EmPOWERed Kids™
Teacher Guide
(NATURAL GAS K-2)

Consumers Energy Count on Us

PROVIDING ENERGY EDUCATION TO STUDENTS IN THE COMMUNITIES WE SERVE.
THAT'S OUR PROMISE TO MICHIGAN.

EmPOWERed Kids
Teacher Guide
(NATURAL GAS K-2)

Dear Educator,

Throughout our 128-year history, Consumers Energy has been dedicated to supporting education in the communities we serve.

This commitment is more than just a belief, it's how we do business. During the last five years, our Foundation has donated more than $3.8 million to educational organizations and initiatives because we know that education is the key to creating successful communities and a successful state. Our educational outreach programs have reached more than 330,000 students over 22 years, and we aren't done.

EmPOWERed Kids is an interactive educational app that was created to teach children about electricity and natural gas in a fun and informative way. It is intended to be taught through a live presenter or teacher who relays the information to students as they follow along.

We continue to believe that having a live presenter from Consumers Energy provides your students with the best experience, and will continue to offer our free in-class presentations where available. We also know that due to scheduling, location and popularity, a live presentation is not always possible. This teacher's guide will give teachers and educators the information they need to successfully navigate their students through the EmPOWERed Kids app.

We appreciate your interest in our EmPOWERed Kids app and programs and hope you will find them useful and effective for your students. Please reach out to us or provide feedback by contacting education@cmsenergy.com.

Thank you,

Tara Ragauss
Education Programs Manager
EmPOWERed Kids

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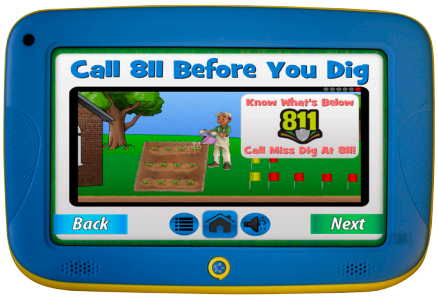


ANTICIPATORY SET

The EmPOWERed Kids app presents high-interest content that encourages users to raise questions and become familiar with current resources used for energy. The use of this guide with our app is meant to supplement your curriculum and not to replace it. Begin the lesson by reviewing classroom procedures involving the use of technology in the classroom as well as energy vocabulary appropriate to class content. (See vocabulary list at the end of the Teacher's Guide. **All words included in the vocabulary list are underlined the first time they are encountered in this presentation.)

NOTE: For more information about Consumers Energy:

- Visit – www.ConsumersEnergy.com
- Join us on Facebook – www.facebook.com/ConsumersEnergyMichigan
- Follow us on Twitter – www.twitter.com/ConsumersEnergy
- Brainstation – www.ConsumersEnergy.com/kids
- Edmodo – www.Edmodo.com and search for Consumers Energy

PROCEDURES

PRESENTATION

Students gain knowledge most effectively by exploring and doing. When teaching the content found in our app, we suggest alternating between a presenter or teacher-led discussion, and breakout sessions for exploration among smaller groups of students. Suggestions for group configurations can be found on the next page. When it is necessary to teach new terms, give definitions and use them in a sentence. Also, use the following tips:

1. Keep it short and sweet – avoid rambling and overly detailed explanations
2. Plan ahead – set clear goals for what you want the students to know
3. Use diagrams, pictures and other visual aids when available for students to better understand information
4. Check for understanding by asking questions during and after the presentation
5. Write key words on the board
6. Break up the presentation with time for discussion with a desk mate, small groups or as a whole class

GROUP CONFIGURATIONS

While going through the app, there are several different presentation options. How you decide to present will depend on the characteristics of your group and the availability of technology in your classroom.

1. Teacher presents the app overhead while class watches
    a. This is the best option for younger students and classrooms with limited technology. Students are still able to receive the information, but are limited in their ability to explore and interact.
2. Individual with his/her own tablet:
    a. If your classroom is equipped with individual technology, this arrangement allows for the greatest amount of personal exploration and interactivity, but students may lose out on having a robust scientific discussion.
3. Two students paired together sharing a tablet:
    a. This arrangement allows students to work and explore collaboratively.

How you break up groups for discussion will likely depend on how you decided to configure your students for the presentation and your personal preference for group work. Some arrangements you might find helpful are:

a. Elbow partner – discuss with the person that sits closest to you

b. Small groups – discuss with a few others that sit at your table/group of desks

c. Whole class – discuss as a class with the teacher

Regardless of the configuration you decide, each of the breakout sessions offers your students the opportunity to have a scientific discussion. These discussions are a key component in helping your students think more scientifically. Throughout the presentation, ask and answer scientific questions with your students by making observations, using open ended questions and making predictions. For each breakout session, ask students to point out observations, explain why they think it happened, if there are other possibilities, and what additional questions they might still have. Here are some additional tips:

1. You will be investigating new topics with your students, so remember that to help them acquire the new knowledge, repetition is key. This can be accomplished by having students repeat after you or have students summarize the observations of other classmates into their own words.
2. Whenever possible, encourage open ended questions and answers, as opposed to close ended questions. Ex. Closed = Do the flags mark where pipes and wires can be found underground? Answer: Yes; Open = What is the purpose of the flags placed in the ground? Answer: They show where underground utilities are buried so we can dig safely.
3. Allow students time to predict what may happen next and then discuss with one other person next to them before discussing aloud as a class to arrive at the final answer. Explain that scientists don't just try to find an answer that fits; they look for evidence to support their answer. What evidence do the students see to support their predictions?
4. Throughout the presentation and breakout sessions, have students:
    a. Write questions that occur to them while they are exploring and go back to find the answers
    b. Make a list of questions to ask others that they can't find the answer for in the materials provided
    c. At the end of each section have students list:
        i. What is one new thing I learned?
        ii. What is one question I still have?

HOME VERSUS SCHOOL MODE

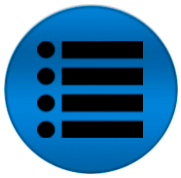
The EmPOWERed Kids app has been designed for K-6th grade. The app is split into two grade bands, K-2nd grade and 3rd-6th grade. Pick which level is appropriate for your student. After you select a grade level, you will be prompted to select "School Presentation Mode" or "Home Activity Center."

Selecting the "School Presentation Mode" will allow you to learn about electricity or natural gas lessons. The Electricity Safety Presentation covers vital information about electric generation, distribution and safety (downed power lines, outlet safety, etc.). The Natural Gas Safety Presentation teaches important messages about underground utility safety, calling 811 to have a locator mark your yard with flags, and how to properly respond to a natural gas leak.

Selecting the "Home Activity Center" allows you to explore a dozen games! There are six games related to electricity and six for natural gas. The games vary slightly depending on the grade level category you selected at the beginning. The "Home Activity Center" is designed for students to play after being taught the safety lessons to help reinforce key safety messages. It is also a great way for students to bring the safety messages home to play with their families.

TECHNOLOGY BUTTONS

At the bottom of the screen, you will notice some technology buttons. They can be used to enhance your presentation experience.



The first icon looks like a bulleted list. This button will bring you to the table of contents page or 'slide menu.' You can choose a slide from this page and it will automatically take you there.

The second icon looks like a home. Using this button will bring you back to the slide where you choose either Electric Safety Presentation or Natural Gas Safety Presentation. If a student mistakenly clicks this button, you can re-enter the safety presentation and use the "bulleted list" button to quickly advance them to the proper page he/she needs to be on. When in the "Home Activity Center," you can use the home button to pause or exit the game you are playing.

The third icon looks like a speaker with music notes. This button will only turn off the background music of the app. The slides themselves have sound that can be turned off with the volume buttons on the physical device (tablet, phone, iPad, etc.) that the app is being viewed on.

The other buttons you will see are "Back" and "Next." These buttons do exactly what they say. "Back" will take you to the previous slide. "Next" will advance you to the following slide in the presentation. If you have not completed the activities on the slide, you may see a "Skip" button instead of "Next." You can either complete the activities on the page to garner a "Next" button, or you can click "Skip" and a box will prompt you to confirm if you indeed want to skip or if you would like to remain on the page.

ANTICIPATION GUIDE

Before we go through the EmPOWERed Kids app from Consumers Energy, respond to the following questions under "Before." If you agree with the statement, check yes. If you do not agree with the statement, check no. After completing the activities in the EmPOWERed Kids app, we will come back to this guide and compare our thinking.

Before		**… completing the EmPOWERed Kids app …**	**After**	
Yes	No		Yes	No
		1. Natural gas is used to turn on my television.		
		2. Natural gas smells like rotten eggs.		
		3. Miss Dig needs seven days to come to your house and mark underground lines.		
		4. The phone number for Miss Dig is 811.		
		5. Some stoves or ovens use natural gas for cooking food.		
		6. The colored flags used to mark underground pipes and wires are toys that should be pulled out of the ground and played with.		
		7. Natural gas can catch on fire.		
		8. Natural gas travels through wires.		
		9. When you think gas is leaking, it is not safe to try and find where the smell is coming from.		

INTRODUCTION

Consumers Energy, Michigan's largest utility, provides electricity and natural gas to 6.6 million of the state's 10 million residents in all 68 Lower Peninsula counties. Today we are going to learn about natural gas safety using the EmPOWERed Kids app.

What kinds of things in your house use natural gas?

Answer: Stove, water heater, clothes dryer, etc.

Does anyone know how natural gas gets to your house?

Answer: It comes through pipes underground.

What does natural gas smell like?

Answer: It smells like rotten eggs after a chemical called mercaptan gets added.

If gas is leaking, what should you do?

Answer: You should react by telling an adult, leaving the area and calling for help once you're in a safe place.

Consumers Energy provides gas to millions of customers across the state. Let's learn more about how that gas gets delivered to your home and how to stay safe around it. First, tap on the K-2nd grade button, then choose school presentation mode, then select natural gas safety presentation.

Now let's click (NEXT) to start learning more about natural gas safety with Consumers Energy using the Empowered Kids app.

First slide opens

HOW NATURAL GAS GETS TO YOUR HOME

First slide opens

[Click first icon on left with the buildings]

Natural gas is sent through underground pipes to homes, businesses, even your school.

(NEXT)

Natural gas comes from underground. We take the gas from porous rock deep underground, usually where we also find coal and oil.

(NEXT)

Natural gas is refined in a processing plant, and then put into storage underground until we are ready to use it.

(NEXT)

Before it goes to your house, natural gas goes through the city gate.

This is a very important step because we add a chemical that smells like rotten eggs. This is how we can tell if natural gas is leaking.

(NEXT)

Now the natural gas is ready to go to your home!

(NEXT) (NEXT)

[Click icon on right with the stove]

What do we use natural gas for in your house?

Answer: stove, water heater, clothes dryer, etc.

(NEXT)

Your stove could be one appliance that uses natural gas in your house.

Does your stove have a knob when you turn; it goes click, click, click?

Does a blue flame then come up?

Answer: That is natural gas burning! If there isn't a flame it means your stove runs on electricity.

(NEXT) (NEXT)

THE FLAGS HELP KEEP US SAFE

There are many objects buried in the ground that help items in your house work. Water and sewer pipes are underground. Electricity can travel through power lines above or underground. Natural gas travels in pipes under the ground as well. It is important to know where the pipes and wires are located so we can be safe while digging.

[Click the icon on left with little girl]

These yellow flags are marking where a pipe is buried in the ground.

(NEXT)

Oh no! What happened?

Answer: The little girl pulled the flags out of the ground.

(NEXT)

STOP! Never touch the flags. They help keep people safe when they are digging. They may look like fun, but they're for safety.

Is this little girl doing something bad on purpose or could this be a mistake because she doesn't know what the flags are for?

Answer: This is probably a mistake but now that we know better, we wouldn't want to act like this little girl.

(NEXT)

[Click the icon on the right with the safety hero]

Be a safety hero and know what each of the flag colors means!

(NEXT)

Yellow Flags show where gas pipes run underground.

What could happen if you accidentally broke a gas pipe?

Answer: The gas would leak out and it could start a fire.

Can people get hurt from fire?

Answer: Yes, they can and that would be very sad. We don't like it when anyone gets hurt.

(NEXT)

Red Flags show where electricity lines run underground.

What could happen if you dig and accidentally hit an underground electric line?

Answer: The electricity could shock a person's body and hurt them badly.

We need the flags to keep us safe!

Are the flags dangerous by themselves?

Answer: No, the flags aren't dangerous but the pipes and wires underneath can be.

(NEXT) (NEXT)

CALL 811 BEFORE YOU DIG!

[Click first icon on left with the tree]

Let's say you wanted to plant a tree. You didn't have any flags in the ground and you wanted to make sure you were not digging right over a natural gas pipe.

Does anyone know how we get the flags in the ground to learn where the natural gas pipes are located?

Answer: You call MISS DIG by dialing 811.

Is there another important number that sounds a lot like 811?

Answer: Yes, 911. Remember that 911 is for emergencies only, and 811 is just for MISS DIG

(NEXT)

Before your parents dig, make sure they call someone from MISS DIG by calling 811. It is a very special number! Try it out now on the number pad. Enter 811. Great job!

You can see where the flags are, so you know where it is safe to plant your tree.

MISS DIG is the only company who can help you get the flags in your yard before you dig. Make sure you call three days ahead of your project.

(NEXT)

[Click icon on the right with the wheelbarrow]

Let's practice calling 811!

Click (NEXT) and dial 811 to move through the slide. Good job!

Uh oh! These flags are right in the way of where he wants to dig his garden. What should he do?

Answer: Try to find another spot to plant his garden where it is safe.

(NEXT) (NEXT)

You Can't See, Touch, Or Taste Natural Gas

YOU CAN'T SEE, TOUCH, OR TASTE NATURAL GAS

[Click on the icon on the left]

The gasoline your parents put into their car is a liquid. We know this because it could spill on the ground and we could see it.

(NEXT)

It is NOT like the natural gas that comes into your home. Natural gas is a real GAS. You can't touch it.

(NEXT)

You can't taste it.

(NEXT)

You can't see it.

(NEXT)

But it smells like rotten eggs.

(NEXT)

A chemical is added to the natural gas coming into your home. The gas smells like rotten eggs because of that chemical. If you ever smell that nasty smell, you would know that something is wrong.

(NEXT)

Natural Gas Can Be Dangerous

NATURAL GAS CAN BE DANGEROUS

[Click on the icon on the left]

Natural gas loves to be on fire. That's why we use it to heat our oven, home and water. If it gets outside the pipes, it can cause a fire or even an explosion. That is why we have to be careful around natural gas. What should you do if you smell natural gas leaking? Watch this example carefully.

(NEXT)

What do you see happening?

Answer: The shovel broke the pipe and natural gas is leaking out of the pipe.

If it were real life, would you be able to see it?

Answer: No, but you would be able to smell it.

(NEXT)

The boy smells rotten eggs coming from the natural gas leak. What do you think he should do?

Answer: He should tell an adult! Then call Consumers Energy to report it, once they are safely away from the leak.

(NEXT)

He got away from the smell and called Consumers Energy.

You can call Consumers Energy anytime to report a natural gas leak, and it's free. If you can't remember our phone number, you can always call 911!

(NEXT) (NEXT) (NEXT)

WHAT TO DO WHEN YOU SMELL GAS

In the last example gas was leaking because someone broke a pipe while digging outside. Natural gas can also leak inside your house because an appliance is broken or because the pipes are really old. If you smell natural gas, do you think you should wait around? Or do you think you should take action? Let's find out.

[Click on the icon on the left]

Click (NEXT) to see why this woman has a shocked look on her face.

The boy is telling an adult that he smells rotten eggs, and there might be a gas leak.

(NEXT)

Leave the area and find some place safe! An example of a safe place is your neighbor's house.

Why do we need to leave the area?

Answer: If we smell gas, there could be an explosion or a fire.

When leaving your house, don't make a spark, and don't try to find where the smell is coming from. That is Consumers Energy's job.

(NEXT)

Once you are at a safe place, you can call 911 or Consumers Energy (1-800-477-5050).

Make sure you get far away from the smell before you call. Wait until it is safe. Remember it's free, even if we don't find a gas leak. By law, Consumers Energy needs to check out a reported gas leak within 30 minutes. That's about as long as the average show on TV! Is waiting 30 minutes outside worth it if your life could be in danger? Absolutely!

(NEXT) (NEXT)

CLOSURE

CONGRATULATIONS! Your students are now safety heroes!

Encourage students to click on the 'play games' icon at the bottom of the screen.

NATURAL GAS GAMES

Pipe Maze

How to Play: Help the natural gas reach the house. Tap the pipes to rotate them and make a path for the gas to flow.

Hints: There are three levels to explore.

Flag Match

How to Play: Be a Safety Hero and know your flags. Drag all five flags to its correct utility to win!

Hint: Once you get an answer correct, that image will stay in place. The incorrect answers will return to the bottom so you can try again.

Flag Treasure Hunt

How to Play: Find the buried treasure in the back yard. Tap a flag to see the utility line that it marks. Don't dig over a utility line! Tap the ground to dig. Don't dig where there are utility lines.

Hint: The pipes flash on the screen momentarily then disappear. Tap one of the colored flag squares to get another look at where that pipe leads. Only one box contains the treasure chest.

If You Smell Gas

How to Play: When you smell gas, it's important to do the right thing quickly. Drag the correct steps into the correct order to win!

Hint: Once you get an answer correct, that image will stay in place. The incorrect answers will return to the bottom so you can try again.

Design a Pipeline

How to Play: Connect the natural gas well to the city gate to add mercaptan (which smells like rotten eggs) to the gas before it reaches the house! Tap the red boxes to lay down natural gas pipes.

Hint: There are three levels. You must go to the city gate building before going to the home. Then "test the grid" to see if you were successful.

Connect the Dots

How to play: Reveal the hidden images by connecting all the dots. Drag or tap your finger from the #1 dot and follow the path to win!

Hints: There are three puzzles. You can either drag your finger from #1 - #2, or you can simply tap on the #2 and it will create the line as well.

ADDITIONAL RESOURCES

MEDIA

(K-6)	Kids and Natural Gas Safety—Video http://www.swgasliving.com/resources/videos/kids-and-natural-gas-safety
(K-3)	Kid's Korner—Pipeline Association of Missouri http://www.showmepipeline.com/Kids-Korner.html
(1 & Up)	Talisman Terry's Energy Adventure—Digital Library book http://www.scribd.com/doc/58317334/Talisman-Terry
(2 & 3)	Dr. Seuss' Horton Energy Guide Hears a Who! Activities: http://www.njresources.com/pdf/community/HortonESActiv508.pdf
(2-5)	Oil, Gas & Geothermal—Photo Gallery (California Department of Conservation Division of Oil, Gas, & Geothermal-Resources) http://www.conservation.ca.gov/dog/photo_gallery/Pages/Index.aspx
(2-6)	Natural Gas Safety for Kids http://www.sourcegas.com/safety/kids-safety.php
	811 Children's Pirate Video http://vimeo.com/9763523

BOOKS

(K-3)	Energy: Heat, Light, and Fuel by Darlene Stille
(K-3)	Energy Makes Things Happen by Kimberly Brubaker Bradley
(K-3)	Solid, Liquid, or Gas? by Sally Hewitt
(K & Up)	Solids, Liquids, and Gases by Ginger Garrett
(2-5)	How Did that Get to my House? Natural Gas by Nancy Robinson Masters
(2-5)	Oil, Gas and Coal by Tea Benduhn
(K-2)	Using Coal, Oil and Gas by Sharon Katz Cooper

EXTENSIONS

NATURAL GAS PIPELINE ACTIVITY

Natural gas is created when plants and gases are buried under many layers of dirt and is heated by Earth's core. Methane is one of the main ingredients in natural gas. Natural gas helps heat our homes in the winter and runs appliances like the hot water heater and dishwasher. There are pipes underneath the ground that transport this gas from the storage fields to our houses. We created an activity to show you what happens behind the scenes to help keep everyone warm and safe! It's encouraged to teach about natural gas safety and uses before this so kids can really understand this activity.

MATERIALS:

- 1 sponge (in place for the porous rocks the natural gas is stored in)
- 1 cardboard box (size of a shoe-box or smaller in place for the city gates)
- Glue sticks
- Pieces of construction paper cut into 1" by 6" strips, along with 2" by 12" strips (to make paper chains). Keep extras of both sizes for later in the activity
- Stapler

PROCEDURE:

1. Split class into thirds. One third will become the "crewkids"; the others will be the customers. Split the customers into groups of 2 or 3.

2. Have the groups of customers create their own pipelines with the smaller strips. Take a strip of paper, roll into a circle, then glue the ends together. Continue to do that and connect them.
3. Have the crewkids create a long pipeline with the larger paper strips. This should be as long as the front of the class so the "customers" can connect their lines to the larger pipe.
4. When all of the lines are made, connect the smaller lines to the larger line with the stapler
5. In front of the class, place the sponge on the ground. Then place the box in front of the sponge and the pipes after.
6. After explaining the setup, the teacher should "turn on the gas" imaginarily. Set up the crewkids at different stations and tell them to make sure there are no "leaks", or tears in the links.
7. Ask the kids how their household plans on using the natural gas. Try to get as many different ideas as possible.
8. Now we will get to safety! Take a pair of scissors and cut a link of one of the smaller, customer lines. Sometimes, the pipes are damaged or broken. Have the students that created that line pretend to smell natural gas, or rotten eggs.
9. Go through all of the safety steps listed in the explanation for step 8, and when the kids pretend to call for help, have them call Consumers Energy at 1-800-477-5050. Pretend to answer the phone, turn off the gas, and alert the crewkid closest to the leak to take an extra link and fix the leak. Have the crewkid tell the group of students they are now safe to go back in their house. Turn the gas on again.

10. Repeat steps 8 and 9 until students understand what to do if they smell rotten eggs.
11. Next, cut one of the larger links and instruct multiple crewkids to come and help fix the leak. When they are on their way, turn the gas off. One student could grab the strip, hand it to another student that has the glue stick, and another could hold it together until it is fixed. Then turn the imaginary gas back on.

EXPLANATIONS FOR THE STEPS:

2 and 3. The reason we are making different sized chains is because there are different sizes of pipes. Natural gas is stored in porous rocks under the ground, and is transported through the city gates to compress it so it can fit in the pipes, then it travels through the larger pipes that are underneath the streets in our neighborhoods. The smaller pipes are connected to the larger one and those bring the natural gas into our homes.

5. The gas is stored underground in porous rocks. Sponges absorb water just like the rocks absorb the natural gas. The box represents the city gates. City gates are very large pipes that help "squeeze" or compress the gas into the smaller pipes. The large pipeline the crewkids made would be underneath our side roads and neighborhoods. The smaller lines the customers created would be what traveled to their houses.

7. Go to these websites before to give kids ideas to use for this step.

http://naturalgas.org/overview/uses-residential/

http://science.howstuffworks.com/environmental/energy/latest-uses-natural-gas.htm

https://www.consumersenergy.com/kids/Student.aspx?id=599

8. If you or anyone you know smells rotten eggs, which means there is a natural gas leak. This could be very dangerous because since natural gas is flammable, it could lead to a fire or an explosion. There are six safety steps Consumers Energy wants customers to follow in order to keep them and the people around them safe.

1. Tell an adult. Leave the area.
2. Don't make a spark.
3. Don't try to find where the smell is coming from.
4. Leave the area.
5. Call for help.
6. Wait. Don't go back until Consumers Energy says it's okay.

CLOSURE:

Go over the different stages of the natural gas progression, from the porous rocks to the city gates to the different sizes of pipes. Go over the safety steps and stress to the kids that safety always comes first.

Resources:

https://www.consumersenergy.com/kids/TeachersParents.aspx?id=627|Lesson Plans

VOCABULARY WORDS

EmPOWERed Kids! Natural Gas K-2

Utility Color Code — MISS DIG System, Inc. — Michigan

- Red Flags — Electric Lines
- Orange Flags — Cable Lines/Communications
- Blue Flags — Water Lines
- Yellow Flags — Gas, Oil, Steam or Petroleum
- Green — Sewer and Drain Lines

Appliance: a household or office device (such as a stove, fan, or refrigerator) operated by gas or electric current.

Example: The appliance in your kitchen that keeps your food cold is the refrigerator.

City Gate: the city gate is generally the point where natural gas is transferred from an interstate or intrastate pipeline to a local gas utility.

Example: Natural gas passes through the city gate before it gets to your home. That is when mercaptan is added.

Mercaptan: material added to natural gas or LP gas in small concentrations to impart a distinctive odor.

Example: Consumers Energy adds the chemical mercaptan to natural gas before it gets to your home. Mercaptan smells gross, like rotten eggs.

Natural Gas: gas that comes from the earth's crust through natural openings or bored wells.

Example: Natural gas is found in the earth and burned at power plants to provide heat to homes and businesses.

Porous: having small holes that allow air or liquid to pass through.

Example: Natural gas can be kept in the holes of a porous rock.

Refined: to free (as metal, sugar, or oil) from impurities or unwanted material.

Example: Natural gas is refined at a processing plant.

Utility: a public service (such as power or water) provided by a public utility.

Example: Consumers Energy is a utility company that provides a utility, energy, to people.

Sources:

MISS DIG System—http://missdig.net/

Merriam-Webster's Student Dictionary— www.wordcentral.com

www.vocabulary.com

YourDictionary—www.sentence.yourdictionary.com

American Gas Association, www.aga.org