

Program Development

State **Ohio** State Park
Park/Center:

Date: 12/2010

EIT/EES: Barbara Drbal Wallace, Katherine Schmid

Program Length:

?minutes

I. Title: Pennsylvania's Got Gas!

II. Program Theme: Marcellus shale development is impacting our public lands, communities and environment.

III. Target Audience: General public –campground and lecture program for landowners and interested citizens.

IV. Type of Program:
(Check most appropriate)

<input type="checkbox"/>	Env. Education	x	Interpretation
<input type="checkbox"/>	Information	<input type="checkbox"/>	Training

V. Behavioral Objectives:

1. Following the program participants will be able to identify why PA is a hot spot for Marcellus shale and gas production.
2. Following the program participants will be able to list at least one reason why Marcellus drilling is a benefit to our citizens and landowners.
3. Following the program participants will be able to list at least one negative impact of Marcellus drilling to our citizens and land.
4. Fifty percent of participants will take information on DEP's oil and gas website
5. Fifty percent of participants will take a copy of DCNR's Marcellus website (or factsheet when it becomes available)
6. Ten percent of participants will sign up for information about a local watershed group or citizen group doing stream monitoring.

VI. Evaluation Procedure

Used:

**Questioning, attendance at interpretive program
Counting the amount of materials handed out
Counting the number of participants signed up to volunteer
and/or receive information for stream monitoring**

VII. Equipment & Materials:

Bottle with balloon and plant material/sand mixture (set up a week ahead of time); 10 layers of foam board 4 labeled sandstone and 4 labeled limestone 2 labeled shale (it is helpful to have three different colors too); clay or play-doh; piece of Marcellus shale; marine fossil sample; computer with copy of PowerPoint; projector; screen; and any pieces of well parts that are available such as piping, casing, etc.

Title: Marcellus Shale Development...Good or Bad?

Content

Program Preparations: About a week before the program fill a glass or plastic bottle approximately two thirds full with chopped up plant material. Cover the plant material with a thin layer of sand and a thin layer of soil. Place a large balloon over the mouth of the bottle or jar. Set it out in a sunny location for a week. The decomposition of the plant material should fill the balloon with gas. Be careful not to dislodge the balloon. Warning: this is most likely going to be a very smelly mixture when you do remove the balloon. Do not uncork that puppy inside!

Introduction

Welcome participants to program

Introduce self and DCNR

Inform audience that you are about to share with them a secret to potential wealth, freedom from oil wars, and cause of huge controversy in Pennsylvania today. Hold up your jar with balloon to the audience and ask what this could possibly have to do with today's topic. The answer is the simple production of gas by the decomposition of plant and animal material, also known as organic matter. During this program we are going to discuss why

Pennsylvania is so darn gassy (specifically in this rock layer called the Marcellus Shale), how the gas is extracted, how this industry benefits PA, concerns and issues related to its development and how it we as citizens and property owners in Pennsylvania can continue to learn more.

The Body

I. WHY PENNSYLVANIA IS SO DARN GASSY

To understand the answer to this question we first must talk about how rock layers have formed in Pennsylvania. In order to help show this we are going to do a bit of a demonstration.

- **Hand out chunks of clay and play doh to participants (maybe 10-15 chunks). Have participants make a tree/plant or animal out of it. (This is a great thing to do before the program for those folks, particularly kids, who arrive a bit early. If that is not appropriate for your audience, make them ahead of time.)**
- **Also hand out layers of flexible foam board (these are going to represent layers of sedimentary rock).**
- **Most of the rocks we find in Pennsylvania are called sedimentary rocks. We are going to step way back in geologic time in Pennsylvania, over 400 million years back. Little pieces of our earth have been eroded--broken down and worn away by wind and water. These little bits of our earth settle in low-lying areas. Over time, other layers of earth continue to be deposited, covering the ones below. Eventually, pressure from the upper layers smushes the buried layers, slowly turning them into rock.**
- **At the same time this was occurring, Pennsylvania was much further south on the globe. We were closer to the equator so it had a much warmer and wetter climate. It is believed that PA was covered by a shallow inland sea since small fossils of sea life are found in the shale. (Pass around an example of these fossils in shale.)**
- **Ask for someone with a piece of limestone to bring it up and place it on the table. As millions of years go by, material is being deposited on the bottom of the seas in this area, which was similar to the ocean. Time and pressure eventually turn this material into sedimentary rock, taking the form of limestone.**
- **Have 8 people bring up their plants/animals(make sure to refer to it as organic matter). The material continues to be deposited so the shallow sea begins to fill in, turning into something more like a swampy lake. A large amount of organic matter is produced. Think about what it is like in the Everglades of Florida today. There is a lot of plant and animal life there because it is warm and water is plentiful. There is also a good bit of clay deposited in this area where these plants are growing.**
- **Time moves on and this area is finally covered and buried by sand. What type of rock do you think will be created by a large amount of sand? Sandstone- have someone with a piece of sandstone come up and place it on top of the clay plants. Continue to alternate layers of rock with another layer of clay somewhere amongst the others.**
- **This process continues with layer upon layer of sediment piled on top of each other placing the bottom layers under a great deal of pressure getting seriously smushed**

and solidifying into rock. At this time smash all the layers together so they make a flat pile of “rock”.

- **What happened to our organic matter? It got smushed. What happens when organic matter decomposes? (hint-remember our bottle/balloon) It creates gas. And in this case our layer of organic matter way at the bottom had clay mixed with it. Smooshed layers of clay become shale. In our case, all that clay became the Marcellus Shale layer and the organic matter produced gas trapped within that rock.**
- **The Marcellus Shale layer eventually was covered by another shale layer which essentially acts as a cap, containing the gas in the Marcellus.**
- **Geologists have known for a long time about a variety of gas deposits in Pennsylvania but may have been unable to tap those resources with current practices. With the Marcellus, recent advances in technology made it economically feasible to access this resource now. So our next step is to understand why the Marcellus shale and why now.**

II. OUR GAS HISTORY.

- **1859 (Charles Darwin Publishes “The Origin of Species”) Drake drilled an oil well in Titusville PA. We have a rich history of mineral extraction in Pennsylvania. The first commercially successful oil well was drilled within our borders. When Colonel Drake did this he also found natural gas.**
- **1947(Jackie Robinson signs a Major League contract with the Brooklyn Dodgers, gas is 15cents/gallon) The Bureau of Forestry signs its first gas/oil lease on public land. Pennsylvania has been drilling shallow wells for gas for decades. These wells were called vertical wells. Some of the gas obtained from the shallow sandstone layers drilled in PA for the past 100 years may have originated from the Marcellus shale. Some gas has escaped through the overlaying shales and limestones to enter the sandstone layers.**
- **1960 (JFK is elected President, gas is 25cents/gallon) A rudimentary fracking process was first developed. We will talk about what fracking means in a few moments.**
- **1980 (US Olympic Hockey team win the gold medal in Hockey at the Lake Placid Olympics thereafter known as “The Miracle on Ice”, gas is \$1.19/gallon which dropped as the decade continued.) New fracking technology is developed in Texas and horizontal drilling becomes economically feasible.**
- **2004 (Google introduces its Gmail product to the public. The launch is met with skepticism on account of the April 1st launch date, gas is \$2.10/gallon) Range Resources drills the first gas well intentionally targeting the Marcellus formation, the Renz #1, in Washington County, PA.**
- **2007 Pennsylvania State University estimates that Pennsylvania has 50 trillion cubic feet of recoverable gas underneath the boundaries of the Commonwealth.**

- **2010 Estimates of recoverable gas in Pennsylvania now range from 200-500 trillion cubic feet, that's up to ten times what was thought to available just three years before. (Geologists agree that the total amount of gas within the Marcellus shale is roughly 1500 trillion cubic feet. But that with current technology only 200-500 trillion cubic feet can be brought to the surface.)**

III. WHERE IT IS AND HOW IT IS EXTRACTED

- **Display map of Marcellus Range** You can see that roughly two-thirds of the state of Pennsylvania has Marcellus underground. Incidentally the rock layer is called the Marcellus because there is a surface outcropping in a town called Marcellus, New York. Marcellus can also be seen at the surface in some spots in PA. This might cause you to wonder, "I thought the rock was a mile deep. How is it at the surface?" Good question.
- **Display a topographic map of Pennsylvania.** Let's go back to our foam model. When our rock layers were deposited they were lying flat. But if you have ever driven across the state of PA you know it is not flat. Millions of years ago mountain-building took place in PA and our rock layers were folded, compressed and heated. This increased compression and heating had a large impact on the thickness and location of the Marcellus Shale.
- **Display map of Marcellus shale thickness next to topo map.** The folding that took place coincides with the folding of the land. All this movement means that the Marcellus layers are not always at the same depth from the surface.
- **Why are some counties being targeted for Marcellus drilling?** In the case of Marcellus shale more thickness doesn't necessarily mean more gas. Drilling companies are going to target places that are the most profitable. For example in Washington County, perhaps because there was less folding and heat, the Marcellus layer is not thick but the rock produces what is called wet gas. This gas contains other gasses besides methane such as propane and butane. It is worth more so there is more incentive to drill there. Additionally, since some areas are closer to existing pipelines, it is easier and more cost effective to transport the gas to major markets like Boston, New York and DC.
- **How do companies know where to drill?** Drilling companies rely on seismic data, exploratory wells, appropriate land leases and maps and data from previous wells to determine the best places to drill. Drilling is an expensive process so this exploration is critical. Once an appropriate site is determined the drilling begins.
- **Display example of vertical well and example of horizontal well.** Remember Marcellus drilling is done using a horizontal well instead of a vertical well. This is necessary because the gas is tied up within the structure of the rock. This is a good time to pass around a sample of the rock.
- **Display example of horizontal well graphic.** (Reiterate the process of drilling) First the well is drilled vertically past the fresh water zone and is cased. This is required by PA State Law. In Pennsylvania, the rock layers below the aquifer layers also contain gas and are sometimes also cased by some companies and in

some instances. Although these additional casings are not required by law, they are often used to further protect drinking water. The drill bit is then extended into the Marcellus, turned horizontal, and the rock layer fraced using 3-8 million gallons of water mixed with sand and chemicals for each well. Fracing basically cracks the shale layer, releasing the gas that has been trapped inside the Marcellus.

Remember, the gas is under extreme pressure. When you put cracks in the shale, you build a pathway where the gas can move from high pressure to lower pressure.

- It's also good to note that at this point that wells are occasionally flared (which looks like a huge burning torch.) This can be a bit alarming to view but is generally done only to the first well on a pad for increased safety. This practice is generally short-term and as more pipelines come online, this practice will reduce.
- Drilling companies try to recapture as much of the water as they can back out of the well. Rates of success for this range from 9-40% of the water sent down the well. So if they send 5 million gallons down the well the most they will get back out is 2 million gallons. Typically the recovered water is containerized so it can be reused in another frac. If this cannot be done, it must be hauled away and disposed of in an approved water-treatment facility. What happened to the other 3 million or so gallons? It is lost in the rock deep beneath the surface and has truly been removed from the water table, unable to be recovered.
- Lastly, the gas is sent to a pipeline for use by us all.

IV. BENEFITS

- **We need energy and we use energy every day: Pennsylvanians alone use one trillion cubic feet of gas per year for both residential and industrial purposes.**
- **It's also more energy efficient to have your energy source close to where it's being used. Transmmission and loss of gas is a problem in long pipelines.**
- **Natural gas burns cleaner, with less carbon emissions, than some other fossil fuels.**
- **If the Marcellus produces up to its full potential (500 trillion cubic feet) it will provide enough natural gas to power the entire United States for an estimated 20-25 years. The Marcellus field is the second largest gas field in the world.**
 - 1. Pennsylvania property owners who own their natural gas rights can realize economic gain. (clarify that in PA even though you own the land that does not mean you own the natural gas or mineral rights, even shallow and deep mineral rights are sometimes separated. It depends on the terms of their ownership.**
 - 2. lease rights to their land (generally a per acre rate)**
 - 3. a percentage of drilling profit (based on well production rate)**
State law currently requires a minimum of 12.5% of profit
- **Yes, natural gas prices are tied to a global market, but they will rise if we don't add new sources to the market. So, drilling the Marcellus may**

help keep gas prices down. (At least, this is how I understand those confusing economics.)

- **Drilling requires a large number of employees.**
- **Industries in areas where drilling take place also benefit:**
 - 1. truck owners (water and gravel haulers)**
 - 2. gravel/cement companies supply product**
 - 3. lodging for workers- like hotels and even the local housing market**
 - 4. restaurant owners feeding workers**
 - 5. Pipeline construction workers**
- **With horizontal technology, one or multiple wellheads can be placed on one pad and more gas can be obtained with less surface damage. Fewer well pads mean fewer roads, less deforestation, less disturbance.**

V. Potential impacts of Marcellus gas production

As with everything in life, there are pros and cons to energy use. All energy comes with a cost. No matter what the source of energy, whether it is 'green', a fossil fuel or somewhere in-between, producing energy always has a cost, making reduced energy use the most sustainable option.

- **Use of large amounts of water; 3-8 million gallons per well. To give an example of how much water that is, consider Ohiopyle Falls. (Facilitators: use an appropriate analogy to your local area.) At a typical river level of 2 feet it would take roughly 7 minutes for 5 million gallons to pass the over the Falls. Or it is the equivalent of water 15 feet deep on a football field, including the end zones. Keep in mind, this is only one well. Multiply this by hundreds or thousands of wells and it really begins to add up. This water is taken by permit from local waterways or purchased from local water companies.**
- **Getting that much water onsite requires a great deal of truck traffic. Some wells have a water pipeline coming to them but most don't. Getting 5 million gallons of water on site requires around 2,000 truckloads of water for each well. Remember that most of these wells are located in rural areas with small roads not meant for large amounts of truck traffic. The noise and dust created by this much traffic is also an issue, as are safety concerns related to large trucks on small roads.**
- **Concern about the chemicals used in the frac water. Each drilling company uses a mixture of regular and industrial chemicals in their frac water. There is concern about the safety of these chemicals traveling to the site, on site and traveling to a treatment facility. There is also concern that these chemicals may get into drinking water if wells are not cased properly.**
- **Concern that the jobs being created are not going to Pennsylvanians. Because states like Texas and Oklahoma have expertise in the horizontal drilling and fracing process, many experienced workers are being imported from these states. Drilling companies are working to increase the number of Pennsylvania workers on site.**

- **Concern about whether there are enough facilities to treat used frac water properly and how this water is being kept safely on site.**
- **Due to the sheer number of new wells, it may be difficult for regulatory staff/agencies to keep up with environmental oversight. In 2010, DEP issued 2,916 permits for Marcellus Shale drilling, although not all permits result in actual wells being drilled. (Facilitators: be sure to check the Marcellus Shale page on intraparks for the most recent and accurate number of permits issued.)**
- **Pennsylvania land owners who do not own their natural gas rights have little control over drilling on their property (including some State Parks). Drilling companies can legally drill on a landowner's property if the owner of the mineral rights has leased it with them. There are, of course, minimum setbacks to structures and compensations for loss, but this is perfectly legal.**
- **Numerous drilling pads may lead to forest fragmentation. Many drilling pads are being located in forested areas. This previously intact forest will now have openings that could lead to a change in the forest ecosystem, the introduction of invasive plant and animal species such as brown headed cowbirds and garlic mustard, which could possibly endanger native plant and animal communities.**
- **Cuttings disposal. Concerns exist about disposal of the material removed from the hole bored when tapping into the Marcellus shale called cuttings. Some of this material has above average, but not dangerously high, level so radioactivity, similar to the amount given off by granite or marble buildings. Therefore, all cuttings should be disposed of at approved locations.**
- **Change to the overall wild character, aesthetics and recreational uses that define Pennsylvania and especially our public lands.**

VI. Marcellus Shale In DCNR lands

- **What is DCNR and what kind of land do they own?**
 - **Bureau of Forestry: Oversees State Forests that are managed for multiple uses and values.**
 - **In addition to managing for recreation, water quality, timber, wild plants, wildlife, etc, part of the Bureau of Forestry's mission is to foster the environmentally sound utilization of mineral resources.**
 - **The Bureau of Forestry has had some parts of its lands under lease since 1947 for shallow gas drilling.**
 - **In 2008 and 2010, the Bureau of Forestry leased land for the purpose of drilling, targeting Marcellus. These leases contain strong guidelines for land use and environmental protection. The amount of land leased for Marcellus drilling is five times the amount leased for shallow gas drilling**
 - **The profits from these leases and gas production are going into Pennsylvania's Oil and Gas Lease Fund. This fund was created in 1955. In the first 50 years of its existence, it raised \$150 million dollars. The Oil and Gas law stated that**

monies generated from these leases were to be used for “recreation, conservation and flood protection.” In 2008, leases earned \$148 million in one year, doubling the fund. In 2009 and 2010, some of the money from the Oil and Gas Lease Fund was transferred to the General Fund to offset a shortfall in revenues. These were one time transfers during two distinct fiscal years that were approved by the legislature in the budget process.

- **The Commonwealth of Pennsylvania, like other land owners, does not own all of the oil and gas rights to its property. In these cases they are subject to drilling without any compensation for the gas produced.**
- **Bureau of State Parks: Oversees State Parks that are managed to conserve and sustain Pennsylvania’s natural resources.**
 - **It is not in the Bureau of State Parks mission to extract resources. Our policy states that we will prohibit all oil and gas development EXCEPT when significant land and water conservation benefits will result OR it will benefit the Bureau and result in no significant impact on park resources. (For more information, see the Bureau’s management directive on intraparks.)**
 - **However, like Forestry, some Parks do not own all of their mineral rights. In these cases, they are subject to drilling without compensation. We will still strive to work with the owner/lessee to minimize surface impact on park natural and recreational resources.**

VII. Considerations for Landowners

- **Know your property rights. As we discussed earlier, mineral rights in PA may be separate from oil and gas rights. If you own your property ‘fee simple’, it means that you own all the rights- surface and subsurface. Otherwise, the terms may be a bit more complex. Whether in relation to Marcellus Shale exploration or not, it may be in your best interest to explore your property ownership terms.**
- **If you own your oil and gas rights, consider legal council before signing a lease. Some lawyers are now specializing in gas leasing. The Bureau of Forestry leases are lengthy and involve strong guidelines for land use and environmental protection. Seeking legal council may simply allow you to consider all angles of a lease prior to its implementation.**
- **If drilling is going to take place near your home, have your water properly tested before drilling begins. Although a thorough test may be costly, it will provide a baseline for any changes after drilling begins. Without it, you will have no proof of water quality changes.**

- **Know oil and gas regulations.** DEP's bureau of oil and gas management has a good webpage listing the regulations and numbers to call if a landowner is concerned about companies following those regulations.
<http://www.dep.state.pa.us/dep/deputate/minres/oilgas/oilgas.htm>

I have this website address on a card that you can pick up after the program

Conclusion:

Hold up our good old bottle of gas: Who would have thought that a little bit of decomposing organic matter could cause such strong opinions? Obviously this issue is very controversial. For some it provides a bright economic future while for others it causes great concern about many issues. Either way it is providing access to a relatively untapped opportunity to provide energy to Pennsylvanians and the United States.

We hope the information we have discussed today helps you form your own opinion on an industry that is sure to be a part of Pennsylvania's landscape for many years to come. For more information, visit...

<http://www.dep.state.pa.us/dep/deputate/minres/oilgas/oilgas.htm>

... and feel free to pick up the following materials ...