items or pictures that show what energy does—a toy car, a flashlight, a small plant, a calculator, a radio, etc.
- Pour water back and forth between two cups to show renewable energy and have small crackers to eat to show nonrenewable.
- Make posters of the ways we use energy and the energy sources we use.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Petroleum
Energy Source Exhibit 2

Step 1: Learn About Petroleum

1. Read about petroleum in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How was petroleum formed? Where do we find it?
- Is petroleum renewable or nonrenewable?
- How do we get petroleum? How do we move it?
- How do we use petroleum?
- How does using petroleum affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display things, or pictures of things, that are made with petroleum—plastics, clothes, medicines, etc.
- Make a colorful graph of petroleum uses.
- Make a diagram or model of a drilling rig.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Natural Gas
Energy Source Exhibit 3

Step 1: Learn About Natural Gas

1. Read about natural gas in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How was natural gas formed? Where do we find it?
- Is natural gas renewable or nonrenewable?
- How do we get natural gas? How do we move it?
- How do we use natural gas?
- How does using natural gas affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display pictures of things that use natural gas—stove, furnace, water heater, etc.
- Make a colorful graph of natural gas uses.
- Make a map of where natural gas is found in the United States.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Coal
Energy Source Exhibit 4

Step 1: Learn About Coal

1. Read about coal in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How was coal formed? Where do we find it?
- Is coal renewable or nonrenewable?
- How do we get coal? How do we move it?
- How do we use coal?
- How does using coal affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display pieces of different kinds of coal.
- Make diagrams of underground and surface mines.
- Display pictures of coal miners and machines.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Propane
Energy Source Exhibit 5

Step 1: Learn About Propane

1. Read about propane in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How was propane formed? Where do we find it?
- Is propane renewable or nonrenewable?
- How do we get propane? How do we move it?
- How do we use propane?
- How does using propane affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display pictures of things that use propane—grill, hot air balloon, farm, etc.
- Make two containers that show the volume of propane as a liquid and as a gas.
- Make a list of ways to use propane safely.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Uranium
Energy Source Exhibit 6

Step 1: Learn About Uranium

1. Read about uranium in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is uranium? Where do we find it?
- Is uranium renewable or nonrenewable?
- How do we use uranium?
- What is radiation? How can it help and hurt us?
- How does using uranium in a power plant affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a model of an atom showing protons, neutrons, and electrons.
- Make a diagram showing how we use uranium.
- Take a survey of the parents of students in the class to see how many think nuclear power is a good way to make the electricity we need. Display a graph of the results.
- Make a map showing where the nuclear power plants are in the U.S. or in your state.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Hydropower
Energy Source Exhibit 7

Step 1: Learn About Hydropower

1. Read about hydropower in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is the water cycle?
- Is hydropower renewable or nonrenewable?
- How do we capture the power in moving water?
- How do we use hydropower?
- How does using hydropower affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a water wheel to show the power in water.
- Make a colorful diagram of the water cycle.
- Make a diagram or model of how a hydropower dam works.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Biomass
Energy Source Exhibit 8

Step 1: Learn About Biomass

1. Read about biomass in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is biomass?
- Is biomass renewable or nonrenewable?
- How do we make biomass?
- How do we use biomass?
- How does using biomass affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display different kinds of biomass—paper, wood, garbage, etc.
- Make a colorful graph of biomass uses.
- Mix some juice and yeast in a ziplock bag to show how biomass can produce a gas.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Solar
Energy Source Exhibit 9

Step 1: Learn About Solar Energy

1. Read about solar energy in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How is solar energy made?
- Is solar energy renewable or nonrenewable?
- How do we harness solar energy?
- What other energy sources depend on solar energy?
- How does using solar energy affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display a solar cell or a solar calculator.
- Make a colorful poster of solar energy uses.
- Make a simple solar oven to show how you can cook with solar energy.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

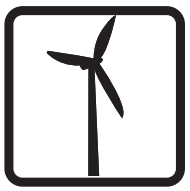
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



Wind
Energy Source Exhibit 10

Step 1: Learn About Wind Energy

1. Read about wind energy in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How is wind formed?
- Is wind energy renewable or nonrenewable?
- How do we capture the energy in wind?
- How do we use wind energy?
- How does using wind affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display pictures of windmills and wind turbines.
- Make a colorful diagram of how wind is made.
- Make a pinwheel to show how wind energy works.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Geothermal
Energy Source Exhibit 11

Step 1: Learn About Geothermal Energy

1. Read about geothermal energy in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How is geothermal energy made? Where do we find it?
- Is geothermal energy renewable or nonrenewable?
- How do we capture geothermal energy?
- How do we use geothermal energy?
- How does using geothermal energy affect the environment?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display pictures of things that show geothermal energy—volcano, Old Faithful, hot springs, etc.
- Make a display of the Earth out of clay, showing the Earth's layers.
- Make a diagram of how a geothermal power plant or heat pump works.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

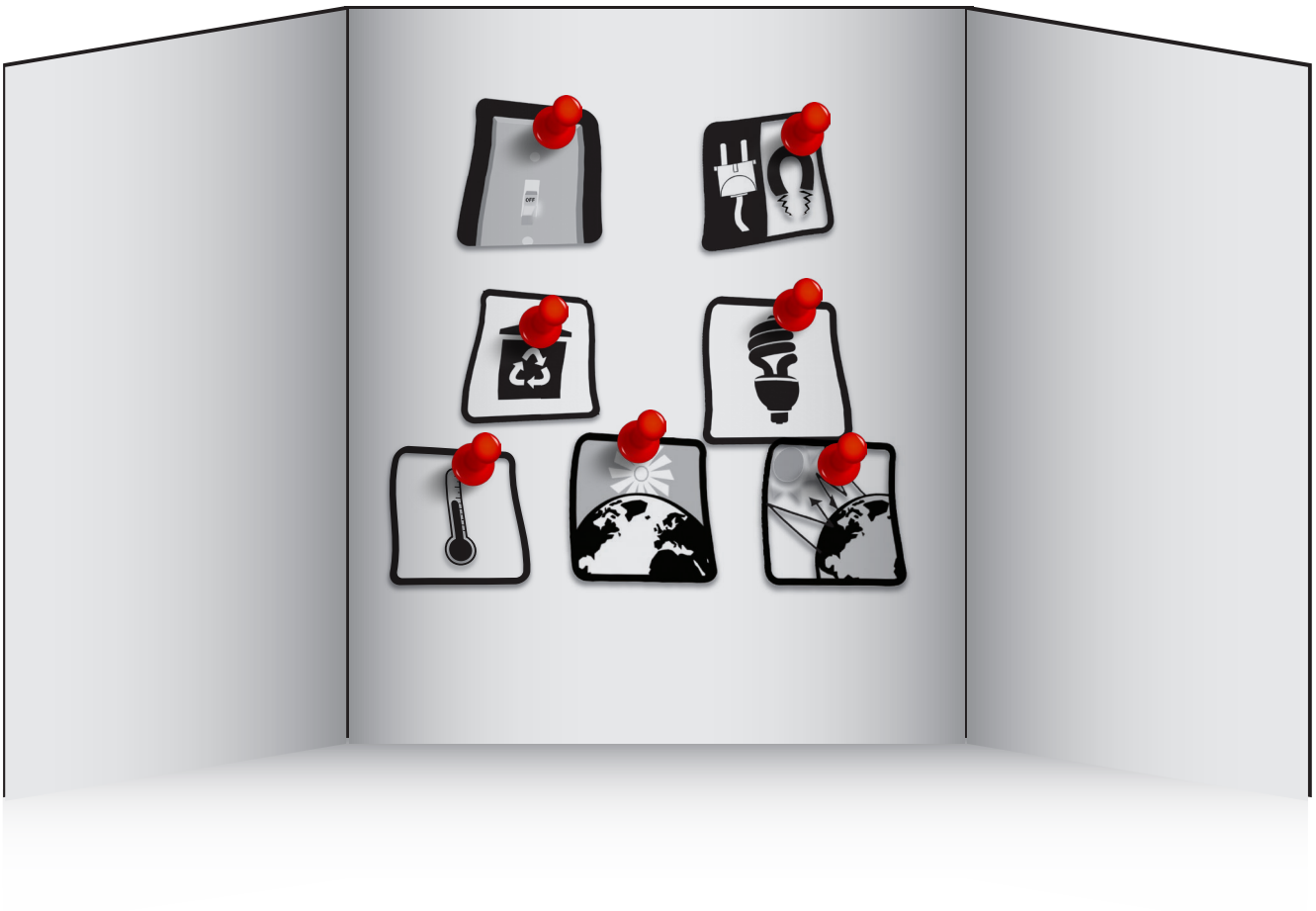
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



STUDENT GUIDE TO CREATING AN ENERGY EXHIBIT

Saving Energy Exhibits

Energy Consumption in the U.S.
Saving Energy Exhibit 1

Step 1: Learn About Energy Consumption

1. Read about energy consumption in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How much energy do we use in the U.S.?
- How does energy consumption in the U.S. compare to that of other countries?
- What are the sectors of the economy and how much energy do they use?
- What are the main tasks for which we use energy?
- What are the advantages and disadvantages of U.S. energy consumption?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make graphs of U.S. population and U.S. energy consumption.
- Make a poster explaining the sectors of the economy and how they use energy.
- Display objects that use energy even when they are turned off.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Why Saving Energy is Important
Saving Energy Exhibit 2

Step 1: Learn About Saving Energy

1. Read about saving energy in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How much of each energy source does the U.S. use?
- What is the percentage of renewable and nonrenewable energy use?
- What are the environmental impacts of U.S. energy consumption?
- What are the economic impacts of U.S. energy consumption?
- Why is it important for the U.S. to conserve energy?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a diagram of how much of each energy source we use.
- Display utility bills for electricity and natural gas.
- Draw a map showing possible impacts of global warming on low lying areas.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Heating
Saving Energy Exhibit 3

Step 1: Learn About Heating

1. Read about heating in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- Why do we heat buildings and to what temperatures should we heat them?
- What devices do we use to heat buildings and what fuels do they use?
- How much energy does heating buildings consume?
- How is energy wasted when heating buildings?
- How can we conserve energy when heating buildings?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display different types of insulation.
- Display caulking and weatherstripping.
- Make a poster showing where heat escapes in the typical house.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

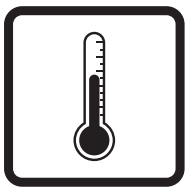
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



Cooling
Saving Energy Exhibit 4

Step 1: Learn About Cooling

1. Read about cooling in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- Why do we cool buildings and to what temperatures should we cool them?
- What devices do we use to cool buildings and how are they powered?
- How much energy does cooling buildings consume?
- How is energy wasted when cooling buildings?
- How can we conserve energy when cooling buildings?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display a programmable thermostat and explain how it can save energy.
- Demonstrate how a fan can make people feel cooler.
- Display pictures of other alternatives to air conditioners.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Lighting
Saving Energy Exhibit 5

Step 1: Learn About Lighting

1. Read about lighting in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- Why is lighting important?
- What types of lighting are used in homes and schools?
- What is the energy consumption of different lights?
- How much light is needed for different tasks—reading, television, security?
- How can we reduce the energy used to light homes and schools?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Compare life cycle costs of incandescent, fluorescent, and LED lights.
- Display the optimum light levels for different tasks.
- Demonstrate the use of daylight to reduce artificial lighting use.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

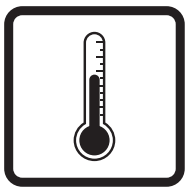
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



Water Heating
Saving Energy Exhibit 6

Step 1: Learn About Water Heating

1. Read about water heating in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- Why is hot water important?
- What methods and energy sources do we use to heat water?
- How hot should water be to perform different tasks?
- How do we waste hot water?
- How can we save energy when heating water?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a poster showing important uses of hot water.
- Make a chart showing the optimum temperature for different tasks that need hot water.
- Make a hot water DO and DON'T chart.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Electrical Devices and Appliances
Saving Energy Exhibit 7

Step 1: Learn About Electrical Devices and Appliances

1. Read about electrical devices and appliances in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What energy sources generate electricity in the U.S.?
- Why is electricity important to the U.S. economy and individuals?
- How is electricity measured and how much does it cost?
- How do electrical devices and appliances waste energy?
- How can we save energy when using electrical devices and appliances?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a diagram showing how electricity is generated.
- Display devices that use energy even when they are turned off.
- Make a display showing how to read EnergyGuide Labels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Taking Care of Trash
Saving Energy Exhibit 8

Step 1: Learn About Trash and Energy

1. Read about trash and energy in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How is trash part of the energy picture?
- How much trash does the typical American generate compared to people in other countries?
- How do we dispose of our trash in the U.S.?
- How is energy wasted in trash disposal?
- How can we save energy when disposing of our trash?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display different kinds of trash and explain its energy content.
- Make a poster showing how reducing, reusing, repairing, and recycling can save energy.
- Show how landfills can produce methane gas for energy use.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

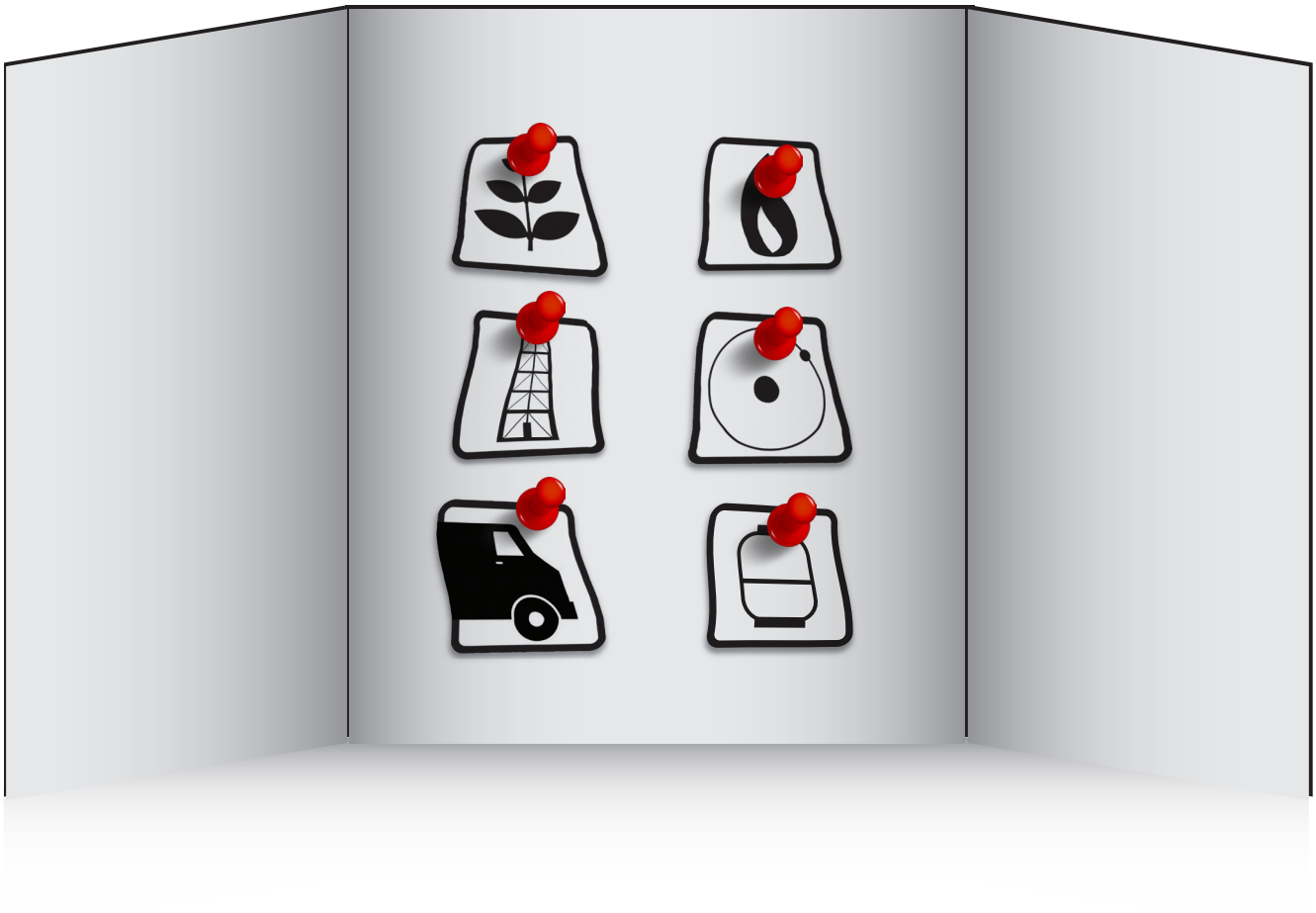
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



STUDENT GUIDE TO CREATING AN ENERGY EXHIBIT

Transportation Fuels Exhibits

Petroleum Fuels—Gasoline and Diesel

Transportation Fuels Exhibit 1

Step 1: Learn About Petroleum Fuels

1. Read about petroleum fuels in your *Transportation Fuels Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What are gasoline and diesel?
- How are gasoline and diesel produced and distributed?
- What are some vehicles that use gasoline and diesel?
- What are the environmental impacts of gasoline and diesel?
- What is the economic impact of gasoline and diesel?
- What challenges are there when considering the use of other fuels in place of gasoline and diesel?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a poster showing how petroleum fuels are produced.
- Display a chart showing the advantages and disadvantages of using gasoline and diesel.
- Show pictures/models of vehicles that use gasoline and diesel.
- Draw a diagram comparing petroleum fuels to other fuels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Biodiesel
Transportation Fuels Exhibit 2

Step 1: Learn About Biodiesel

1. Read about biodiesel in your *Transportation Fuels Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is biodiesel?
- How is biodiesel produced and distributed?
- What are some vehicles that use biodiesel?
- What is the environmental impact of biodiesel?
- What is the economic impact of biodiesel?
- What are the challenges to widespread use?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a poster showing how biodiesel is produced.
- Display a chart showing the advantages and disadvantages of using biodiesel.
- Show pictures/models of vehicles that use biodiesel.
- Draw a diagram comparing biodiesel to other fuels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Ethanol
Transportation Fuels Exhibit 3

Step 1: Learn About Ethanol

1. Read about ethanol in your *Transportation Fuels Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is ethanol?
- How is ethanol produced and distributed? What is the difference between E10 and E85?
- What vehicles use ethanol (E85)?
- What are the environmental impacts of ethanol?
- What are the economic impacts of ethanol?
- What are the challenges to widespread use?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a poster showing how ethanol is produced.
- Display a chart showing the advantages and disadvantages of using ethanol.
- Show pictures/models of vehicles that use ethanol (E85).
- Draw a diagram comparing ethanol to other fuels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Hydrogen
Transportation Fuels Exhibit 4

Step 1: Learn About Hydrogen

1. Read about hydrogen in your *Transportation Fuels Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is hydrogen?
- How is hydrogen produced and distributed?
- What vehicles use hydrogen?
- What are the environmental impacts of hydrogen?
- What is the economic impact of hydrogen?
- What are the challenges to widespread use?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a poster showing how hydrogen is produced.
- Display a chart showing the advantages and disadvantages of using hydrogen.
- Show pictures/models of vehicles that use hydrogen.
- Draw a diagram comparing hydrogen to other fuels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Electricity
Transportation Fuels Exhibit 5

Step 1: Learn About Electricity

1. Read about electric vehicles in your *Transportation Fuels Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is electricity?
- How is electricity produced and distributed?
- What vehicles use electricity?
- What are the environmental impacts of electricity fueled vehicles?
- What is the economic impact of electricity fueled vehicles?
- What are challenges to widespread use?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a poster showing how electricity is produced.
- Display a chart showing advantages and disadvantages of electricity fueled vehicles.
- Find pictures/models of vehicles that use electricity.
- Draw a diagram comparing electricity to other fuels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Hybrid Electric
Transportation Fuels Exhibit 6

Step 1: Learn About Hybrid Electric Vehicles

1. Read about hybrid electric vehicles in your *Transportation Fuels Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*
2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*
   - What are hybrid electric vehicles?
   - How are the fuels used in a hybrid electric vehicle produced and distributed?
   - What vehicles are hybrid electric?
   - What are the environmental impacts of hybrid electric vehicles?
   - What is the economic impact of hybrid electric fuels?
   - What are challenges to widespread use?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*
   - Make a poster showing how hybrid electric vehicles use both gasoline and electricity.
   - Display a chart showing the advantages and disadvantages of hybrid electric vehicles.
   - Find pictures/models of hybrid electric vehicles.
   - Draw a graph comparing the number of hybrid electric vehicles on the road to other vehicles.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*
   - Who will write the script?
   - Who will make the displays?
   - Who will collect the materials we need?
   - Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*
3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Propane
Transportation Fuels Exhibit 7

Step 1: Learn About Propane

1. Read about propane in your *Transportation Fuels Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is propane?
- How is propane produced and distributed?
- What vehicles use propane?
- What are the environmental impacts of propane?
- What is the economic impact of using propane as a transportation fuel?
- What are challenges to widespread use?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a poster showing how propane is produced.
- Display a chart showing the advantages and disadvantages of using propane.
- Find pictures/models of vehicles that use propane.
- Draw a diagram comparing propane to other fuels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Compressed and Liquefied Natural Gas
Transportation Fuels Exhibit 8

Step 1: Learn About Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG)

1. Read about CNG and LNG in your *Transportation Fuels Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What are CNG and LNG?
- How are CNG and LNG produced and distributed?
- What vehicles use CNG or LNG?
- What are the environmental impacts of CNG and LNG?
- What are the economic impacts of CNG and LNG?
- What are challenges to widespread use?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a poster showing how CNG and LNG are produced.
- Display a chart showing the advantages and disadvantages of using CNG and LNG.
- Find pictures/models of vehicles that use CNG and LNG.
- Draw a diagram comparing CNG and LNG to other fuels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

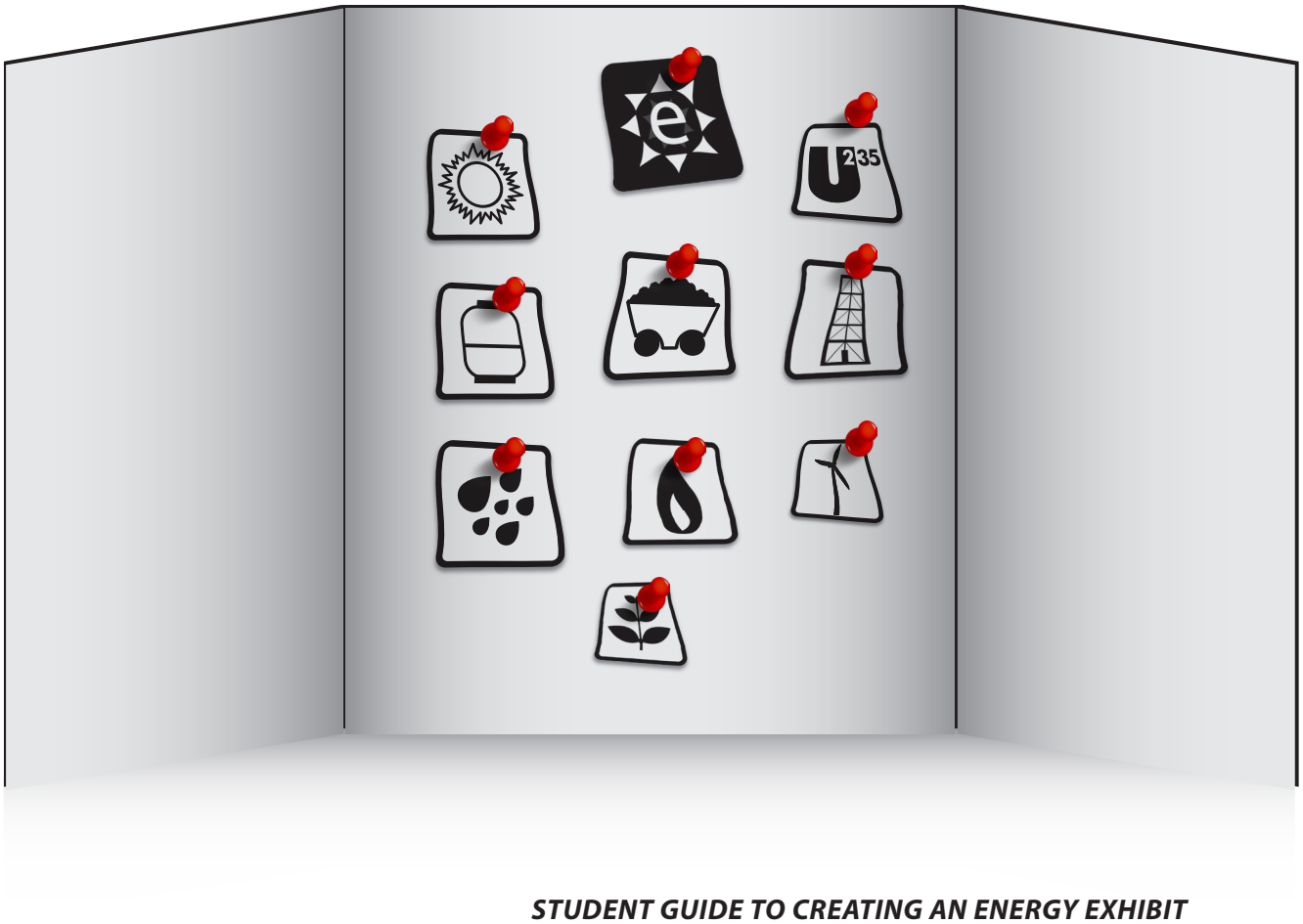
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



STUDENT GUIDE TO CREATING AN ENERGY EXHIBIT

Electricity Exhibits

Electricity and Magnetism
Electricity Generation Exhibit 1

Step 1: Learn About Electricity and Magnetism

1. Read about electricity and magnetism in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What are electrons and where are they found?
- What is the difference between magnets and magnetic fields?
- How are electricity and magnetism related?
- What is a circuit?
- What are the ways electricity can be produced?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Create or display a diagram of an atom.
- Make a diagram of a circuit and label its parts.
- Draw a magnetic field.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

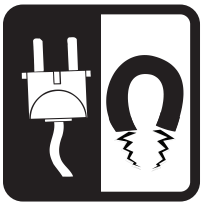
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



How A Generator Works
Electricity Generation Exhibit 2

Step 1: Learn About How A Generator Works

1. Read about how a generator works in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How are electricity and magnetism related?
- What are the parts of a generator?
- What is the turbine's role in electricity generation?
- What are the two options for configuration of a generator?
- What is the voltage produced by utility-scale generators?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a diagram of a turbine generator.
- Display pictures of powerplants.
- Create a model of a generator.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

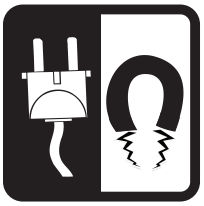
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



How the Grid Works
Electricity Generation Exhibit 3

Step 1: Learn About How the Grid Works

1. Read about how the grid works in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is the electrical grid?
- What are the different components of the grid? Describe their roles.
- What is baseload power and peak demand?
- How do utilities and organizations monitor and manage demand?
- What could lead to "brown outs" or "black outs"?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display maps of the electric grid and transmission systems.
- Diagram how electricity moves from power plants to consumers.
- Create or showcase a graph of power demand over time.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Smart Meters and the Smart Grid
Electricity Generation Exhibit 4

Step 1: Learn About Smart Meters and the Smart Grid

1. Read about Smart Meters and the Smart Grid in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is a smart meter?
- How do smart meters work?
- How does a smart meter improve demand-side management?
- What is a smart grid?
- What is the purpose of advancing the grid?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Display pictures of smart meters and other electrical meters.
- Create a diagram depicting how smart meters communicate with other entities.
- Draw a map of the electrical grid.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Thermal Power Plants
Electricity Generation Exhibit 5

Step 1: Learn About Thermal Power Plants

1. Read about thermal power plants in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What are the parts of a thermal power plant and what do they do?
- What sources of energy can be used in thermal power plants?
- How are nuclear power plants different from other thermal power plants?
- What is the efficiency of a thermal power plant?
- What are some drawbacks to thermal electricity generation?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Draw a diagram of how a thermal power plant works.
- Create a graphic comparing the types of thermal power plants.
- Make a graph showing the amount of electricity produced in thermal power plants.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

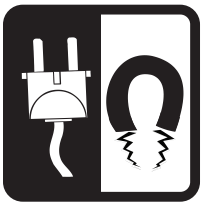
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



Generating Electricity with Renewable Sources

Electricity Generation Exhibit 6

Step 1: Learn About Generating Electricity with Renewable Sources

1. Read about generating electricity with renewable sources in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How do CSP facilities generate electricity?
- What is the energy transformation involved when using photovoltaic cells for electricity generation?
- How are hydropower and wind generation mechanisms similar?
- How are hydropower and wind generation mechanisms different?
- What are the benefits and drawbacks of waste-to-energy plants?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Create or draw a graphic showing and comparing solar electric generation technologies.
- Display pictures of wind and hydropower turbine generators.
- Make a graph showing the amount of electricity produced by renewable energy sources.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

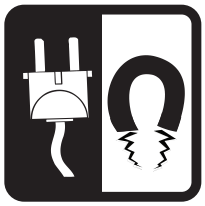
2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____



Electric Vehicles
Electricity Generation Exhibit 7

Step 1: Learn About Electric Vehicles

1. Read about electric vehicles in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What types of vehicles use electricity?
- How does an electric vehicle work?
- What are the environmental impacts of using electric vehicles?
- What are the economic impacts of using electricity fueled vehicles?
- What are the challenges of widespread use?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a chart showing advantages and disadvantages of electric vehicles.
- Display pictures of models of electric cars.
- Draw a diagram comparing electricity to other vehicle fuels.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

History of Electricity
Electricity Generation Exhibit 8

Step 1: Learn About The History of Electricity

1. Read about the history of electricity in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What was Benjamin Franklin's contribution to electricity discovery and research?
- What was Alessandro Volta's invention?
- What did Michael Faraday learn about generating electrical current?
- What two major developments did Thomas Edison receive credit for?
- Why did Edison feel threatened by Nikola Tesla?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a chart or graphic timeline of the major electricity discoveries.
- Draw or display a picture of each scientists' invention.
- Find pictures of each scientist.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Measuring Electricity
Electricity Generation Exhibit 9

Step 1: Learn About Measuring Electricity

1. Read about measuring electricity in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- What is voltage and how is it measured?
- What is current and how is it measured?
- What is resistance and how is it measured?
- What is power and how is it measured?
- How are voltage, current, resistance, and power related?
- How do utilities measure our electricity consumption?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Make a chart comparing/outlining the different units.
- Create a diagram to visually describe each unit.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Economics of Electricity
Electricity Generation Exhibit 10

Step 1: Learn About Economics of Electricity

1. Read about the economics of electricity in your *Infobook* and in your other materials. Underline the main ideas. Put a star (*) by the most important facts. *1-5 points*

2. As a group, make a list of the facts you want to teach others. Make sure you answer these questions: *1-5 points*

- How does the electric utility charge customers for its electricity consumption?
- What determines the cost electric utilities charge customers?
- What U.S. areas pay the most for electricity? What areas pay the least?
- Which generation technologies are most expensive?
- How have deregulation and competition changed the cost of electricity?

Step 2: Plan Your Exhibit

1. As a group, make a list of the displays you can use to make your exhibit interesting. Here are some suggestions: *1-5 points*

- Draw or display a map comparing costs of electricity in various areas.
- Draw or create a graph comparing relative costs for various generation facilities.

Step 3: Use Your Talent

1. As a group, decide who will do which jobs. Write down the name of each person in the group. Next to each name, write the person's jobs. You can have more than one person helping on each job. *1-5 points*

- Who will write the script?
- Who will make the displays?
- Who will collect the materials we need?
- Who will learn the script and teach others?

Step 4: Create Your Exhibit and Write Your Script

1. Write a two minute script using the list of important facts. *1-5 points*

2. Create an interesting display with posters and hands-on materials. Make sure the display and the script cover the same information. *1-5 points*

3. Practice the script so that you do not have to read it. Use note cards with the important facts listed on them. *1-5 points*

Step 5: Teach Others

1. Give a presentation of your exhibit to others. *1-5 points*

Total Points: _____

Energy Expos Evaluation Form

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

1. Did you conduct the entire activity?	❑ Yes	❑ No
2. Were the instructions clear and easy to follow?	❑ Yes	❑ No
3. Did the activity meet your academic objectives?	❑ Yes	❑ No
4. Was the activity age appropriate?	❑ Yes	❑ No
5. Was the allotted time sufficient to conduct the activity?	❑ Yes	❑ No
6. Was the activity easy to use?	❑ Yes	❑ No
7. Was the preparation required acceptable for the activity?	❑ Yes	❑ No
8. Were the students interested and motivated?	❑ Yes	❑ No
9. Was the energy knowledge content age appropriate?	❑ Yes	❑ No
10. Would you teach this activity again?	❑ Yes	❑ No

Please explain any 'no' statement below

How would you rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor
How would your students rate the activity overall?	❑ excellent	❑ good	❑ fair	❑ poor

What would make the activity more useful to you?

Other Comments:

Please fax or mail to: **The NEED Project**
8408 Kao Circle
Manassas, VA 20110
FAX: 1-800-847-1820

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NextEra Energy Resources
NEXTracker
Nicor Gas
Nisource Charitable Foundation
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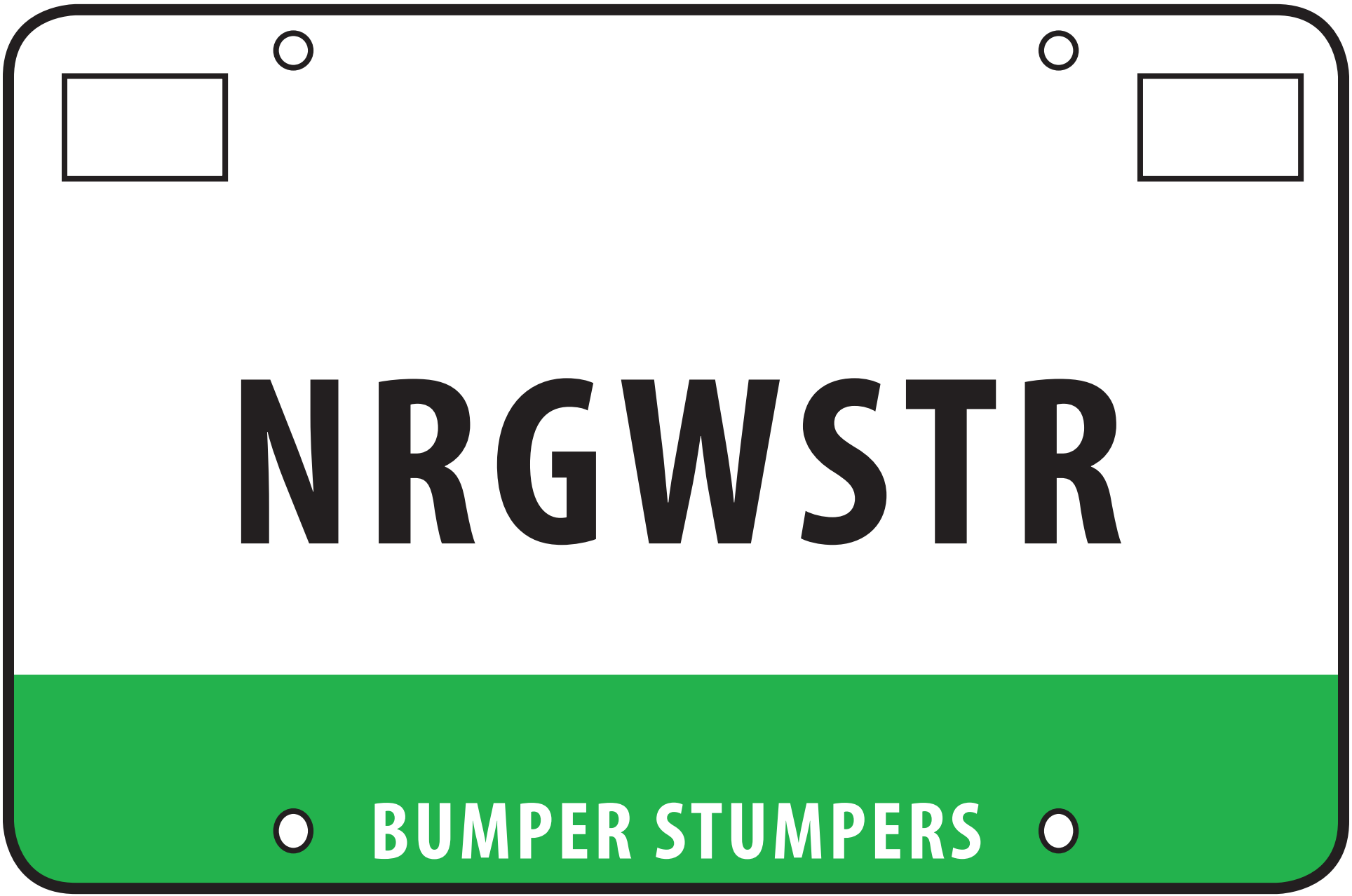
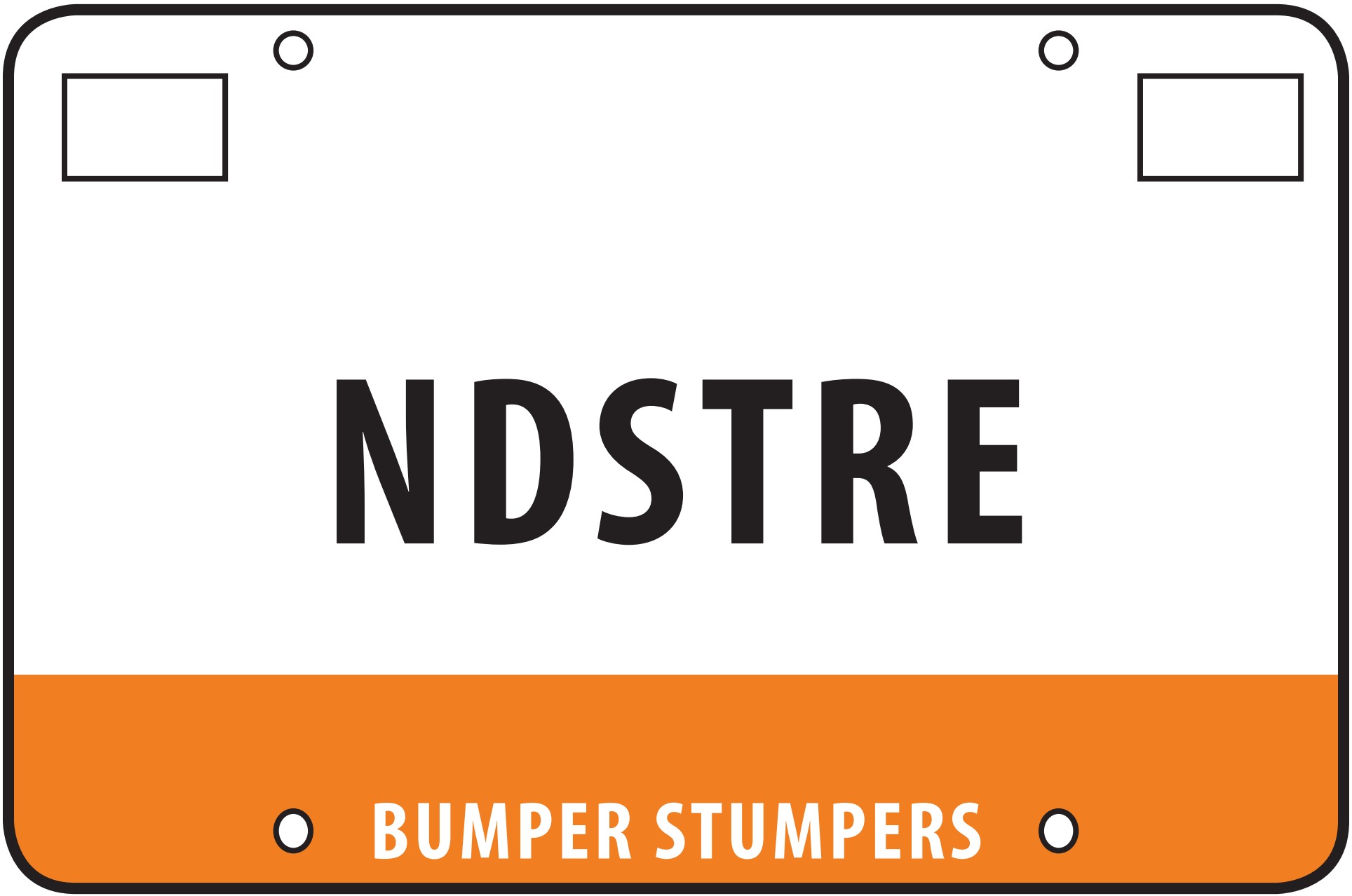
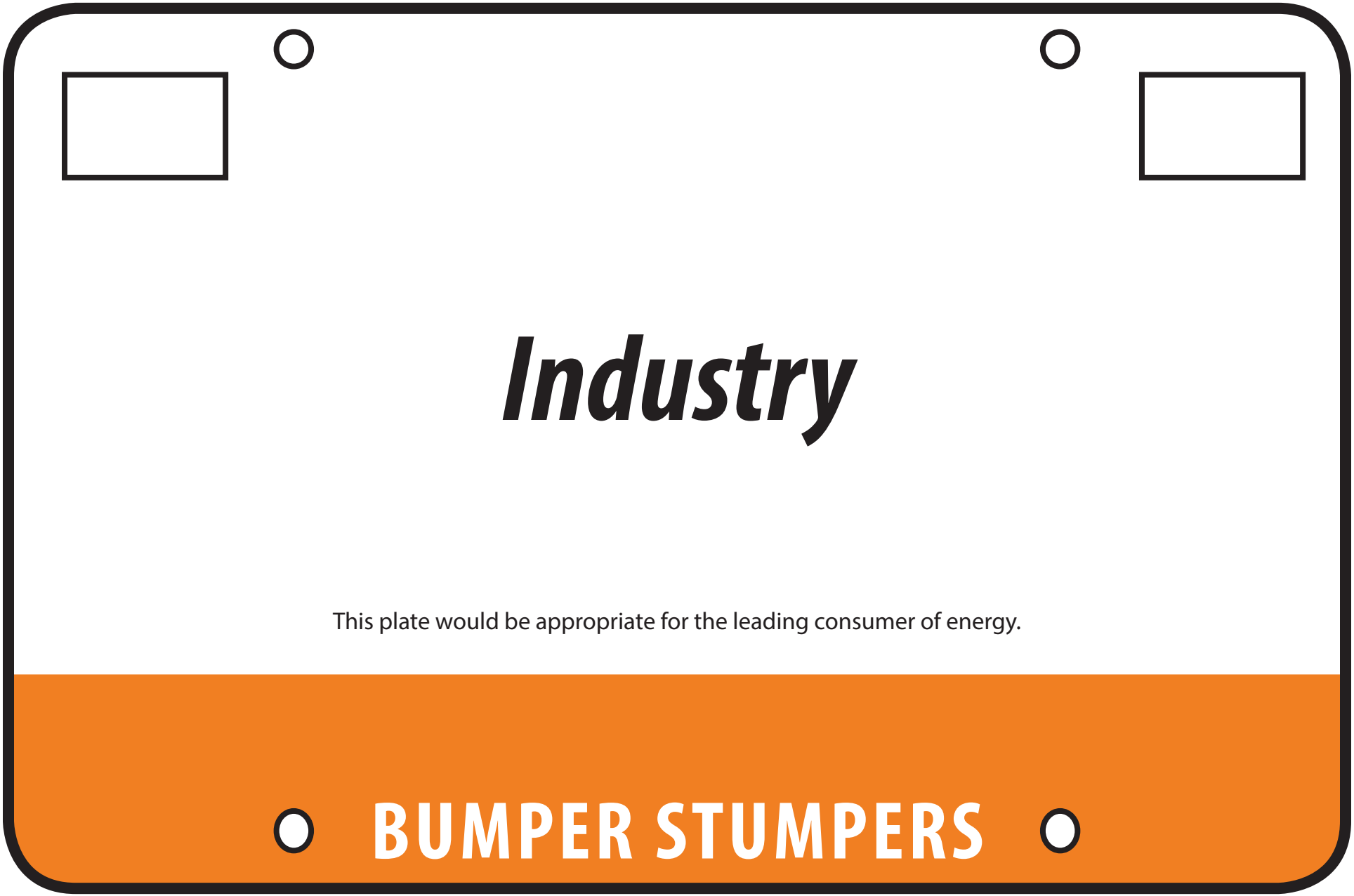
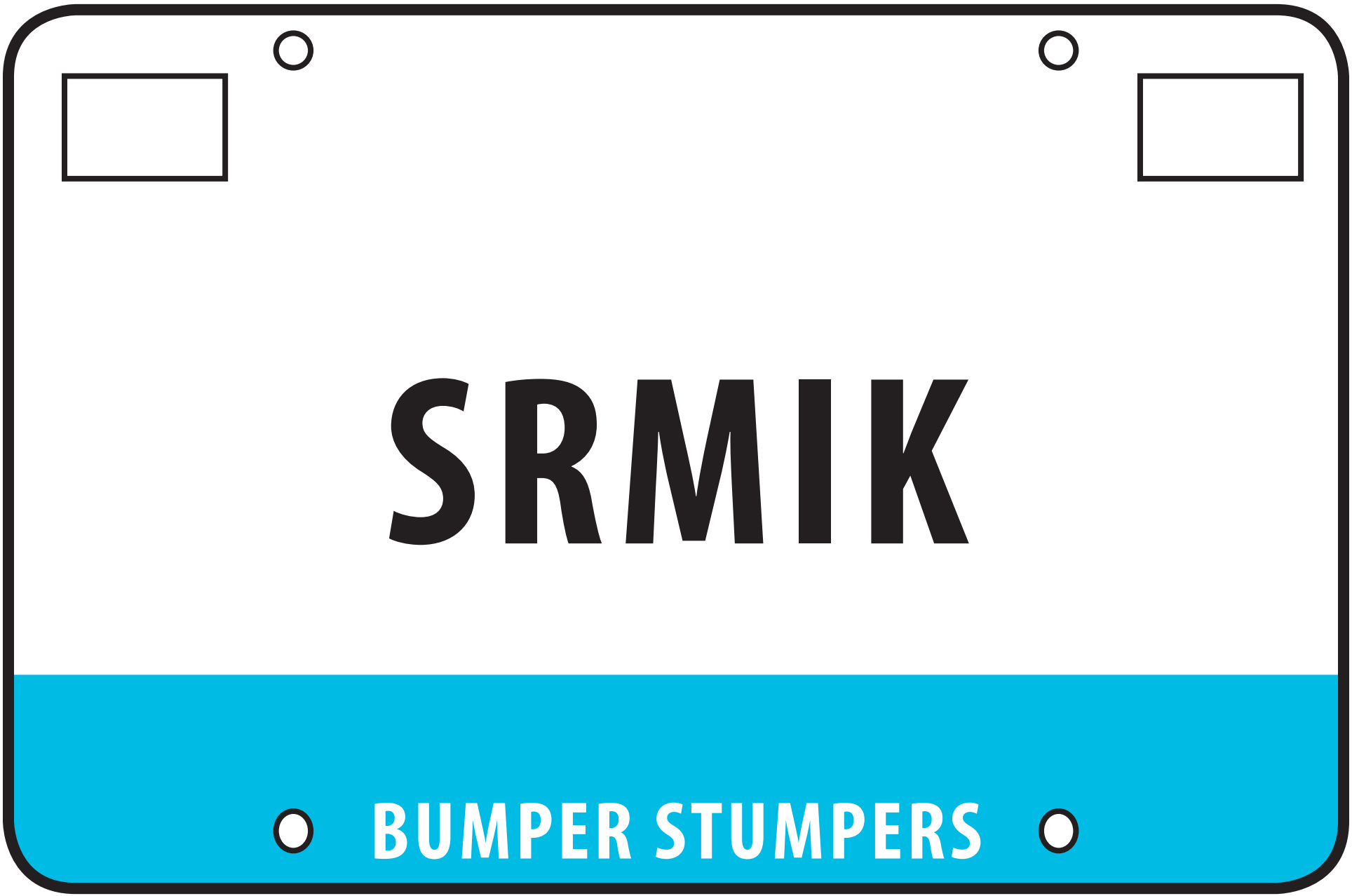
U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy
U.S. Department of Energy–Wind for Schools
U.S. Energy Information Administration
United States Virgin Islands Energy Office
Wayne County Sustainable Energy
Western Massachusetts Electric Company
Yates Petroleum Corporation


NRGWSTR
BUMPER STUMPERS


Energy Waster
This license plate would be ideal for a person who doesn't believe in conserving our resources.
BUMPER STUMPERS


NDSTRE
BUMPER STUMPERS


Industry
This plate would be appropriate for the leading consumer of energy.
BUMPER STUMPERS


SRMIK
BUMPER STUMPERS

Ceramic

This plate describes the protective covering that surrounds a uranium fuel pellet.

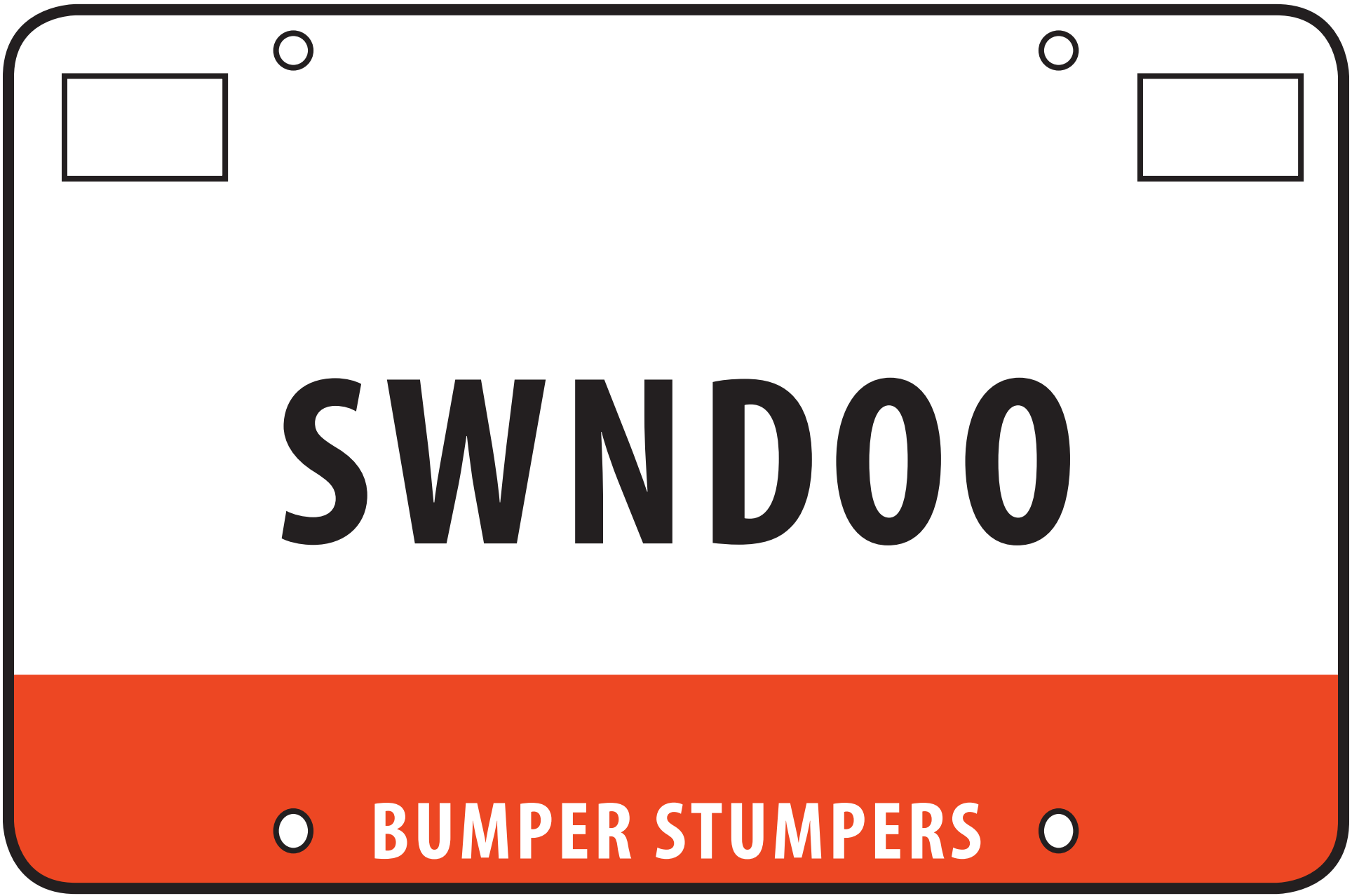
BUMPER STUMPERS


DSTL8N
BUMPER STUMPERS

Distillation

This plate refers to the process in which petroleum is separated into various components.

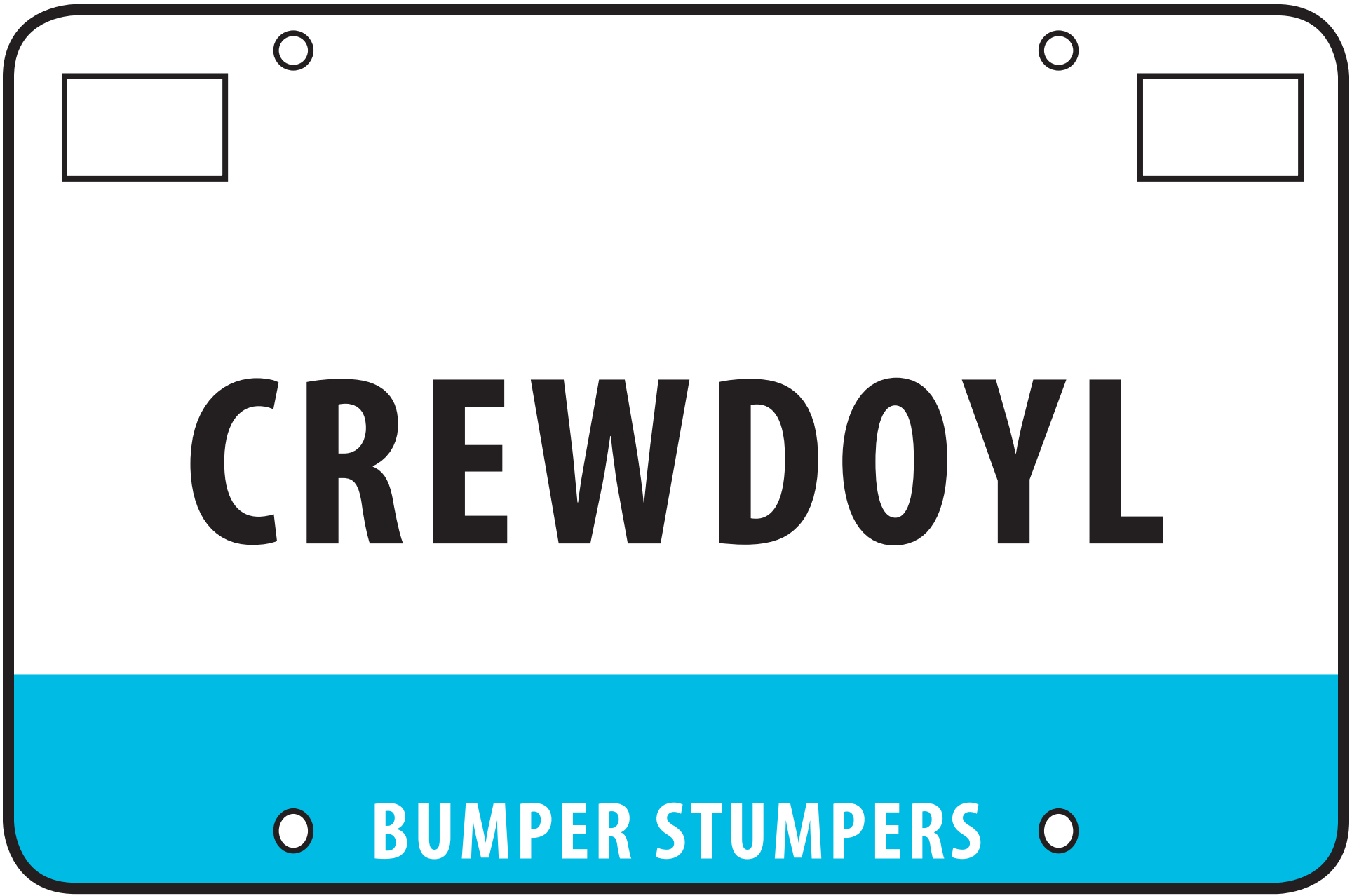
BUMPER STUMPERS


SWNDOO
BUMPER STUMPERS

South Windows

This plate identifies the most favorable method of access for passive solar heating.

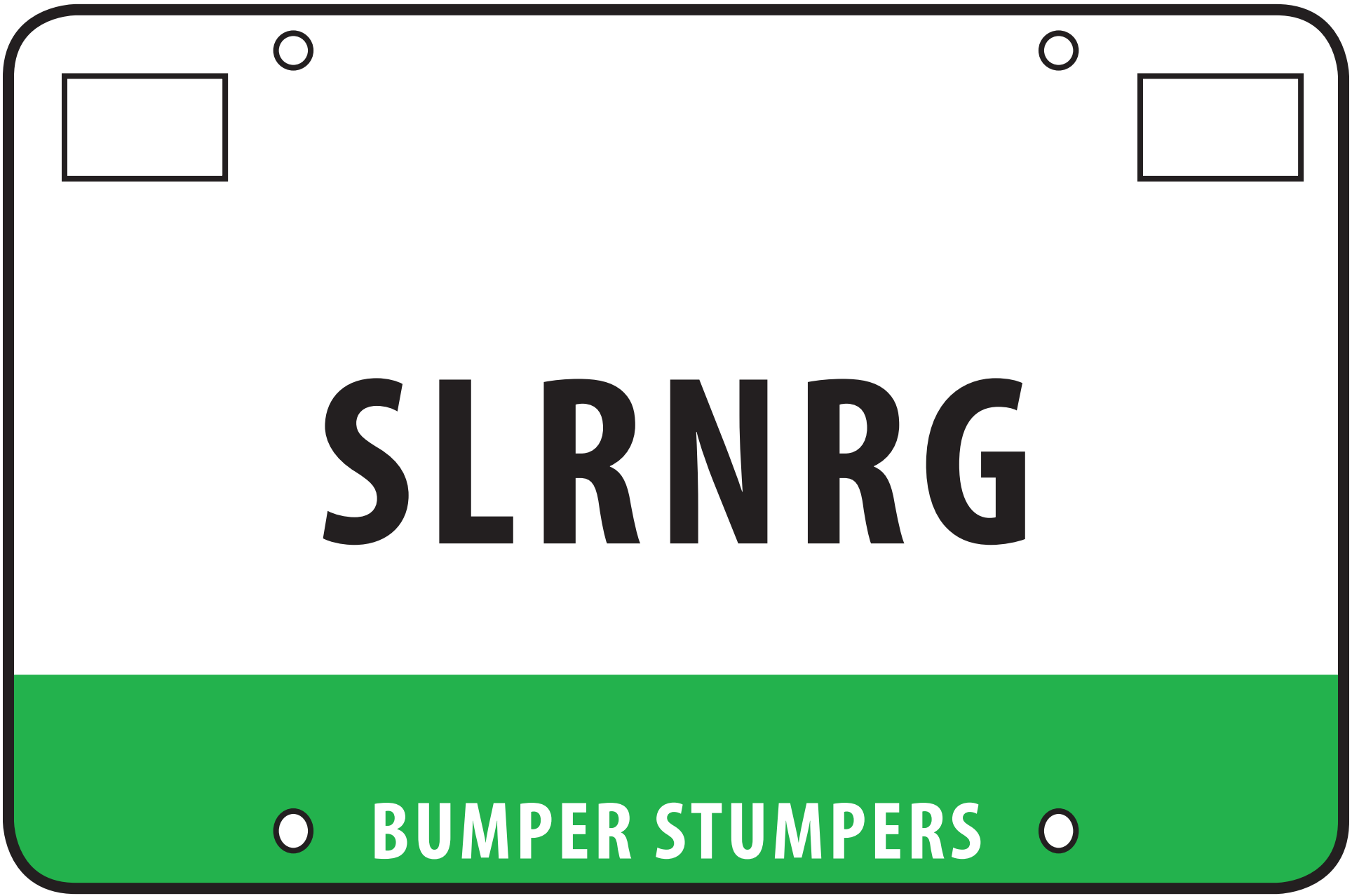
BUMPER STUMPERS


CREWDOYL
BUMPER STUMPERS

Crude Oil

This plate suggests another name for a liquid fossil fuel.

BUMPER STUMPERS


SLRNRG
BUMPER STUMPERS

Solar Energy

This plate describes a type of renewable energy.

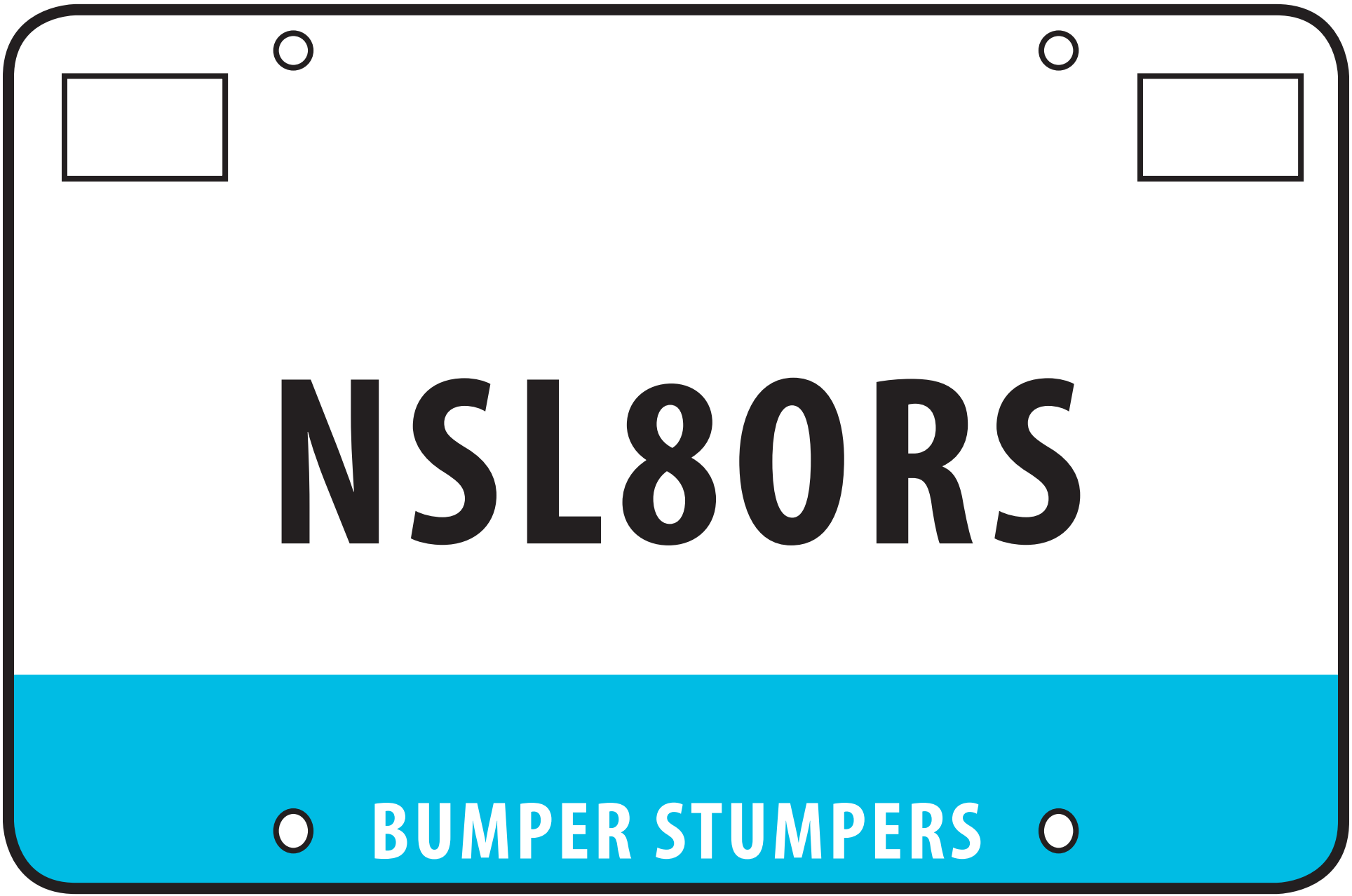
BUMPER STUMPERS


GNR8R
BUMPER STUMPERS

Generator

This plate names a device containing a magnet and a coil of wire.

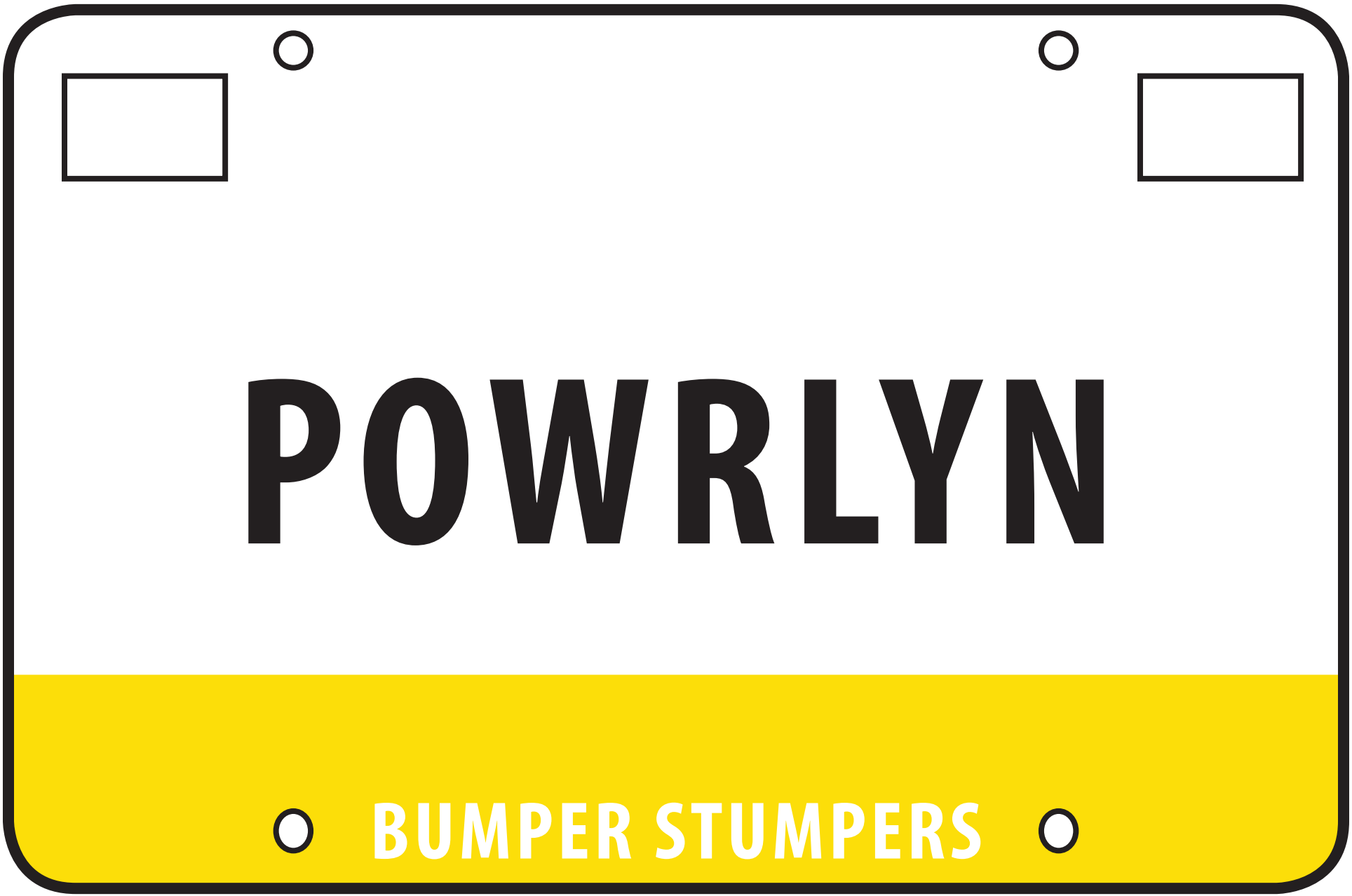
BUMPER STUMPERS


NSL8ORS
BUMPER STUMPERS

Insulators

This plate describes the type of materials that do not conduct electricity well.

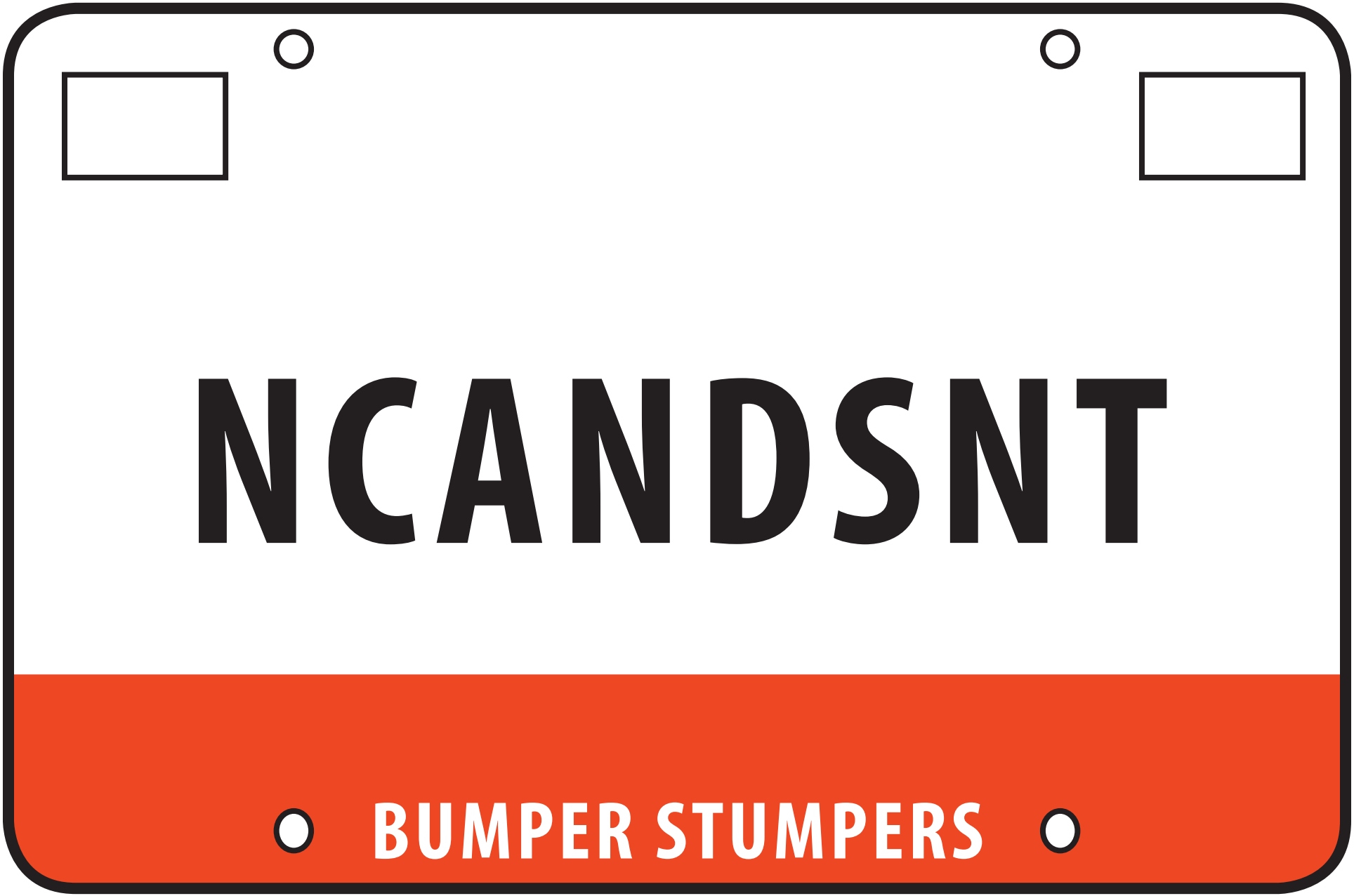
BUMPER STUMPERS


POWRLYN
BUMPER STUMPERS

Power Line

This plate identifies the method of transporting electricity across our nation.

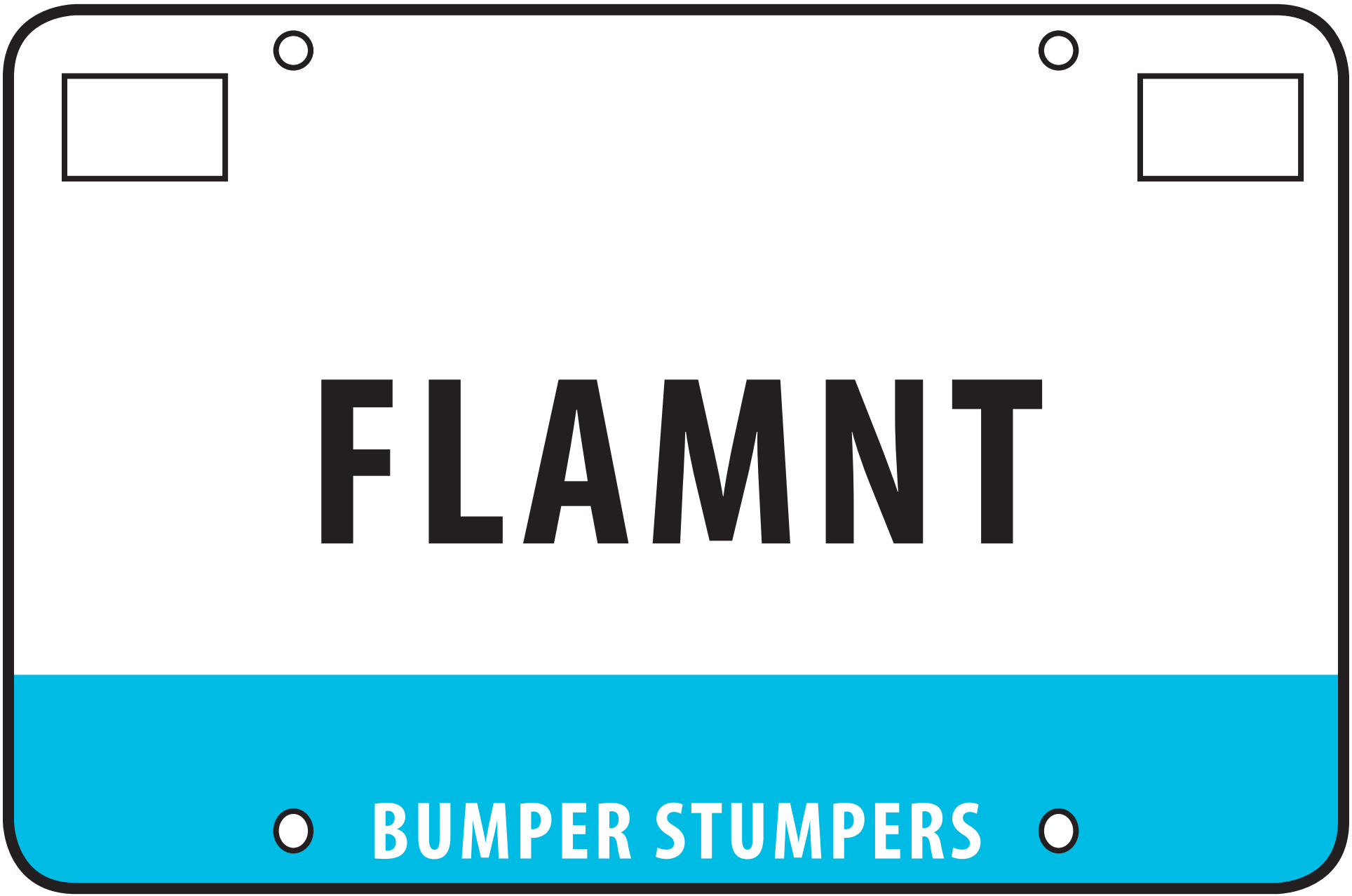
BUMPER STUMPERS


NCANDSNT
BUMPER STUMPERS

Incandescent

This plate refers to one type of device that turns electrical energy into light energy.

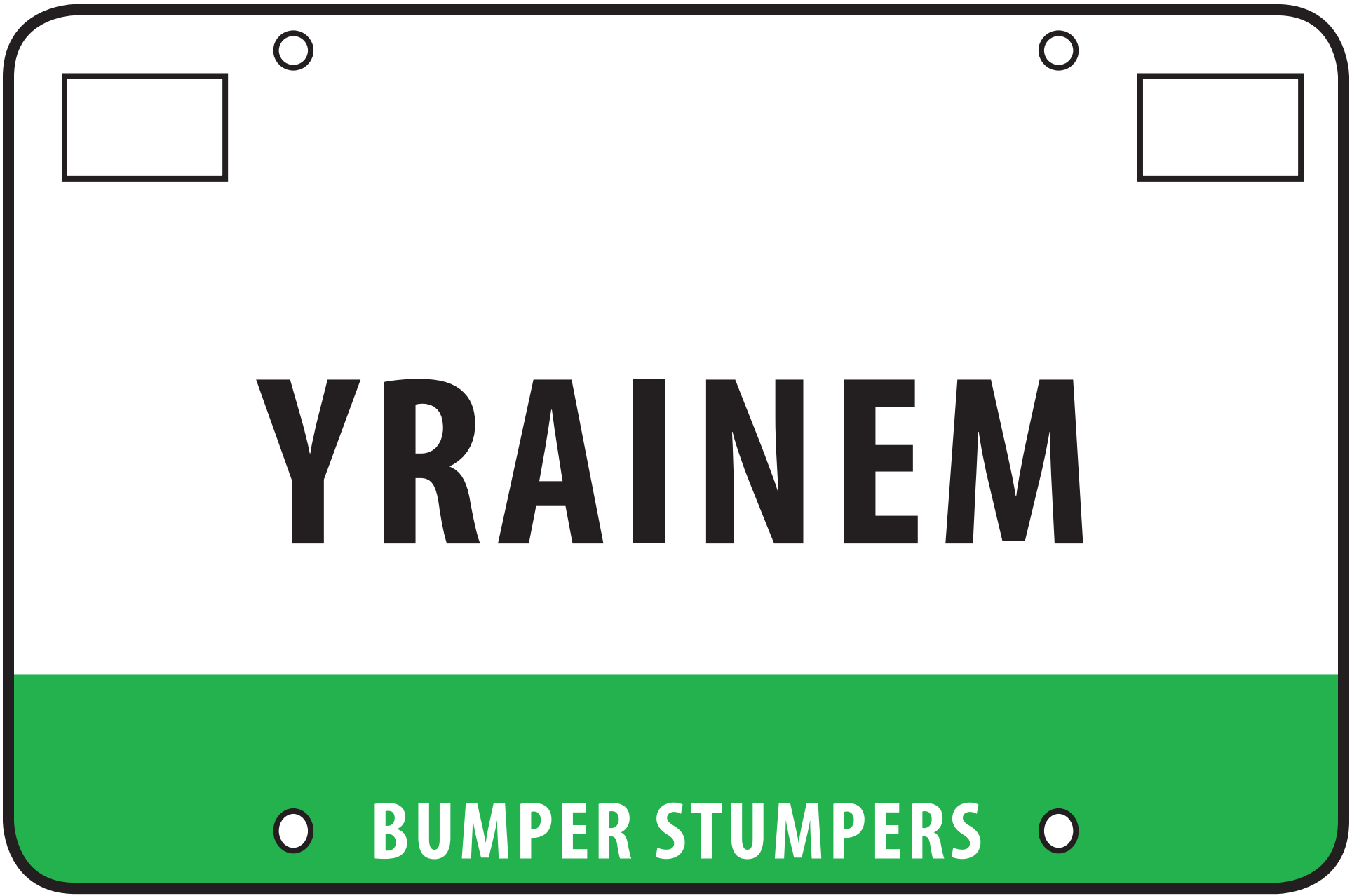
BUMPER STUMPERS


FLAMNT
BUMPER STUMPERS

Filament

This plate describes the wire inside an incandescent light bulb that conducts the electricity.

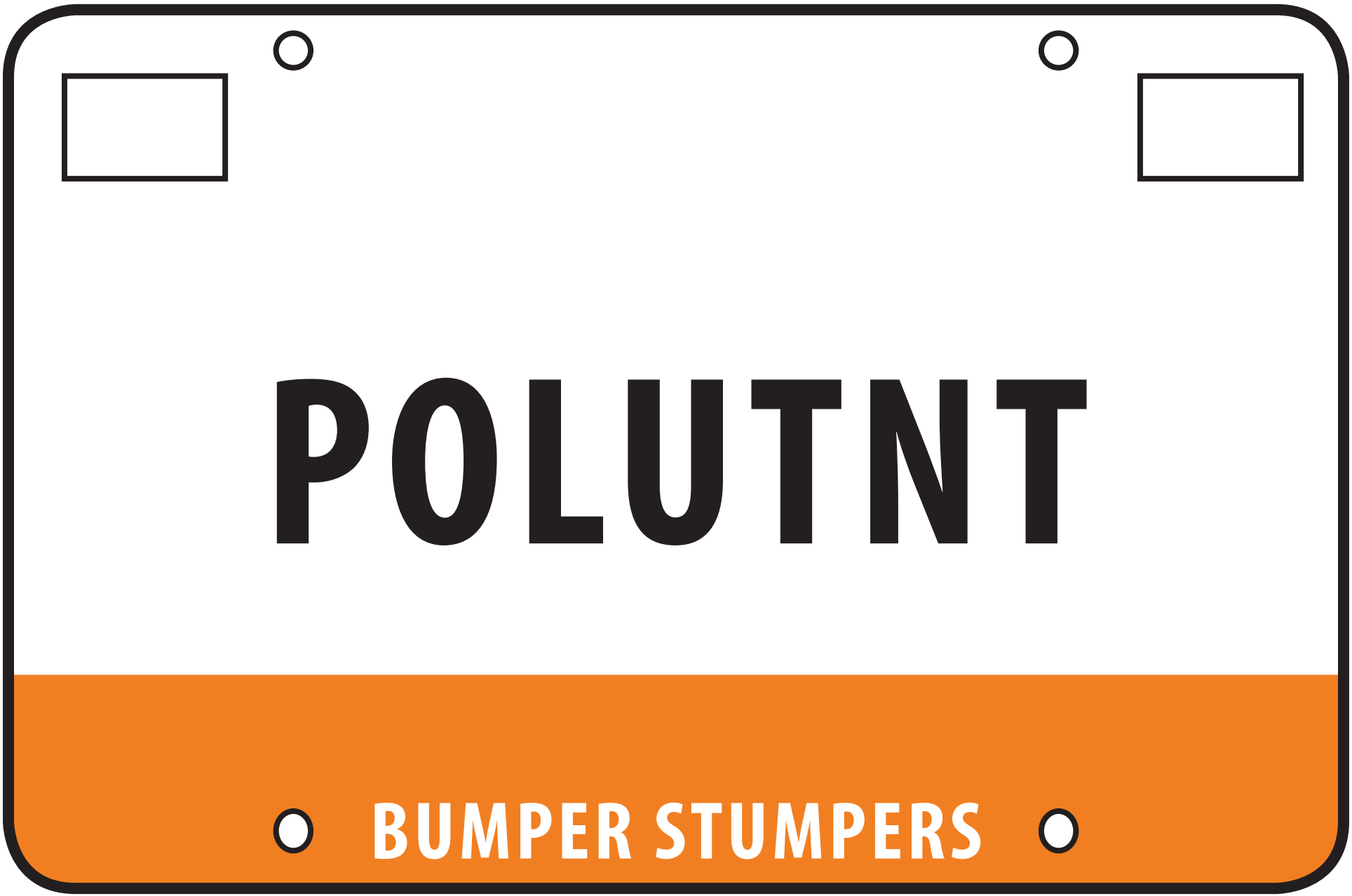
BUMPER STUMPERS


YRAINEM
BUMPER STUMPERS

Uranium

This plate refers to the source of a nonrenewable energy that is not a fossil fuel.

BUMPER STUMPERS


POLUTNT
BUMPER STUMPERS

Pollutant

This plate identifies a hazard of burning fossil fuels.

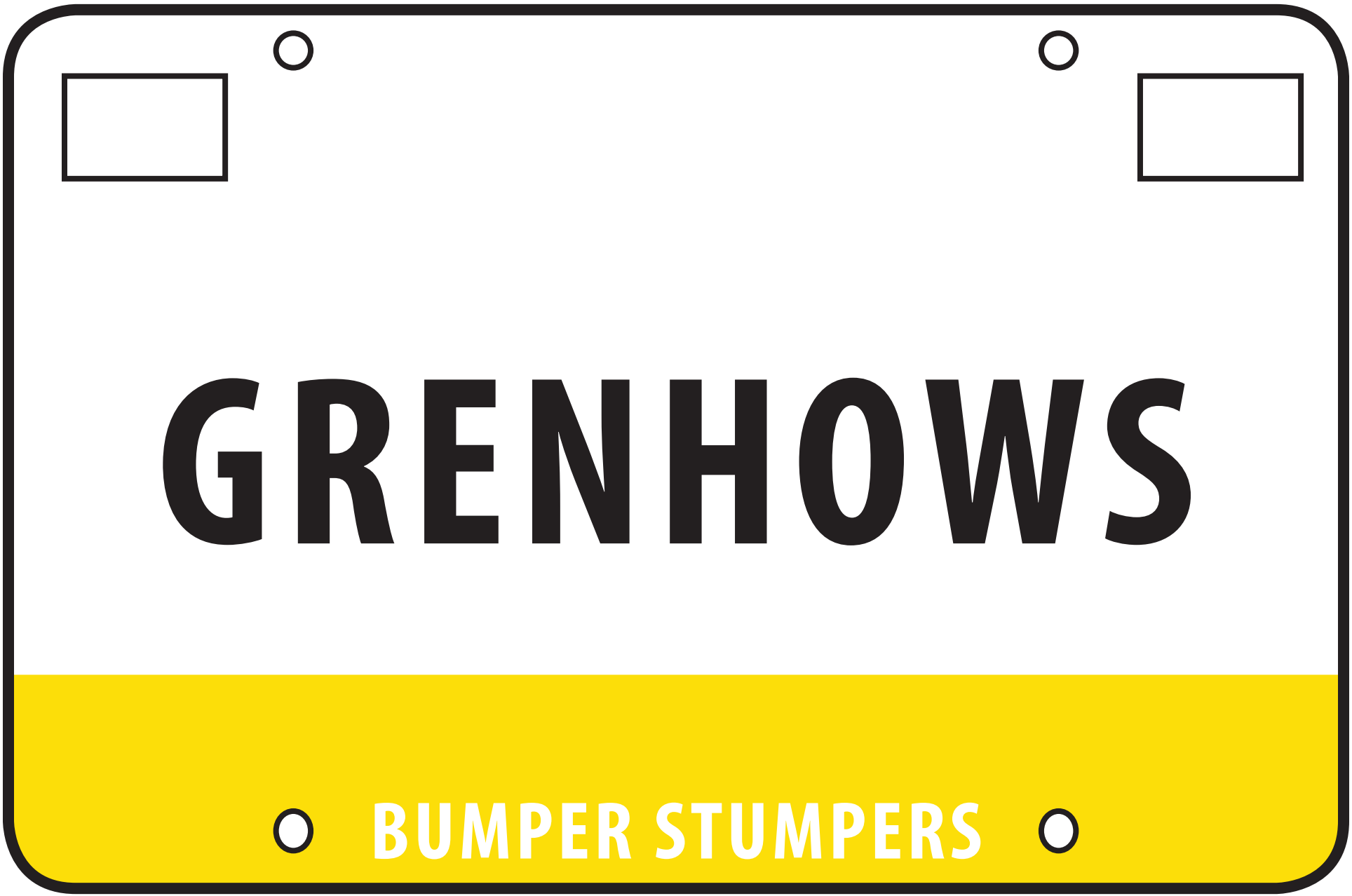
BUMPER STUMPERS


DARYK
BUMPER STUMPERS

Derrick

This plate refers to the tower rig that is used to recover petroleum.

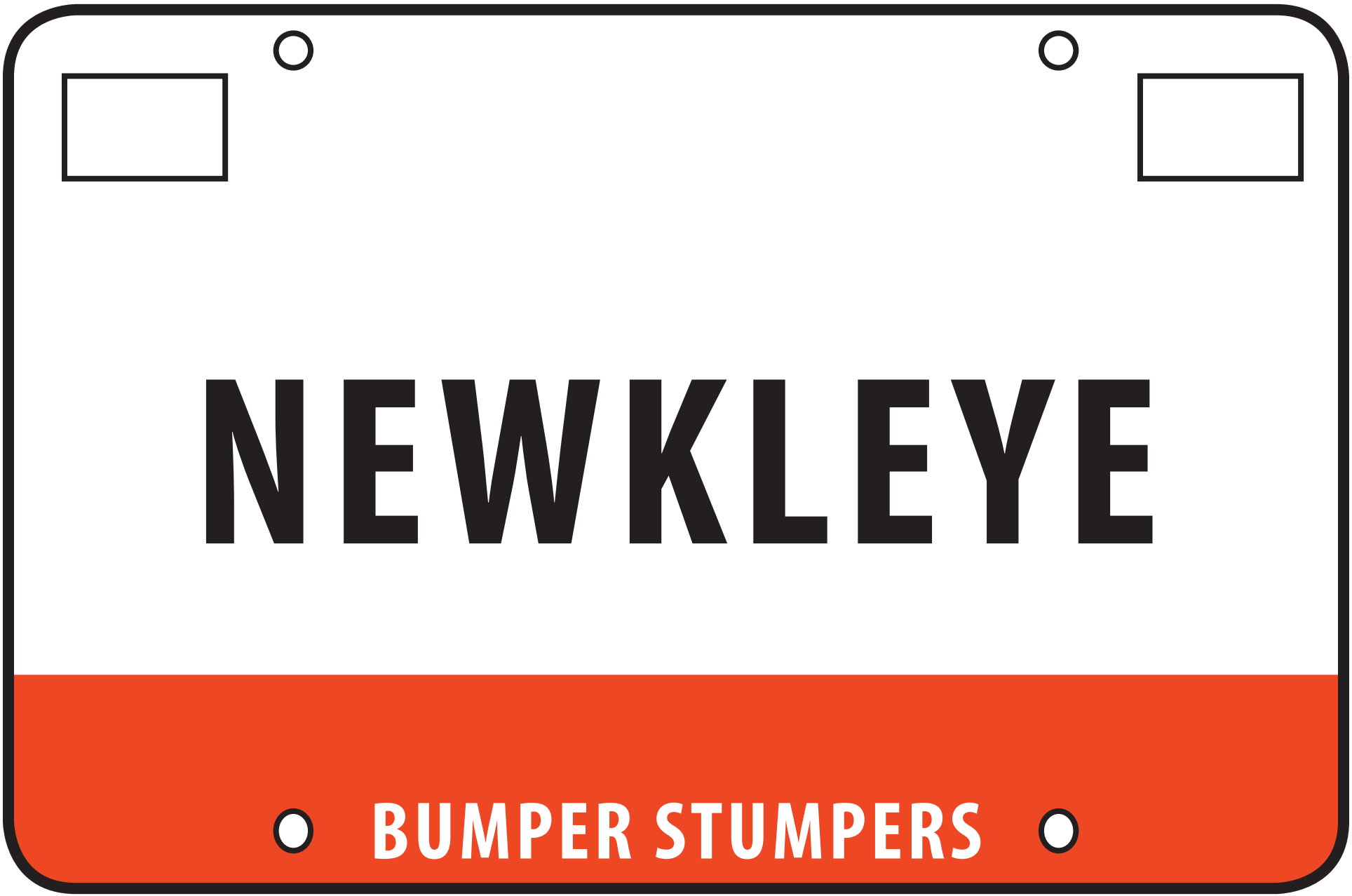
BUMPER STUMPERS


GRENHOWS
BUMPER STUMPERS

Green House

This plate describes a building that effectively uses passive solar heating.

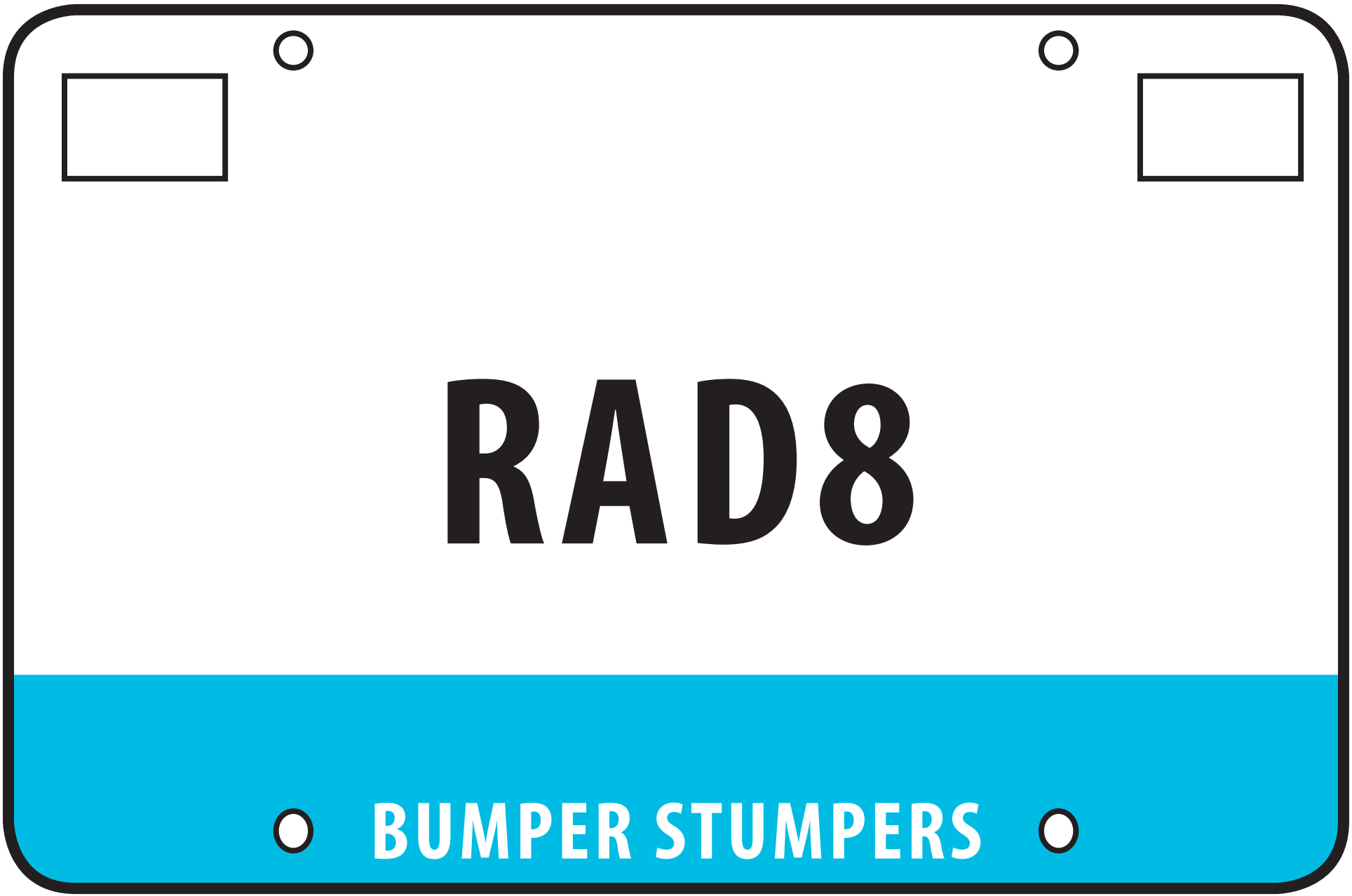
BUMPER STUMPERS


NEWKLEYE
BUMPER STUMPERS

Nuclei

This plate identifies the place where nuclear fission takes place.

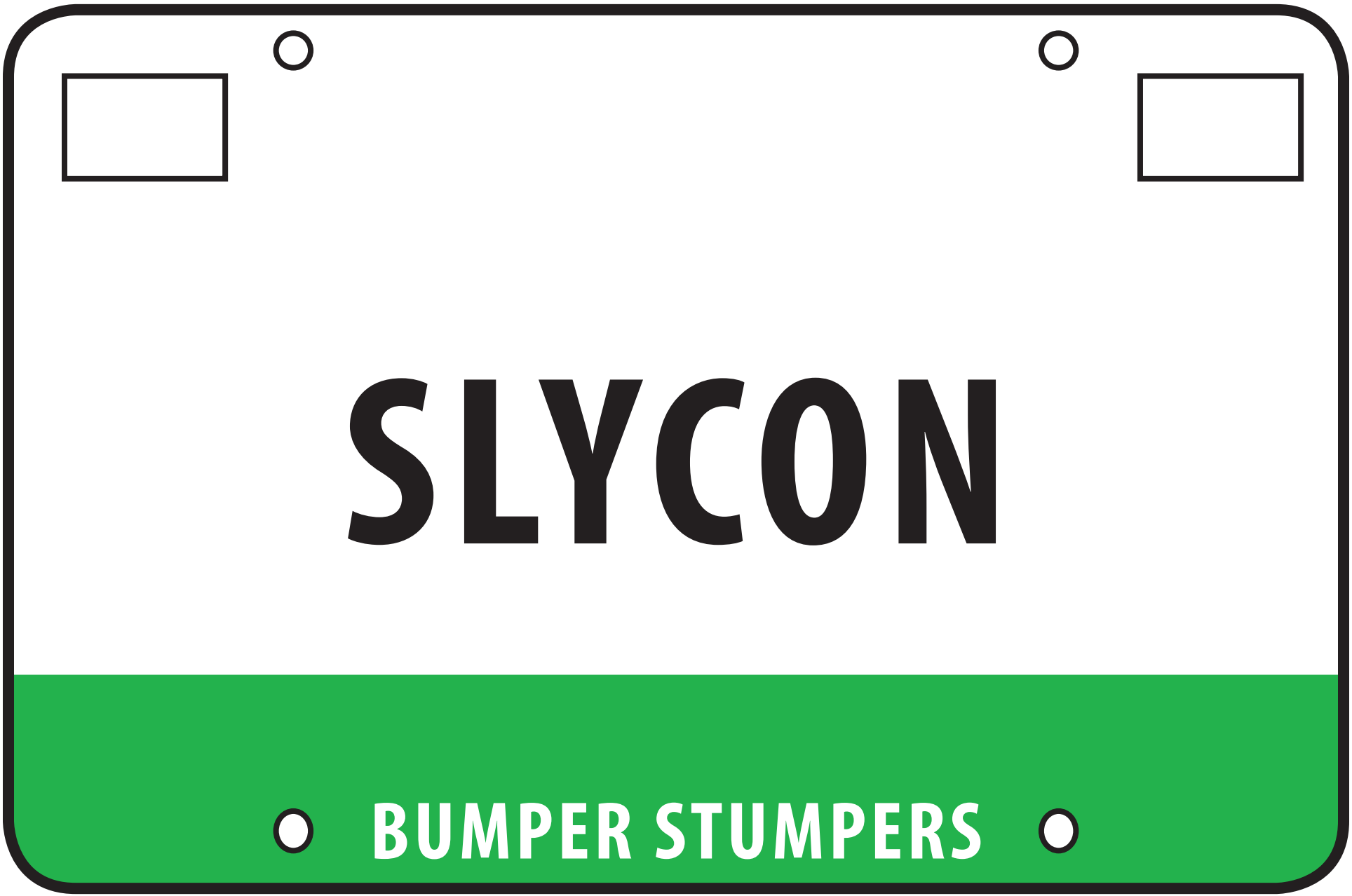
BUMPER STUMPERS


RAD8
BUMPER STUMPERS

Radiate

This plate describes heat energy transfer.

BUMPER STUMPERS


SLYCON
BUMPER STUMPERS

Silicon

This plate identifies the element used in turning solar energy into electrical energy.

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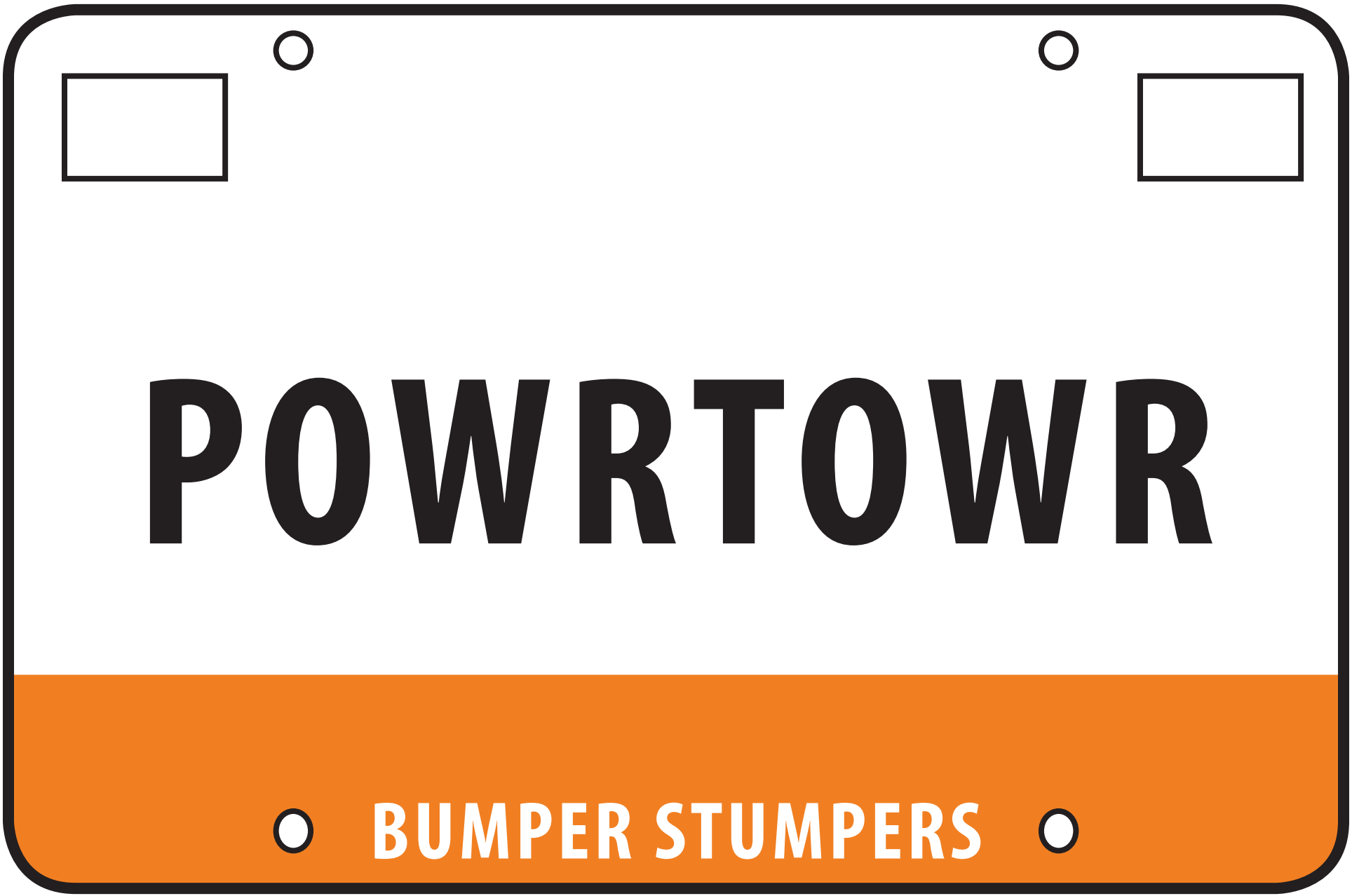
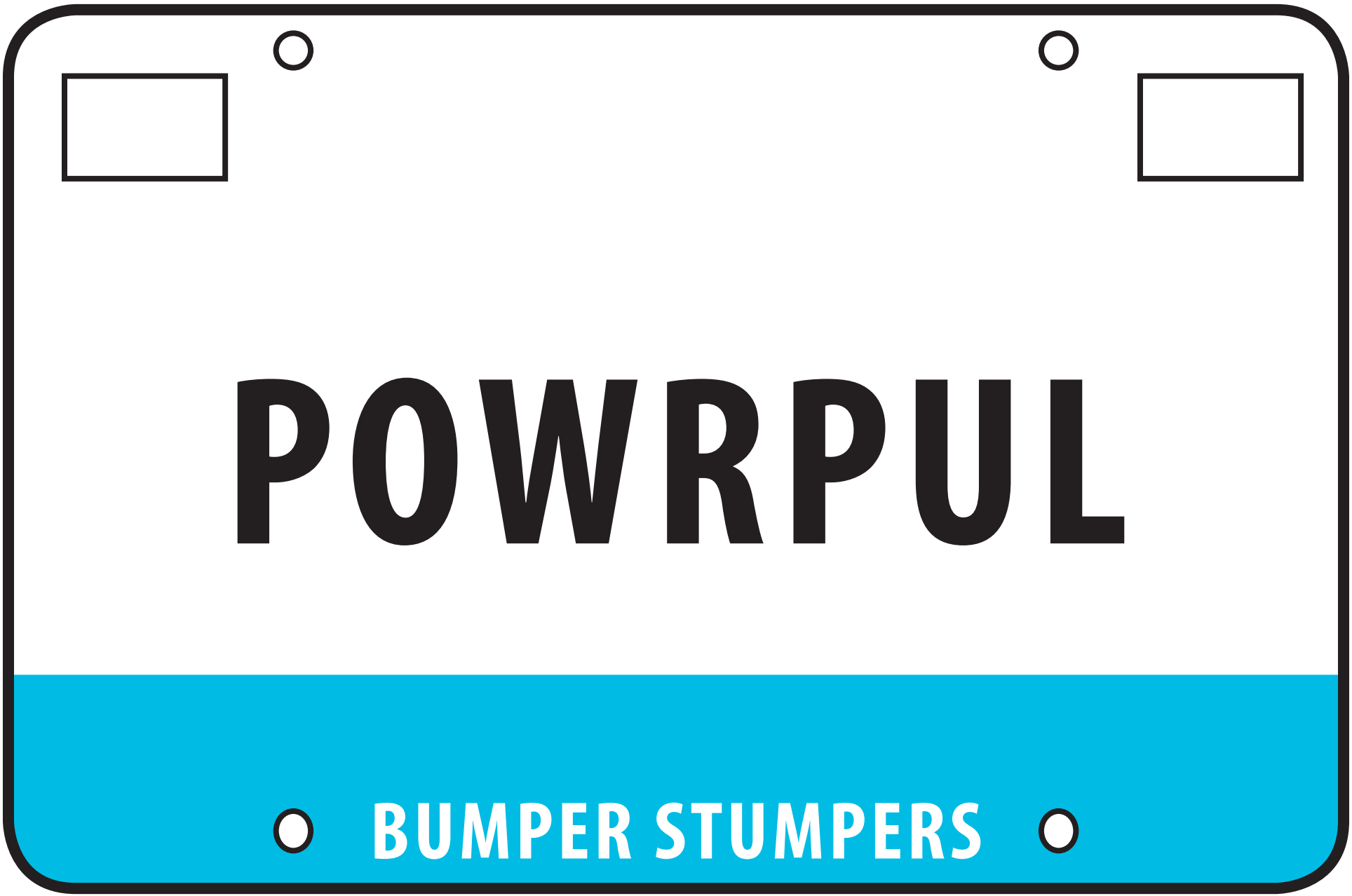

POWRTOWR
BUMPER STUMPERS

Power Tower

This plate refers to a device used to collect solar energy.

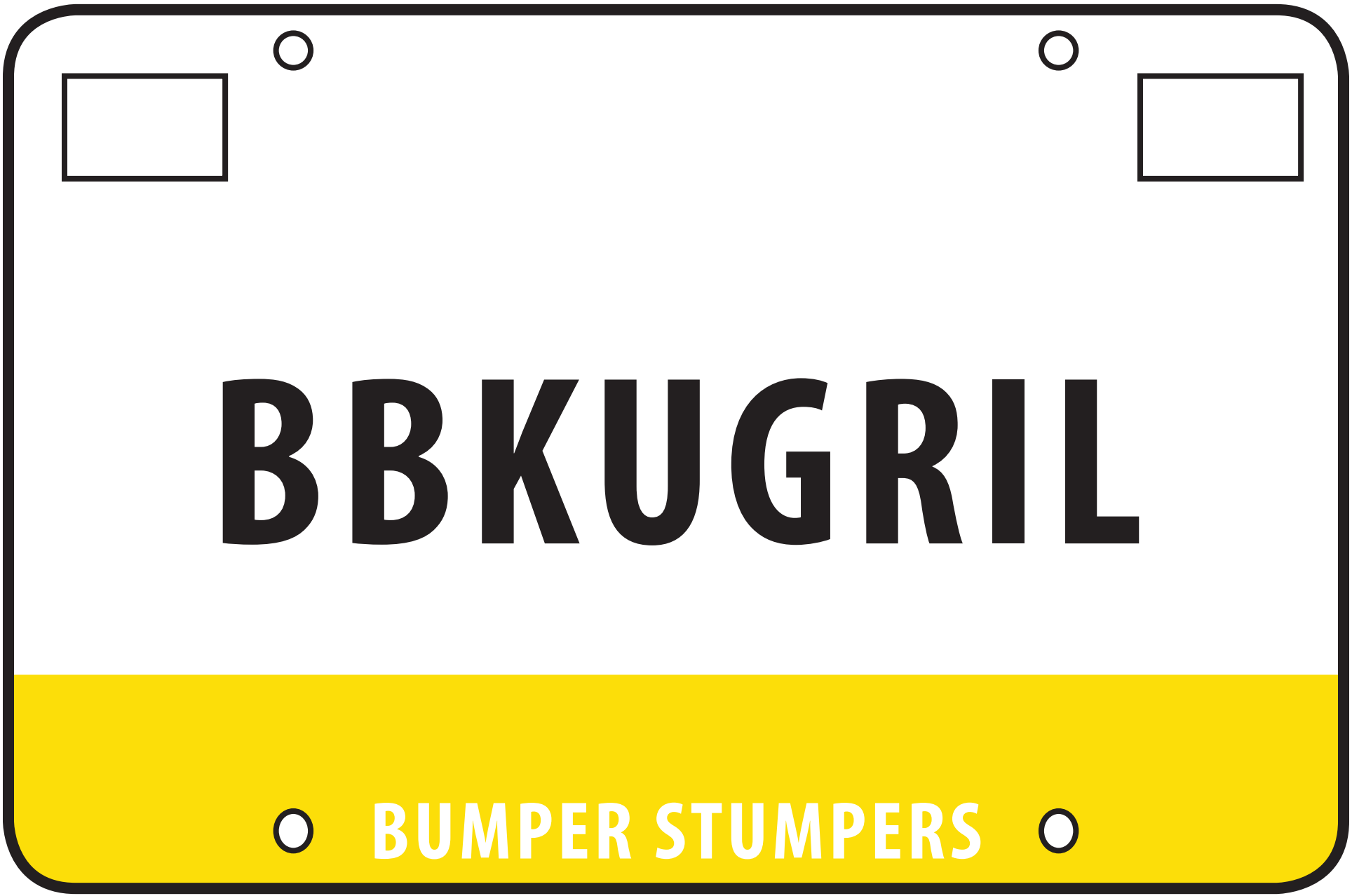
BUMPER STUMPERS


POWRPUL
BUMPER STUMPERS

Power Pool

This plate names the cooperative of utilities linked together to share electricity efficiently.

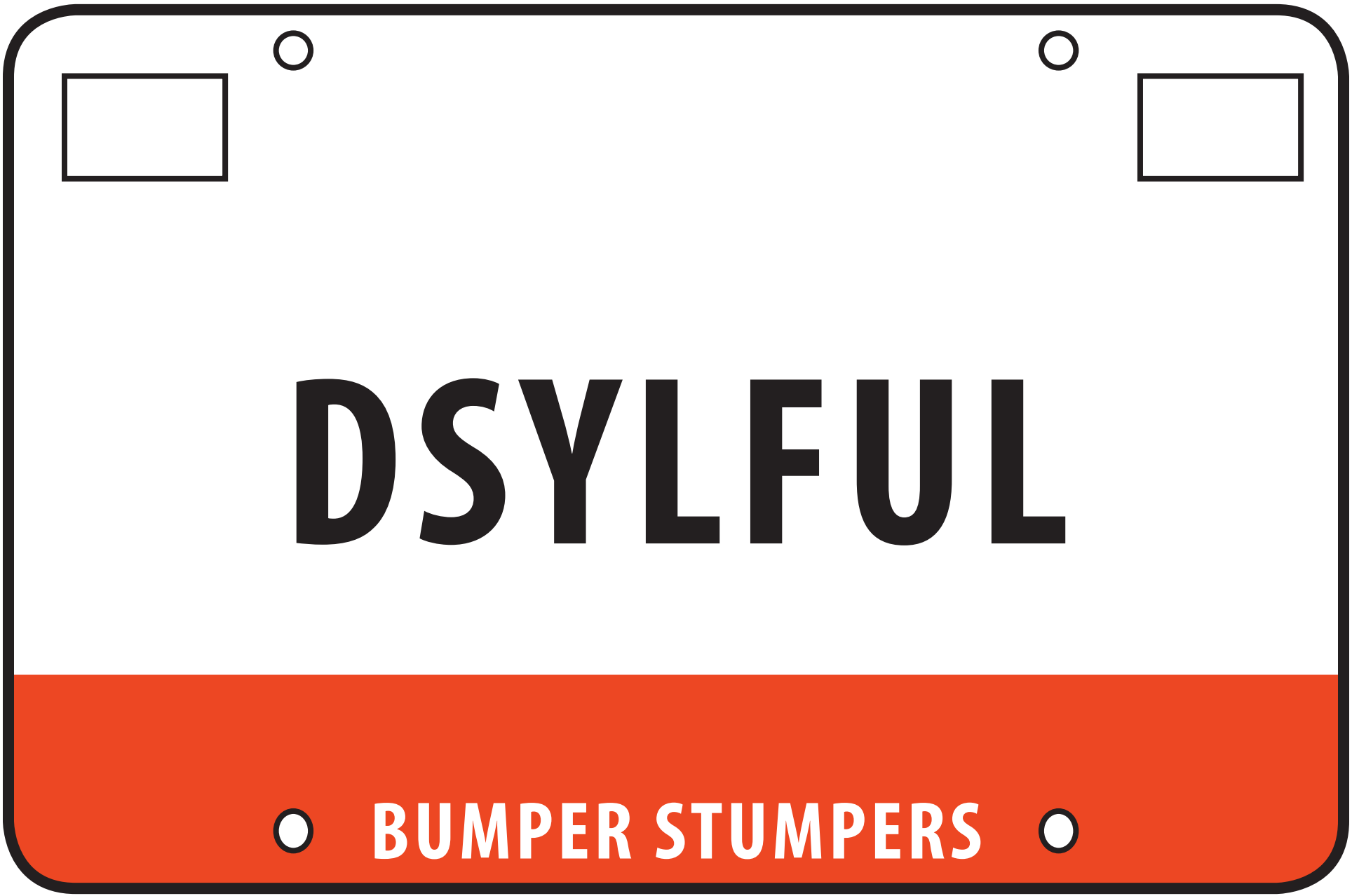
BUMPER STUMPERS


BBKUGRIL
BUMPER STUMPERS

Barbecue Grill

This plate names a device that many people use during the summer, some of which require propane to operate.

BUMPER STUMPERS


DSYLFUL
BUMPER STUMPERS

Diesel Fuel

This plate identifies a product of petroleum distillation used by large trucks.

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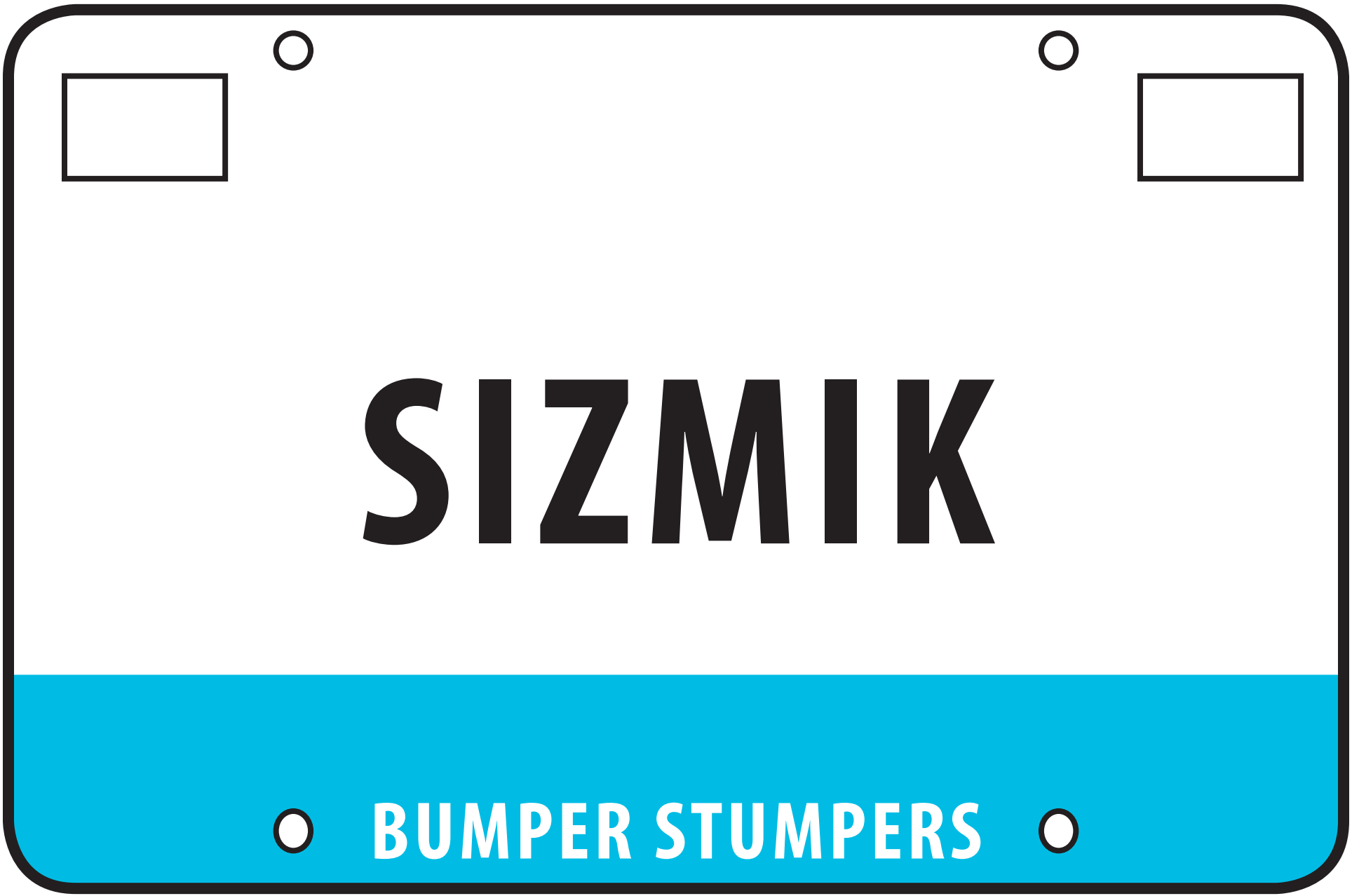
SIZMIK
BUMPER STUMPERS

Seismic

This plate names a method of exploration used to locate types of fossil fuels.

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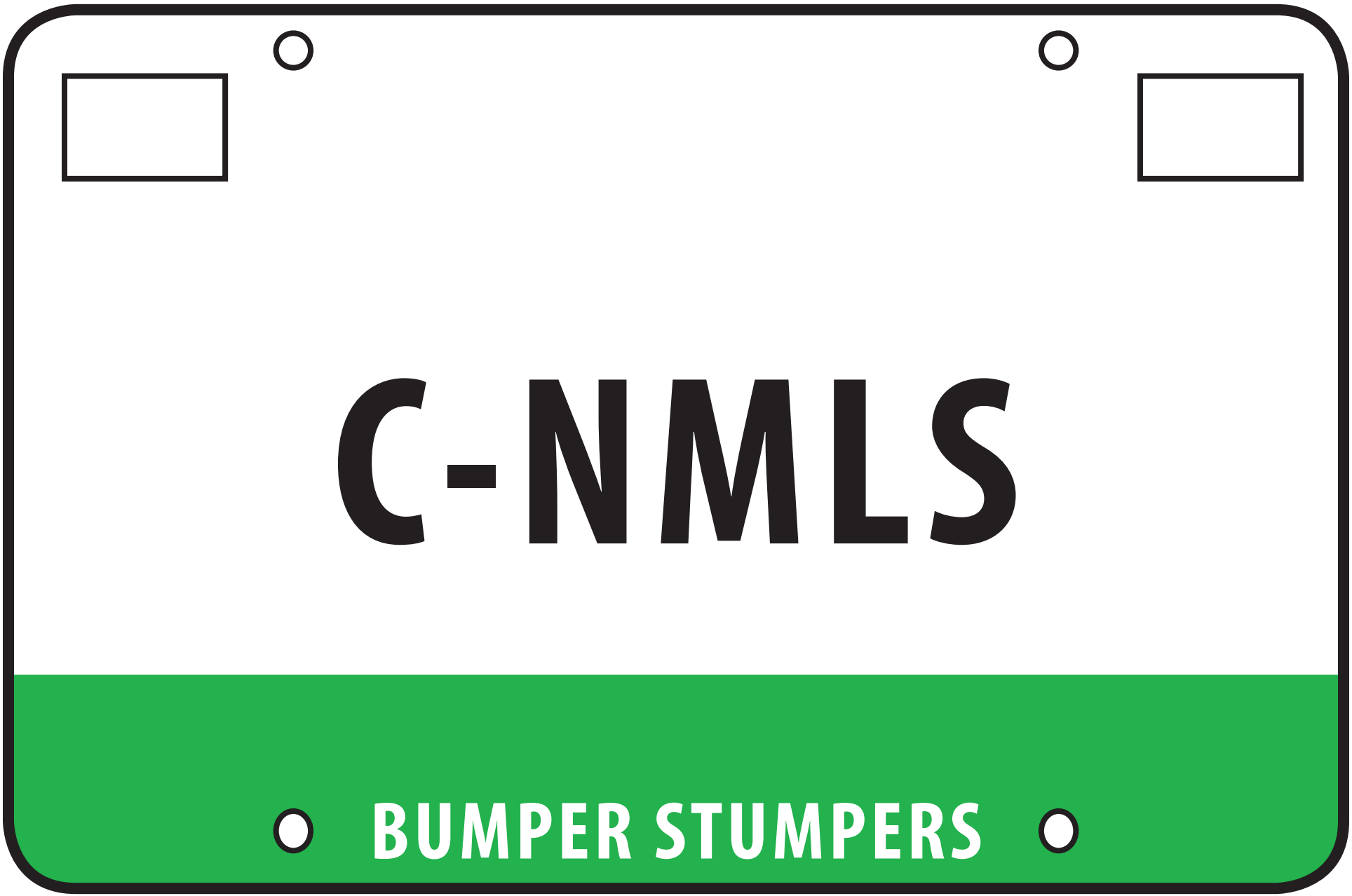
C-NMLS
BUMPER STUMPERS

Sea Animals

This plate names what scientists believe to be the source of several fossil fuels.

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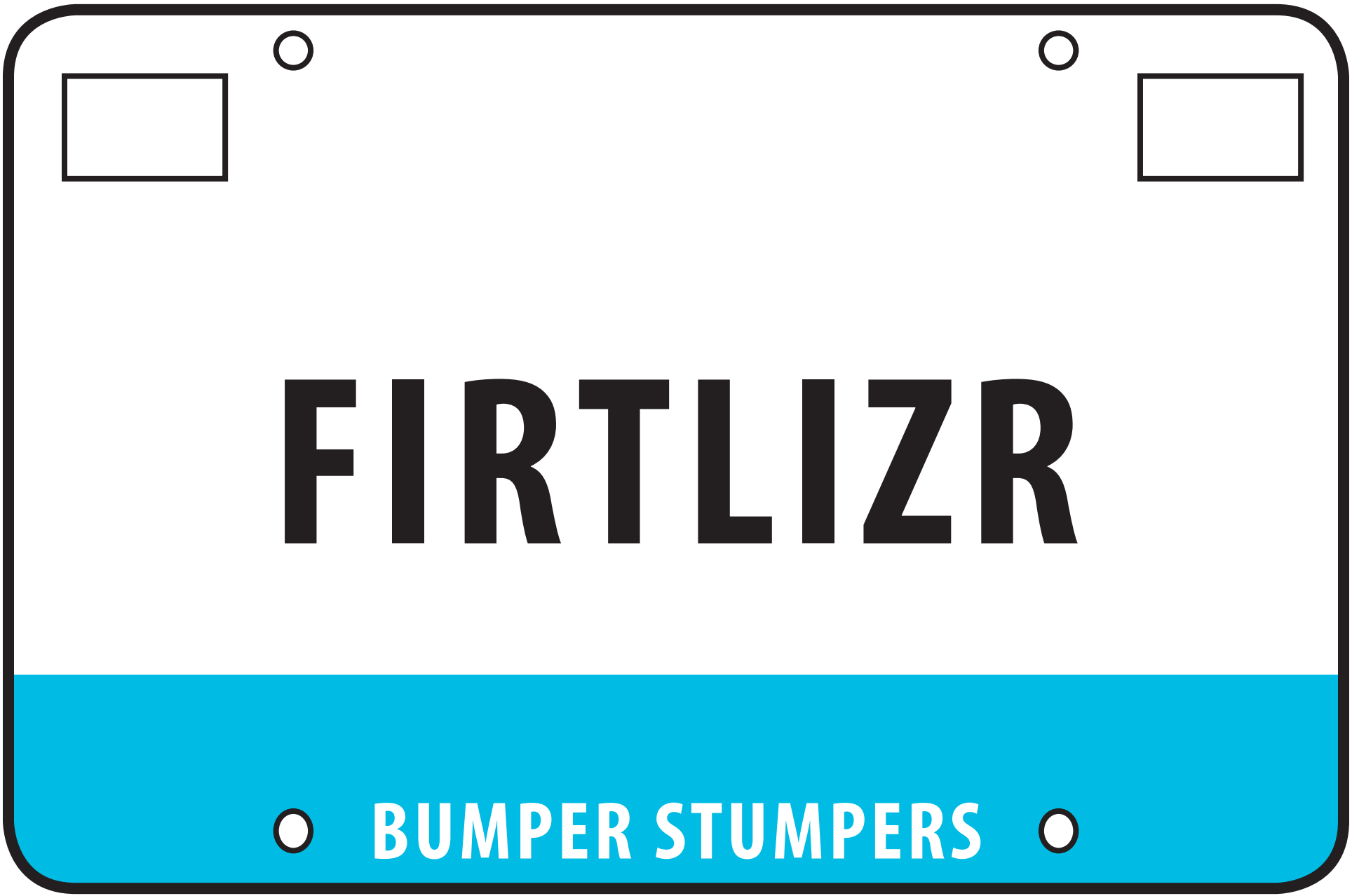
SDIMNT
BUMPER STUMPERS

Sediment

This plate refers to the material that settled on top of ferns to form fossil fuels.

BUMPER STUMPERS


FIRTLIZR
BUMPER STUMPERS

Fertilizer

This plate identifies a way to encourage plant growth for biomass fuels.

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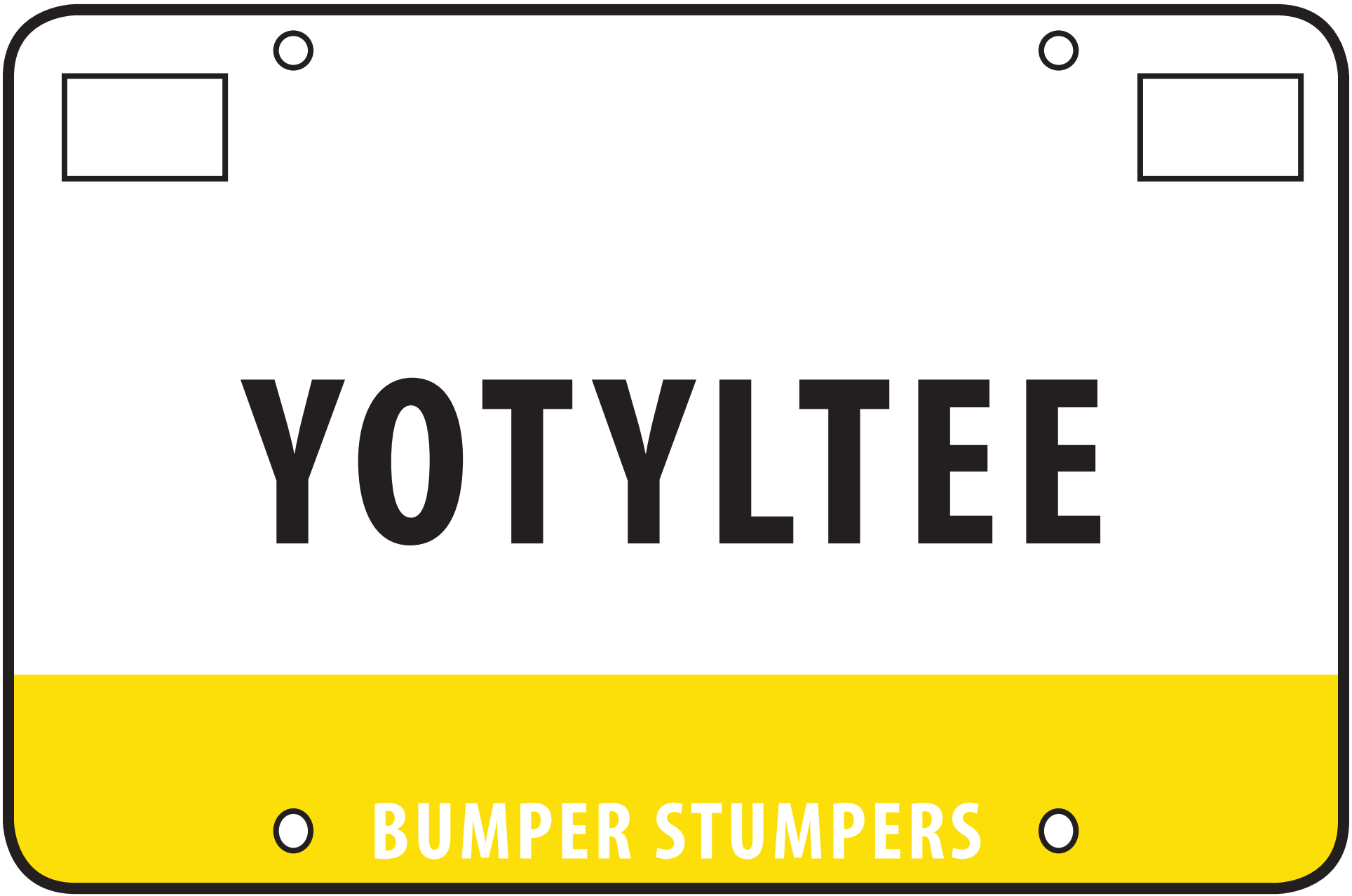
YOTYLTEE
BUMPER STUMPERS

Utilities

This plate identifies the companies responsible for distributing electricity.

BUMPER STUMPERS


RSRFOR
BUMPER STUMPERS

Reservoir

This plate names the location of potential energy at a hydropower plant.

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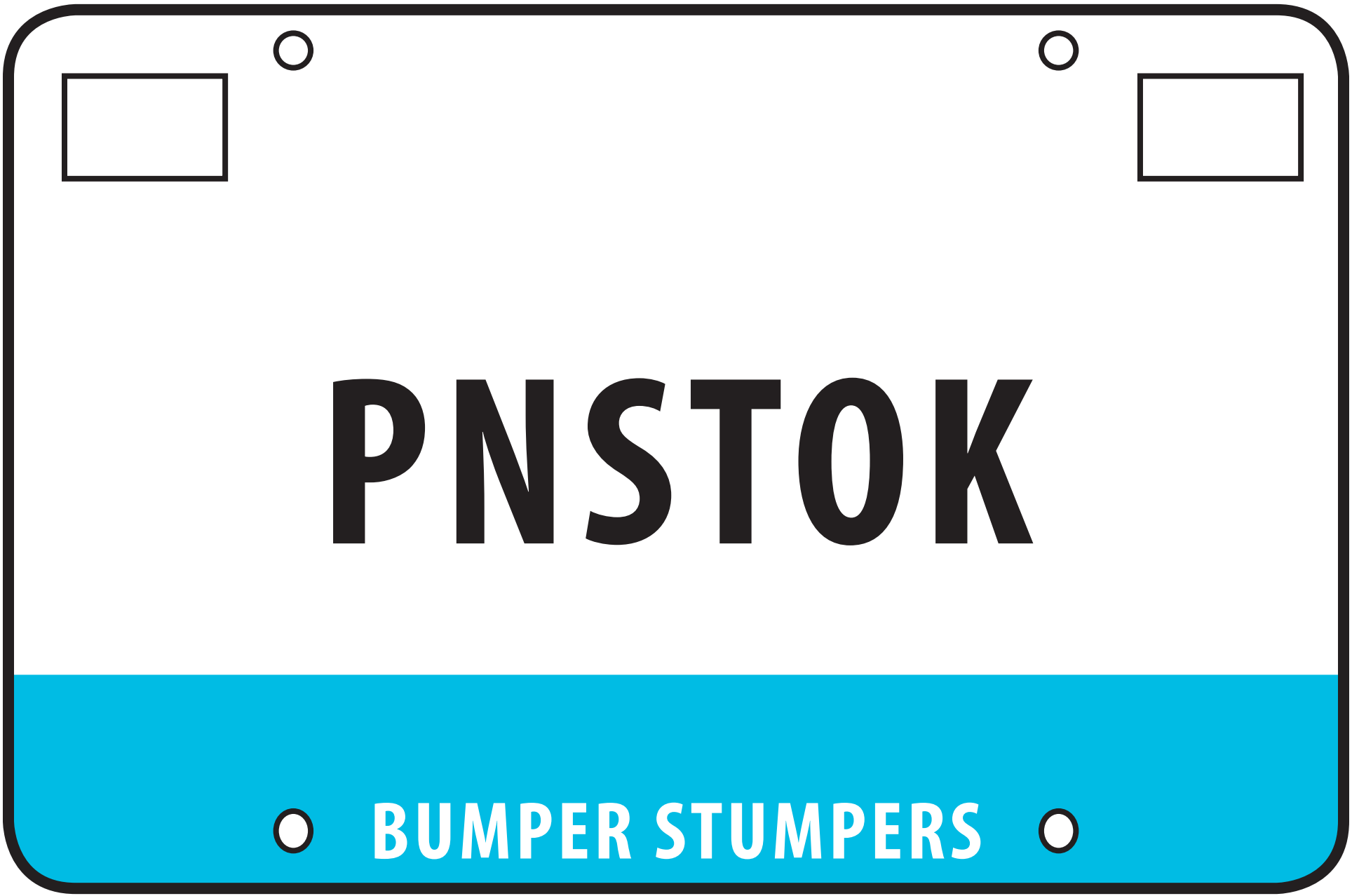
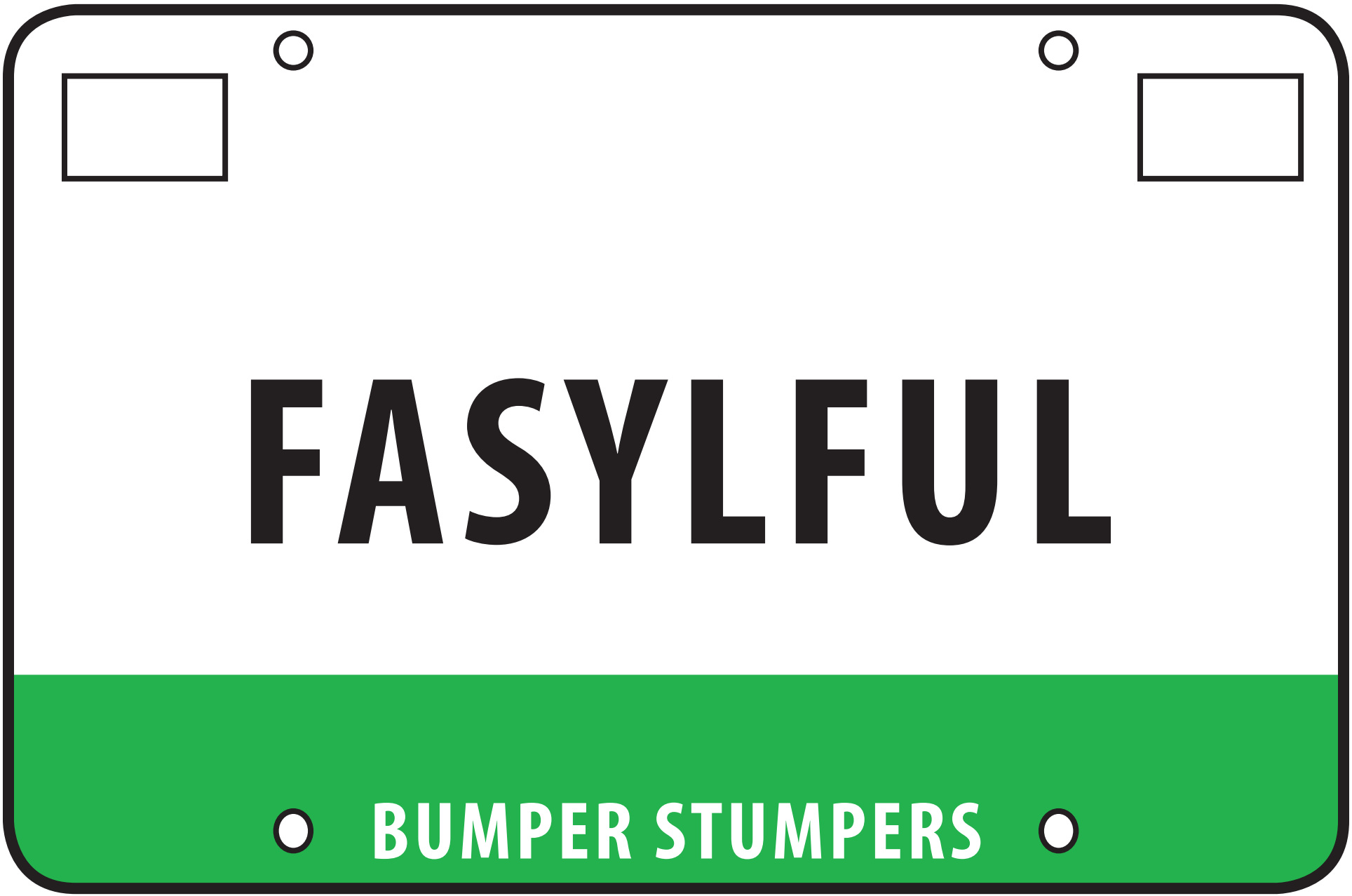

PNSTOK
BUMPER STUMPERS

Penstock

This plate signals the portion of a hydropower plant that brings the water to the turbine.

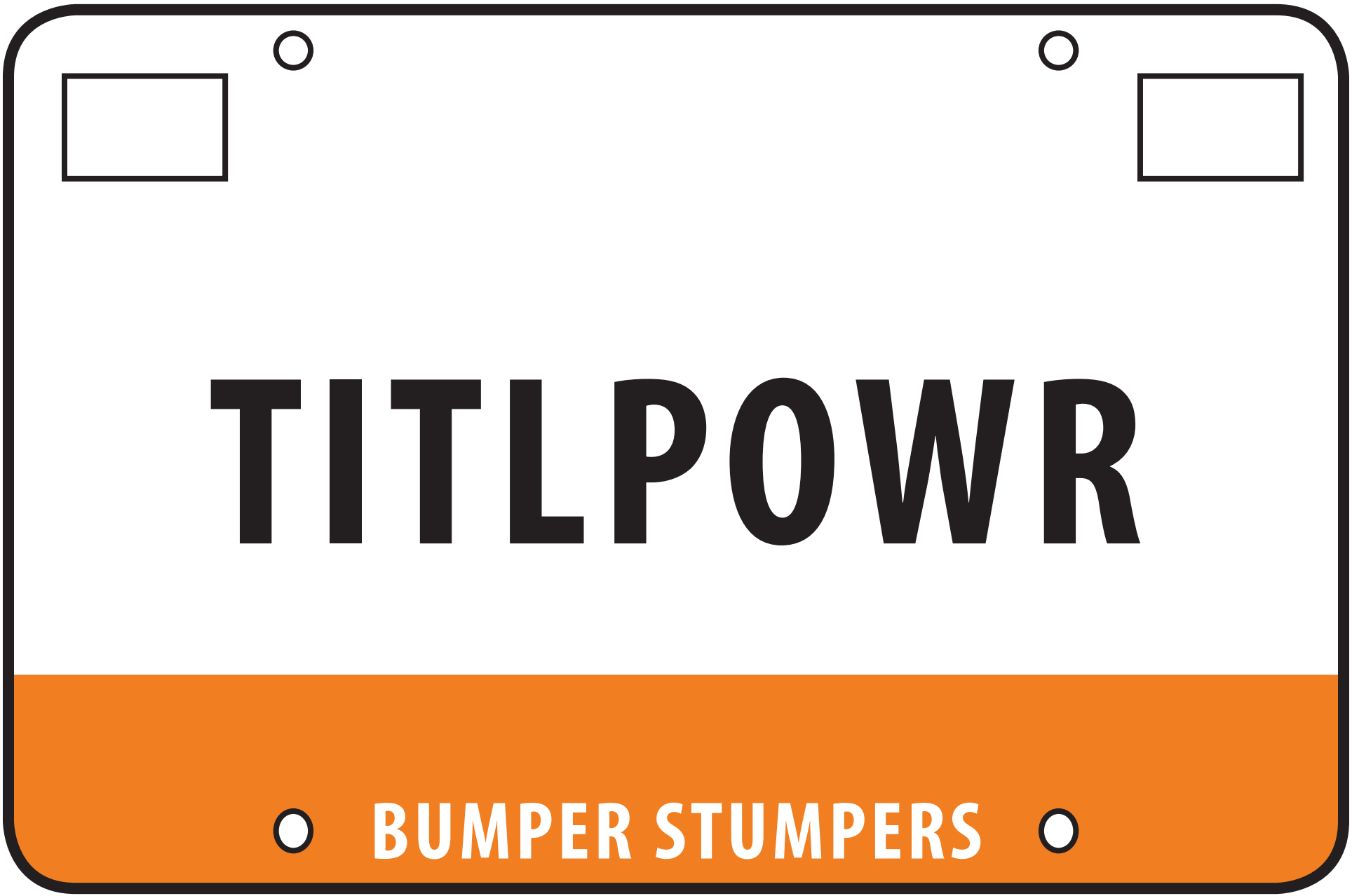
BUMPER STUMPERS


FASYLFUL
BUMPER STUMPERS

Fossil Fuel

This plate identifies a term given to several of the nonrenewable energy sources.

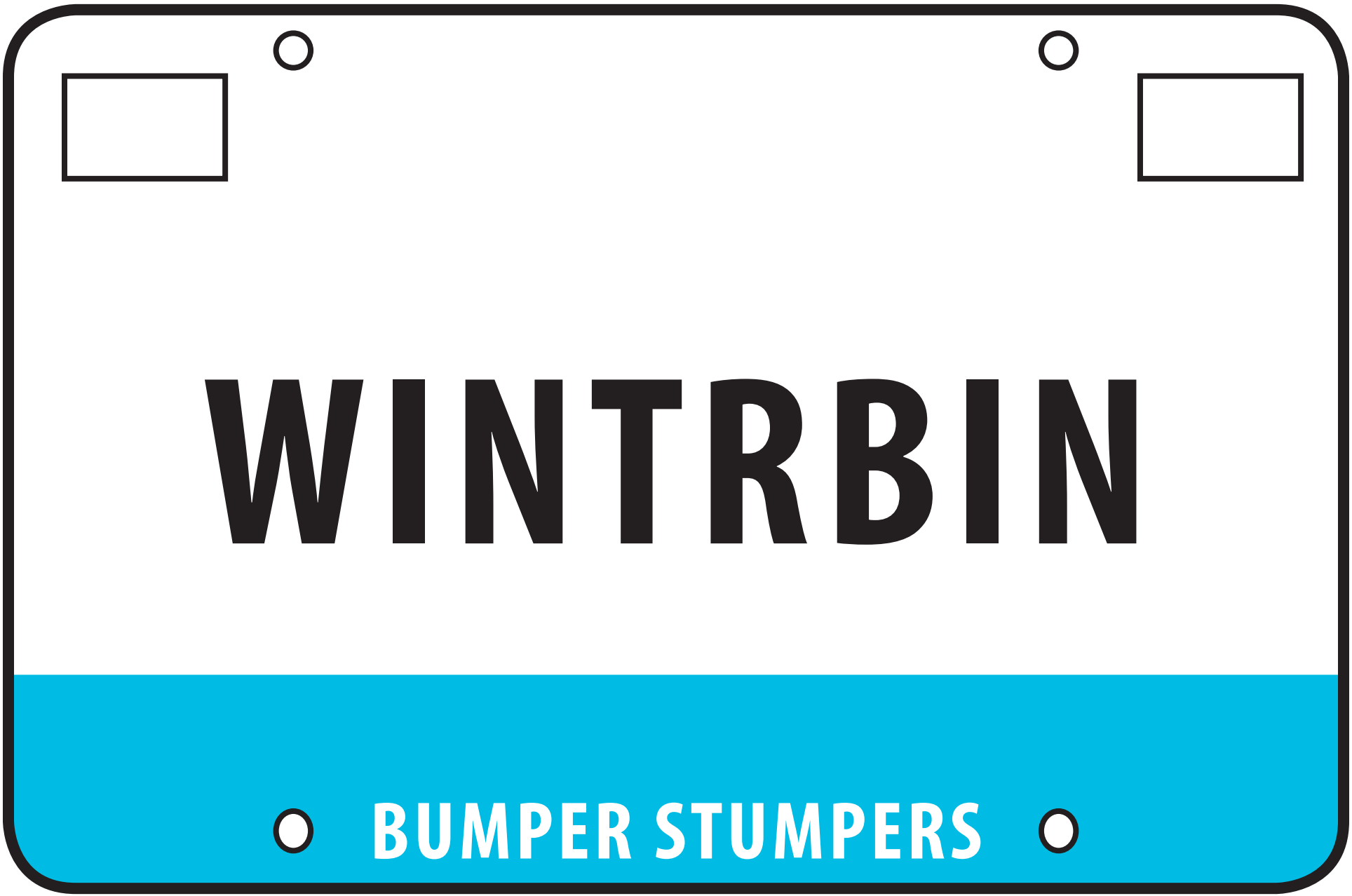
BUMPER STUMPERS


TITLPOWR
BUMPER STUMPERS

Tidal Power

This plate names a type of hydropower that is affected by the moon.

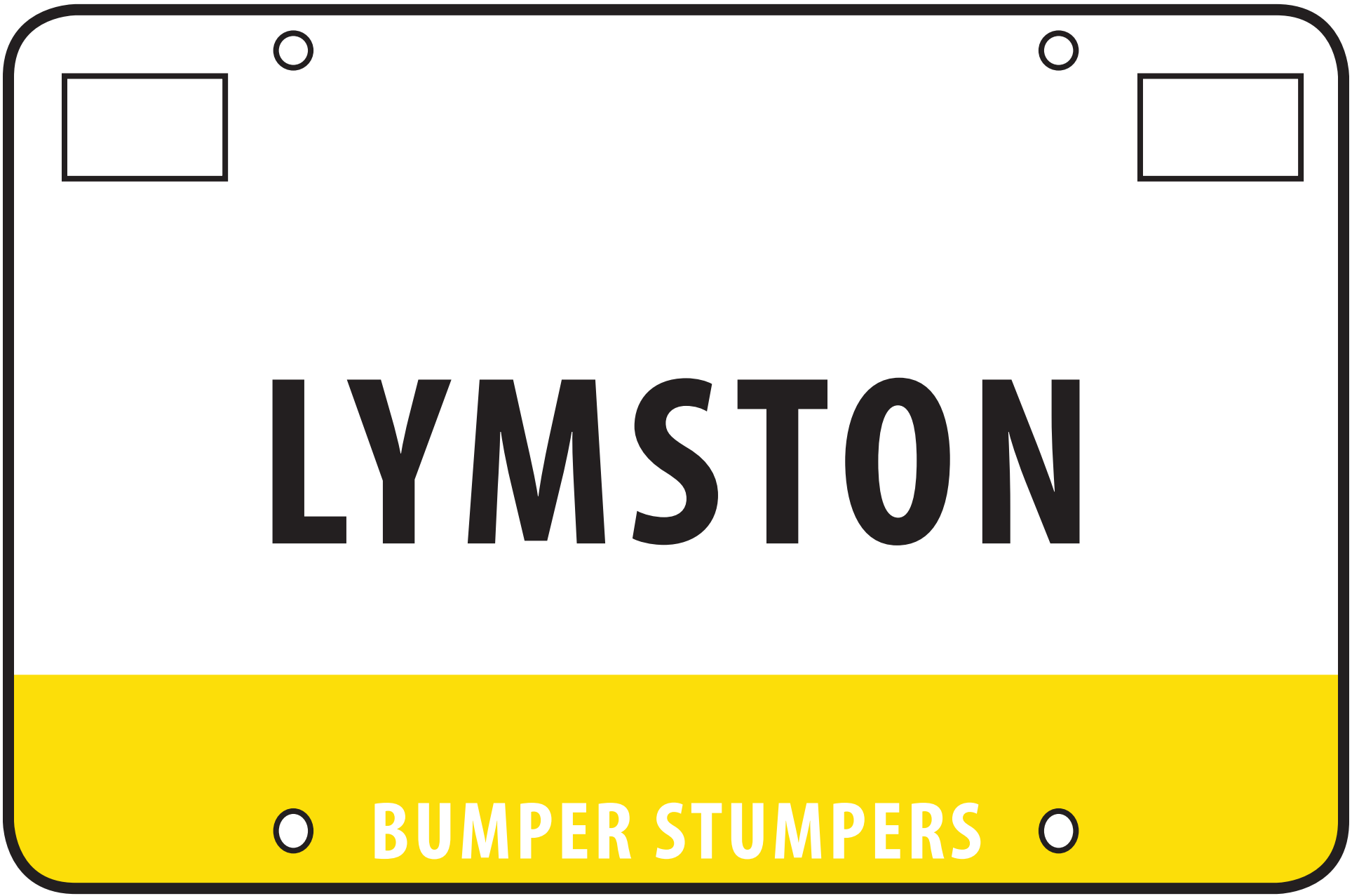
BUMPER STUMPERS


WINTRBIN
BUMPER STUMPERS

Wind Turbine

This plate refers to another name for a windmill.

BUMPER STUMPERS


LYMSTON
BUMPER STUMPERS

Limestone

This plate identifies a type of rock in which petroleum is often trapped.

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