2018-2019

Oil, Natural Gas, and Their Energy

Hands-on and language arts activities that provide primary students with an introduction to energy and how oil and natural gas are formed, transported, and used.

Grade Level:

Pri Primary

Subject Areas:

Science

Social Studies

Language Arts

Math

Technology

NEED

National Energy Education Development Project

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Teacher Advisory Board

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

Energy Data Used in NEED Materials

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

National Energy Education Development

1.800.875.5029
www.NEED.org

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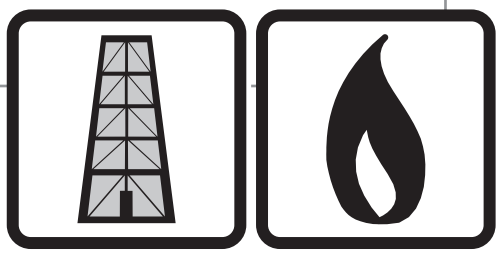
Oil, Natural Gas, and Their Energy

Oil and Natural Gas Kit

- 1 *Oil, Natural Gas, and Their Energy* Teacher/Student Guide
- 1 *Wonders of Oil and Natural Gas* Teacher/Student Guide
- 1 *Exploring Oil and Natural Gas* Teacher/Student Guide
- 5 Large metal slinkies
- 5 Small foam cups
- 5 Large foam cups
- 5 9 oz Clear plastic cups
- 20 Small opaque bathroom sized cups
- 150 Clear straws
- 25 Flexible straws
- 15 600 mL Plastic beakers
- 5 100 mL Graduated cylinder
- 1 Small bottle of food coloring
- 5 Small buttons
- 5 Small corks
- 5 Wooden beads
- 5 Glass marbles
- 5 Pennies
- 2 Bags small rocks (at least enough for 350 mL per beaker)
- 2 Bags medium rocks (at least enough for 350 mL per beaker)
- 2 Bags large rocks (at least enough for 350 mL per beaker)
- 4 Bags of colored sand (not water proof)
- 10 Kitchen sponges
- 1 Turkey injector

Table of Contents



Standards Correlation Information

www.NEED.org/curriculumcorrelations

Next Generation Science Standards

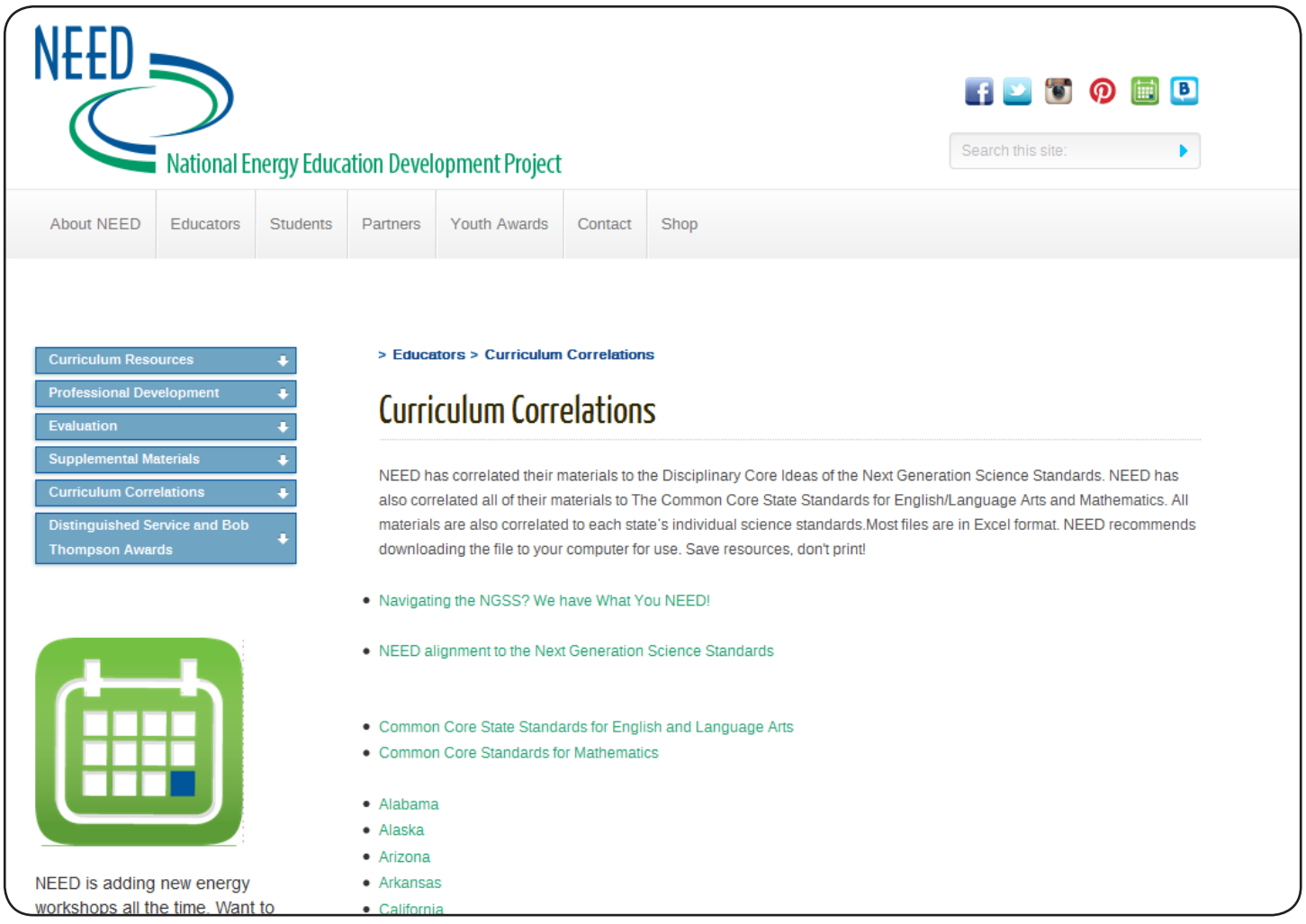
- This guide effectively supports many Next Generation Science Standards. This material can satisfy performance expectations, science and engineering practices, disciplinary core ideas, and cross cutting concepts within your required curriculum. For more details on these correlations, please visit NEED's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



Differentiating Instruction K-2

Students' abilities in Kindergarten through second grade are varied, as are the abilities of individual students within each classroom. Here are some suggestions for using this curriculum across the K-2 setting.

Reading

The student text for *Oil, Natural Gas, and Their Energy* can be found within this guide. Depending on your students' reading level, you may want to make a master copy to read aloud to your class. You can also download this guide from shop.NEED.org and project the text onto a screen that the entire class can see. Older children may be able to read the text independently.

Writing

Kindergarten

As much as possible, students should be interacting with materials and investigating individually or with partners. Students can each have their own science notebook or individual sheets. Teachers may choose to create a classroom set of worksheets or science notebook. Drawing scientific or realistic pictures should be modeled to the students and attempted in their work. Students should be encouraged to label pictures with as many sounds as they can hear, even if this is only the initial consonant at first. Students' individual observations can be glued into a classroom notebook made of large construction paper or chart paper. The teacher should write a summary sentence or two in the class science notebook based on the students' discussion and observations. While the teacher can assess students' pictures, listening to students to gauge their understanding is important. Parent volunteers can be a valuable resource during this unit, helping with investigation management, preparing materials, and being a scribe for students.

First Grade

Depending on the time of year that you teach this unit, you may find yourself using some of the Kindergarten strategies or moving toward second grade strategies. In general, students should be able to follow directions and work independently or with partners on investigations. Each student should have his or her own science notebook or individual worksheets and be encouraged to communicate his or her thinking in pictures and words, although allowing dictation for non-writers is appropriate. Pictures should be realistic in nature and include labels as needed. It is suggested that teachers create a word wall with pertinent vocabulary for the unit that students can use as a resource. Parent volunteers continue to be a good support for investigation management and preparing materials.

Second Grade

As second graders become more comfortable with the inquiry process, teachers are encouraged to extend the investigations further, exploring student generated questions. Second graders should be given more opportunities to record measurable data and units such as length in centimeters.

Oil and Natural Gas Writing Introduction

Have students start thinking about oil and natural gas by integrating it into your writing unit. Depending on whether you are focusing on fiction or nonfiction, you may want to use one of the following prompts:

Personal Narrative: Tell me about how you get to school, practice, church, or a grandparent's house. What would your weekend be like if there was no gasoline for your car?

Fictional Narrative: Pretend you lived at a time where there was no gasoline and no cars. Write a story describing what a day in your life would look like.

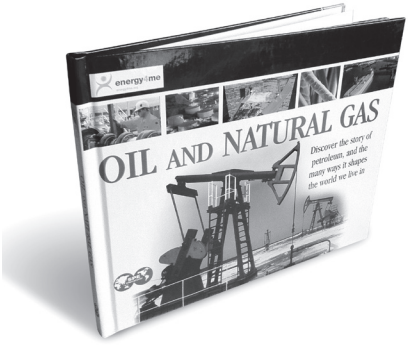
Science Notebooks

You are encouraged to have students record their thinking in science notebooks during this unit. There are many different looks to science notebooks, ways to use them, and ways to assess them. If you currently use student notebooks (or journals) in your classroom you may have your students continue using these as they learn about oil and gas. If you are not using science notebooks, you can make them out of paper that your students are familiar using. If you would like more structure to your science notebooks, you can copy the worksheets included in this guide and staple them together, or have students glue these pages into their existing science notebooks.

A checklist for assessing science notebooks can be found on page 8. Carrying the checklist with you as you circulate among your students will allow you to make some notes for formative assessment and guide your conversation with students as you help them become stronger scientists. You may want to customize the checklist based on your state standards.

Oil, Natural Gas, and Their Energy Materials

ACTIVITY	MATERIALS INCLUDED IN KIT	ADDITIONAL MATERIALS NEEDED
Where is the Oil and Natural Gas?		▪Pencils ▪Crayons or colored pencils
Illustrating Stories		▪Construction paper ▪Art supplies ▪Poster board or cardstock ▪Binding materials (staples, yarn, rings, etc.)
Exploring Core Sampling	▪3-4 Colors of sand ▪Clear straws ▪20 Small opaque bathroom sized cups	▪Spray bottles ▪Water ▪Plastic spoons ▪Rulers ▪Gravel or soil (optional)
Petroleum Ponder and Navigating Natural Gas		▪Various petroleum or natural gas products ▪Various non-petroleum or non-natural gas products ▪Box ▪Paper ▪Pencils
Sequence Oil and Natural Gas		▪Scissors ▪Glue sticks ▪Paper
Pretzel Power		▪"3x5" Note cards ▪Bag of pretzels ▪Plastic sandwich bags ▪Three signs or sheets of paper



Oil and Natural Gas, from the Society of Petroleum Engineers, is a great resource that supplements the information and activities in *Oil, Natural Gas, and Their Energy.* Available in several languages, this book showcases the geology, technology, careers, and difficult concepts of oil and natural gas in a fun, colorfully illustrated, and informational way.

To download the book or order a free classroom copy, visit http://energy4me.org/resources/oil-and-natural-gas-book/.

Teacher Guide

Background

Primary students are introduced to the concept of energy and how oil and natural gas are formed, transported, and used. Bold graphics, simple words and sentences, and supporting activities are used to learn science content as well as enhance their reading, comprehension, and critical thinking skills.

The *Oil, Natural Gas, and Their Energy* text is designed to be read aloud to students. Each section contains background information for the teacher and easy to understand information for students. Additional information is provided in each section for teachers and students who want to go deeper into the topic. You may project this guide so that more advanced readers may read at their own pace, where applicable. *Oil, Natural Gas, and Their Energy* is also available in an e-reader format, which is great for projection on a smart board or for use on tablets. Download this guide from shop.NEED.org.

★ Skills

- Nonfiction Reading
- Listening
- Critical Thinking
- Sequencing
- Vocabulary
- Compare and Contrast

Preparation

- Pre-read the student and teacher sections, and consult additional resources as needed for further information.
- Decide which activities you want to conduct to reinforce the information presented in the nonfiction text.

  Note: *If you decide to conduct the activity* Exploring Core Sampling*, depending on the level of your students, you may want to set up the cups ahead of time.*
- Plan your unit and procure any materials you need to conduct the activities. Consult the chart on page 6 for a list of materials needed.
- Make copies of any worksheets and activities needed and prepare digital or physical copies of masters for projection.

✔ Procedure

1. Introduce energy, oil, and natural gas to the students with a brief discussion about energy. Ask students what they know about oil and natural gas. If they are able, have them write or draw their thoughts and associations in a KWL chart. A template can be found on page 9.
2. Read the guide with the students. "What is..." pages could also be projected for the class as you read aloud. Have students add to their KWL charts by writing or drawing pictures to show what they've learned.
3. Conduct the activities you have planned to reinforce the information.
4. Assess student writing and work using the checklist on page 8.
5. Evaluate the activities with the students using the evaluation form on page 55 and return it to NEED.

Grade Level

- Primary, grades K-2

Time

Approximately 5-10 class periods, depending on the extent of activities you choose to utilize in the unit

Additional Resources

NEED has many other resources that can be used in the classroom to enhance student learning or as additional background for the unit. Visit shop.NEED.org to find these titles and more:

- *Energy on Stage*
- *Energy Live!*
- *Energy Stories and More*
- *Primary Energy Infobook*

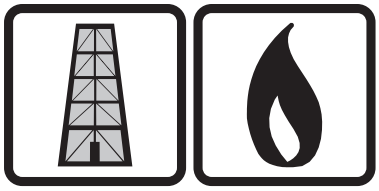
Also, check out these great websites for additional information on energy and oil and natural gas:

- EIA Kids — www.eia.gov/kids/
- Energy4me — https://energy4me.org

Science Notebook Skills Checklist

Designed to be a formative assessment tool, you may find this checklist useful as you work with students. Put all of your students' names down the left hand side. When you look at a student's worksheet or science notebook and see a skill demonstrated, put a dot in the box. Decide how many times (typically 3–5) you want to see the student use the skill independently before checking off the box as a sign that the student has mastered this skill.

Student Name	Drawings	Picture is realistic (colors, shape, size)	Includes appropriate labels	Notes and Observations	Uses senses to record observations	Observations are "big picture"	Observations focus on details	Graphs and Charts	Data is accurate	Includes appropriate labels	Clear presentation	Communication	Communicates verbally	Communicates in writing	Makes predictions	Makes predictions with reasoning	Uses evidence to support reasoning	Compares and contrasts	Communication is personal



KWL Chart

What I Think I **KNOW**	What I **WANT TO KNOW**	What I **LEARNED**

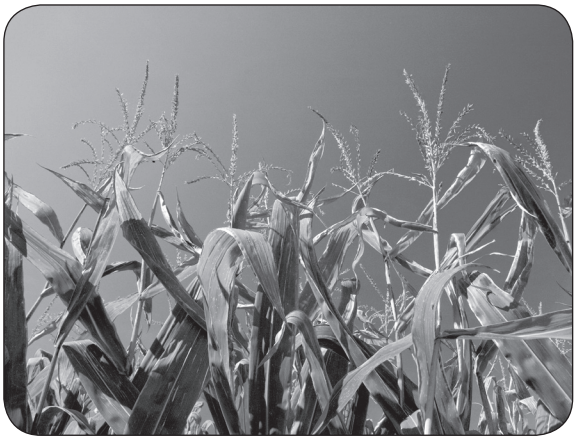
What is Energy?

TV

Girl

Rain

Car



Corn

Energy makes change.

Energy
TEACHER

What is Energy?

Energy makes a change of some kind; it does things for us. We use energy to move cars along the road and boats over the water. Energy is used to bake a cake in the oven, and to keep ice frozen in the freezer. It provides power so we can listen to our favorite songs on the radio, and light our homes. Energy makes our bodies grow and allows our minds to think. Scientists define energy as the ability to do work.

Energy is found in many different forms such as light, heat, motion, sound, and growth.

Discussion Questions

1. What changes occur with the objects in the pictures (on page 10)?
2. Where does the girl get her energy? *(food that she eats)* How is she using energy? *(to move, see, hear, think, stay warm or cool)*
3. Where does the television get its energy? *(electricity)* What kind of energy does it make? *(sound, light, heat)*
4. Where does the car get its energy? *(battery and gasoline)* What kind of energy does it make? *(motion, sound, heat)*
5. Where does the rain get its energy? *(the sun and gravity drive the water cycle)*
6. Where does the corn get its energy? *(light from the sun)*

Activity

1. Look around the classroom and point out things that are using energy *(computer, clock, lights, plants, animals)*. Decide where each item gets its energy and how it uses it.

What is Oil?

These machines called pumpjacks are used to pump oil out of the ground.

Oil is a liquid found underground. It can be thick like honey, or thin like water. It can be a yellowish color or dark brown. Oil must be pumped out of the ground so we can use the energy stored in it. Oil is also called petroleum or crude oil.

What is Oil?
TEACHER

What is Oil?

Petroleum is a liquid that is found underground. Sometimes we call it oil. Oil in its natural state is called crude oil and can be as thick and black as tar or as thin and transparent as water. Petroleum has a lot of energy in it. We can turn it into different fuels—like gasoline, diesel fuel, jet fuel, kerosene, and heating oil. Many other products are made from petroleum, such as rubber, plastics, inks, cosmetics, and crayons.

We use more petroleum than any other energy source, providing more than one-third of our energy. Most petroleum is used for transportation or making products.

More Information

1. Oil is a mixture of many different compounds, and must be separated before it can be used. Ask (or show) students to think about oil and water or salad dressing and how they can be mixed up or separated. The process of separating the compounds in petroleum is called refining.

2. The ancient Egyptians burned crude oil for light.

3. Edwin Drake drilled the first oil well in 1859. The well was only 69 feet deep, which is very shallow compared to oil wells drilled today. Most wells today can be a mile deep or more.

Discussion Question

1. How do we get the energy from oil? *Oil is turned into different fuels, like gasoline, diesel fuel, and jet fuel, and is used in the engines of cars, trucks, and jet planes. Oil is also burned for light in kerosene lamps and in homes in oil furnaces.*

What is Natural Gas?

Some cooking stoves burn natural gas using flames like this one.

Natural gas is invisible, like the air we breathe, but it is very different from air. You cannot see natural gas. We add an odor to natural gas so we can smell it. We burn natural gas to get energy from it.

What is Natural Gas?
TEACHER

What is Natural Gas?

Natural gas is like the air we breathe—it is a mixture of gases you can't see, smell, or taste. But it is different, too. It has a lot of energy in it. You can burn it to make heat. Ancient people discovered natural gas many centuries ago and used it in their temples.

About 2,500 years ago the Chinese burned natural gas to separate salt out of seawater, using evaporation. In 1816, street lamps in Baltimore, MD used natural gas.

Today, natural gas is the country's second largest source of energy, providing a little more than one quarter of our energy.

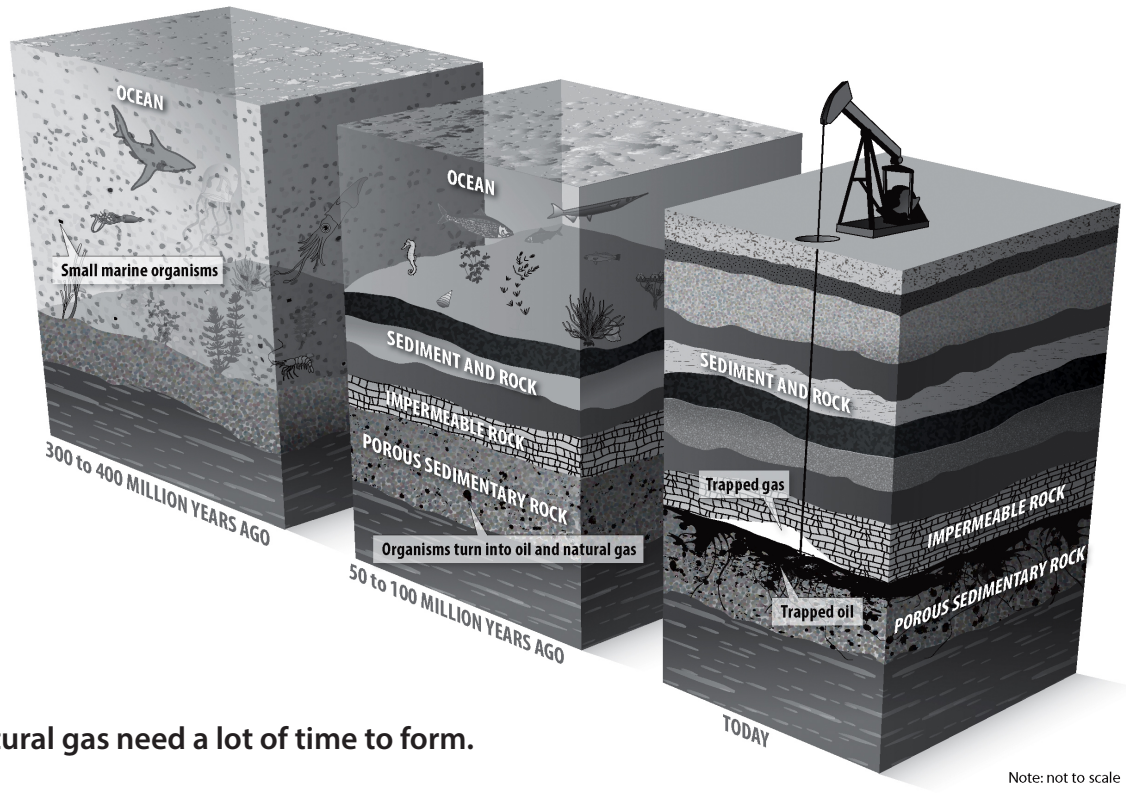
More Information

1. Natural gas can be found alone, or in combination with petroleum. It is also often found in coal deposits.
2. The mixture we call natural gas is a mixture made mostly of methane. A chemical, called mercaptan, is added to give it an odor and make it detectable if a leak occurs.
3. Most natural gas is nonrenewable, which means we cannot make more in a short amount of time. However, some sources of natural gas are renewable, such as landfills and biogas from livestock farms.

Discussion Questions

1. What is natural gas? *Natural gas is a clear, colorless gas we burn for energy.*
2. How is natural gas the same as air? How is it different from air? *Natural gas and air are both gases at room temperature, and are both invisible. Natural gas can be burned for energy, and air cannot.*
3. How is oil the same as natural gas? How is oil different from natural gas? *Like natural gas, oil is found in rocks underground. Oil has many different uses and can be made into many products. Natural gas is mostly burned for heat, cooking, or electricity.*

How Did Oil and Natural Gas Form?



Oil and natural gas need a lot of time to form.

Note: not to scale

A very long time ago, the oceans were filled with many different plants and animals. The dead plants and animals were buried and turned into oil and natural gas. Oil and natural gas are called fossil fuels.

Nonrenewable

NON - re - NEW - a - ble

NOT able to be NEW again

Some energy sources take hundreds of millions of years to form.

How Did Oil and Natural Gas Form?

TEACHER

Natural Gas and Petroleum are Fossil Fuels

Petroleum and natural gas were formed in the Earth hundreds of millions of years ago, before the dinosaurs. Oceans covered much of the Earth, filled with tiny sea plants and animals. When the plants and animals died, they sank to the bottom of the ocean, and were eventually covered by sand. Layers of dead plants, animals, and sand built up over time.

Over time, heat and pressure changed the sand into sedimentary rock, and the plants and animals were changed into oil and natural gas. Since oil and natural gas are made from the remains of plants and animals, they are called fossil fuels.

The plants and animals received their energy when they were alive from the sun. That energy was stored in them when they died. This is the energy found in oil and natural gas.

Natural Gas and Petroleum are Nonrenewable

The natural gas and petroleum we use today took hundreds of millions of years to form. That's why we call them nonrenewable energy sources. We can't make more in a short time. The United States doesn't produce enough oil to meet our needs. We buy about 51% of the oil we use from other countries.

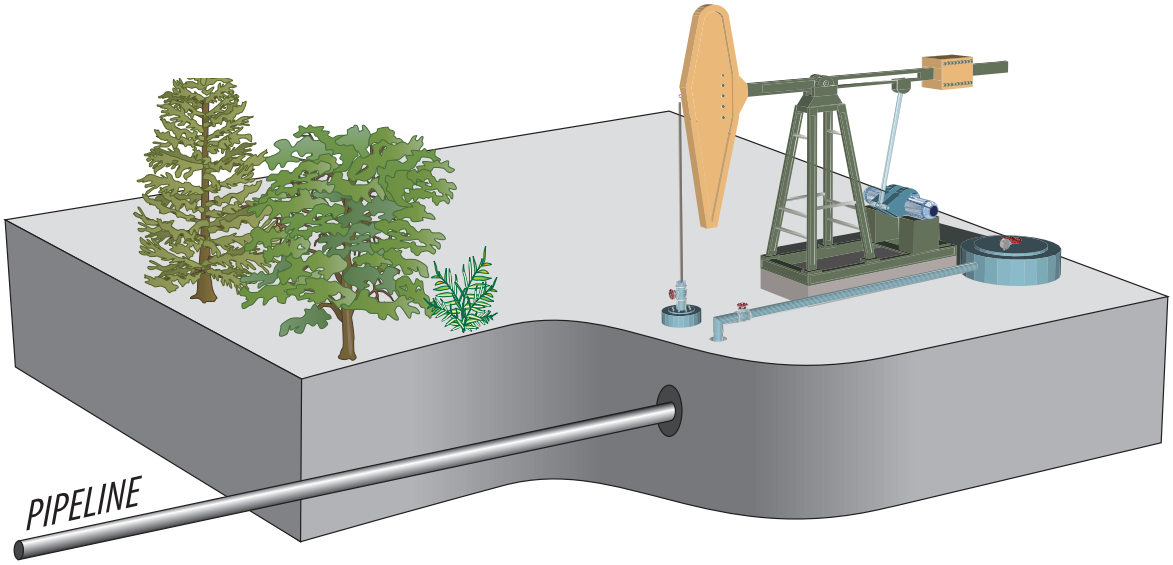
More Information

1. Oil and natural gas are usually trapped in porous rocks, the way water is trapped in a sponge. The most common rocks in which oil and natural gas are found are sedimentary rocks like sandstone and limestone.
2. To keep the oil or natural gas from seeping to the surface, the deposits must be capped with a nonporous rock.
3. The tiny plants and animals that eventually formed natural gas and oil were living about 400 million years ago, which is about 150 million years before the dinosaurs roamed the Earth.
4. Natural gas can be found along with oil underground, but it can also be found alone.

Discussion Questions

1. What has to happen to make oil and natural gas? *A great many plants and animals must die and be buried by many layers of rock and dirt. Also, a very long time must pass with lots of heat and pressure before the plants and animals have been turned into oil and natural gas.*
2. Why are oil and natural gas called fossil fuels? *Fossil fuels are energy sources made from dead plants or animals that died a long time ago. Plants and animals that were not turned into fossil fuels might be discovered today preserved in rocks as fossils.*
3. Why are oil and natural gas called nonrenewable? *It takes a very long time and just the right conditions to make oil and natural gas. We cannot make more in a reasonable amount of time. Therefore, they are nonrenewable.*

How Do We Get Oil and Natural Gas?



Natural gas is moved from one place to another through pipelines.

Scientists must explore deep below the surface. A hole called a well is drilled. Oil and natural gas are then pumped out of the ground. Natural gas is carried by pipes underground. Oil is carried by tankers to refineries.

An oil tanker. Image courtesy of BP

How Do We Get Oil and Natural Gas?
TEACHER

Drilling for Natural Gas

Natural gas is trapped in underground rocks. We drill wells into the ground to reach the gas. Some wells are a mile or more deep! Natural gas can be found under land or under the ocean's floor.

Natural gas is a mixture of gases. The main ingredient in natural gas is methane. Methane has no color, odor, or taste. To be safe, gas companies add a rotten egg smell to the gas so that leaks can be easily found.

Transporting Natural Gas

We move natural gas from one place to another in pipelines. There are two million miles of pipeline all across the United States. These pipes connect wells to refineries, to power plants, and to our homes, factories, and other buildings.

Oil Production

Petroleum is buried underground in tiny pockets in rocks. Geologists locate oil and gas deposits deep within the Earth using special equipment. We drill oil wells into the rocks to pump out the oil. The typical well today is about one mile deep (select a familiar site about one mile from the school and explain to students that this is about how deep most wells are today). Oil can be found under land. Texas and North Dakota are the states that produce the most oil.

A lot of oil is also under the oceans along our shores. Oil rigs that can float are used to reach this oil. Most of these wells are in the Gulf of Mexico.

Transporting Oil

We move oil from offshore wells and other countries with large ships called tankers. The tankers take the oil to special places called refineries, where the oil is separated into its many different compounds, such as gasoline or jet fuel. Then the compounds are transported by truck or train.

Technology and the Petroleum Industry

Current drilling techniques are better now because of technology. Computers and other special instruments are used by workers to greatly improve the amount of oil produced by a well, which is good for the economy and the environment.

Special drills let companies drill down and across and in different directions so that they can reach oil in a big area from just one oil well. This type of well saves a lot of land and uses only one well instead of many wells. An engineer in one location can operate a drill in a location very far away. This saves a lot of money and time by helping scientists to drill wells only in places where oil is found.

More Information

1. Many different types of technology are used to explore for oil and natural gas. Seismic technology uses sound waves to reveal what lies deep in the ground. 3-D imaging uses several seismic instruments and underground probes to construct a 3-D image of the area. When exploring in oceans, boats tow cables with hydrophones to locate oil beneath the ocean floor. Slight differences in the density of the rocks will show slight differences in gravitational pull, and these differences can be used to reveal certain subterranean features that could house oil or natural gas.

2. Getting oil out of the ground first begins with obtaining permission, and then drilling the well. While drilling, rocks and other debris must be removed. Once the hole is drilled, a number of different steps must be taken before pumping can begin. This is called completion.

3. A detailed description of the exploration and drilling process can be found in the guide *Exploring Oil and Natural Gas*.

Discussion Questions

1. Why can't oil be transported by pipeline the way natural gas can? *Oil first has to be separated into its different compounds before it can be used. Natural gas can be used straight out of the ground.*

2. How do geologists know where to drill a well? *Geologists perform tests and use special equipment that helps them find the oil and natural gas deep within the Earth.*

How Do We Use Oil and Natural Gas?

Some city buses run on natural gas.

We use oil and natural gas every day. Many homes are heated with natural gas. Natural gas is used to make electricity and is even used in cars and buses.

How Do We Use Oil and Natural Gas?

Lipstick

Action figures

Tape

Rubber bands

Oil is used to make gasoline, diesel fuel, jet fuel, and plastics. Plastic bags from the store, your toys, and even some clothing are all made from oil.

How Do We Use Oil and Natural Gas?
TEACHER

We Use Natural Gas Every Day

Almost everyone in the United States uses natural gas.

Factories burn natural gas to produce heat to make products like paper and cement. Natural gas is also an ingredient in paints, glues, fertilizers, plastics, medicines, and many other products.

Natural Gas is Cleaner to Burn

You need to burn natural gas to get to its energy. Anytime something is burned, pollutants are put in the air. However, natural gas doesn't pollute the air as much as coal or oil. That's why it is a good fuel for heating our homes, for making electricity, and for transportation.

Homes are big users of natural gas. More than half of the homes in the United States use natural gas for heating! Many also use it for cooking and heating water.

Schools, stores, offices, churches, and hospitals use natural gas, too!

Natural gas is also used to make electricity. Natural gas plants can produce electricity quickly. It is the biggest source for electricity in the U.S.

Natural gas burns cleaner than regular gasoline. Some cities use natural gas in their city buses and school buses. Some parks use natural gas in their vehicles. There aren't many gas stations that sell natural gas, so most families do not have natural gas powered cars.

We Use Petroleum Every Day

People have burned oil for a long time. Long ago, they didn't drill for it. They gathered oil that seeped from under the ground into ponds. It floated on the water. This oil was burned where it was found.

Now, oil is pumped from underground and used elsewhere. After the oil is pumped to the surface, it is shipped from one place to another through pipelines and by ships and trucks to special processing plants called refineries. At the refineries, it is separated into different fuels and made into other products. The first crude oil was refined into kerosene for use in kerosene lamps for lighting. At that time, the rest of the product was tossed away until Henry Ford began making lots of automobiles in 1913. Because automobiles use gasoline, the need for gasoline greatly increased. Today, a little more than 44% of all crude oil is made into gasoline.

Today, our country would come to a stop without fuels made from petroleum. Most of our cars, trucks, ships, and planes are powered by petroleum products. We depend on petroleum fuels to travel from place to place and to bring us food and other items that we need in our daily lives.

Our factories use oil to make plastics and paints, medicines, and soaps. Did you ever think about your action figures, your CDs, or even lip balm being made from petroleum? We also burn oil to make electricity that runs our lights and appliances. We use more petroleum than any other energy source.

How Do We Use Oil and Natural Gas?
TEACHER

More Information

1. Before it can be used, oil must be separated into its different compounds. A process called fractional distillation, which heats the oil until it boils, is used for the separation.

2. The mixture we call natural gas is a mixture made mostly of methane. A chemical, called mercaptan, is added to give it an odor and make it detectable if a pipeline leak occurs.

3. There are many, many different jobs available in the oil and gas industries. More information about careers can be found in *Exploring Oil and Natural Gas* and from the U.S. Department of Energy and the Society of Petroleum Engineers.

Discussion Questions

1. What are three things for which natural gas is used every day? *Heating homes, generating electricity, and in factories as a source of heat*

2. Which part of our society uses the most natural gas? *Industry uses the most natural gas, followed by electric power plants and homes.*

3. What are the major uses of oil? *Oil is used to make fuels for transportation, and products such as toys and CDs.*

4. What would happen if suddenly there was no oil? *Almost all vehicles run on a fuel made from oil. Very few cars, trucks, buses, trains, or jet planes would be able to move. Products and people could not move from place to place, and some areas would run out of food because it could not be trucked in to them. We use more oil than any other energy source.*

Where is the Oil and Natural Gas?

Question

- Where can oil and natural gas can be found in the United States?

Materials

- Copies of maps, *Top Natural Gas Producing States, 2016,* and *Top Oil Producing States, 2016*
- Pencils and crayons

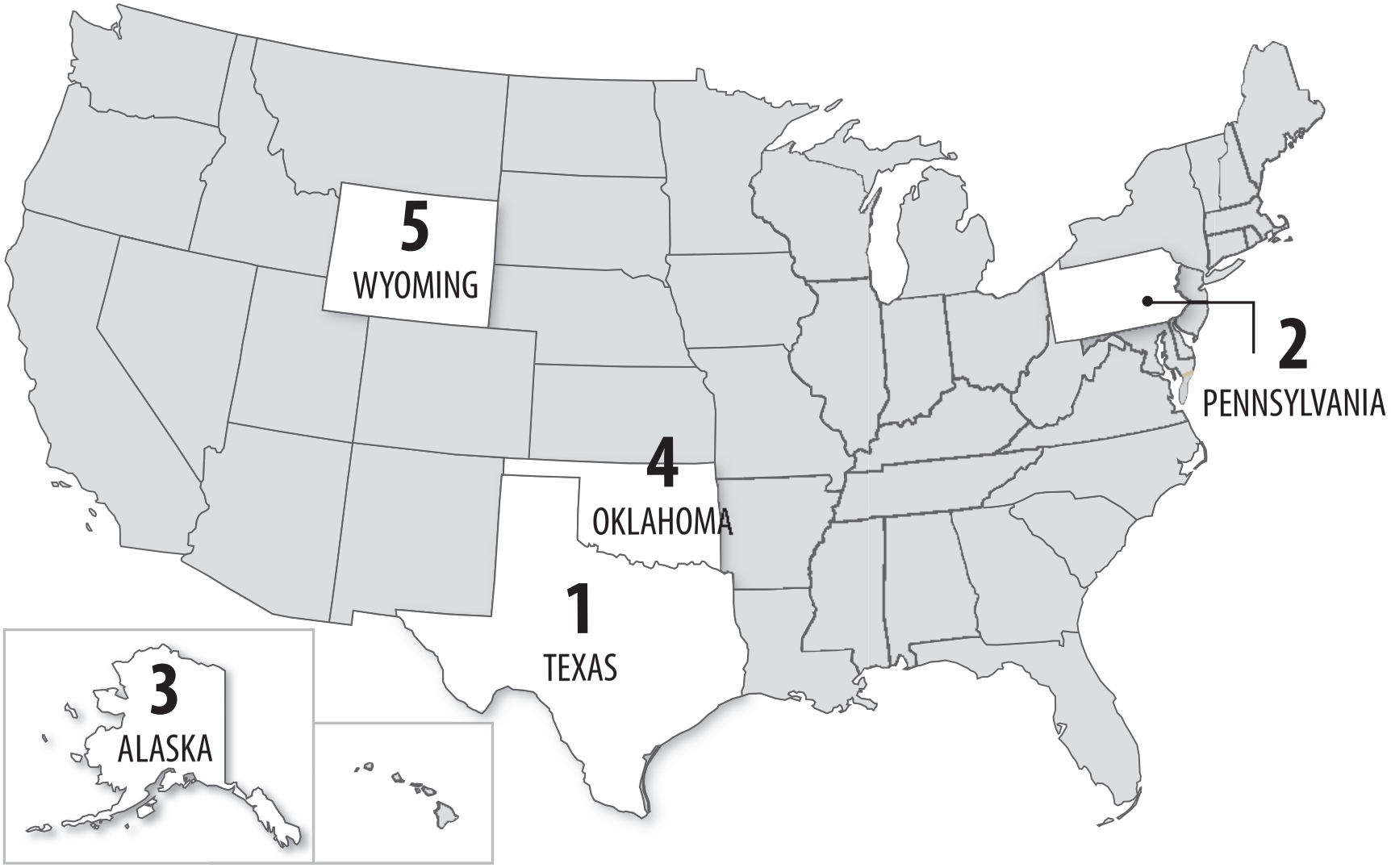
Preparation

- Make copies of each map for each student.

Procedure

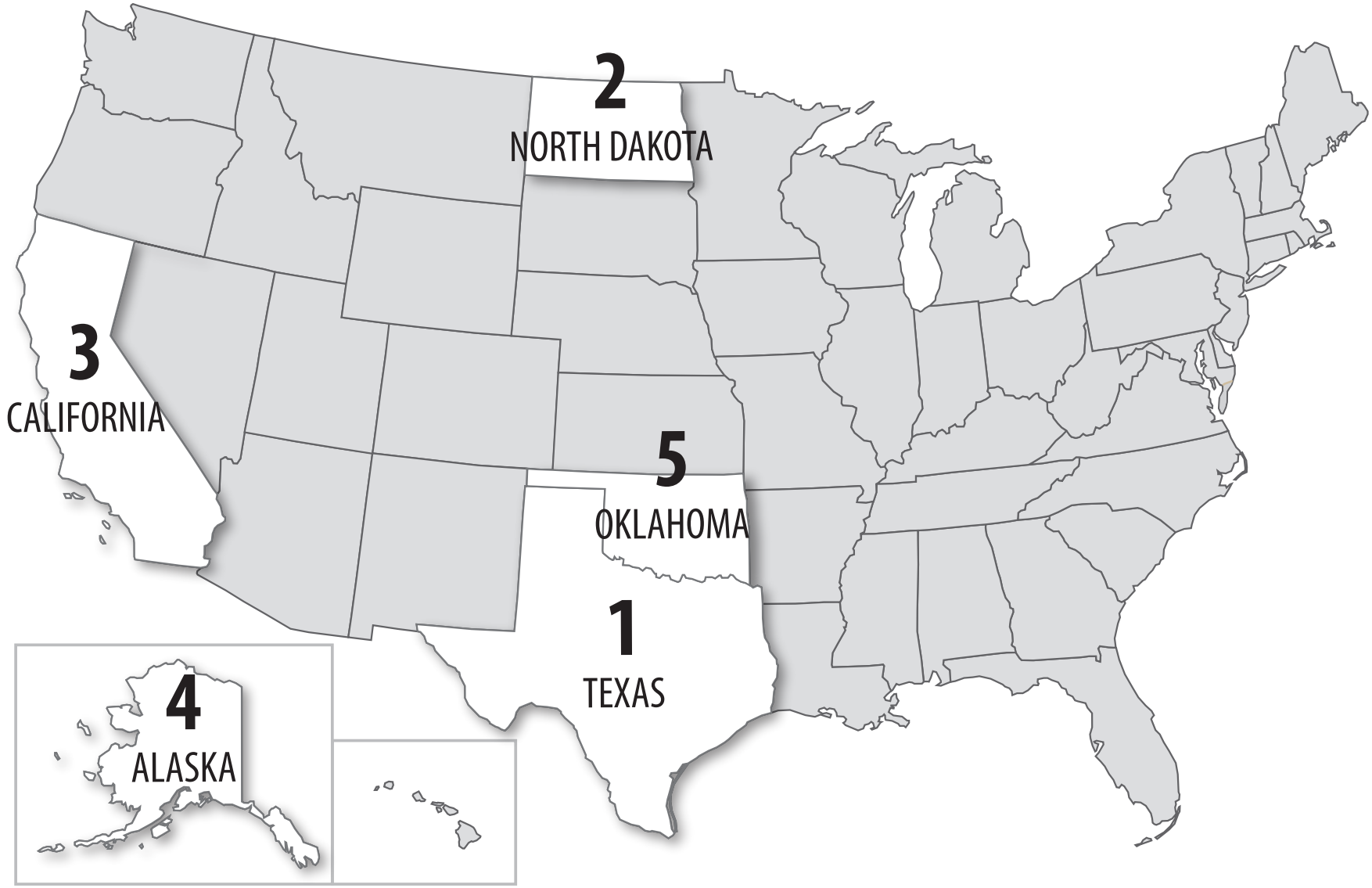
1. Have students locate their home state on each map and color it.
2. Identify the states that produce petroleum and natural gas by putting a red star on each one.
3. Discuss your state compared to the maps. Discuss how oil and natural gas might be transported to your state. Have students brainstorm what might be easy or difficult about getting these energy sources to their area.

Top Natural Gas Producing States, 2016



Data: Energy Information Administration

Top Oil Producing States, 2016



Data: Energy Information Administration

Illustrating Stories

Questions

- How were oil and natural gas formed?
- How do we get them from under the ocean?

Materials

- Construction paper
- Poster board or material for cover
- Markers or crayons
- Binding materials
- Copies of stories

Stories

- *Under the Sea*, found in *Energy Stories and More*
- *Into Deep Water: Drilling for Oil and Natural Gas*, found in *Energy Stories and More*

NOTE: *Energy Stories and More* can be accessed on the NEED website at shop.NEED.org.

Procedure

1. Have students work in groups of 3-4.
2. Each group should be given one copy of one story.
3. Students read their stories, then brainstorm ways to illustrate the story. *Alternative Option: Students write their own stories about oil or natural gas.*
4. Students draw scenes from their given stories, and write the story beneath the illustration.
5. Students create a cover for their stories. They can use construction paper, poster board, or something heavy that will provide a good, sturdy cover.
6. Help students bind their stories and covers, either by stapling them together, or by punching holes and tying them together with yarn or string.
7. If you like, your class can go to the classroom of younger or different students to share their stories.

Exploring Core Sampling

Background

Scientists explore the Earth to find oil and gas and then drill deep down in the Earth to get it out. Explore what it's like to drill deep down into the Earth.

Question

- Are all core samples the same?

Materials

- 3-4 Colors of sand
- 1 Clear plastic straw
- 1 Small opaque bathroom sized cup
- Water in a spray bottle
- Plastic spoons
- Ruler
- 1 Bag of soil or small gravel (optional)

NOTE: When layering earth materials in cups, students can arrange the layers in any order.

Procedure

1. Using the ruler to measure, place a 1 cm layer of one of the earth materials in the cup with a spoon. Mist the layer with water to make it a bit damp.
2. Place another earth material 1 cm deep on top of the first layer. Moisten with water until damp.
3. Continue alternating layers of earth materials and water. The total height of the layers stacked in the cup will be at least 4 cm deep.
4. Students should trade cups so they are not pulling a core sample from their own cup.
5. Use a straw to extract a core sample by pushing the straw straight down through the layers in the cup.
6. Place a finger tightly over the top end of the straw and withdraw it from the cup. Observe the layers in the straw core sample.
7. Lay several core samples from different cups side by side. Compare results.

Conclusions

- What are core samples?

- What are petroleum geologists looking for when they examine core samples?

Petroleum Ponder

Question

- What materials are made from petroleum?

Activity Goal and Rules

The object of *Petroleum Ponder* is for each team to correctly identify as many items as possible that are made from petroleum in their *Petroleum Ponder* box. In a relay fashion, each team member will get the chance to look over the contents of the box and return to "home base" to write down as many items as they can remember. Each team member will proceed to the box in numerical order, however the pencil or pen must remain at home base, and there is no talking while the game is being played. As soon as the first player arrives at the box, they may "ponder" the contents of the box without touching the items or stopping. This player returns to home base, tags the next player, and begins to write down as many items that he/she can remember from the box that were made from petroleum. The second player returns from the box, tags the next player and begins to record. Players waiting their turn should review the list silently and carefully to be sure they look for new items when it becomes their turn to "ponder." Once all players have walked past the box, they may add or cross off items on their list. The team with the most correctly identified items will be the winner.

At least one item in the box is NOT made from petroleum. If these items appear on the team's final list, five points will be deducted. One point will be awarded for each correctly identified item. No item can receive more than one point if listed more than once. For example, if pencil is on the list, it will not be awarded 2 points for pencil AND writing utensil; only one point will be awarded.

Materials *FOR EACH GROUP*

- Sheet of paper
- Pen or pencil
- *Petroleum Ponder* box

Preparation

- Gather supplies and assemble *Petroleum Ponder* boxes from the list of supplies on the next page. Assemble an appropriate number of boxes to correspond with the number of student teams you will have. Make sure to include **at least** one item ***not*** made from petroleum.
- Divide students into teams. Pre-assign each group member a number, if desired.
- Set up the room with home bases that are separate or at a small distance from each *Petroleum Ponder* box.

✔Procedure

1. Send student groups to their home base. Remind students not to go near the box until instructions have been given.
2. Each team will need a sheet of paper and one pen or pencil. Instruct teams to put their name on their paper.
3. Assign each participant a number if they were not pre-assigned.
4. Go over the goal and the rules for the activity, and when ready, begin team play.
5. At the close of the game, identify and discuss all of the items contained in the box and have student teams record their scores.

⁂ Suggestions for Petroleum Ponder Box Ingredients

- Nylon
- Crayon
- Scotch tape
- Masking tape
- Garbage bag
- Sandwich bag
- Aspirin or vitamin bottle
- Plastic cup
- Styrofoam cup
- Makeup
- Phone
- Hand lotion
- Football/sports equipment
- Toothpaste
- Balloons
- Fertilizer
- Deodorant
- Insect repellent
- Sunglasses
- Pen
- Paint brush
- Clothing (polyester or nylon)
- Fake nails
- Anything plastic
- Lipstick
- Chap Stick®
- Dice
- Toothbrush
- Umbrella
- Perfume
- Shoe polish
- Roof shingle
- Novelty candy
- Chunk of asphalt
- Wax paper
- Camera
- Comb
- CD
- Paint
- Toy cars
- Golf balls
- Shoes
- Shampoo
- Petroleum jelly
- Glue
- Electrical tape
- Fishing lures

Navigating Natural Gas

Question

- What materials are made from natural gas?

Activity Goal and Rules

The object of *Navigating Natural Gas* is for each team to correctly identify as many items as possible that are made from natural gas in their *Navigating Natural Gas* box. In a relay fashion, each team member will get the chance to look over the contents of the box and return to "home base" to write down as many items as they can remember. Each team member will proceed to the box in numerical order, however the pencil or pen must remain at home base, and there is no talking while the game is being played. As soon as the first player arrives at the box, they may notice and "navigate" through the contents of the box without touching the items or stopping. This player returns to home base, tags the next player, and begins to write down as many items that he/she can remember from the box that were made from natural gas. The second player returns from the box, tags the next player and begins to record. Players waiting their turn should review the list silently and carefully to be sure they look for new items when it becomes their turn to "notice and navigate." Once all players have walked past the box, they may add or cross off items on their list. The team with the most correctly identified items will be the winner.

At least one item in the box is NOT made from natural gas. If these items appear on the team's final list, five points will be deducted. One point will be awarded for each correctly identified item. No item can receive more than one point if listed more than once. For example, if pencil is on the list, it will not be awarded 2 points for pencil AND writing utensil; only one point will be awarded.

Materials *FOR EACH GROUP*

- Sheet of paper
- Pen or pencil
- *Navigating Natural Gas* box

Preparation

- Gather supplies and assemble *Navigating Natural Gas* boxes from the list of supplies on the next page. Assemble an appropriate number of boxes to correspond with the number of student teams you will have. Make sure to include **at least** one item ***not*** made from natural gas.
- Divide students into teams. Pre-assign each group member a number, if desired.
- Set up the room with home bases that are separate or at a small distance from each *Navigating Natural Gas* box.

✔Procedure

1. Send student groups to their home base. Remind students not to go near the box until instructions have been given.
2. Each team will need a sheet of paper and one pen or pencil. Instruct teams to put their name on their paper.
3. Assign each participant a number if they were not pre-assigned.
4. Go over the goal and the rules for the activity, and when ready, begin team play.
5. At the close of the game, identify and discuss all of the items contained in the box and have student teams record their scores.

⁂ Suggestions for *Navigating Natural Gas* Box Ingredients

- Allergy medicine
- Aluminum foil*
- Anti-freeze
- Bandages
- Bug Spray
- Cell phones
- Crayons
- Dish soap
- Disposable diapers
- Fertilizer
- Fishing line
- Foam lunch trays or cups
- Food packaging (plastic)
- Golf balls
- Golf pencils*
- Glue
- Helmet (football and bike)
- Household cleaning wipes
- Insulated wiring
- Lip stick
- Nalgene® water bottle
- Pantyhose
- Paint
- Paint brush
- Penny*
- Perfume
- Pumice stone (natural)*
- PVC pipe elbow
- Safety glasses
- Tires (toy car)
- Tooth brush
- Trash bags
- Wood*

*Items NOT made from natural gas

Sequence Oil and Natural Gas

Question

- What is the process of getting oil and natural gas from beginning to end?

Materials

- 5 Pictures from *What Order?*, page 34
- Scissors
- Glue sticks
- Science notebook or separate sheets of paper

Preparation

- Make copies of *What Order?* for each student.

Procedure

1. Review what oil and natural gas are and tell students they will need to sequence 5 pictures showing the steps from formation to products.

2. Instruct students to cut the pictures apart. Emphasize that they are not printed in order.

3. Have students glue the pictures in order on a separate sheet of paper or in their science notebooks, and instruct students to label what each picture represents in the sequence. They may do this individually or you can provide them with a word bank.

Word Bank Example

- formation
- movement
- uses
- exploration and drilling
- pumping

What Order?

Lipstick

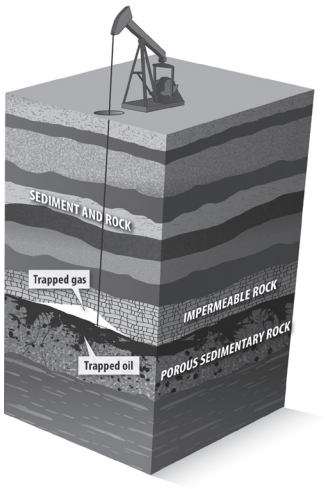
Action figures

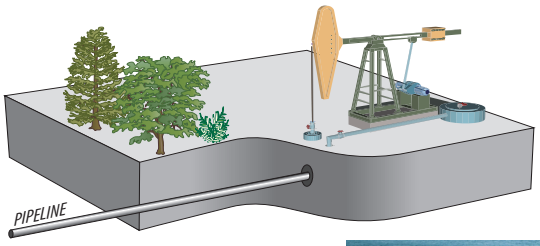
Rubber bands

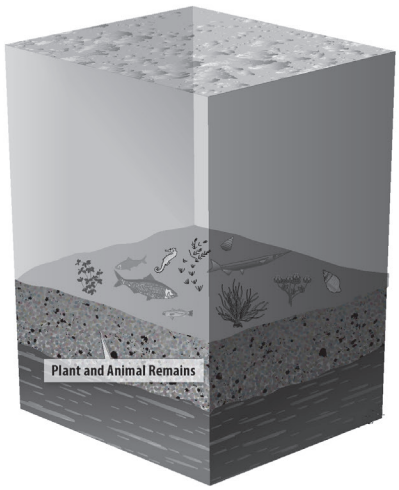
Natural gas flame

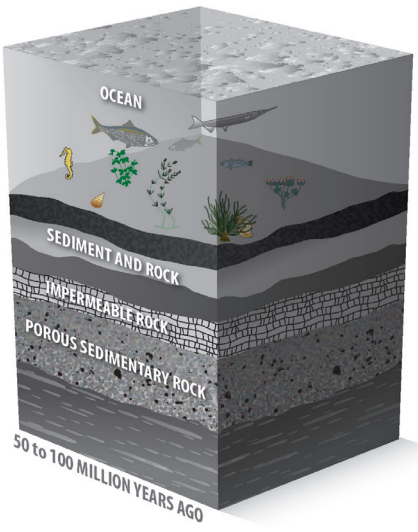
Tape

Pen









Pretzel Power

Background

Oil and natural gas are widely used as transportation fuels. Most of our cars run on petroleum. Some vehicles are more efficient than others and allow us to go farther with less fuel while being kind to the environment.

Question

- Why is the miles per gallon (mpg) rating of a car important?

Materials

- 3" x 5" Cards
- Internet access for students (see "optional" note below)
- Bag of pretzels (or alternative food item)
- Plastic sandwich bags
- Three signs (Home, Near Town, Far Town)

Preparation

- Prepare a plastic bag with ten pretzels or an alternative for each student.
- Make three signs, one labeled "Home", one labeled "Near Town", and one labeled "Far Town." The signs should be large enough to see from across the room.
- Select a large area and place the Home, Near Town, and Far Town signs on poles or walls. The distance from Home to Near Town should be 50 steps. The distance from Home to Far Town should be 100 steps. (Do not give these distances to students.)

Procedure

1. Have students look up a car they would like to drive on www.fueleconomy.gov. On 3" x 5" cards, students should record the car's name, model year, miles per gallon, and the number of passengers the car holds. It may be helpful if students have chosen an FFV (flex fuel vehicle), that they choose which fuel they will use—gasoline or E85—before recording mileage.

   OPTIONAL: Depending on the age and independence of your students, you may wish to use the information on pages 37-49 to print pre-made automobile cards. If you would like to print the cards on adhesive labels use Avery 5392. When handing out cards for vehicles using Flex Fuel, assign the fuel choice to students.

2. Distribute a bag of pretzels to each student. Tell students not to eat the pretzels until they are instructed to begin.
3. Explain to the students that each pretzel represents one gallon of gasoline, and each step (heel-to-toe) the student takes represents one mile traveled.
4. Students eat a pretzel and take the appropriate number of steps before eating the next pretzel. All steps are heel-to-toe.

❶ Round One

- Use only five pretzels for this round. Each person will drive his/her car to work in Near Town and return Home. If anyone runs out of fuel (pretzels), he/she must stay at that point until round one is over. Line up at Home and start stepping!
- Discuss:
  - Which cars got you to work and home? Which didn't?
  - Did anyone have extra fuel remaining?
  - What alternatives to driving your own car are there?

❷ Round Two

- Use the remaining five pretzels and try some of the alternative suggestions discussed above. Everyone will travel to Far Town and return Home. Expect "negotiations". Suggest students carpool to work. Drivers may eat each passenger's pretzels as fuel. Line up at Home and start stepping!
- Discuss:
  - Who made it to Far Town and back? How did you do this?
  - Who did not make it to Far Town and back? Why not?

2007 Toyota Camry

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	24
MAXIMUM RANGE	444

2007 Honda Accord

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	25
MAXIMUM RANGE	428

2008 Cadillac Escalade AWD

CLASS	SUV 4WD
NUMBER OF PASSENGERS	8
FUEL	Gasoline
COMBINED MPG	14
MAXIMUM RANGE	364

2008 Ford Escape Hybrid 4WD

CLASS	SUV
NUMBER OF PASSENGERS	5
FUEL	Hybrid
COMBINED MPG	28
MAXIMUM RANGE	420

2008 Volkswagen New Beetle Convertible

CLASS	Minicompact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	23
MAXIMUM RANGE	334

2008 BMW 335ci Manual Convertible

CLASS	Subcompact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	20
MAXIMUM RANGE	322

2008 Volvo V50 AWD

CLASS	Small Station Wagon
NUMBER OF PASSENGERS	5
FUEL	Premium Gasoline
COMBINED MPG	21
MAXIMUM RANGE	332

2009 Jeep Liberty 2WD

CLASS	SUV 2WD
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	18
MAXIMUM RANGE	351

2009 Dodge Caliber

CLASS	Small Station Wagon
NUMBER OF PASSENGERS	5
FUEL	Premium Gasoline
COMBINED MPG	22
MAXIMUM RANGE	299

2009 Saturn Vue Hybrid

CLASS	SUV 2WD
NUMBER OF PASSENGERS	5
FUEL	Hybrid
COMBINED MPG	28
MAXIMUM RANGE	504

2009 Nissan Xterra 4WD

CLASS	SUV 4WD
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	17
MAXIMUM RANGE	359

2009 Aston Martin DBS Coupe - Manual

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	13
MAXIMUM RANGE	266

2010 Acura RL

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	18
MAXIMUM RANGE	349

2010 Dodge Viper Coupe

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	16
MAXIMUM RANGE	256

2010 Bentley Continental GT

CLASS	Luxury Compact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	13
MAXIMUM RANGE	309

2010 Ford Taurus FWD

CLASS	Large Sedan
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	22
MAXIMUM RANGE	418

2010 Buick Lucerne FFV

CLASS	Large Sedan
NUMBER OF PASSENGERS	5
FUEL	Gasoline/E85
COMBINED MPG	20 (gas)/15 (E85)
MAXIMUM RANGE	370/278

2010 Hummer H3T4WD

CLASS	Pickup 4WD
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	16
MAXIMUM RANGE	432

2010 Chevrolet HHR FFV

CLASS	SUV 2WD
NUMBER OF PASSENGERS	5
FUEL	Gasoline/E85
COMBINED MPG	25 (gas)/17 (E85)
MAXIMUM RANGE	400/272

2010 Hyundai Elantra

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	29
MAXIMUM RANGE	406

2010 Mazda 6

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	24
MAXIMUM RANGE	444

2011 Chevrolet Malibu FFV

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline/E85
COMBINED MPG	26 (gas)/18 (E85)
MAXIMUM RANGE	416/288

2010 Toyota Prius

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Hybrid
COMBINED MPG	50
MAXIMUM RANGE	595

2011 Honda Fit

CLASS	Small Station Wagon
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	30
MAXIMUM RANGE	318

2011 Audi S5 Cabriolet

CLASS	Subcompact
NUMBER OF PASSENGERS	4
FUEL	Premium Gasoline
COMBINED MPG	20
MAXIMUM RANGE	338

2011 Kia Forte Eco

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	3
MAXIMUM RANGE	411

2011 Bugatti Veyron

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	10
MAXIMUM RANGE	264

2011 Lexus RX 450h

CLASS	SUV
NUMBER OF PASSENGERS	5
FUEL	Hybrid
COMBINED MPG	30
MAXIMUM RANGE	516

2011 Mini Cooper Convertible

CLASS	Subcompact
NUMBER OF PASSENGERS	4
FUEL	Premium Gasoline
COMBINED MPG	30
MAXIMUM RANGE	396

2012 Azure Dynamic Transit Connect

CLASS	Van, Special Purpose
NUMBER OF PASSENGERS	2
FUEL	Electric
COMBINED MPG	62e
MAXIMUM RANGE	56

2011 Porsche 911 Carrera 4S Targa

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	20
MAXIMUM RANGE	354

2012 BMW Active Hybrid 7

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Hybrid
COMBINED MPG	20
MAXIMUM RANGE	434

2011 Subaru Outback AWD

CLASS	SUV 4WD
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	24
MAXIMUM RANGE	444

2012 Cadillac CTS Supercharger

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Premium Gasoline
COMBINED MPG	14
MAXIMUM RANGE	252

2011 Toyota Yaris

CLASS	Subcompact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	31
MAXIMUM RANGE	344

2012 Coda

CLASS	Subcompact
NUMBER OF PASSENGERS	4
FUEL	Electric
COMBINED MPG	73e
MAXIMUM RANGE	88

2012 Ferrari 458 Italia Spider

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	14
MAXIMUM RANGE	318

2012 Land Rover Range Rover Sport

CLASS	SUV 4WD
NUMBER OF PASSENGERS	5
FUEL	Premium Gasoline
COMBINED MPG	15
MAXIMUM RANGE	345

2012 Fiat 500 Abarth

CLASS	Minicompact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	31
MAXIMUM RANGE	326

2012 Lincoln MKT FWD

CLASS	SUV 2WD
NUMBER OF PASSENGERS	7
FUEL	Gasoline
COMBINED MPG	20
MAXIMUM RANGE	372

2012 GMC Acadia AWD

CLASS	SUV 4WD
NUMBER OF PASSENGERS	8
FUEL	Gasoline
COMBINED MPG	19
MAXIMUM RANGE	418

2012 Maserati Quattroporte

CLASS	Large Luxury Sedan
NUMBER OF PASSENGERS	5
FUEL	Premium Gasoline
COMBINED MPG	15
MAXIMUM RANGE	357

2012 Jaguar XJ LWB

CLASS	Large Luxury Sedan
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	18
MAXIMUM RANGE	391

2012 Mitsubishi i-MiEV

CLASS	Subcompact
NUMBER OF PASSENGERS	4
FUEL	Electric
COMBINED MPG	112e
MAXIMUM RANGE	52

2012 Rolls-Royce Phantom Coupe

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Premium Gasoline
COMBINED MPG	14
MAXIMUM RANGE	369

2013 BYD e6

CLASS	Small SUV
NUMBER OF PASSENGERS	5
FUEL	Electric
COMBINED MPG	63e
MAXIMUM RANGE	127

2012 Scion XD

CLASS	Subcompact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	29
MAXIMUM RANGE	322

2013 Chevrolet Volt

CLASS	Compact
NUMBER OF PASSENGERS	5
FUEL	Plug-in Hybrid
COMBINED MPG	98e/37 (gas)
MAXIMUM RANGE	38e/380

2013 Honda Civic CNG

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	CNG
COMBINED MPG	31e
MAXIMUM RANGE	193

2013 Dodge Charger FFV

CLASS	Large Sedan
NUMBER OF PASSENGERS	5
FUEL	Gasoline/E85
COMBINED MPG	23 (gas)/17 (E85)
MAXIMUM RANGE	439/325

2013 Nissan Leaf

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Electric
COMBINED MPG	115e
MAXIMUM RANGE	75

2013 Ford E350 Wagon

CLASS	Van, Passenger
NUMBER OF PASSENGERS	12
FUEL	Gasoline
COMBINED MPG	11
MAXIMUM RANGE	396

2013 GMC Sierra C15 XFE

CLASS	Standard Pickup
NUMBER OF PASSENGERS	3
FUEL	Gasoline/E85
COMBINED MPG	18 (gas)/13 (E85)
MAXIMUM RANGE	468/338

2013 smart fortwo Coupe Electric

CLASS	Minicompact
NUMBER OF PASSENGERS	2
FUEL	Electric
COMBINED MPG	107e
MAXIMUM RANGE	68

2013 Jeep Wrangler Unlimited

CLASS	Small SUV
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	18
MAXIMUM RANGE	405

2013 Toyota Rav 4

CLASS	Small SUV
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	26
MAXIMUM RANGE	413

2013 Mercedes-Benz S400 Hybrid

CLASS	Large Sedan
NUMBER OF PASSENGERS	5
FUEL	Hybrid
COMBINED MPG	21
MAXIMUM RANGE	500

2014 Audi Q5

CLASS	Small SUV
NUMBER OF PASSENGERS	5
FUEL	Diesel
COMBINED MPG	27
MAXIMUM RANGE	535

2013 Ram 1500 4WD

CLASS	Standard Pickup
NUMBER OF PASSENGERS	3
FUEL	Gasoline/E85
COMBINED MPG	19 (gas)/13 (E85)
MAXIMUM RANGE	494/338

2014 Buick LaCrosse eAssist

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Hybrid
COMBINED MPG	29
MAXIMUM RANGE	458

2014 Chrysler 300 FFV

CLASS	Large Sedan
NUMBER OF PASSENGERS	5
FUEL	Gasoline/E85
COMBINED MPG	23 (gas)/17 (E85)
MAXIMUM RANGE	439/325

2014 Mini JCW Countryman

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	26
MAXIMUM RANGE	322

2014 Ford Edge

CLASS	Small SUV
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	22
MAXIMUM RANGE	403

2014 Ford C-max Energy Plug-in

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Plug-in Hybrid
COMBINED MPG	88e/38 (gas)
MAXIMUM RANGE	20e/550

2014 Honda Accord

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Plug-in Hybrid
COMBINED MPG	115e/46 (gas)
MAXIMUM RANGE	13e/570

2014 Pagani Huayra Coupe

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	13
MAXIMUM RANGE	250

2014 McLaren MP4-12C Spider

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	18
MAXIMUM RANGE	250

2014 Subaru Forester AWD

CLASS	Small SUV
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	27
MAXIMUM RANGE	429

2014 Kia Soul

CLASS	Small Station Wagon
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	26
MAXIMUM RANGE	369

2015 Chevrolet Impala bi-fuel

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline/CNG
COMBINED MPG	20 (gas)/19 (CNG)
MAXIMUM RANGE	368/119

2014 Volkswagon Passat

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Diesel
COMBINED MPG	34
MAXIMUM RANGE	629

2015 Chrysler Town & Country FFV

CLASS	Minivan
NUMBER OF PASSENGERS	7
FUEL	Gasoline/E85
COMBINED MPG	20 (gas)/14 (E85)
MAXIMUM RANGE	400/280

2014 Volvo XC60

CLASS	Small SUV
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	21
MAXIMUM RANGE	388

2015 Dodge Viper SRT

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	15
MAXIMUM RANGE	240

2015 Acura TLX

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Premium Gasoline
COMBINED MPG	28
MAXIMUM RANGE	482

2015 Fiat 500e

CLASS	Minicompact
NUMBER OF PASSENGERS	5
FUEL	Electric
COMBINED MPG	116e
MAXIMUM RANGE	87

2015 GMC Sierra K15 FFV

CLASS	Standard Pickup 4WD
NUMBER OF PASSENGERS	4
FUEL	Gasoline/E85
COMBINED MPG	17 (gas)/12 (E85)
MAXIMUM RANGE	442/312

2015 Lincoln MKS

CLASS	Large Sedan
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	22
MAXIMUM RANGE	418

2015 Hyundai Veloster

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	30
MAXIMUM RANGE	396

2015 Mazda MX-5

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	23
MAXIMUM RANGE	292

2015 Infiniti Q50 Hybrid

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Hybrid
COMBINED MPG	31
MAXIMUM RANGE	552

2015 Nissan Juke

CLASS	Small Station Wagon
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	30
MAXIMUM RANGE	396

2015 Jeep Grand Cherokee

CLASS	SUV 4WD
NUMBER OF PASSENGERS	5
FUEL	Gasoline/E85
COMBINED MPG	19 (gas)/15 (E85)
MAXIMUM RANGE	467/369

2015 Tesla Model S 90 kWh

CLASS	Large Sedan
NUMBER OF PASSENGERS	5
FUEL	Electric
COMBINED MPG	89e
MAXIMUM RANGE	265

2015 Toyota Prius Plug-in

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Plug-in Hybrid
COMBINED MPG	95e/50 (gas)
MAXIMUM RANGE	11e/450

2016 Chevrolet Corvette

CLASS	Sports Car
NUMBER OF PASSENGERS	2
FUEL	Premium Gasoline
COMBINED MPG	21
MAXIMUM RANGE	388

2015 Volkswagon Jetta

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Diesel
COMBINED MPG	36
MAXIMUM RANGE	522

2016 Ford Mustang Convertible

CLASS	Subcompact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	24
MAXIMUM RANGE	372

2016 Audi S4

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Premium Gasoline
COMBINED MPG	21
MAXIMUM RANGE	338

2016 Kia Optima Hybrid

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Hybrid
COMBINED MPG	38
MAXIMUM RANGE	703

2016 BMW 328i XDrive Sports Wagon

CLASS	Small Station Wagon
NUMBER OF PASSENGERS	4
FUEL	Premium Gasoline
COMBINED MPG	26
MAXIMUM RANGE	411

2016 Porsche Cayenne Diesel

CLASS	SUV
NUMBER OF PASSENGERS	5
FUEL	Diesel
COMBINED MPG	23
MAXIMUM RANGE	607

2016 smart fortwo Coupe Electric

CLASS	Minicompact
NUMBER OF PASSENGERS	2
FUEL	Gasoline
COMBINED MPG	36
MAXIMUM RANGE	277

2016 Ford Escape Hybrid 4WD

CLASS	Small SUV
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	26
MAXIMUM RANGE	403

2016 Toyota Sienna

CLASS	Minivan
NUMBER OF PASSENGERS	7
FUEL	Gasoline
COMBINED MPG	21
MAXIMUM RANGE	420

2016 Volvo XC90 PHEV

CLASS	SUV
NUMBER OF PASSENGERS	5
FUEL	Plug-in Hybrid
COMBINED MPG	53e/25 (gas)
MAXIMUM RANGE	14e/350

2017 Nissan Altima

CLASS	Midsize
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	31
MAXIMUM RANGE	588

2017 Buick Encore

CLASS	SUV
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	30
MAXIMUM RANGE	420

2017 Audi A5 Quattro

CLASS	Sports Car
NUMBER OF PASSENGERS	5
FUEL	Gasoline
COMBINED MPG	26
MAXIMUM RANGE	390

2017 Tesla Model S AWD – 90D

CLASS	Luxury Sedan
NUMBER OF PASSENGERS	5
FUEL	Electric
COMBINED MPG	104e
MAXIMUM RANGE	294

2018 GMC Sierra K15 4WD

CLASS	Standard Pickup
NUMBER OF PASSENGERS	6
FUEL	Gasoline
COMBINED MPG	18
MAXIMUM RANGE	540

2018 Chevrolet Cruze Premier

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	33
MAXIMUM RANGE	452

2018 MINI Cooper Hardtop 4 door

CLASS	Compact
NUMBER OF PASSENGERS	4
FUEL	Gasoline
COMBINED MPG	32
MAXIMUM RANGE	371

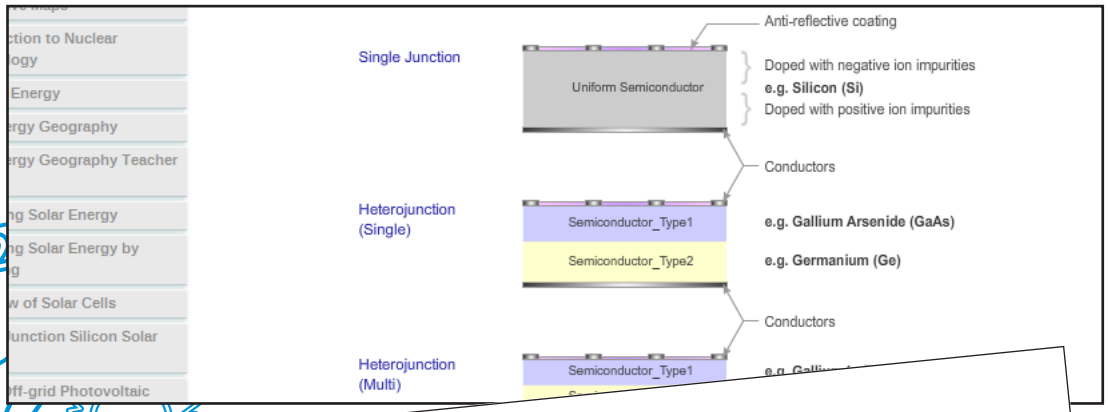
2018 Mercedes-Benz GLC350e 4matic

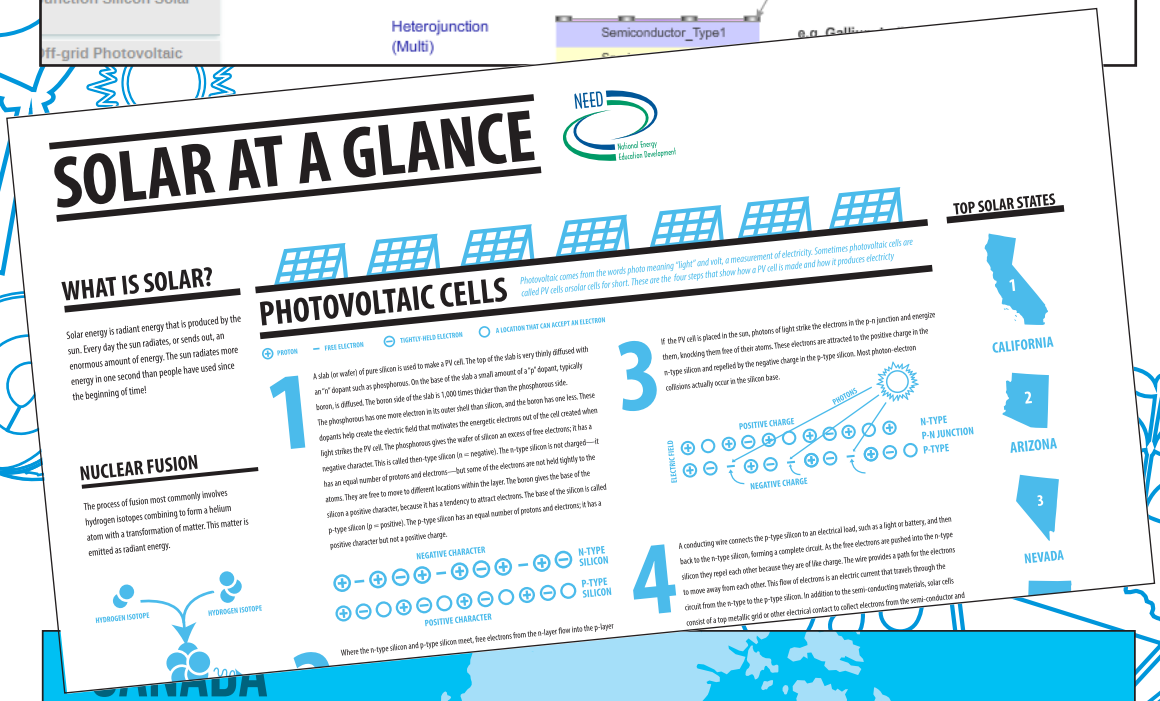
CLASS	Plug-in Hybrid
NUMBER OF PASSENGERS	5
FUEL	Electric/Gas
COMBINED MPG	56e/25 (gas)
MAXIMUM RANGE	10 mi electric/350 total

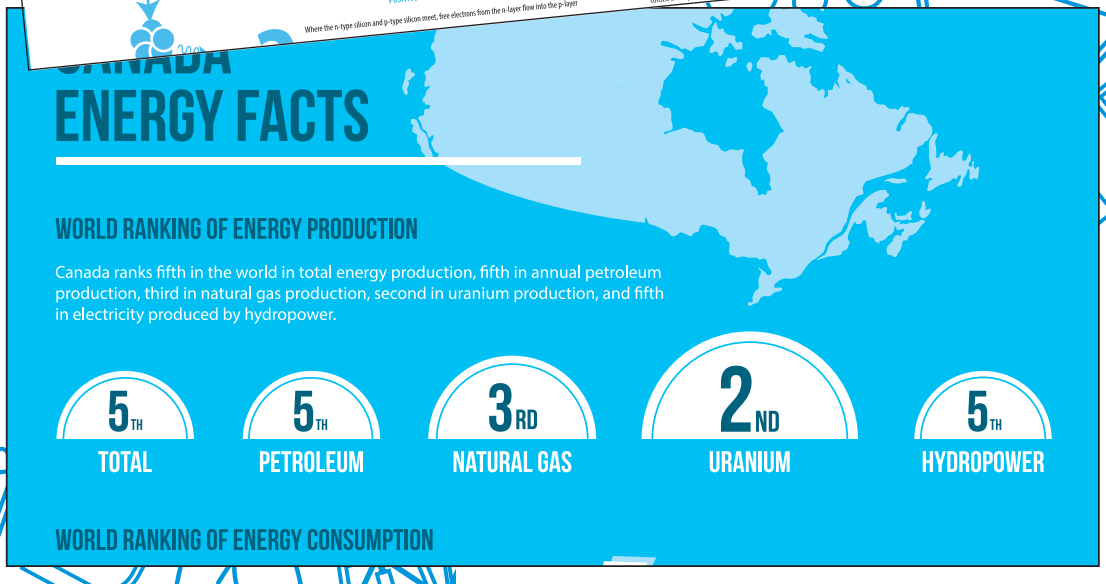
Awesome Extras!

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

This page is available at www.NEED.org/awesomeextras.







YOUTH ENERGY CONFERENCE AND AWARDS

The NEED Youth Energy Conference and Awards gives students more opportunities 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

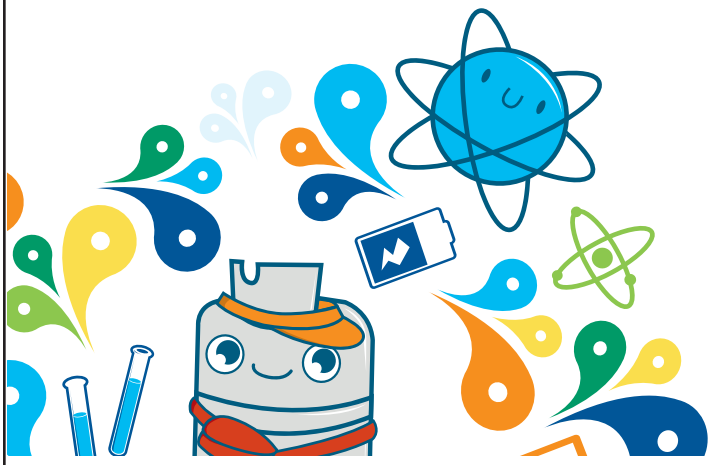
All NEED schools have outstanding classroom-based programs in which students learn about energy. Does your school have student leaders who extend these activities into their communities? To recognize outstanding achievement and reward student leadership, The NEED Project conducts the National Youth Awards 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/Youth-Awards** for more application and program information, previous winners, and photos of past events.



NEED's Online Resources

NEED'S SMUGMUG GALLERY

http://need-media.smugmug.com/

On NEED's SmugMug page, you'll find pictures of NEED students learning and teaching about energy. Would you like to submit images or videos to NEED's gallery? E-mail info@NEED.org for more information.
Also use SmugMug to find these visual resources:

Videos

Need a refresher on how to use Science of Energy with your students? Watch the Science of Energy videos. Also check out our Energy Chants videos! Find videos produced by NEED students teaching their peers and community members about energy.

Online Graphics Library

Would you like to use NEED's graphics in your own classroom presentations, or allow students to use them in their presentations? Download graphics for easy use in your classroom.

AWESOME EXTRAS

Looking for more resources? Our Awesome Extras page contains PowerPoints, animations, and other great resources to compliment what you are teaching in your classroom! This page is available under the Educators tab at www.NEED.org.

THE BLOG

We feature new curriculum, teacher news, upcoming programs, and exciting resources regularly. To read the latest from the NEED network, visit www.NEED.org/blog_home.asp.

EVALUATIONS AND ASSESSMENT

Building an assessment? Searching for standards? Check out our Evaluations page for a question bank, NEED's Energy Polls, sample rubrics, links to standards alignment, and more at www.NEED.org/evaluation.

E-PUBLICATIONS

The NEED Project offers e-publication versions of various guides for in-classroom use. Guides that are currently available as an e-publication can be found at www.issuu.com/theneedproject.

SOCIAL MEDIA

Stay up-to-date with NEED. "Like" us on Facebook! Search for The NEED Project, and check out all we've got going on!

Follow us on Twitter. We share the latest energy news from around the country, @NEED_Project.

Follow us on Instagram and check out the photos taken at NEED events, instagram.com/theneedproject.

Follow us on Pinterest and pin ideas to use in your classroom, Pinterest.com/NeedProject.

Subscribe to our YouTube channel!
www.youtube.com/user/NEEDproject

NEED ENERGY BOOKLIST

Looking for cross-curricular connections, or extra background reading for your students? NEED's booklist provides an extensive list of fiction and nonfiction titles for all grade levels to support energy units in the science, social studies, or language arts setting. Check it out at www.NEED.org/booklist.asp.

U.S. ENERGY GEOGRAPHY

Maps are a great way for students to visualize the energy picture in the United States. This set of maps will support your energy discussion and multi-disciplinary energy activities. Go to www.need.org/energyinsocietymaterials to see energy production, consumption, and reserves all over the country!

Oil, Natural Gas, and Their Energy Evaluation Form

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

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

Please explain any 'no' statement below.

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

What would make the unit 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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FPL
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George Mason University – Environmental Science and Policy
Gerald Harrington, Geologist
Government of Thailand–Energy Ministry
Green Power EMC
Greenwired, Inc.
Guilford County Schools–North Carolina
Gulf Power
Harvard Petroleum
Hawaii Energy
Idaho National Laboratory
Idaho Power
Illinois Clean Energy Community Foundation
Illinois International Brotherhood of Electrical Workers Renewable Energy Fund
Illinois Institute of Technology
Independent Petroleum Association of New Mexico
Inter-County Energy
Jackson Energy
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Kansas Corporation Commission
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Kentucky Environmental Education Council
Kentucky Power–An AEP Company
Kentucky Utilities Company
League of United Latin American Citizens – National Educational Service Centers
Leidos
Let's GO Boys and Girls, Inc.
Linn County Rural Electric Cooperative
Llano Land and Exploration
Louisville Gas and Electric Company
Midwest Wind and Solar
Minneapolis Public Schools
Mississippi Development Authority–Energy Division
Mississippi Gulf Coast Community Foundation
Mojave Environmental Education Consortium
National Fuel
National Grid
National Hydropower Association
National Ocean Industries Association
National Renewable Energy Laboratory
NC Green Power
Nebraskans for Solar
New Mexico Oil Corporation
New Mexico Landman's Association
NextEra Energy Resources
NEXTracker
Nicor Gas
Nisource Charitable Foundation
Noble Energy
Nolin Rural Electric Cooperative
Northern Rivers Family Services
North Carolina Department of Environmental Quality
North Shore Gas
Offshore Technology Conference
Ohio Energy Project
Oklahoma Gas and Electric Energy Corportation
Opterra Energy
Pacific Gas and Electric Company
PECO
Pecos Valley Energy Committee
Peoples Gas
Pepco
Performance Services, Inc.
Petroleum Equipment and Services Association
Phillips 66
PNM
PowerSouth Energy Cooperative
Providence Public Schools
Quarto Publishing Group
Read & Stevens, Inc.
Renewable Energy Alaska Project
Resource Central
Rhode Island Office of Energy Resources
Robert Armstrong
Roswell Geological Society
Salt River Project
Salt River Rural Electric Cooperative
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University of Wisconsin – Platteville
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. Energy Information Administration
United States Virgin Islands Energy Office
Wayne County Sustainable Energy
Western Massachusetts Electric Company - Eversource
Yates Petroleum Corporation