A Natural Gas Story

Natural gas is an important energy source. We burn it in furnaces to heat our homes. We burn it in stoves and ovens to cook our food. Power plants, factories, and landfills burn and use the heat to make electricity. Some vehicles even burn natural gas instead of gasoline. But where does this important energy source come from?

The sun produces lots of light from a process called nuclear fusion. The sun's radiant energy travels to Earth and is changed into chemical energy by plants. Hundreds of millions of years ago, before dinosaurs lived, oceans covered most of the earth. Tiny plants and animals lived in these oceans. They stored the sun's energy in their bodies as chemical energy. The animals ate the plants, and both the plants and animals stored the sun's energy in their bodies as chemical energy.

As the plants and animals died, the organisms sank to the ocean floor. As more and more plants and animals died, they sank and made a thick layer deep under the water. Over time, more layers of rock, sand, and other dead plants and animals built up. As the layers built up, they pressed down hard on the layers beneath.

Over time, those layers of sediment were compacted until they turned into rock. Oxygen and other elements were pushed out, and carbon, hydrogen, and a little bit of sulfur remained. The carbon and hydrogen made molecules of all different sizes, called hydrocarbons. The smallest molecules are what we call natural gas.

Geologists look for natural gas using special equipment. Using their knowledge of the Earth and its processes, geologists are able to create a picture of the layers underneath the surface. They use data from scientific instruments and tests to tell them which layers likely have natural gas. Engineers then make a plan to drill a hole, called a well, in the ground and get the natural gas.

From the well, natural gas flows through a pipeline to a processing plant. There it is cleaned, and water is removed. Natural gas found underground and processed this way is a nonrenewable energy source. This means that we cannot make more natural gas this way in a short amount of time. But this is not the only source of natural gas.

Renewable natural gas comes from places you might not expect, landfills full of garbage and farms. What do these places have in common? Decomposition.

Decomposition is the word for what happens when things break down over time, such as a fallen tree softening and sinking into the forest floor. Slugs, pill bugs, bacteria, fungi, and other organisms get food from dead plants, dead animals, and even garbage. Sometimes, decomposition happens where there is not a lot of oxygen. This is also called anaerobic respiration, and produces a compound called methane, the main component of natural gas. Anaerobic decomposition happens in landfills where everything is buried, on farms where wastes are piled up, and special systems called digesters.

Landfills have pipes sticking out of them to vent the methane out, so it doesn't build up too much pressure. This methane is burned or flared off or it can be captured and burned in a generator turning chemical energy into electrical energy. They can also collect and sell the natural gas, sending it out to customers on a pipeline. Large farms with many hundreds of animals capture methane from the waste animals leave behind. They can use it to heat their barns, power their facilities, and sell it to gas utility companies.

What is the difference between natural gas from landfills and farms and that found underground? Absolutely nothing! The burners in furnaces, stoves, and power plants don't know the difference. Methane is methane, regardless of where it comes from.

As you may have been able to tell, methane is very flammable. This means it catches fire easily. And, because it has no odor or color, you would not be able to see if a pipe is leaking. Processing and utility companies solve this problem by adding a stinky chemical to natural gas. Now, everyone knows when a pipe is leaking! If you smell natural gas, leave the area and call 911!

Now you know where natural gas comes from – underground, landfills, and farms – and you know how it gets to where it's needed, by pipeline. Then what?

Homes and businesses may use a number of different kinds of natural gas appliances, including furnaces, stoves and dryers. When natural gas burns, it produces carbon dioxide and water vapor. Sometimes carbon monoxide is produced, too. Appliances can be safely and reliably used with proper, professional installation and plenty of air circulation and ventilation.

Factories use natural gas as a heat source to make lots of different products. They might melt plastic to shape it, they might cook foods or process canned goods, and they might make glass, paper, and cement. Natural gas molecules are also used to make products, such as paint, glue, fertilizer, plastic, medicine, laundry detergent, insect repellent, and many more!

Some cars, trucks, delivery vans, and buses also burn natural gas. Parks and cities often have buses powered by natural gas because it is a cleaner-burning fuel than gasoline or diesel fuel.

Electric power plants burn natural gas to generate electricity. The natural gas comes in through a pipe and enters a giant furnace. The burning natural gas releases a lot of heat energy that is used to boil water. The water becomes steam, which travels through pipes and pushes on a machine called a turbine. The turbine is attached to a generator, and electricity is the result.

Natural gas is a valuable energy source that is both nonrenewable and renewable. While most natural gas we use is nonrenewable, more and more renewable natural gas is being used. Aren't you glad we have natural gas for heating, cooking, and making electricity?

A Natural Gas Story Pantomime

Students will demonstrate the flow of energy to heat homes using props. Depending on the audience, signs with the different forms of energy can be used by the students to identify the energy transformations. This activity with different props can also be used to demonstrate other energy flows, like coal to electricity, biodiesel, ethanol, etc.

ROLE	PROP	ACTION	TEXT
Sun – Nuclear Energy	Yellow ball	Hold up the yellow ball and move fingers to suggest nuclear fusion producing energy	The sun produces lots of light from nuclear fusion.
Sun – Radiant Energy	Yellow ribbons	Wave the ribbons in the air	Radiant energy from the sun travels to Earth in waves
Plants and Animals – Chemical Energy	Green leaves and sugar cubes	Green leaves are pushed upward (growth) and then "produce" sugar cubes	Tiny, prehistoric plants and animals absorbed the radiant energy and stored it as chemical energy in their bodies. Animals eat the plants and get the stored energy for themselves.
Chemical Energy changing to Nonrenewable Natural Gas	Brown leaves, cardboard, brown paper, black paper	Brown leaves fall to the floor.	Plants and animals died
		They are buried by layers of paper and cardboard.	Plants and animals were buried under layer upon layer of sand and dirt and stayed there for hundreds of millions of years.
	Clock	Stand on the paper and cardboard, hold a clock	Over time they changed into natural gas. The natural gas is called nonrenewable natural gas.
Natural Gas Production	Shovel	Walk over to where the "plants" were "buried" and pretend to dig	Geologists look for natural gas and dig a hole called a well to get it out of the ground.
Natural Gas Processing	Length of hose or rope	Stick the hose into the "well"	The natural gas from the ground is processed and sent into a pipeline. This nonrenewable natural gas is not the only kind we use.
Waste – Chemical energy	Clean "trash" and a bucket – on the other side of the room	Drop the trash into the bucket	When we throw things away, it is collected by waste removal companies in big garbage trucks.
Waste – Chemical Energy on the Move	Bucket of trash and a large box	Empty the bucket into the box	The garbage trucks carry the trash to a place called a landfill.
Waste – chemical energy turning into natural gas	Box of trash and several pieces of cardboard	Drop the cardboard on top of the trash in the box, covering it	When a landfill is full, it is covered by dirt and the trash is buried where it is decomposed and creates methane (natural gas).
Natural Gas – chemical energy	Pieces of tube or pipe, orange and red construction paper	Stick the pipe in the box, "pretend" to light the flared natural gas	Pipes are added to vent the natural gas that forms in the landfill, this gas is often flared or burned, OR turned into energy on site.

Natural gas transportation	Another hose or rope	Attach the garden hose to the pipe	The natural gas that forms in the landfill can be into a pipeline. Farms can also capture natural gas from wastes and send it into a pipeline. These two sources are called renewable natural gas.
Natural Gas Processing	Third length of hose or rope	The first two hoses, from the landfill and the well, are held up to the third so they feed into it	Natural gas from many sources is collected in a pipeline and sent to homes, businesses, factories, and electric power plants.
Natural Gas – Chemical to Thermal	Red and orange construction paper	Demonstrate fire with construction paper	Natural gas enters homes and businesses through a smaller pipe and is used to heat buildings. It is also used in stoves to cook food.
Natural Gas Chemical to Electrical	Pipe or rope, Coil of wire and magnets; spinning desk chair, extension cord	Have the pipe or rope push the coil of wire on the spinning char near the magnets, the magnets hold an extension cord to show electricity generated and moved	Natural gas is also used in power plants to turn a generator. The generator produces electricity.
Electrical Energy	Battery operated flashlight or bulb	Turn on light	Wires carry the electricity to buildings, where it is used to power devices.