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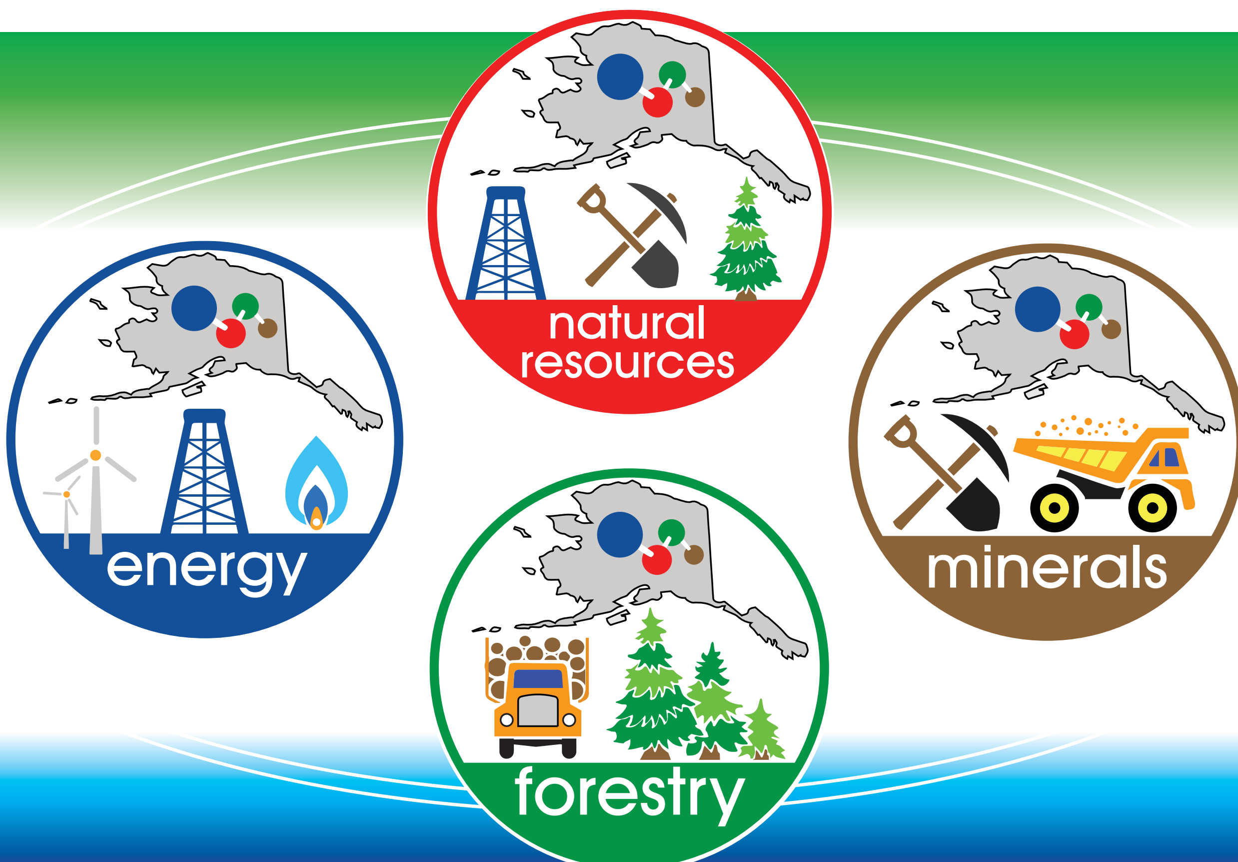
EDUCATION

Natural Resources

Patch Series



Girl Scouts of Alaska | Alaska Resource Education

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Energy

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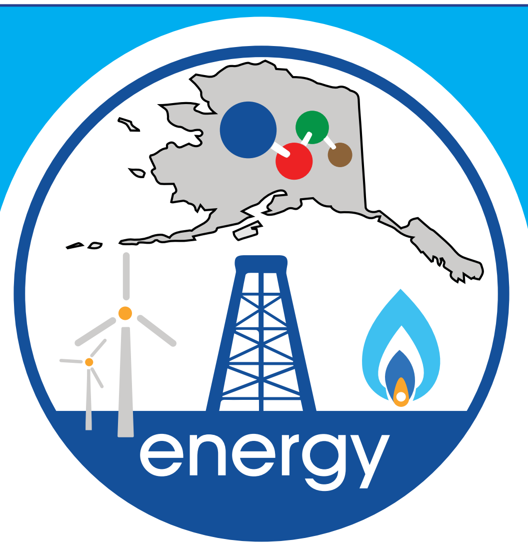


Girl Scouts of Alaska
Alaska Resource Education
Energy Patch

Level: **Brownie**

Requirements:
Complete item 1, or 2, or 3, and at least 2 other activities.

Level: **Junior, Cadette, or Senior**

Requirements:
Complete item 1, or 2, or 3, plus item 4 and at least 2 other activities.

1. Finding Oil...In a Cupcake

2. Renew a Bean

3. The Sun's Energy

4. Current Event: Look through current newspapers (perhaps Petroleum News) to see what is going on in the news on a local level relating to energy projects.

Answer the following:

a. Who is the article about?
b. What is the article about?
c. Where is the article/story located?
d. Why is this important to Alaska?

Share your findings and thoughts with your troop.

5. List: Identify 4 energy SOURCES and their related TYPE of energy produced i.e. Oil (SOURCE) is refined to make fuel (TYPE) like gasoline. List where in the state of Alaska the source is found, and where the type is used. (Oil: north slope, Fuel: everywhere) See *The Sun's Energy* lesson for help learning the difference between source and type.

6. Research and Locate: Identify what and where the following energy-related projects are:

a. Where are the 2 main geographic areas in Alaska that produce Oil and Natural Gas?

b. What is the Trans-Alaska Pipeline? Where does it start? Where does it end? What does it carry? Why do you think it ends where it does?

c. What is on Fire Island? What is the SOURCE of energy? What TYPE of energy is produced?

For lessons, more information, and helpful links, visit:
www.akresource.org

WHERE DOES ENERGY COME FROM?

Finding Oil in a Cupcake

Essential Question: **What are fossil fuels?**

Time: 2 hours

Girl Scouts learn about how geologists help find oil that is deep below the ground through a fun activity to find oil in a cupcake.

Vocabulary

- Fossil fuel
- Petroleum
- Non-renewable
- Porous
- Core Sample

Information and Procedure

Materials needed

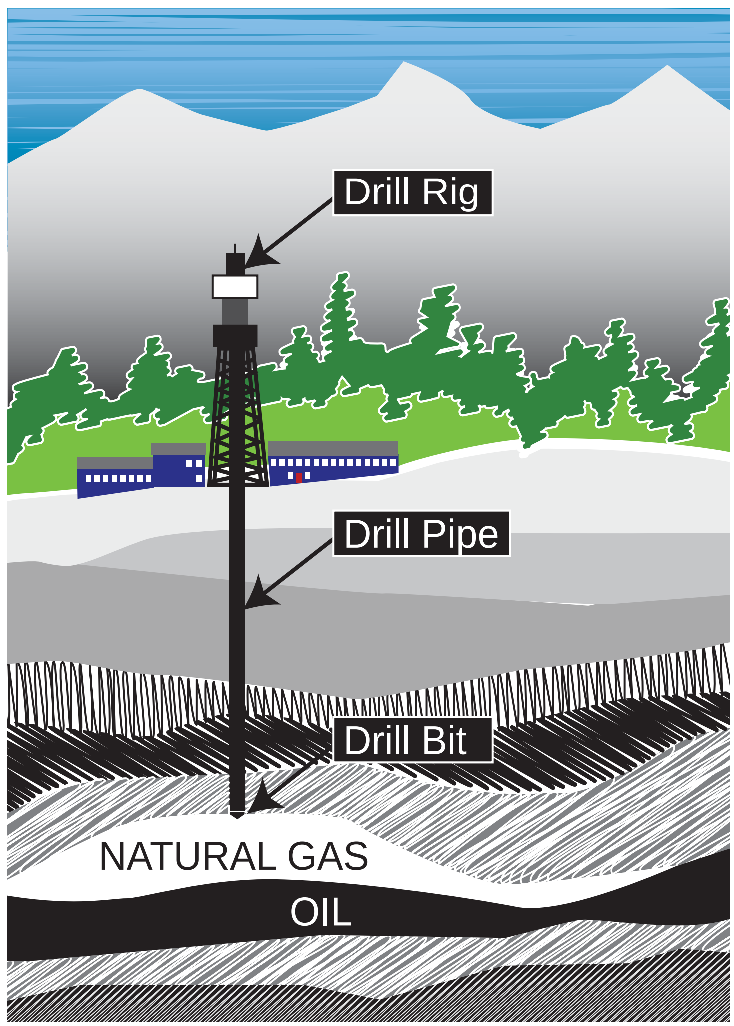
- Handout: *What are Fossil Fuels?*
- Cupcakes, 1 per Girl Scout (See info on "Preparing Cupcakes")
- Clear plastic straws
- Handout *Finding Oil....In a Cupcake?*
- Colored Pencils
- Sharp Knife

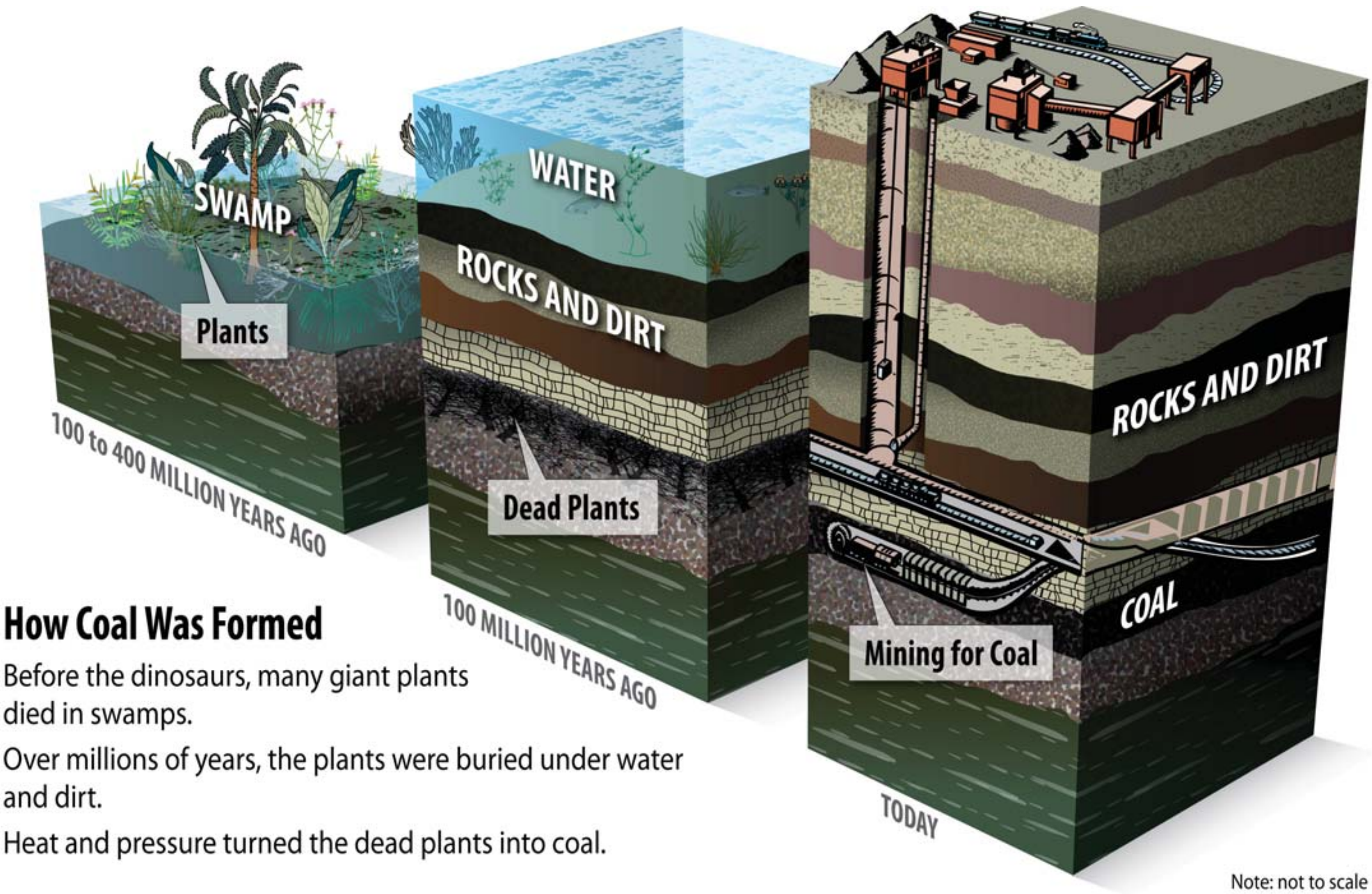
What to do in advance

- Collect resources and select useful web-sites.
- Print the"Information Scavenger Hunt" worksheet

Gear up

Introduce the idea that we use some resources today that are as old as dinosaurs. Explain what a fossil fuel is and where they come from.





How Coal Was Formed

Before the dinosaurs, many giant plants died in swamps.

Over millions of years, the plants were buried under water and dirt.

Heat and pressure turned the dead plants into coal.

What Are Fossil Fuels?

Coal, oil, and natural gas are considered fossil fuels because they were formed from things that were alive many millions of years ago. Oil and gas come from both plants and animals and coal comes from plants. Much of the world's coal and oil was formed about 250 million years ago during the carboniferous period, or the Coal Age. Swamps were very extensive during the carboniferous period, and when plants died their remains accumulated in the swamps and eventually were covered by sand and mud. Through time, they became buried more deeply. Pressure and heat slowly changed the plant material into coal.

Oil was formed in the same way but comes from plankton and other plants and animals that lived in the sea. The dead plants and animals settled on the sea bottom and were covered with mud and sand. Heat and pressure slowly changed them into oil. Oil is a liquid and can move under ground. It is trapped in porous rocks deep underground.

How do we use fossil fuels? We use energy from fossil fuels for heat, transportation, and electricity. Almost all of the energy we use comes from oil, gas, and coal.

Many things that we use every day also are made from fossil fuels. For example, nylon and manmade rubber are made from coal. Waxes, cosmetics, plastics, asphalt, fertilizers, and many other things are made from oil.

When oil and coal are burned in engines or power plants, they can cause air pollution problems. Scientists are finding ways to reduce the amount of air pollution that comes from burning fossil fuels.

There is a lot of oil, gas, and coal in Alaska. Most of it is shipped to other places, and Alaska gets money in return. The biggest coal mine is in Healy. Some of the coal from the mine is used in Fairbanks for heat and electricity. Because it takes so long to make fossil fuels, they are considered a non-renewable resource.

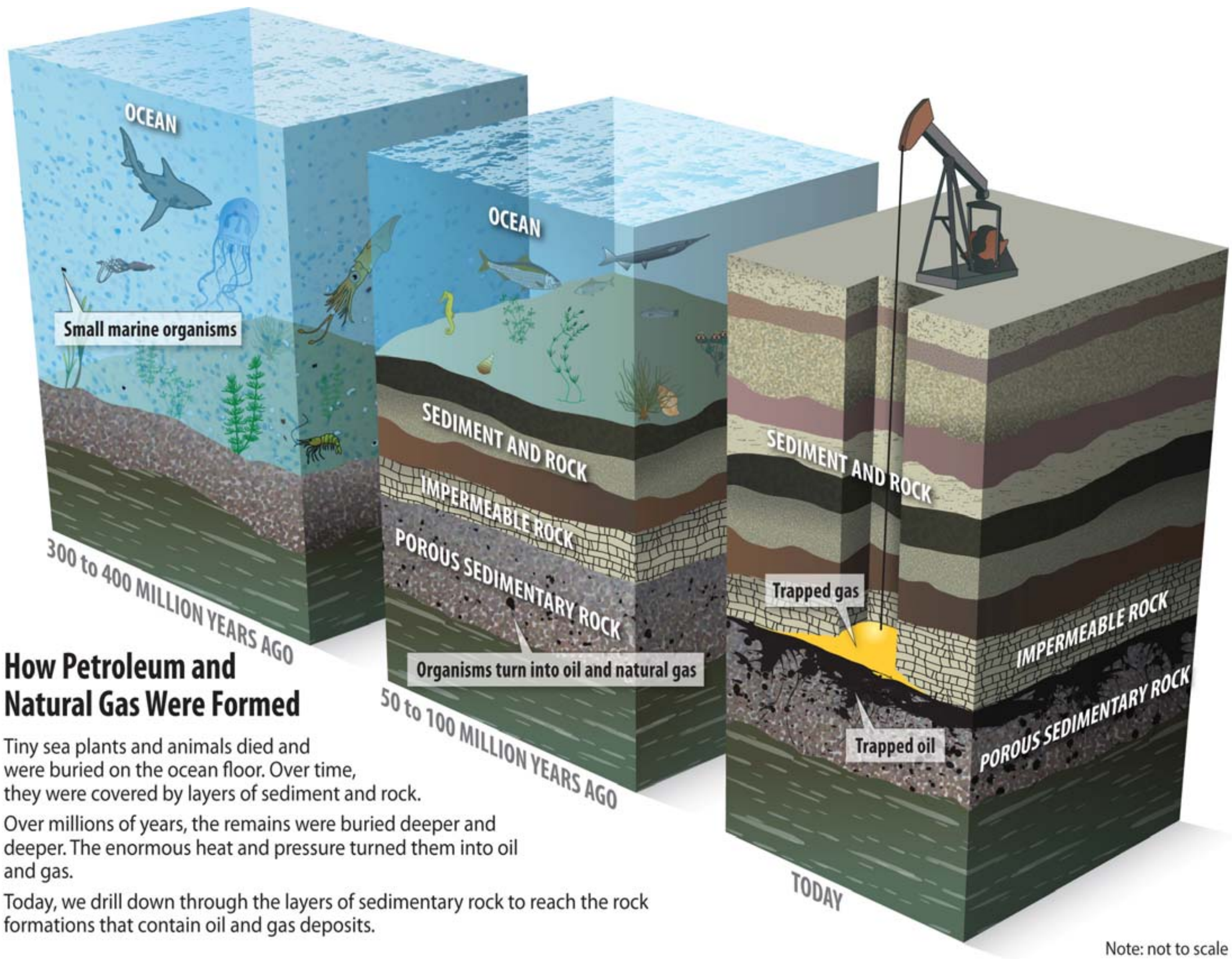
How do we find oil? Trying to "see" what is beneath the surface of the Earth is one of the jobs of a geologist. Rather than digging up vast tracts of land to expose an oil field, drills can collect samples from underground that can be analyzed to determine the composition of the Earth's interior. You will work as a geologist to discover if there is oil beneath the surface of a cupcake, representing the earth's crust.

Where is oil found? Because oil and gas are lighter than water, they float on top of water. Oil and gas that formed in the source rock deep within the earth floated up through tiny open spaces in the rock called pores. Some seeped out at the surface of the earth. Some was trapped by dense, non-porous rock, called shale. These underground traps of oil and gas are called reservoirs. Reservoirs contain porous rocks that allow fluids to flow through the pore spaces, that is, that are permeable. Often discovered in dome-shaped structures called anticlines, oil does not reside in underground lakes as is commonly supposed. Instead, it is trapped in rocks with holes (pores) like sponges. Natural gas is dissolved in the oil or separates and is trapped on top of the oil as a separate layer.

How do you know where to drill? At first, people drilled wells near spots where oil seeped naturally to the surface. Or they made haphazard guesses about where to drill, often with disappointing results. Even with modern technology, the search for oil is fraught with uncertainty. The odds are against discovering oil in a new location. And when oil is found, rarely is there enough to make production commercially viable.

What are core samples? When oil wells are drilled, sometimes a coring tool is used to obtain samples of the reservoir rock for study. Geologists study these core samples to learn about the reservoir and help decide how to produce the oil and gas from it. A rotary tool with a tough diamond bit drills through the rock. Drilling proceeds at a rate of 30 to 60 feet per hour. In the United States, the average well is more than a mile deep; the deepest is nearly seven miles.

By studying the core samples and by interpreting other subsurface data, scientists and engineers can reasonably predict how big the reservoir is and how much oil it contains, and how easy or difficult it will be to produce the oil. Economic studies are then done to assess production methods and the equipment needed to develop the oil field.



How Petroleum and Natural Gas Were Formed

Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of sediment and rock.

Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.

Today, we drill down through the layers of sedimentary rock to reach the rock formations that contain oil and gas deposits.

Activity

Finding Oil...In a Cupcake?

In this activity, Girl Scouts look at the structure of differently tinted layers of a cupcake and discover the "oil" hidden in the cupcake.

Preparing Cupcakes and Exploring for "Oil". Materials needed

- Enough white cupcake mix to make one cupcake for each Girl Scout
- Foil baking cups
- 2 or 3 colors of food coloring
- Frosting
- Clear straws

Divide the batter into several bowls and add food coloring to the bowls. Make them dark. Leave some of the batter white. Choose one color to be "oil" and use it in a smaller amount of batter. Layer the different colors of batter into the baking cups and make sure that the "oil" is hidden near the bottom and does not extend all the way across the cupcake.

The foil and the frosting prevent Girl Scouts from being able to see inside the cupcake. Cupcakes taste better when fresh, but the "sampling" works better if they are a little dry, so bake them a day or so ahead.

A quicker way to do this is to use purchased, filled cupcakes....but it doesn't work as well since Girl Scouts probably already know where the filling will be!

Conduct the Activity:

- Pass out cupcakes with instructions to Girl Scouts not to eat them until you give the go-ahead.
- Tell the girls there are several colors of cake inside their cupcake and that there might be "oil" (tell them which color the oil is!).
- Pass out the handouts and have Girl Scouts draw what they imagine the inside of their cupcake might look like. Ask Girl Scouts how they might discover what's inside without removing the frosting or the foil, or cutting the cupcake.
- Pass out straws and have Girl Scouts "drill" their cupcake three times, making a new drawing each time to illustrate what the "core" looks like and what the inside of the cupcake looks like. As they do it, discuss how their activity is like the work that geologists do to find oil.
- Let Girl Scouts cut the cupcakes open and make a final drawing, then eat the cupcakes!

Worksheet - Finding Oil...In a Cupcake?

Geologist's Name ____

What do you imagine is inside your cupcake?   Draw a picture here:

Draw "Core Sample 1" here:
Try drawing your cupcake after
you have seen the first sample.

Draw "Core Sample 2" here:
Try drawing your cupcake after
you have seen the second sample.

Finding Oil…In a Cupcake? *(continued)*

Draw "Core Sample 3" here:

Try drawing your cupcake after
you have seen the third sample.

Cut open the cupcake and draw what it really looks like inside:

WHERE DOES ENERGY COME FROM?

RENEW A BEAN

Essential Question: **What are renewable and non-renewable energy sources?**

Time: 1-2 hours

Beans are used to represent renewable and non-renewable energy in a simulation to help Girl Scouts understand how, over several years, non-renewable resources will be depleted.

Vocabulary

- Biomass
- Renewable
- Non-renewable
- Consumption

Information and Procedure

Materials needed

- 1 open container for every 2 Girl Scouts, with two types of dried beans of similar size and shape.
- Blindfolds
- Handouts *Background Reading, Draw Charts*

What to do in advance

- Give Girl Scouts the handout on practical sources of energy and read it together or ask them to read it as homework.
- Prepare containers of beans.
  - ◊ 94% one color; 6% another color (i.e. pinto and garbanzo beans)
  - ◊ Be sure to maintain the 94:6 ratio to represent the ratio of nonrenewable to renewable energy consumption in the U.S.
  - ◊ For the first bean color, count 94 beans into a measuring cup. Use that measure to put 6 X 94 beans into each girl scout container.
  - ◊ For the second color, count out 6 beans into the measuring cup. Use that measure to put 6 beans into each girl scout container.
  - ◊ If you have more beans available, adjust accordingly.
- Make copies of handouts.
- Be sure to look the charts over before you begin so the procedure is familiar.

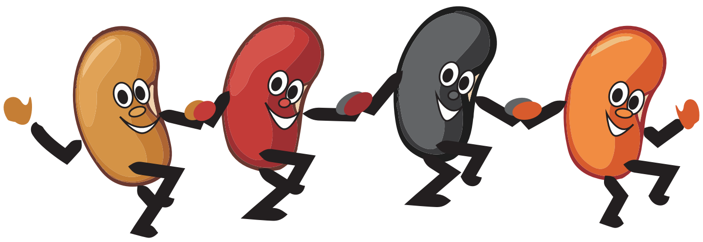
Gear-up: Discuss the difference between renewable and non-renewable energy and give examples of each using the Background Reading. This can be done by reading, drawing pictures, open discussion, or whatever works best for the group.

Explore:

1) Divide Girl Scouts into pairs. Hand out the draw chart and explain that you will play 5 rounds of the game. The first two rounds will NOT include renewable energy sources, and the last three WILL include renewable energy sources.

2) Explain to Girl Scouts that because the U.S. depends on non-renewable energy and because the human population is growing (thereby demanding more energy), we face the eventual depletion of this resource. But when? It all depends on how quickly and how much we use energy. If all our energy was renewable, we wouldn't have a problem...there would always be energy. This simulation will show the conditions that affect the depletion of non-renewable resources. Girl Scouts will experiment with these conditions to see how long they can extend the use of energy resources.

3) Discuss: Scientists, economists, and politicians frequently make predictions of how long various energy resources will last. In the early 1970s, it was predicted that we would run out of natural gas by the late 1980s! In the 1950s, some electric companies in California



predicted that they would need a nuclear power plant every 10 miles along their coastline to meet their electrical energy needs.

Predictions are always based on some kind of assumptions, and it is important to understand those assumptions when you hear or read a prediction. Maybe the prediction is based on the assumption that we will keep using energy at the same rate as we do now, like the predictions we just made. Or maybe it is assumed that we will use more and more energy each year. When the prediction says that we will run out, are they assuming that no new sources of energy will be found?

We will use some different charts that tell you how many beans to draw if you want to adapt for changes in rate of energy use. For example, if use remains constant from year to year, each person draws 10 beans. If you want to simulate an increase in energy use, you take out more beans each year than you took the year before.

4) Round 1: The first round simulates a population with no growth and constant energy needs for all 10 years.

- Have the students predict how many years the energy source (beans) will last with 10 units (1 bean = 1 unit) being used each year.
- Record the prediction in Data Chart #1
- Have one scout pull 10 beans for each year until there is no longer enough to meet the energy needs of 10 units per year.
- Have the girls then record how many years (how many rounds of beans) they could meet their energy needs.

5) Round 2: The second round simulates a growing population with growing energy needs each year.

- Have the students predict how many years the energy source (beans) will last with the provided units, listed on Draw Chart #2, being used each year.
- Record the prediction in Data Chart #2
- Have one scout pull out the listed number of beans for each year until there is no longer enough to meet the energy needs.
- Have them then record how many years they could meet their energy needs.

6) Round 3: Add the renewable beans to the bowl and blindfold the Girl Scout who is picking the beans. As in Round 1, Round 3 will simulate a population with no growth and constant energy needs for 10 years, but with the introduction of renewable resources (beans). The blindfold represents a population that is using energy without thinking about whether it is renewable or non-renewable. Note: Each renewable bean pulled can count towards the year's energy needs and then be replaced into the bowl.

- Have the students predict how many years the energy source will last with 10 units being used each year, knowing there are now renewables.
- Record the prediction in Data Chart #3.
- Have the blindfolded girl pull out 10 beans for each year, replacing the renewable beans, until there is no longer enough to pull 10 units per year.
- Have them then record how many years they could meet the energy needs.

7) Round 4: With the renewable beans in the bowl, switch the blindfold to the other girl. As in Round 2, Round 4 simulates a growing population with growing energy needs, but with renewable resources (beans). The blindfold represents a population using energy without thinking about whether it is renewable or non-renewable. Note: Renewable beans can be replaced into the bowl once they are pulled.

- Have the students predict how many years the energy source (beans) will last with the provided units listed on Draw Chart #4 being used each year, remembering renewables can be replaced.
- Record the predictions in Data Chart #4.
- Have the blindfolded girl pull out the listed number of beans for each year until there are no longer enough to meet the energy needs.
- Have the girls record how many years they could meet their energy needs.

8) Round 5: With the renewable beans in the bowl, let the girls proceed with this round like the others, except without the blindfold. Let them see how many years they can make the energy last for a growing population with growing energy needs, but strategize how they can most wisely conserve their resources. Challenge them to see who can make their energy last the longest!

Discuss methods used to extend energy resources, both renewable and non-renewable.

Background Reading

WHAT ARE THE PRACTICAL SOURCES OF ENERGY?

- The practical sources of energy include fossil fuels such as natural gas, petroleum (or oil), and coal.
- Fossil fuels are referred to as nonrenewable energy sources because, once used, they are gone.
- Renewable energy resources include sun, wind, geothermal, water, and biomass. These are important in long range energy planning because they will not be depleted.

Natural Gas Sometimes natural gas is confused with gasoline, the fuel in cars. Gasoline is a mixture of liquids, while natural gas is mainly methane and is piped into buildings where it is used as a source for heating, cooking, washing, and drying. It is material to make other chemicals and is the cleanest-burning fossil fuel, which means it creates little environmental pollutants when burned.

Petroleum or Oil This is the black, thick liquid pumped from below the earth's surface wherever you see an oil rig. It is refined for use, which separates the gasoline portion that is used in transportation. Products from the remaining portions include synthetic rubber, detergents, fertilizers, textiles, paints, and pharmaceuticals.

Coal Coal is the most abundant fossil fuel. It supplies over half of the electricity consumed in the United States. Coal is mined from underground and from large surface excavations called open pits or strip mines. Most coal is transported from mines to power plants by trains and ships. While large amounts exist, it is non-renewable.

Solar The sun is 93 million miles away and yet this ball of hot gases is the primary source of all energy on earth. In the high temperature of the sun, small atoms of hydrogen are fused; the centers of the two atoms are combined. Fusion releases large amounts of energy. Without sunlight, fossil fuels could never have existed. The sun is the supplier of energy which runs the water cycle. Solar energy can be used to cook food, heat water, and generate electricity. It remains the cleanest energy source and it is renewable.

Wind The unequal heating of the earth's surface by the sun produces wind energy, which can be converted into mechanical and electrical energy. For a long time, the energy of wind has been used to drive pumps. Today windmills can be connected to electric generators to turn the wind's motion energy into electrical energy, and wind over 8 miles per hour can be used to generate electricity. It is a renewable energy source.

Hydroelectric (Falling Water) When water is collected behind dams on large rivers, it provides a source of energy for the production of electricity. The enormous power of falling water is capable of turning giant turbines. These turbines drive the generators, which produce electricity. The amount of power is determined by the amount of water and the distance it falls. Hydroelectric power plants do not cause pollution, but there are few places to build dams. Water is a renewable energy source.

Ocean Tides The currents created by daily tides are a form of kinetic energy that can be used to generate electricity. Channels and bays that focus tidal currents and surface motions created by waves can be used to run turbines and generators. Electricity generated from tidal movements is being used in places like Norway and is being investigated at many places along the world's coasts. Tidal energy is a renewable resource.

Geothermal The interior of the earth is very hot. This heat is left over from when the Earth first formed and from the decay of radioactive elements within it. There is a gradual increase of temperature with depth everywhere, but in some places the rocks are extra hot. Hot rocks are common around volcanoes, for example. Hot springs and geysers form where water comes in contact with hot rocks. Electricity can be generated by controlling the flow of hot water or steam through hot rocks. This is done several places around the world, including California. Iceland gets most of its electricity (and heats many of its facilities with hot water) from geothermal sources. Geothermal energy is not exactly a renewable resource, but there is a tremendous amount of it and it will last a very long time.

Biomass Biomass is living or recently living material that can be used for fuel. Wood is the principal biomass fuel, but other biomass energy sources include garbage and fuels such as ethanol (an alcohol distilled from plants) and biodiesel (fuel from animal or plant fats and oils). In some places, wood is still an important source of energy for individual families. Many biomass energy projects focus on the use of decaying organic matter in garbage as a source of methane or use garbage as part of the fuel burned in power plants. Biomass is considered a renewable resource.

Nuclear Fission In the 1930s scientists found that splitting the nucleus of an uranium atom releases a tremendous amount of heat energy. This knowledge was used to make atom bombs. Today, power companies use the heat produced by nuclear fission to produce electricity. Some countries (like France) supply most of their electricity from nuclear fission. Uranium is not a renewable resource.

Currently, nonrenewable resources supply the majority of our energy needs because they have been inexpensive and we have designed ways to transform their energy on a large scale to meet consumer needs. Regardless of the source of energy, the energy contained in the source is changed into a more useful form – electricity. Electricity is sometimes referred to as a secondary energy source. All the other sources are primary.

Name ____

Data Chart #1 **ONLY NONRENEWABLES**

CONSUMPTION LEVEL	Prediction of years to deplete	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Years energy needs were met
Number of beans to be removed		10	10	10	10	10	10	10	10	10	10	
Energy Needs Met? (Yes or No)												

Data Chart #2 **ONLY NONRENEWABLES**

CONSUMPTION LEVEL	Prediction of years to deplete	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Years energy needs were met
Number of beans to be removed		10	12	14	18	22	25	30	32	36	40	
Energy Needs Met? (Yes or No)												

Data Chart #3 **WITH RENEWABLES** Blindfolded

CONSUMPTION LEVEL	Prediction of years to deplete	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Years energy needs were met
Number of beans to be removed		10	10	10	10	10	10	10	10	10	10	
Energy Needs Met? (Yes or No)												

Data Chart #4 **WITH RENEWABLES** Blindfolded

CONSUMPTION LEVEL	Prediction of years to deplete	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Years energy needs were met
Number of beans to be removed		10	12	14	18	22	25	30	32	36	40	
Energy Needs Met? (Yes or No)												

Data Chart #5 **WITH RENEWABLES** NO Blindfold

CONSUMPTION LEVEL	Prediction of years to deplete	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Total Years energy needs were met
Number of beans to be removed		10	12	14	18	22	25	30	32	36	40	
Energy Needs Met? (Yes or No)												

WHERE DOES ENERGY COME FROM?

The Sun’s Energy

Essential Question: **What kinds of energy are converted from sunlight?**

Time: 1-2 hours

Girl Scouts explore the idea that most of the energy we use comes from the sun, by reading, discussing, playing a game, and making a concept map.

Vocabulary

- Solar Energy
- Wind Energy
- Electricity
- Generator
- Fossil Fuel
- Renewable
- Non-Renewable

Information and Procedure

Materials needed

- Crayons
- Handout “Energy from the Sun”
- Large sheets of paper or tag board and drawing materials
- Timer
- Handouts *Solar Use Cards* and *Solar Energy* reading

What to do in advance

Print handouts *Energy Use Cards* and *Solar Energy*

Gear up

- Ask the Girl Scouts for their ideas about what kind of work the sun’s energy does when it gets to earth.
- Split the Grirl Scouts into groups and assign one topic to each group from the solar energy handout.

Explore

1) Have each group read and discuss their section of the handout about energy from the sun.

Hand out drawing materials and ask each group to make a large picture or sign that illustrates their topic and present it:

- Sun
- Heat
- Light
- Berries, roots, leaves (use names of plants in your part of the state that are eaten by animals and humans)
- Trees
- Caribou, fish, porcupine (use animals from your area that are used for subsistence)
- Small sea plants and animals
- Humans
- Moving Water
- Wind
- Electricity
- Oil
- Gas
- Coal

2) Play the following "Energy Chains" game in two or three teams as a way of discussing and analyzing the ways in which all of the energy we use originally comes from the sun.

A) The first team draws a card with a use of energy. The team has three minutes to discuss and then hold up the pictures or signs to illustrate how the sun's energy is connected to the action.

They should be able to answer questions to explain their connections. For each sign used correctly, they get one point for their team.

For example, the action drawn is "using a computer." Girl Scouts might go up in front of the class and hold up pictures *sun-heat-wind-electricity*. They would get 4 points for their team.

B) The other team(s) is invited to illustrate different ways that the same action is related to the sun. They also have 3 minutes to discuss and show the "energy chain"

Examples: Another team might show *Sunlight-small sea plants* and *animals-oil-electricity*.

They would get 5 points. A very astute team could show a "double" chain, with *sunlight-berries-caribou-human beings* (punching the keys) in one direction and *sun-moving water-electricity* in another direction and get 9 points, while another could show *sun-electricity* for 2 points.

C) When all ideas are exhausted, it is time for the next team to draw a card.

Variations

- Girl Scouts can make their own cards with ways that they use energy.
- Signs/pictures can be made ahead of time by volunteers, to save time.
- To make the game and lesson easier, eliminate types of energy (such as coal, wind, water) that are not used locally.

Generalize

Discuss the ways that most of our energy needs are provided in directly or directly by the sun. If the Girl Scouts missed any important "energy chain" connections during the game, review those. Ask Girl Scouts if they can think of any kinds of energy that do not come from the sun, and discuss their answers.

***Note:** Some energy can also come from tides (gravitational forces), geothermal heat stored in the earth(from original Earth aggregation and radioactive decay), fission fuels (unstable uranium and thorium nuclei), and fusion fuels (deuterium and tritium).*

Assess

Have Girl Scouts draw an energy concept map using the list of words that they illustrated and used in the game.

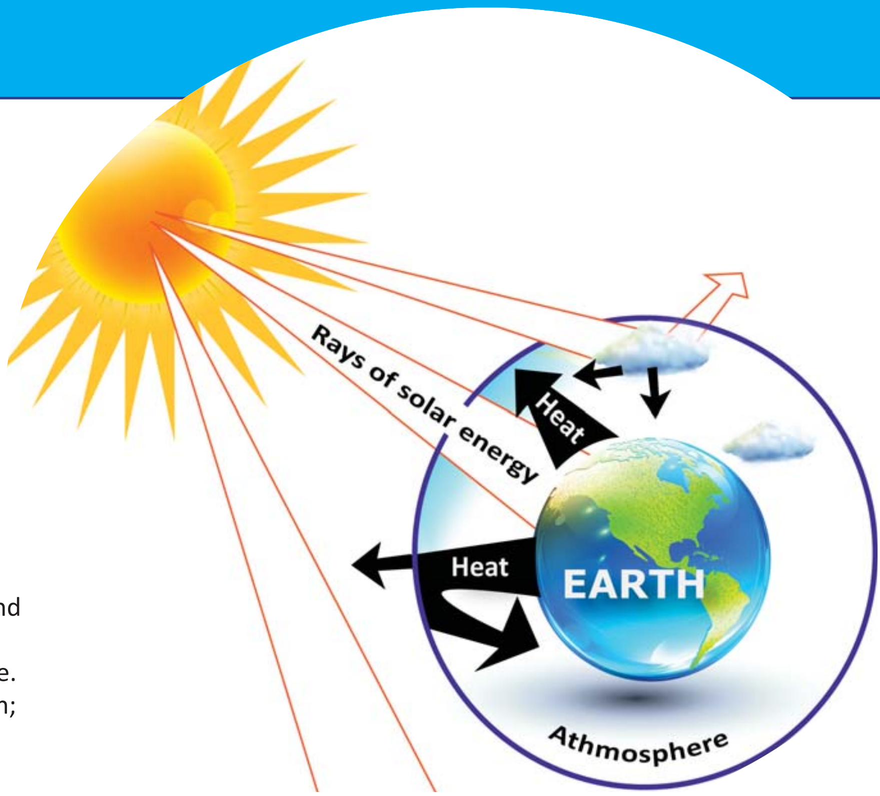
Girl Scouts should show how the words are related to each other, using connecting words like "driven by", "makes", or "comes from". There are many ways that the map can be drawn correctly, but you should expect them to illustrate the ways in which each word relates to the sun, to show several different sources of electricity, and to connect humans' energy back to the sun through a simple food chain.

Energy Use Cards

Heating a house	*Paddling a kayak or canoe*	*Playing basketball*
Riding on a snowmachine	*Swimming*	*Turning on the lights*
Riding in a car	*Riding a bicycle*	*Cooking dinner*
Washing the dishes	*Flying a kite*	*Drying clothes*
Riding on a dog sled	*Walking to school*	*Watching television*

Handout

Solar Energy



Our earth gets most of its energy from the sun.

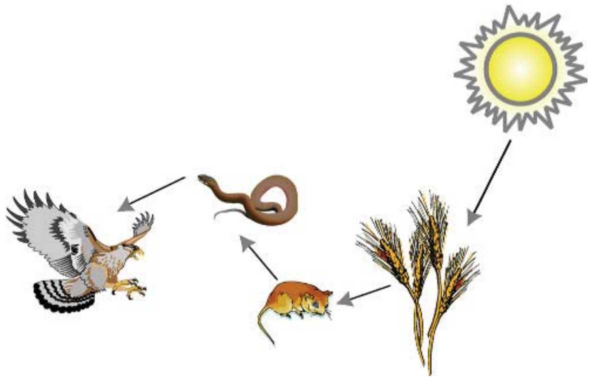
We call this energy solar energy. **Sol** means sun. Solar energy travels from the sun to the earth in rays. Some are light rays that we can see. Some are rays we can't see, like x-rays. Energy in rays is called radiant energy.

The sun is a giant ball of gas. It sends out huge amounts of energy every day. Most of the rays go off into space. Only a small part reaches the earth. When the rays reach the earth, some bounce off the clouds and back into space. In this way, the rays are reflected. The earth absorbs most of the solar energy and turns it into heat. This heat warms the earth and the air around it, which is the atmosphere. Without the sun, we couldn't live on the earth; it would be too cold.

We use solar energy to see and grow things

We use solar energy in many ways. During the day, we use sunlight to see what we are doing and where we are going. Plants use the light from the sun to grow. Plants absorb (take in) the solar energy and use it to grow. The plants keep some of the solar energy in their roots, fruits, and leaves. They store it as chemical energy.

The energy stored in plants feeds every living thing on the earth. When we eat plants and food made from plants, we store the energy in our bodies. We use the energy to grow and move. We use it to pump our blood, think, see, hear, taste, smell and feel. We use energy for everything we do. The energy in the meat that we eat also comes from plants. Animals eat plants to grow. They store the plants' energy in their bodies.

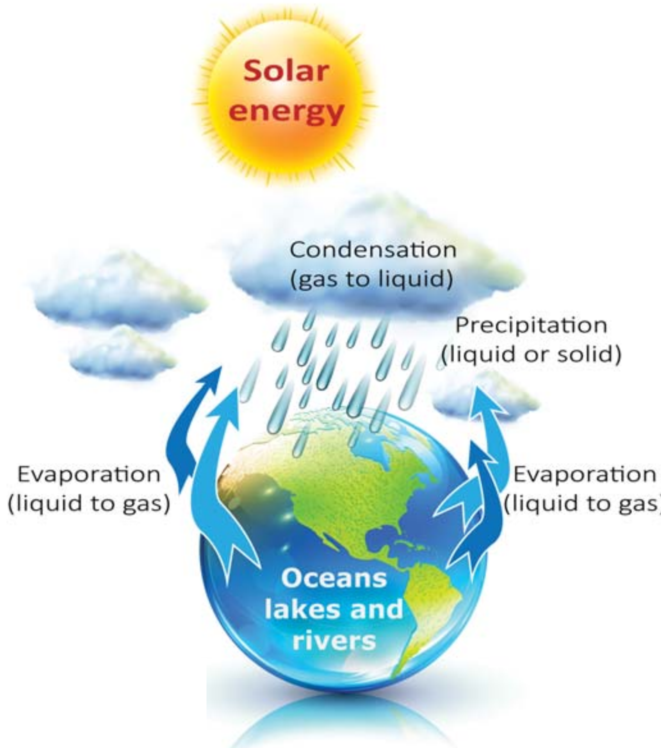


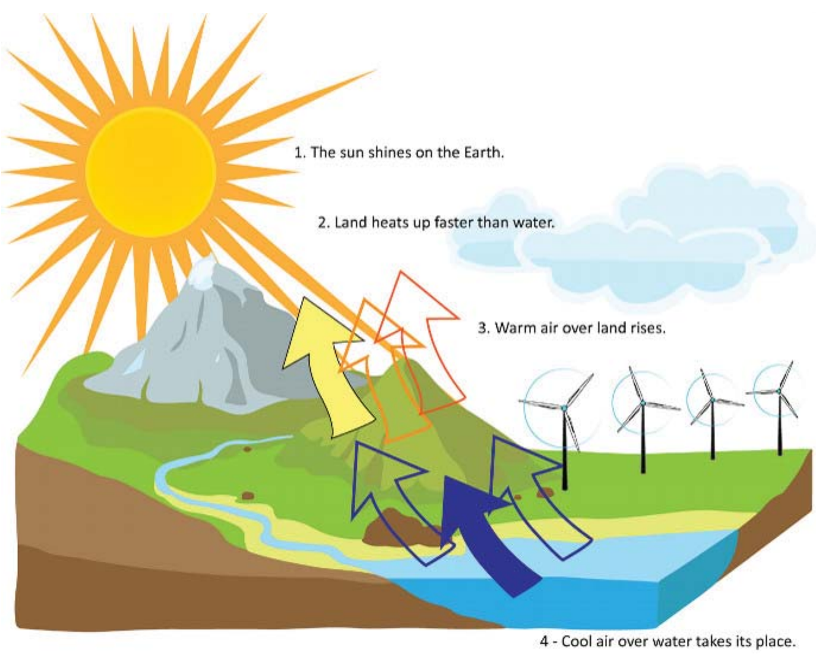
We can use the sun's energy for heat

We also use the energy stored in plants to make heat. We burn wood in campfires and fireplaces. Early humans burned wood to cook food, scare away wild animals, and keep warm. Solar energy turns into heat when it hits objects. That's why we feel warmer in the sun than in the shade. The light from the sun turns into heat when it hits our clothes or our skin. We use the sun's energy to cook food and dry our clothes.

The sun's energy is in many things

Solar energy powers the water cycle. The water cycle is how water moves from clouds to the Earth and back again. The sun heats water on the earth. The water evaporates, which means it turns into water vapor and rises into the air to form clouds. The water then falls from the clouds as precipitation, such as rain, sleet, hail, or snow. When water falls on high ground, gravity pulls it to lower ground. There is energy in the moving water. We can capture that energy with dams and use it to make electricity.

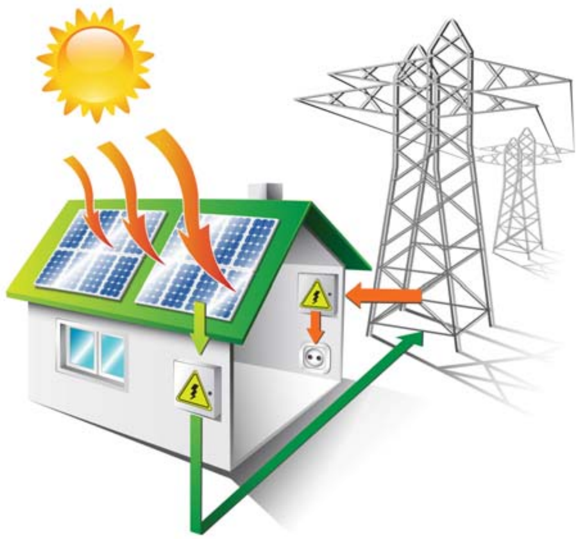




The sun makes the wind

Solar energy makes the winds that blow over the earth. The sun shines down on the land and water. However, the land heats up faster than the water, and then the air over the land gets warm. This warm air rises, and the cooler air over the water moves in where the warm air was. This moving air is wind.

Windmills can capture the wind's energy by turning the energy in moving air into electricity. The wind pushes against the blades of the windmill and they begin to spin. A generator inside the windmill changes the motion into electricity.



Fossil fuels have solar energy

Coal, oil, and natural gas are called fossil fuels because they were made from prehistoric plants and animals. The energy in them came from the sun. We use the energy in fossil fuels to cook our food, warm our homes, run our cars, and make electricity. Most of the energy we use today still comes from fossil fuels.

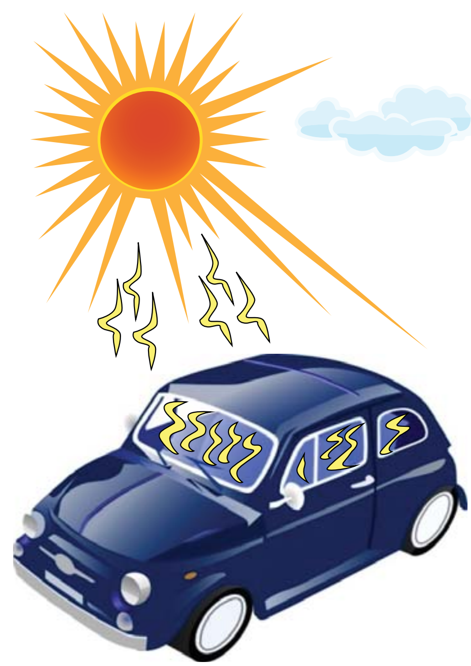
Solar energy can make electricity

Photovoltaic (PV) cells turn the sun's energy into electricity. "Photo" means light and "volt" is a measure of electricity. PV cells are made of two pieces of silicon, the main ingredient in sand. Each piece of silicon has a different chemical added. When radiant energy hits the PV cell, the layers of silicon work together to change the radiant energy into electricity.

Some toys and calculators use small PV cells instead of batteries. Big PV cells can make enough electricity for a house. They are expensive, but good for houses far away from power lines. Some schools are adding PV cells to their roofs. The electricity helps lower the amount of money schools must pay for energy. Do you have PV cells on your school building? Today, solar energy provides only a small amount of the electricity we use. In the future, it could be a major source of energy. Scientists are looking for new ways to capture and use solar energy.

Solar energy is renewable

Solar energy is free, clean, and renewable. We will never run out of it. The sun will keep making energy for millions of years. Why don't we use the sun for all our energy needs? We don't know how to, yet. The hard part is capturing the energy. Only a little bit reaches any one place. On a cloudy day, most of the solar energy never reaches the ground at all.



Ways we capture solar energy

Lots of people put solar collectors on their roofs. Solar collectors capture the energy from the sun and tum it into heat. People heat their houses and their water using the solar energy. A closed car on a sunny day is a solar collector. Solar energy passes through the glass, hits the inside of the car, and changes into heat. The heat gets trapped Inside.

alaskaresource EDUCATION

Minerals

Girl Scouts of Alaska | Alaska Resource Education | Minerals Patch

Girl Scouts of Alaska
Alaska Resource Education
Minerals Patch

Level: **Brownie**

Requirements:
Complete item 1, or 2, or 3, and at least 2 other activities.

Level: **Junior, Cadette, or Senior**

Requirements:
Complete item 1, or 2, or 3, plus activity number 5, and at least 2 other activities.

1. JellyBelly Geology

2. Mine a Cookie

3. The Rock Game

4. Speaking Science

Define the following terms related to minerals or mining:

a. Rock
b. Mineral
c. Luster
d. Hardness
e. Exploration
f. Operation
g. Reclamation

For lessons, more information, and helpful links visit:
www.akresource.org

5. Look Up

Find and record information for the following:

- A proposed/exploration mining project (i.e. Donlin Creek, Pebble, Niblack, Livengood)
- An operating mine (i.e. Red Dog, Fort Knox, Pogo, Greens Creek, Kensington, Usibelli)

a. Name the project
b. Locate the project (Within Alaska)
c. List the mineral(s) in the deposit/mine
d. Identify the type of mine (or what is proposed)

6. Compare and Contrast

What are differences between a rock and a mineral? What are the similarities? List as many of both as you can.

7. Identify

List 3 items you use in your everyday life. Research what minerals are used to make those items and list at least 3. Determine which of those minerals are mined here in Alaska.

WHERE DO MINERALS COME FROM?

Jelly Belly Geology & Rock Identification

Essential Question: **How do you identify rocks and minerals?**

Time: 1-2 hours

Girl Scouts will learn to identify and classify rocks and minerals by their properties.

Vocabulary

- Geologist
- Classification
- Characteristics
- Opaque
- Translucent

Information and Procedure

Materials needed

- Small cups or bag to hold Jelly Bellys
- Jelly Bellys (see the Jelly Belly Key for flavors)
- Jelly Belly key and Rock Key
- Alaska Rock and Mineral Collection **(40-specimen set can be checked-out at your local Girl Scouts office)**

What to do in advance

Copy the attached handouts for the Girl Scouts. In each small cup, put 1 of each flavor of Jelly Belly.

Gear up

1. Discuss prior knowledge of rocks and minerals to gauge how much introduction or review to include in the lesson. Let them describe a favorite rock they have by using one or two descriptive words.
2. Explain the term "geologist." A geologist is a scientist who studies the solid and liquid matter that constitutes the Earth.

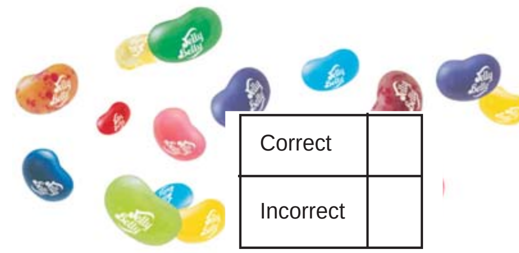
Explore

1. Hand out the Jelly Bellys and Keys for the Girl Scouts. Instruct Girl Scouts to NOT EAT the Jelly Bellys because they are the rocks that they are going to classify and identify.
2. Have the Girl Scouts start with the color of the Jelly Bean and follow the lines that most appropriately describe their Jelly Belly until they reach the flavor. Have them continue until all their Jelly Bellys have been classified.
3. When finished, have the Girl Scouts taste test their Jelly Bellys to see if they matched it with the correct flavor. Have them tally their answers as correct or incorrect and log it in the box on the Jelly Belly Key.
4. Discuss that geologists are not always accurate in their assessments. Rocks can have many similar characteristics but still be different. It is important for geologists to conduct several types of tests and to repeat their work to make sure they are accurate. A mistake in real life could cost millions of dollars to the company.
5. Have Girl Scouts partner up. Show them the Alaska Rock and Mineral Kit and explain that these are materials that are mined currently or historically in Alaska. Pull out the rocks listed on the Rock Key and hand one or two out (depending on class size) to each pair. Be sure to keep the lid of the Rock Key with you as they contain the answers.
6. Instruct the Girl Scouts to classify their rock samples from the rock kit using the Rock Key. Have them write their answer next to their rock on a sheet of paper. Confirm with them if they matched the correct rock with the name.

Generalize

- What were some of the observable characteristics that helped you to identify one rock/mineral out of many?
- Why might it be important for scientists and geologists to observe and describe things carefully?
- What makes it difficult to identify one rock from another?

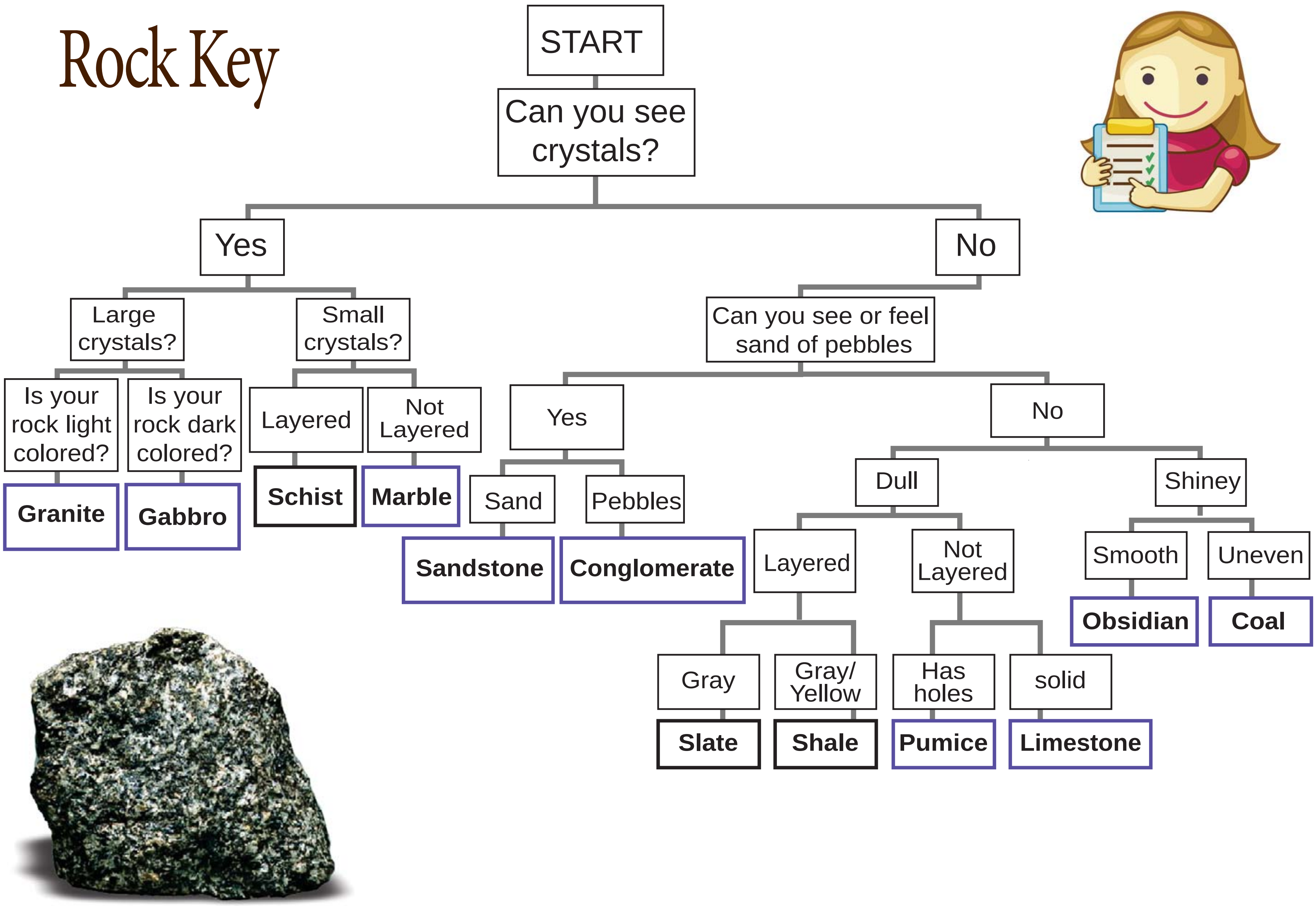
Jelly Belly Geology Key



Correct	
Incorrect	

- Orange
  - Opaque
    - Spots — Peach
    - Dark — Orange shetbet
  - Translucent
    - Light — Grapefruit
- Yellow
  - Opaque
    - Spots spots — Banana
    - Light spots — Battered popcorn
    - Dark — Pineapple coconut punch
  - Translucent
    - Dark — Lemon
    - Light — Crushed pineapple
- Red
  - Red
    - Spots
      - Light spots — Sizzling cinnamon
      - Dark spotd — Raspberry
    - No spots
      - Dark — Cinnamon
      - Light — Cherry
  - Pink
    - Spots
      - Colored spots — Tutti fruitti
      - Small spots — Strawberry punch
    - No spots — Bubble gum
- Green
  - Opaque
    - Dark — Watermelon
  - Translucent
    - Dark — Green apple
    - Medium — Sunkist lime
    - Light — 7-Up
- Purple
  - Dark — Grape jelly
  - Spots — Berry smoothie
- White
  - Opaque
    - Spots — Toasted marshmallow
    - No spots — Coconut
  - Translucent — Cream soda
- Blue — Blueberry
- Brown
  - Opaque
    - Dark — Chocolate pudding
    - Spots — Cappuchino
  - Translucent
    - No spots — Root beer

Rock Key


START
Can you see crystals?
Yes
No
Large crystals?
Small crystals?
Is your rock light colored?
Is your rock dark colored?
Granite
Gabbro
Layered
Not Layered
Schist
Marble
Can you see or feel sand of pebbles
Yes
Sand
Pebbles
Sandstone
Conglomerate
No
Dull
Shiney
Layered
Not Layered
Gray
Gray/ Yellow
Slate
Shale
Has holes
solid
Pumice
Limestone
Smooth
Uneven
Obsidian
Coal

WHERE DO MINERALS COME FROM?

Mine a Cookie

Essential Question: **What is mining like and how does it work?**

Time: 1 hour

Girl Scouts “mine” cookies to determine their “mineral” value

Vocabulary

- Profit
- Mining
- Milling
- Reclamation
- Ore
- Extraction

Information and Procedure

Materials needed (1 per student)

- cookie
- price chart
- tally sheet
- flat toothpicks
- popsicle stick
- plastic spoons
- plastic forks
- napkins
- small paper plates
- frosting

What to do in advance

- Use cookies that have at least 1 different “mineral” (nuts, chocolate chips, raisins, etc.) in it. (Softer cookies work better than hard ones.)
- Adjust the price chart and tally sheet based on the type of cookie you are using. Give the “minerals” which may be rarer a higher value than the others.

Gear up

Discuss what mining means and where mining happens in Alaska. Use a map to locate the active mines in the state.

Explore

1. Tell the Girl Scouts they will be “mining” their cookie for “minerals”. Tell them they may not eat their cookie until after they have mined it.
2. Review the price sheet.
3. Cover the cookies with frosting. Have Girl Scouts predict the type and amount of each mineral they will find in the “mine”. This is true to real life. Miners don’t know what is underground until they actually start digging; they can only predict.
4. Have Girl Scouts choose mining tool(s): a toothpick, popsicle stick, spoon, or fork. If they break their tool, they have to get a new one. They may NOT use their hands.
5. Have them try to extract the “minerals” from their cookie and place them on a plate. Once they have mined, tell them they must “mill” the mined material (ore) to concentrate the valuable minerals more. They do this by taking off as much cookie off the “mineral” as possible. Milling in real life separates the earth from the valuable minerals.
6. The clump of mined material (dough and “minerals”) is known as the “ore” and the leftovers are called the tailings. Girl Scouts “mill” their ore to get the minerals out.
7. After the “minerals” have been milled, Girl Scouts tally their totals. For older girls, you may want to add the concept of profit or loss and tell them they are starting off with a certain amount of debt and they have to make more than that to make a profit.
8. Tell Girl Scouts they must put their cookie back together as best they can without the minerals they mined, before they eat it. This is called reclamation.

Generalize

Compare the predictions and actual amounts mined. Were some of the cookies more valuable than others? How do you think this compares to the way that minerals are really mined? What are some of the things that miners have to pay for to get minerals?

Change it up!

Use colored frosting and/or sprinkles to create wetlands, parks, or preserves on the surface of the cookie. These must not be disturbed when mining. Instead of using food, make the mining cookie from clay, mud, gravel and objects like marbles, buttons, etc.

MINE A COOKIE | Profit Analysis Sheet

COST:

Land Lease	Cost
Half the Cookie	$100
Whole Cookie	$200

Equipment	Cost
Spoon	$50
Fork	$70
Toothpick	$20

Land Lease	Cost

Equipment Items	Cost
Reclamation	$50
TOTAL	**$**

PERMIT

Regulator Signature

INCOME:

Item	Value
Chocolate Chips	$200
# Chocolate Chips x $200	

PROFIT:

Income - Costs = Profit

.... - .... = ...

WHAT ARE MINERALS?

The Rock Game

Essential Questions:

What are properties of rocks and minerals?
How and why do scientists describe things?

Time: About 1-2 hours

Girl Scouts describe rocks in detail using new and common terminology in a game where teams try to identify the rock being described.

Vocabulary

- Luster
- Texture
- Stratification
- Composition
- Classification

Information and Procedure

Materials needed

- 30-70 rocks of any kind
- Paper
- Markers

What to do in advance

Set up Girl Scouts in stations of 2-4 girls each. Place 4 rocks, paper, and markers at each station, and assign 1 girl to be the recorder.

Gear Up

Show rock samples to demonstrate vocabulary for describing rock properties:

- **Luster:** The way in which the surface of a mineral reflects light. Show samples of obsidian (glassy), talc (dull), pyrite or galena (metallic), graphite (waxy).
- **Texture:** General appearance of the rock surface in terms of its minerals or crystals. Show samples of gabbro, granite (coarse) halite, shale (fine), obsidian (smooth).
- **Stratification:** The accumulation of material as layers in rocks. "Stratified" is another term for "layered". Sandstone or shale may or may not show stratification. If not, try to find a layered rock.

Composition: Describes "ingredients" of the rock. Girl Scouts will describe this in terms of what they see in the rock: Big white grains, black shiny grains, little holes, white veins, etc. Conglomerate, granite, and other rocks can describe composition.

Encourage Girl Scouts to use other, more familiar terms for describing the rock samples. Describe the color, the way it feels (soapy, rough), or whether it is heavy or light. To prepare for future identification and classification of rocks, it is helpful if Girl Scouts don't use "size" as a descriptor. Discuss the idea that smaller rocks come from the breaking and weathering of larger rocks as part of the rock cycle. Have the research groups replicate each others' experiments.

Explore

1. Have each group secretly select one rock from their station. Tell them to hide this from the other groups. Give them 5-10 minutes to write adjectives describing their rock on paper.
2. Switch stations and have each group read the previous group's description and try to guess the orignal group's rock. Give the reading group 5 minutes to come to a consensus.
3. Have each group present which rock they think was described by the previous group. Which clues helped them most?

Generalize

What did all of the rocks have in common? What were some of the characteristics that helped you identify each rock? Why might it be important for scientists to observe and describe things carefully? Why do rocks sometimes have the same characterisitcs, even though their sizes and shapes are different?

Forestry

Girl Scouts of Alaska | Alaska Resource Education | Forestry Patch

Girl Scouts of Alaska
Alaska Resource Education
Forestry Patch

Level: **Brownie**

Requirements:
Complete item 1, or 2, or 3, and at least 2 other activities.

Level: **Junior, Cadette, or Senior**

Requirements:
Complete item 1, or 2, or 3, plus activity number 6, and at least 2 other activities.

1. Every Tree for Itself

2. Trees, a Renewable Resource

3. Effects of the Non-living Environment

4. What are tree rings? What do thicker rings mean? What about thinner ones? Go find a log or piece of fire wood and look at the rings. Can you count them? Share your findings with your troop.

5. Design: Pretend you are a tree. On a paper plate, start with a small circle in the middle representing the year you were born, and label it with your birthday. Draw a ring for every year you have been alive. Are there any years you grew more or less? Should those rings be thicker or thinner? Now on the other side, draw a picture of a tree.
Label the following:
- a. Leaves/needles
- b. Trunk
- c. Branches
- d. Roots

6. Collect, Compare, and Contrast: Go outside and gather the following items from at least 3 different types of trees or woody vegetation:
- a. Leaves or needles
- b. Stems or branches
- c. Flowers
- d. Pine Cones
- e. Bark

Can you identify what species they are? What do you notice that is the same? What is different? What is each part used for? Share with your troop?

7. Identify: List 10 items in your home that you use on a daily basis that are made from wood or wood products. Then look at www.akresource.org for the wood products tree. List 5 products that surprised you and share them with your troop.

For lessons, more information, and helpful links visit:
www.akresource.org

HOW DO FORESTS CHANGE OVER TIME?

Every Tree for Itself

Essential Questions:

What do forests need to survive and be healthy?
What is the relationship between plants and the non-living environment?

Time: 1-2 hours

Girl Scouts play a game to simulate how trees compete for their essential needs.

Vocabulary

- Competition
- Photosynthesis
- Drought
- Nutrients
- Roots
- Growth
- Motion

Information and Procedure

Materials needed

- 8 1/2" x 11" pieces of paper or white paper plates
- Pieces of blue, yellow, and green paper, or three colors of poker chips
- Markers or crayons
- Tree trunk or branch cross-sections showing annual growth rings, if available (often available from tree-trimming services or forest industries)

What to do in advance

Cut two 3" x 3" squares out of blue, yellow, and green construction paper for each Girl Scout. To save time, you could use colored poker chips. Poker chips work much better than paper if you're doing the activity outdoors on a breezy day.

Gear up

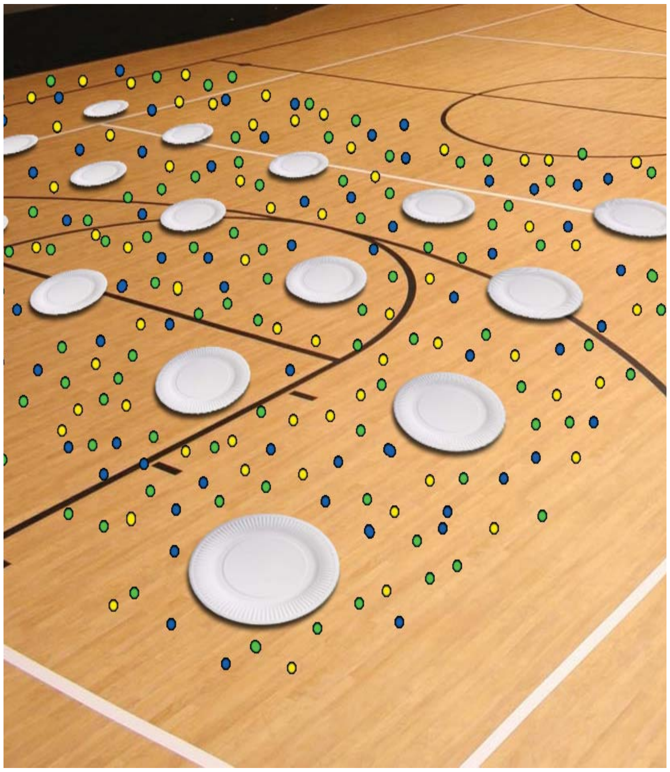
Ask the Girl Scouts that if they were a tree and lived in the forest would they rather be a strong older tree, a regular size tree, a small tree just starting out, or a tree that preferred shade. Why?

Explore

Pass out any cross-sections of trees you have. Have your Girl Scouts examine the growth rings. (If you don't have an actual cross-section, draw one. Explain that the number of rings indicates a tree's age.

Discuss

What do trees need so they can grow? Trees have some of the same needs as those of people and animals. For example, they all need plenty of water and nutrients, which they get from food. But trees and people don't get food in the same way. Plants make their own food by using energy from the sun. If trees don't get enough water, nutrients, or sunlight, they may grow slowly or die. Growth rings show this graphically. In general, wide rings indicate good conditions for growth (plenty of nutrients, water, and sunshine) while narrow rings often indicate less growth due to drought, short growing seasons, insect damage, lack of nutrients, or competition.



Round 1:
Have Girl Scouts stand on their cross-sections (paper or plates) about three feet from each other.

Equally distribute the colored squares (or poker chips) on the floor around the Girl Scouts.

Give a signal to start. Have Girl Scout trees reach out with their roots and branches (arms and legs) to gather their requirements. Allow Girl Scout trees to gather these requirements for one 30-second round. Have Girl Scouts use the tally sheet provided to record how many of each color requirement they gathered. Use the following questions to discuss the results of the first round:

- How many requirements did each tree get?
- Do any trees lack a particular requirement?
- What might happen to a real tree that lacked one of its requirements? (It might grow slowly or eventually die. Point out to the Girl Scouts that different species of trees have different requirements.)
- Is there such a thing as too much water, sunlight, or nutrients? (Yes, every species has optimum levels for each requirement beyond which the tree becomes stressed.)

Activity
Give each Girl Scout a piece of paper or white paper plate. Tell Girl Scouts to imagine that they are trees. Have them draw a cross-section of themselves representing their age in growth rings.

Tell Girl Scouts that they'll be playing a game called **"Every Tree for Itself."** The object of the game is for the "trees" to gather as many colored squares (poker chips) as they can. Explain that each colored square, or poker chip, represents a tree requirement. Blue represents water, yellow represents sunlight, and green represents nutrients such as nitrogen, oxygen or carbon dioxide. Make appropriate adjustments if you use poker chips. (Blue = water, White = oxygen/nutrients, Red=sunshine)

Rules:
Girl Scouts must keep one foot (their tap root) planted on their cross-section (paper or plate) at all times. They are not allowed to slide their cross-section (paper or plate) along the floor or step off it; they will be disqualified for doing so.

Round 2:
This time, have Girl Scouts stand in groups of three to five, about one foot apart within each group. Gather the colored squares and spread them around the room again. Play another round and have Girl Scout trees record their results. Compare the results of this round with those of the first.

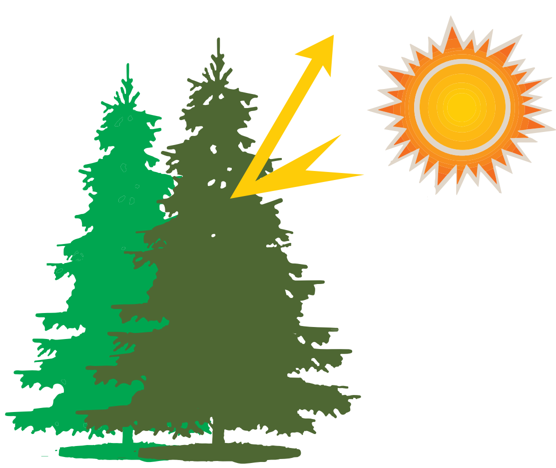
In most cases, Girl Scouts will notice that each tree gathered fewer requirements. Ask your Girl Scouts if they can reach any conclusion about trees that grow close to each other. (Such trees compete for requirements. Often they don't grow as well as trees that are more widely separated from one another.)

Ask if any trees "died" because they couldn't get a particular requirement. (You can allow trees to fall down or look tired and droopy if they haven't received their vital requirements.)

Try several more rounds, comparing the results each time. As before, each Girl Scout should examine her results after each round. Older Girl Scouts can record those results and later graph or chart the results of each round and draw conclusions.

Here are suggestions for setting up additional rounds:

- Use fewer water squares (representing a drought).
- Use fewer sunlight squares (representing lack of sunlight for young trees because of overcrowding).
- Use fewer nutrient squares (representing poor quality soil).
- Introduce a natural disaster at the end of a round. For example, any tree with eight or more yellow chips was devastated in a forest fire. Any tree with six or more blue chips was washed away in a flood. Any tree with five or more green chips was destroyed by spruce beetles.



Background

The pattern of change from bare rock to deep forest is called succession - the order that plants colonize a barren site or reestablish themselves on a disturbed site. How a forest grows and which plants come first or second depends on 1) differences in the needs of the plants, 2) the effects of the non-living environment on plants and other living things, and 3) competition. (Items #1 and #2 have been addressed in previous lessons.) Competition occurs when the supplies of energy, nutrients, and space are limited. Any plant that can get more water, nutrients, and sunlight than its neighbors will grow better and be able to have more offspring.

Plants have a variety of adaptations to help them compete for the resources they need for survival and growth. Some plants grow tall, such as Sitka spruce, to get more of the available sunlight energy. Plants with long roots, such as black or white spruce, reach farther and get more water and nutrients than those with short roots. Some produce chemicals to kill the roots of other plants and assure a larger supply of nutrients and water for themselves.

All living things compete with similar organisms to one degree or another. It is not unusual to find 2 trees of the same species, same height, and same diameter growing side by side, which are significantly different in age. One scientist in Southeast Alaska analyzed western hemlock trees growing next to one another. He found it was not uncommon to find trees of the same diameter in which one was 1,000 years old and the other only 200 years old. The slower growth of the older tree can be attributed to the competition for soil nutrients and sunlight during a time when the forest was young and overcrowded. The younger tree, growing in an old growth forest which has more space, was able to grow quickly, putting on more girth and height during a growing season than its next-door neighbor at its same age.

In early successional Coastal forests, trees will usually grow very closely spaced with several thousand trees per acre. Foresters often thin these young forests to several hundred trees per acre. In looking at these forests several years after such thinning, growth on the remaining trees is more extreme as the competition was minimized.
Competition is a constant interaction among ecosystem organisms. The specific mixture of organisms in any forest is due, in part, to the effects of competition.

Adapted with permission from Alaska Wildlife Curriculum series, Alaska's Forests and Wildlife, Alaska Department of Fish and Game, 1999, page 49 and 65.

Date: ____________________ **Name:** ____________________

"EVERY TREE FOR ITSELF" Activity

Tally Chart

	ROUND									
Description	1	2	3	4	5	6	7	8	9	10
Spacing from other trees										
Sun Intake										
Water Intake										
Nutrients Intake										
Other Factors										

Health of the Tree Please circle one									
Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy
Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk
Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk
Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead

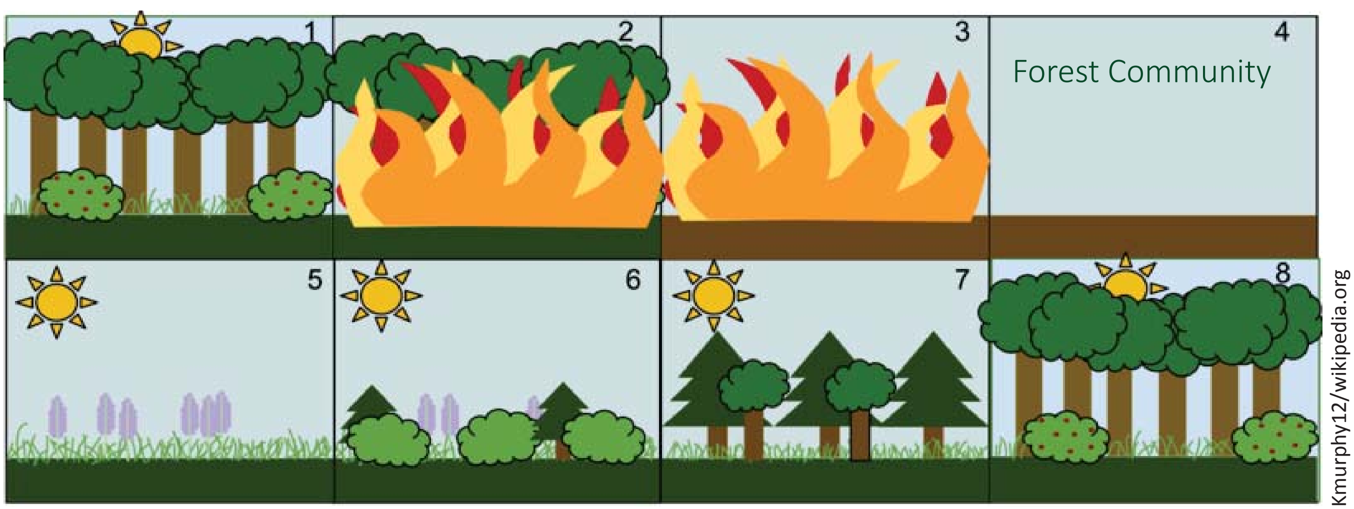
Healthy = 8 of Each Color Chips
Slight Risk = 6 of Each Color Chips
Great Risk = 4 of Each Color Chips
Dead/Dying = 2 of Each Color Chips

If one color greatly out numbers the others, then:

Too many water units = flooded roots, soil erosion, etc.

Too many sun units = very hot? Wilted? Or Drought if water is low.

Too many nutrient units = if not much water then nutrients could not be absorbed.



An example of Secondary Succession by stages:

1. A stable deciduous forest community
2. A disturbance, such as a wild fire, destroys the forest
3. The fire burns the forest to the ground
4. The fire leaves behind empty, but not destroyed, soil
5. Grasses and other herbaceous plants grow back first
6. Small bushes and trees begin to colonize the area
7. Fast growing evergreen trees develop to their fullest, while shade-tolerant trees develop in the understory
8. The short-lived and shade intolerant evergreen trees die as the larger deciduous trees overtop them. The ecosystem is now back to a similar state to where it began.

HOW DO WE USE TREES AS RESOURCES?

Trees, A Renewable Resource

Essential Questions:

How do we use renewable resources wisely?

Time: 1-2 hours

Girl Scouts simulate consumption, recycling, renewal, and conservation of wood products in a game using lima beans.

Vocabulary

- Consumption
- Conservation
- Renewable
- Biodegradable
- Recyclable

Information and Procedure

Materials needed

- large bag of lima beans or other dried beans
- paper bags - 1 per Girl Scout

Gear up

Ask the Girl Scouts: Are there any resources, things from the earth that can be replenished as people consume them so that they will always be available? If so, what are these and how would we be able to use them indefinitely? What are some of the non-renewable natural resources that could eventually run out?

Explore

1. Divide the troop into teams of 4. Give each team a paper bag of beans (at least 100). Explain to the Girl Scouts that they will be given 10 seconds to collect as many lima beans as they can, picking one bean at a time from the bag. After the round, the beans will be counted and anyone who has at least 5 will be able to continue the game.
2. Say “GO!” and count to ten, allowing Girl Scouts to collect as many beans as possible. Count and calculate who is still in the game. (It should be everyone).
3. Explain that the beans represent trees. Review that trees are a renewable resource. However, discuss that a tree may take 100 years to grow to a size that would be worth using.
4. Optional, for older Girl Scouts: Ask Girl Scouts to calculate how many people would be born to a couple in 100 years if each person lived to be about 80 and each couple had 3 children by age 25. After 100 years, how many people would there be? In 100 years, one tree grows to replace the one that was cut. In 100 years, a couple would turn into 184 people. In one year, on average, every American consumes the amount of paper and lumber to equal one 100-foot tree.
5. Explain that the Girl Scouts will be consuming trees for 4 generations, or 100 years. (For younger Girl Scouts, you may want great-grandma to go first, then grandma, then mom, then child to reinforce

TREES, A RENEWABLE RESOURCE *(continued)*

the concept of 4 generations). Each generation will be called a round and Girl Scouts will be given 10 seconds to collect their beans. After each round, each Girl Scout must have collected at least 5 beans. Anyone who has not is out.

6. After each round, ask the Girl Scouts if they want to recycle their trees. If they say yes, give them 1 bean for every 10. Ask them if they want to replant a tree to use for the future; give them 1 bean for every 1. Have them put the given beans back into the pot.
7. Play 4 rounds. Calculate and discuss.
8. Play again. This time, explain that 100 beans is not realistic and give each team 30. Ask the Girl Scouts why 30 instead of 100? (Because trees are limited resources, the entire earth isn't covered with trees).
9. Play round 1 and calculate who is still in the game. Tell them in these 4 rounds no one can recycle or plant. Play out the 4 rounds and see if anyone is left. Did any team conserve their resources for the next generation? What happened to everyone? Is it true that there are limited resources in the world, especially if they can't be replaced? Ask them if trees can be replaced. If trees can be replaced they are considered a renewable resource.
10. Play 4 rounds again. This time, give each group 30 beans and tell them after each round they can recycle or replant. After each round, give the team any applicable lima beans for recyling or replanting. At the end, calculate who is still in the game. Discuss.

Generalize

Ask the Girl Scouts the following questions:

a) Do you think trees are renewable resources? Why or why not?

b) Do you think trees are an unlimited resource? (In other words, do you think there will always be trees no matter what we do?) Why or why not?

c) Do you think there will always be trees available for future use? Why or why not?

d) Do you think there is anything that could be done to ensure that there are trees available for future use? If so, what?

Background

Wood (from trees) is a natural resource, something we get from the earth that helps meets our needs and wants. Alaska provides many other natural resources, including fish, oil, natural gas, coal, and abundant wildlife.

Wood is a unique resource as it is renewable, biodegradable, and recyclable. Renewable means that it can be replenished through natural or manipulated processes. Trees can be harvested, replanted, and grown again for future use. Wood is also biodegradable, meaning that it decomposes naturally and is reabsorbed back into the earth. While wood is biodegradable, it should not be confused that all wood products are biodegradable; for example, rayon and cellophane are not.

An additional benefit of wood is its ability to be recycled, meaning it can be broken down and used again. Wood, however, is not recyclable indefinitely as would be true of metals or glass. The fibers eventually become too short to bond into new products. This, however, does not diminish the need for recycling and reusing materials.

HOW DO FORESTS CHANGE OVER TIME?

Bottled Forest

Essential Questions:

What is the life cycle of a forest?
What things do forests need to survive and be healthy?
What is the relationship between plants and the non-living environment?

Time: 1 hour setup, followed by growing baby plants over several weeks at home

Girl Scouts make soda bottle terrariums and explore the effects of simulated natural and man-made events on their "forests".

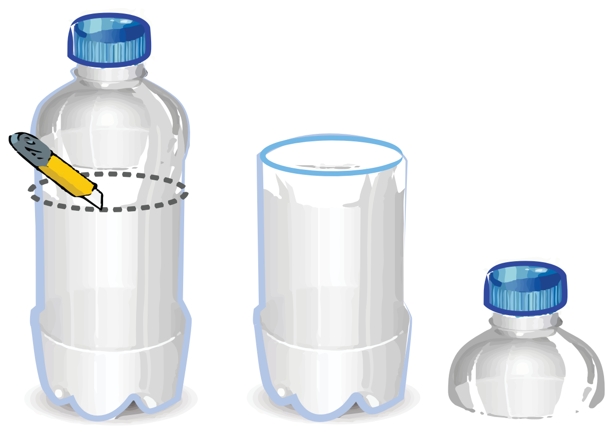
Vocabulary

- Agents of Change
- Terrarium
- Ecosystem
- Hypothesis
- Observation

Information and Procedure

Materials needed

- (2) 1-liter plastic pop bottles for each Girl Scout
- Soil
- Seed or small plants, at least 3 different species, 10-15 of each type for every Girl Scouts
- Masking or duct tape, a long strip per Girl Scout
- Cup of water, 1 per Girl Scout
- Utility knife for troop leader's use only



What to do in advance

Begin collecting materials well in advance of the lesson. Slice all pop bottles in half with a utility knife. Save the cap for later use.

Gear up

Discuss with the Girl Scouts things that could affect the growth of trees or plants in the forest. Explain to them that these are called "agents of change." See how many they can list. Discuss which ones are human causes and which are natural causes.

BOTTLED FOREST *(continued)*

Discuss

There are many factors which can influence the growth of a single tree or a part of a forest. These agents are both natural and man made.

The human causes of change include development, timber harvest, road construction, manufacturing, and human-caused catastrophes such as forest fires. Humans have been changing their environment since first walking the earth. We continue to do so, weighing the trade offs along the way. For instance, the National Forest Service may hold on to certain forests as a means of preservation while other areas may be sold or leased for development or a timber harvest that, in turn, causes changes to the ecosystem. Knowing the human caused agents of change can help managers and land owners make the best decisions they can regarding forest use.

Explore

1. Explain to the Girl Scouts that they will be making two terrariums in each of which natural or man-made agents of change will be influencing the ecosystem.
2. Although each Girl Scout will be making her own terrariums, have Girl Scouts work in teams of 2 to assist one another.
3. Pass out the materials.
4. Tell Girl Scouts to place soil in their bottle bottom until it is at least 3-4 inches thick at the deepest part. Carefully plant seeds according the directions on the package. Girl Scouts may plant as many as they want, but should record the number they planted.

5. Have Girl Scouts replace the top half on their bottle and tape it closed all the way around, making it air tight. The cap should also be replaced.
6. Girl Scouts then allow their plants to grow until they are established in the terrarium. This usually takes a few weeks.
7. Once the plants are growing, have the girls pick one terrarium and decide how they want to test the natural changes. They may decide to change the amount of sunlight by putting it in a shady place, or the amount of water by letting some water evaporate. They may shake the bottle up gently, simulating an earthquake. Or they may pour more water into the terrarium to simulate a flood, and so on.
8. Have Girl Scouts record their natural change, their hypothesis for its affect on their terrarium, and then experiment and record the results. They should keep records over at least a 2 week growing time to determine the effects.
9. On the second terrarium, have the Girl Scouts choose a man-made agent of change. This could be placing boxes (buildings) outside the terrarium to shade an area. This will decrease the sunlight to certain plants and may lower the temperature of the terrarium. They might remove some of the plants, simulating timber harvest or development.
10. Have Girl Scouts record their man made agents of change as with the natural agents.
11. The Girl Scouts will then compare their data and discuss their ideas.

Generalize

Ask the following questions:

1. How did the human changes effect the ecosystem?
2. How did the natural changes effect the ecosystem?
3. What change has the largest effect and why?
4. How do you think this experiment does and does not simulate real life forests? Explain your answer.
5. Do you think humans can cause changes to forest ecosystems? How so?

BOTTLED FOREST **Data Collection Sheet**	**Natural Change:**	**Man-made Change:**
Hypothesis *Example*: I think ... will affect by plants by		
Week 1 Observations		
Week 2 Observations		

alaskaresource
EDUCATION

Natural Resources

Girl Scouts of Alaska | Alaska Resource Education | Natural Resources Patch

Girl Scouts of Alaska
Alaska Resource Education
Natural Resource Patch

Level: **Brownie, Junior, Cadette, or Senior**

Requirements:

After completing the Energy, Mineral, and Forestry patches, complete the following activity.

Identify, Locate, and Map the following Natural Resource-related areas, projects, or sites:

a. Anchorage: Headquarters for many industry and service companies
b. Fairbanks: Headquarters for many industry and service companies
c. North Slope Oil Production Fields:
   Companies such as Conoco and BP and ExxonMobil
d. North Slope Oil and Natural Gas Exploration Leases in the Chukchi Sea:
   Companies such as Statoil and Shell
e. Cook Inlet Oil and Natural Gas Production Fields:
   Companies such as Conoco and Hilcorp
f. Cook Inlet Oil and Natural Gas Exploration leases:
   Companies such as Apache and Cook Inlet Energy
g Kinross, Fort Knox: Gold Mine
h Hecla, Greens Creek: Silver Mine
i. Teck, Red Dog: Zinc and Lead Mine
j. Donlin Gold: Proposed Mine
k. Pebble Project: Proposed Mine
l. Chena Hot Springs: Geothermal
m. Kotzebue: Wind Farm
n. Fire Island: Wind Farm
o. Juneau: Hydroelectric Plant
p. Trans-Alaska Pipeline
q. Tok School Biomass Heating Project

For lessons, more information, and helpful links visit:
www.akresource.org


Legend
City
Oil Field
Active Mine
Proposed Mine
Wind Farm
Pipe Line
Geothermal
Hydroelectric
Forestry

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