My Nat and Gus Natural Gas Activity Booklet
Teacher's Guide

Introduction
My Nat and Gus Natural Gas Activity Booklet uses engaging puzzles and activities to explain natural gas science concepts and describe how to safely use natural gas in daily life. This guide provides background and discussion ideas, suggested activities, and answers to the booklet's puzzles.

Pages 2-3: Sources of Energy
Energy is the ability to change or move matter. Without energy there would be no motion, no light, and no heat, and life would not exist as food would not grow. Most of the energy on earth comes from the sun, which warms the earth's surface. Natural gas is a fossil fuel that can be used for heating air and water, cooking, and producing electricity. Composed mainly of methane, natural gas is colorless, odorless, and lighter than air.

Discussion:
1. Where do you get your energy? *(Food.)*
2. Where do the appliances in your home get energy? *(Sources like electricity or natural gas.)*
3. Where do your cars and buses get energy? *(Answers could include gasoline, natural gas, electricity.)*

Pages 4-5: Formation and Distribution of Natural Gas
When ancient plants and animals were buried under swamps, lakes, or mud, they decayed, slowly forming methane gas. This gas became trapped under layers of solid rock. The resulting "traditional" natural gas is buried deep underground in the same areas that contain crude oil, also known as petroleum. Today, natural gas can also be made from waste materials such as garden and lawn clippings, food scraps, and cow manure. This is known as renewable natural gas, or RNG.

Geologists (scientists who study the earth) send shock waves down from the earth's surface to try to locate traditional natural gas deposits. They measure how long it takes the waves to bounce back. A derrick is constructed to support the equipment needed for drilling a well and for hoisting and lowering pipe into it. In some offshore locations, drilling platforms are used to obtain gas.

When traditional natural gas is found, it is pumped from the well to a processing plant where other substances found with the gas are removed. After processing, it goes through underground steel pipelines with the aid of compressors. Compressors are large pumps that push the gas through the pipelines at about 15 m.p.h.

Before reaching us, the gas passes through a regulator station that controls the amount of gas pumped into the smaller pipes that lead to our homes, businesses, and factories. At this point a chemical (*mercaptan*) that can smell like sulfur or rotten eggs is added to the gas so leaks can be detected.

Discussion:
1. Why is natural gas called a "fossil fuel"? *(It was formed from the remains of plants and animals.)*
2. How do you think gas is obtained from below the surface of the earth? *(Through wells.)*
3. How is gas sent from where it is found to homes, schools, and businesses? *(Through underground pipes.)*

Activities:

1. To understand how traditional natural gas is found deep underground, have students make clay models of the rock layers in the earth. Rock layers can be different thicknesses and shapes. Use red clay for natural gas and green clay for oil. When finished, punch a hole down to the natural gas and oil layers and put a straw in it to simulate a pipe.
2. Fill an aquarium half full of water. Blow up a balloon and hold the opening closed as you submerge the balloon in water. Relate this to natural gas trapped beneath impermeable rock (like clay). Discuss what would happen if you drilled a hole to where the natural gas was trapped. Let the air out of the balloon under water.
3. Fill several small-necked glass jars (8 oz.) with a mixture of $^1/_4$ cup of soil and $^1/_3$ cup of vegetable scraps (carrot and cucumber peels) and grass clippings. Stretch a balloon over the opening of each jar and secure it well. With a magic marker, mark the level of the mixture that you start with. Place the jars in different places (direct sunlight, artificial light, in a dark place, etc.). Observe the jars for a week. Chart the results, both the level of each mixture and what happens to each balloon. (Depending on the contents of the mixture and the amount of heat in each location, mixtures will decompose at different rates and produce different amounts of gas.)

Pages 6-11: Uses of Natural Gas

A compressed form of natural gas can be used in specially adapted cars, buses, and trucks known as natural gas vehicles (NGVs). Natural gas burns more cleanly than diesel fuel (used to power some generators and vehicles), meaning that it puts fewer pollutants into the air.

Natural gas can be used in homes, schools, businesses, and factories for heating, cooling, clothes drying, cooking, and providing hot water. Natural gas can provide heating and cooling for stores and offices and can be used for cooking in restaurants. Industry uses natural gas as a fuel, and transforms it chemically into plastics, fabrics, and durable goods. Natural gas can also be used to generate electricity.

It is important to stay safe around natural gas, as it is flammable. It is also a good idea to conserve it, as our supply of traditional natural gas is finite.

<u>Discussion:</u>

1. Which type of vehicle fuel is cleaner: natural gas or diesel? *(Vehicles that run on natural gas emit fewer pollutants than vehicles that run on diesel.)*
2. What equipment in a restaurant would use natural gas? *(Water heater, fryer, range/oven, steamer, grill.)*
3. How could natural gas be used in offices and stores? *(For heating air and water.)*

<u>Activities:</u>

- Survey your home to determine which appliances, if any, run on natural gas. *(Answers could include natural gas furnace, barbecue, range, water heater, dryer, fireplace, swimming pool heater, and/or outdoor lighting.)*
- With the help of an adult, locate where gas lines lead to and from appliances such as the water heater, furnace, and stove. Notice how the vents are connected.

Pages 12, 14-15: Natural Gas Safety

Natural gas is a safe fuel when used properly. However, stress to your students that homes should not be heated with gas ovens, and that you should never put toys or papers near gas appliances like furnaces, water heaters, or the stovetop. Tell them that there is a risk of fire and explosion from gas leaks. That is why when you smell gas, you should leave the house. Do not turn a light on or off; unplug an appliance; or use a flashlight, a match, or a telephone, because a spark from these could cause an explosion. Make sure children know that they should call for help from a neighbor's house. (It should be a neighbor that they know.)

Discussion:

1. What senses do you have? *(Sight, hearing, smell, taste, touch.)*
2. How can you use your sense of smell to detect a natural gas leak? *(Natural gas has a chemical [mercaptan] added to it that can smell like sulfur or rotten eggs. When gas is leaking, this odor is typically present. If you smell this odor in your home, tell an adult and leave immediately.)*
3. What other senses can you use to detect a natural gas leak? *(You may SEE grass/plants dead or dying for no apparent reason. You may HEAR a hissing, whistling, or roaring sound. You may SEE or HEAR continuous bubbling in water, or dirt spraying or blowing into the air.)*
4. Why is it dangerous to hang from gas pipes? *(Pipes could break and gas would leak out.)*

Activities:

- Do a natural gas leak drill in the classroom. When you return, or while outside, discuss why you have these rules and drills.
- As a class, create mini safety charts to list natural gas safety rules.
- At home, practice a safety drill for getting your family out of the house in the event of a suspected natural gas leak. Stress not to turn on lights, and not to use flashlights, matches, or telephones.

Page 16: Calling 811 Before Digging

Read aloud the text beneath the 811 logo. Explain that dialing 8-1-1 connects you to a special service that arranges for marking of underground gas pipelines and other utility lines. This is so that people who are doing digging projects can dig a safe distance away from these underground lines. Be sure to convey to students that calling 811 before a digging project is very different from calling 911 for emergencies.