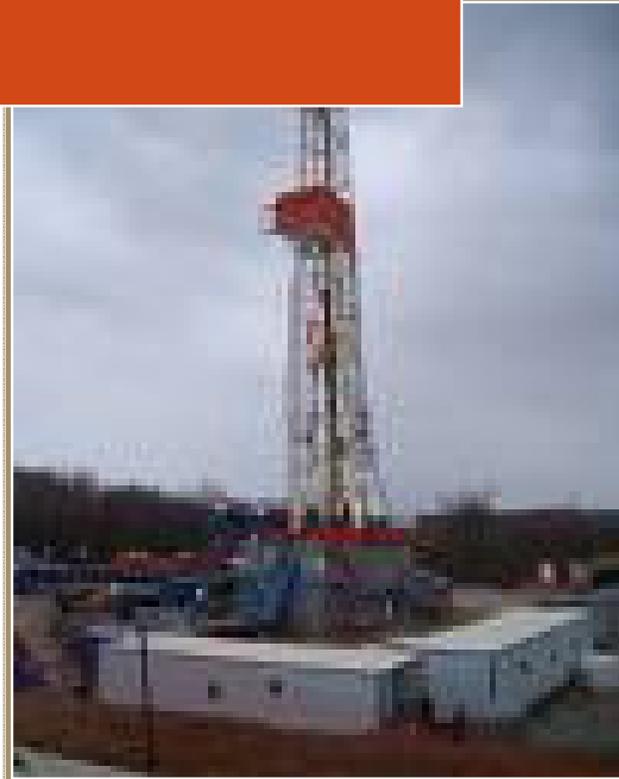


2010

# Marcellus Shale Development In Pennsylvania



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## Marcellus Shale Description

The Marcellus Shale is an organic rich rock formation located about one mile underneath the land surface of two-thirds of Pennsylvania. The Marcellus Shale also stretches to upstate New York to eastern Ohio and as far south as West Virginia.

The first well drilled in Pennsylvania was in Washington County, Pennsylvania in 2003. This project illustrated that by use of methods of hydraulic fracturing, similar to those used in the Barnett Shale in Texas, were successful.

In a 2008 estimate it is expected that the Marcellus Shale may contain as much as five hundred trillion cubic feet of natural gas. (Marcellus Shale - Appalachian Basin Natural Gas Play, 2010) It is estimated that ten percent of the overall gas can be recoverable, which would be enough gas to supply the entire United States with natural gas for two years.

The state of Pennsylvania has been the focus of energy companies due to its low tax and favorable business climate as well as the thickness of the shale and potential for extraction of large deposits of natural gas. The focus of this paper will be on the state of Pennsylvania and the pros and cons of development of the Marcellus Gas industry within the state. Refer to Appendix I for a map of the shale distribution.

## History of Marcellus Shale

While scientists and the industry have known for a long time that the Marcellus Shale contained natural gas, due to its depth of 5,000 to 7,000 feet below the surface, it wasn't economically feasible to extract. It was in 2003, that Range Resources drilled the first modern well in the Marcellus Shale. (Green, 2009) In 2005, Range Resources used a combination of two technologies; hydrofracking and horizontal drilling to extract gas from the Marcellus Shale. Hydrofracking induces fractures in the shale by injecting high pressure water and by drilling horizontally through the shale the

production rate of gas can be dramatically increased. Reports of Range Resources success and skyrocketing gas prices stirred interest from other energy companies. In addition, the proximity of the Marcellus Shale to the northeast part of the United States and major metropolitan areas such as New York City, Pittsburgh, Boston and Cleveland makes it attractive to investors.

The Marcellus gas industry has grown significantly since inception with relatively low levels of drilling in 2006 and 2007. According to statistics from the Department of Environmental Protection there were 308 wells drilled in 2008 in Pennsylvania. The Marcellus Shale Coalition, the industry trade group, estimates that up to 1,750 wells will be drilled in 2010, up from 763 in 2009. (Maykuth, 2010) This equates to a 568% increase in drilling activity over a three year period. Refer to Appendix II for a map that shows the number of Marcellus Shale permits issued by County as of March 2010. As can be noted from the map, the concentration of activity is in the northeastern and southwestern part of the state where the Marcellus shale is the thickest and presumably has more natural gas.

According to information presented by Whitelight Development, Inc, a deep gas and oil brokerage firm, at a meeting on May 1<sup>st</sup> at the Crawford Center in Emlenton wet gas is 70 percent more valuable than dry gas. Wet gas is also known as a partial liquid natural gas. This natural gas is a combination of gas that also contains ethane, propane, isobutene, normal butane and natural gasoline. Currently, it appears the northern half of the Marcellus shale land is richer in wet gas than the southern half of the Marcellus shale territory. The wet gas burns hotter and is primarily used in the petro-chemical industry. The wet gas requires a stripper plant or Cryogenic Facility to treat the gas. Rex Energy and Stonehenge Energy Resources LP formed a joint venture called Keystone Midstream Services, LLC., assisted by capital provider Energy Spectrum Capital, to build a high-pressure gathering and cryogenic gas processing plant in Butler County off of Route 528

in Evans City. Expectations are for the plant to be operational in September 2010.

### Top 20 Players in Marcellus Shale

With the cost of drilling a single Marcellus Shale well between \$3-4 million, this is not an activity for small companies. The top 20 players primarily include large, international publically traded companies. Refer to Appendix III for a chart of the top twenty players in the Marcellus Shale drilling.

### Pros of Marcellus Shale Development

The Marcellus Shale offers many opportunities for job creation, increased tax revenue, and an abundant clean source of fuel for the nation. These benefits come at a perfect time due to the recent economic troubles.

### Job Creation

The Marcellus industry purchases of goods and services, their royalties to landowners, and tax payments directly created more than 14,000 jobs in Pennsylvania during 2008. Indirect and induced impacts created even more jobs so that total jobs created by the Marcellus industry during 2008 were estimated at 29,284. (Timothy Considine, 2009)

The Center for Workforce Information & Analysis in Pennsylvania recently released a report that details projected job creation in Pennsylvania for six primary industries, as defined by the North American Industry Classification System (NAICS), considered relevant to the Marcellus Shale Project. (Industry, 2010, April) The industries covered by the report include the following:

1. 211111-Crude Petroleum & Natural Gas Extraction
2. 211112-Natural Gas Liquid Extraction
3. 213111-Drilling Oil and Gas Wells

4. 213112-Support Activities for Oil and Gas Operations
5. 237120-Oil and Gas Pipeline Construction
6. 486210-Pipeline Transportation of Natural Gas

In 2008, there were 593 businesses that employed 10,287 employees in these industries. According to the third quarter of 2009 Census of Employment and Wages, these numbers are at 693 and 11,428, respectively. (Industry, 2010, April) This represents a 17 percent growth in the number of businesses and 12 percent growth in employment for a nine month period.

The strongest growth is anticipated in the Crude Petroleum and Natural Gas Extraction Industry, which is predicted to add 2,374 jobs, an increase of 123.3 percent, over a ten year period. Refer to Appendix VII for Projected Employment Growth in Six Industries Related to Marcellus Shale Project.

### **Educating the Work Force**

Due to the anticipated employment growth in the gas industry in Pennsylvania there will be workforce training and education requirements that will need to be met. Pennsylvania State Universities, Community Colleges, Education Councils, and High Schools are modifying and adding curriculum geared towards gaining employment in the industry. One example is the new Petroleum Technology program introduced at the University of Pittsburgh-Bradford campus. The Petroleum Technology program is a two year program with core courses including the following;

- INTRODUCTION TO PETROLEUM INDUSTRY
- ENVIRONMENT AND SAFETY
- PETROLEUM GEOLOGY AND EXPLORATION
- WORKSHOP PRACTICES
- DRILLING AND COMPLETION
- PETROLEUM & NATURAL GAS CHEMISTRY
- STRATIGRAPHY AND STRUCTURAL GEOLOGY

- OIL AND GAS GATHERING & TRANSPORTATION
- WELL LOG INTERPRETATION
- INTRODUCTION TO GEOPHYSICAL PROSPECTING

(University of Pittsburgh Bradford) Many Pennsylvania Education Councils and High School Technical Centers have had personnel travel to Texas to learn and experience their curriculum so it can be brought to Pennsylvania. Additionally, there have been several Natural Gas Expos in the past year (Tri-County, Susquehanna Valley, Potter, Cameron, and McKean Counties) held through-out the state of Pennsylvania for the purpose of bringing local businesses, job seekers, and energy companies together.

### **Educating Local Businesses**

The Penn State Cooperative Extension has conducted two webinar series hosted through-out the state by area Economic Development Agencies, Education Councils, Chambers of Commerce's and Small Business Development Centers. The purposes of these webinars were to educate Pennsylvania businesses about the industry, give participants the ability to ask questions to the major energy companies, and learn about potential business opportunities. There are 18 Small Business Development Centers in the state of Pennsylvania. Small Business Development Centers are funded with a combination of federal, state, and local grants whose mission is to assist Pennsylvania companies start, grow and prosper. The Pennsylvania Small Business Development Center Network has as one of its core strategies for 2010 to assist Pennsylvania companies takes advantage of Marcellus Shale opportunities and already has planned several more training seminars in 2010 for Pennsylvania businesses.

### Local Success Stories

*Mill Stream Inn, Coudersport-Potter County-* The Mill Stream Inn is a hotel and conference center located outside the town of Coudersport. The Inn currently has 40 rooms and six apartment buildings available for rent. According to owner, Scott Buchsen, "The Marcellus Shale

industry in Pennsylvania is only at the tip of the iceberg". The Mill Stream Inn has occupancy that exceeds 90 percent and has added five fully furnished cabins and an office as the result of the increased occupancy levels due to the boom of the Marcellus Shale industry in the area. In addition, the Mill Stream Inn is in process of constructing another 30 rooms onto the existing hotel that will be self-financed. (Buchsen, 2010)

*Schlumberger, Brookville-Jefferson County-* Schlumberger, the largest oil and gas field Service Company in the world, will be opening a maintenance facility for the purpose of refurbishing natural gas equipment in June 2010. The Company will be holding a press conference on May 7<sup>th</sup> to outline their plans. Schlumberger purchased the old *Trail King* facility that is located off Exit 81 off of I-80 in Pinecreek Township. *Trail King*, a manufacturer of trailers for the transportation industry closed their Brookville facility after 15 years to move back to South Dakota. Trail King had 300 employees at its peak and had 70 employees when they closed their operations in October 2009. Schlumberger purchased the facilities for \$2.9 million dollars and plan on making \$1 million of improvements. The facilities include 20 acres and 180,000 square feet of building space in three separate structures. This is excellent news for Jefferson County who currently has an unemployment rate of ten percent. Schlumberger plans to directly employ 50 upper management positions and contract for another 30 employees in 2010 and plans to have a total of 200 employees by the end of 2011. (Coon, 2010)

### Increase in Tax Revenues

On May 1st, 2010 a Marcellus Shale Program was held at the Crawford Center in Emlenton, Pennsylvania that Amy Keth attended. According to 64th Legislative District State Representative Scott Hutchinson, "The Marcellus Shale industry generated \$600 million in state and local tax revenue during 2009". Additionally, he added "The industry is estimated to pay \$1 billion in Pennsylvania State and local taxes for 2010." The present value of additional state and local taxes earned

from the Marcellus development between now and 2020 is projected to be almost \$12 billion. (Timothy Considine, 2009)

Not only will the state receive additional tax revenues generated by the industry, but will receive lease and royalty income from leasing state forest land for Marcellus Shale Development. In January 2010, DCNR leased six tracts of land, totaling approximately 31,967 acres for oil and gas rights. The tracts are located in the Elk, Moshannon, Sproul, Susquehannock and Tioga state forests in Cameron, Clinton, Potter and Tioga counties. All six tracts were leased and generated a combined total of about \$128 million to the Oil and Gas Lease Fund. (PA DCNR-Natural Gas Exploration on State Forest Land, 2010) . According to Scott Hutchinson, the leasing of state forest land going forward will be decided on a case by case basis.

### Clean Source of fuel

Natural gas is the cleanest of all the fossil fuels. If coal-fired electric power generation plants were converted to natural gas, there would be fewer pollutants released into the atmosphere.

**Fossil Fuel Emission Levels**  
**- Pounds per Billion Btu of Energy Input**

Pollutant	Natural Gas	Oil	Coal
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208
Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Source: EIA - Natural Gas Issues and Trends 1998

Currently, there are only about 130,000 vehicles running on primarily compressed natural gas. (Timothy Considine, 2009) There is ample room

to expand the market for natural gas to be utilized as a fuel in the transportation sector and comply with tougher emission standards in the large Northeastern cities of the United States.

### Cons of Marcellus Shale Development

While the Marcellus Shale does provide plenty of positive advantages to the states that it covers, there are also the negative repercussions that drilling into the Marcellus Shale would cause. The largest con would be the negative effects on the water supply in the areas being drilled.

### Negative Environmental Impact

The negative environmental impacts that would occur if the Marcellus Shale were to be drilled could be detrimental to the areas around the drilling sites. While the drilling could bring in new jobs to the areas as well as boosting revenue for the states in times of economic difficulty the real question is what environmental price is the state willing to pay for those gains?

There are three major negative environmental impacts that are being risked by potential drillings of the Marcellus Shale, they include; contamination of water sources, noises and odors associated with gas drilling, and the risk of natural gas explosions.

### Contamination of Pennsylvania's water sources

When natural gas drilling occurs it requires billions of gallons of the state's natural water to conduct the drilling. Whether this water is used for the actual drilling process, or treated with chemicals and used as hydraulic fracturing fluid. The average amount of water needed to complete one hydraulic fracturing of a well is four million gallons.

The water that is used in the drilling process can result in sludge which contains drilling slurry and cuttings from the drilling site.

(Marcellus Shale, 2009) Currently all of the sludge being created at the Marcellus Shale drilling sites is being contained in a pit that has a two foot thick wall made of freeboard to protect the ground water in the area surrounding the pit. Depending on which phase of drilling the water is used/sludge is produced depends on which pit the sludge ends up in and eventually how the end decision is made for final disposal of the matter. (Weidenboerner, 2009)

Further into the drilling site bottom hole fluids, which are age old salt water deposits, also referred to as "brine". These fluids cause major issues because it is difficult to treat salt water.

"A lot of people consider it a bottleneck of gas drilling's future. It is difficult and expensive to take salt out of water. Up until now, we've relied on dilution to do that. We take it to a treatment (plant) and take out the metals and sediment and then we are left with a salt solution which goes into a stream where it is diluted. You can't keep doing that forever."  
(Weidenboerner, 2009)

Currently Western Pennsylvania is the only area equipped to treat salt water deposits with the use of water treatment facilities. Central Pennsylvania and Eastern Pennsylvania do not have the facilities available to conduct the treatments. This could cause a heightened threat for ground water contamination while the fluids are being stored while facilities are being built in the areas.

The water that is treated with chemicals and used as hydraulic fracturing fluid cause a wider range of environmental problems than the water that produces the drilling sludge, the chemical treated water used as a hydraulic fracturing fluid not only causes contamination threats to the ground water, but also causes threats to the air quality surrounding the drilling site. This water also ends up in pits in the ground with two foot thick walls to help prevent the surrounding ground water from contamination, however, once the drilling is complete and the water has been disposed of, the pits are

often covered over with soil. The pits that are left in the ground, along with the pits lining and any residue left in the pit from the water can have detrimental affects to the surrounding ground water, landscape, wild life, and the air. (Marcellus Shale, 2009)

### Noise and Odor of gas drilling

The word drilling alone usually insinuates an irritating noise, however when it is associated with gas drilling not only is there one noise, but there are multiple; Whether it is the machinery that is running around the clock, the heavy trucks carrying supplies to and from the site, or the workers coming and going at all hours. The noise pollution associated with gas drilling is enough to cause a residential uproar in the area. (Catskill Mountain Keeper, 2010)

All of the machinery and trucks that frequent a drilling site leave off some form of emission. When gas is found and when the sludge and chemicals are stored all have emissions that affect the quality of air. The largest issues with the air emissions are compounds are being released that are known to cause and accelerate cancer.

Compounds such as Benzene, Xylene, Toluene, and Ethylbenzene are all released into the air during the gas separation process and tank storage. The tank storage also releases methane into the air. (Subra) When you combine these threats with the expected air pollutants such as exhaust fumes from the machinery and the trucks, and the health issues that are caused or escalated due to the compounds in the air are hard to miss. Whether it be the diagnosis or accelerated progression of cancer or even respiratory problems for not just the workers, but the community surrounding the drill site. Is a shortened or complicated life due to increased health issues worth the benefits that could be gained from drilling?

## Risk of Natural Gas Explosions

Drilling into the earth can be a very dangerous job, whether it is the water contaminants, the air contaminants, the heavy machinery malfunctioning, and most importantly - the gas exploding.

Drilling can be very risky, new studies are finding that when hydraulic fracturing is used, as is done across the Marcellus Shale, it is even riskier. On March 31, 2010 at a drilling site in Washington County, Pennsylvania there was such an explosion. The explosion occurred in a gas well operated by Atlas Energy, Inc which caused 100 foot flames. (Piette, 2010) Recently Atlas Energy has faced many infractions from the state due to unsafe drilling environments, including wells where chemicals were spilled into the soil, contaminating the land, water, air, and causing an elevated risk for explosions.

Dimock Township, Pennsylvania, also saw the affects of explosions that occur due to gas drilling. At a drilling site nearby in Dimock methane had seeped into the ground and water supply of nine residential homes surrounding the drill site. Four of the nine homes levels of methane were deemed to have reached explosive levels, however, only one actually exploded. On New Year's Day 2009 the explosion occurred in a resident's well, the well that was in their back yard exploded, shattering an eight foot concrete wall and launching debris through the air. Luckily in this instance nobody was hurt, and after the explosion new regulations are being created to change the way that the drilling companies must treat wells. (LEGERE, 2009) This regulation will be an excellent benefit for future drillings, if they are conducted correctly, but what about the locations that are already contaminated to explosive levels?

## Return on Investments and Payback of Marcellus Shale Wells

Estimates were generated by Deutsche Bank that anticipates the Internal Rate of Return (IRR) for the Marcellus Shale to be between 72 and 100+ percent. The IRR for the Marcellus Shale is the lowest when compared to the Haynesville, Barnett, Fayetteville and Woodford Shale's. (Bilgesu, 2010) This is assumed to be due to the relatively low royalties and the premium natural gas pricing in the location of the shale.

As stated previously, the initial capital needed for this venture is large enough that only large established companies are attempting to get their foot in the door of Marcellus Shale drilling opportunities in Pennsylvania. One of the large companies undertaking the challenge, EQT, posted a payback period of 3 - 3.5 years, based upon their first quarter 2010 earnings analysis. (Executives, 2010)

Both the Internal Rate of Return and Payback period for companies investing in drilling in the Marcellus Shale are favorable. The largest factors that the companies must consider before deciding to undertake the venture is their calculated risk. The risk involved varies company to company, but due to the dangerous environmental nature of the business the risk can very well outweigh the gains depending on a company's view of the project.

## **Conclusions**

In Conclusion the decision to partake in the drilling of the Marcellus Shale in Pennsylvania is one that must be handled on a company to company basis. The pro's and con's are so extreme that a company's values and ideals may need to be taken into account while calculating the assumed risk of the project. If the individual company decides to partake in the drilling the community will benefit from the new jobs created by the drill sites, the state and local government will benefit from the increased tax revenues, and the world will benefit from the increase in availability of clean gas.

While these benefits are desirable the trade off to these gains are threats of environmental pollutants; noise, air, landscape, and water. The risk of gas explosions either at the drilling site or in nearby communities due to chemical spills could be very detrimental to the company, the reputation of the Marcellus Shale, as well as the community at large.

The EPA is taking steps towards regulating the threats to drilling in the Marcellus Shale. As of January 1, 2011 companies will have to comply with more stringent water disposal regulations; however, the final regulations are still being determined with a final vote set for May 19, 2010.

Based off of the research if the new restrictions and regulations are followed; the pros would definitely outweigh the cons. Allowing for both the company's to receive remarkable gains demonstrated through the high IRR and short payback period, as well as the consumer and community receiving all other pro's of the drilling process.

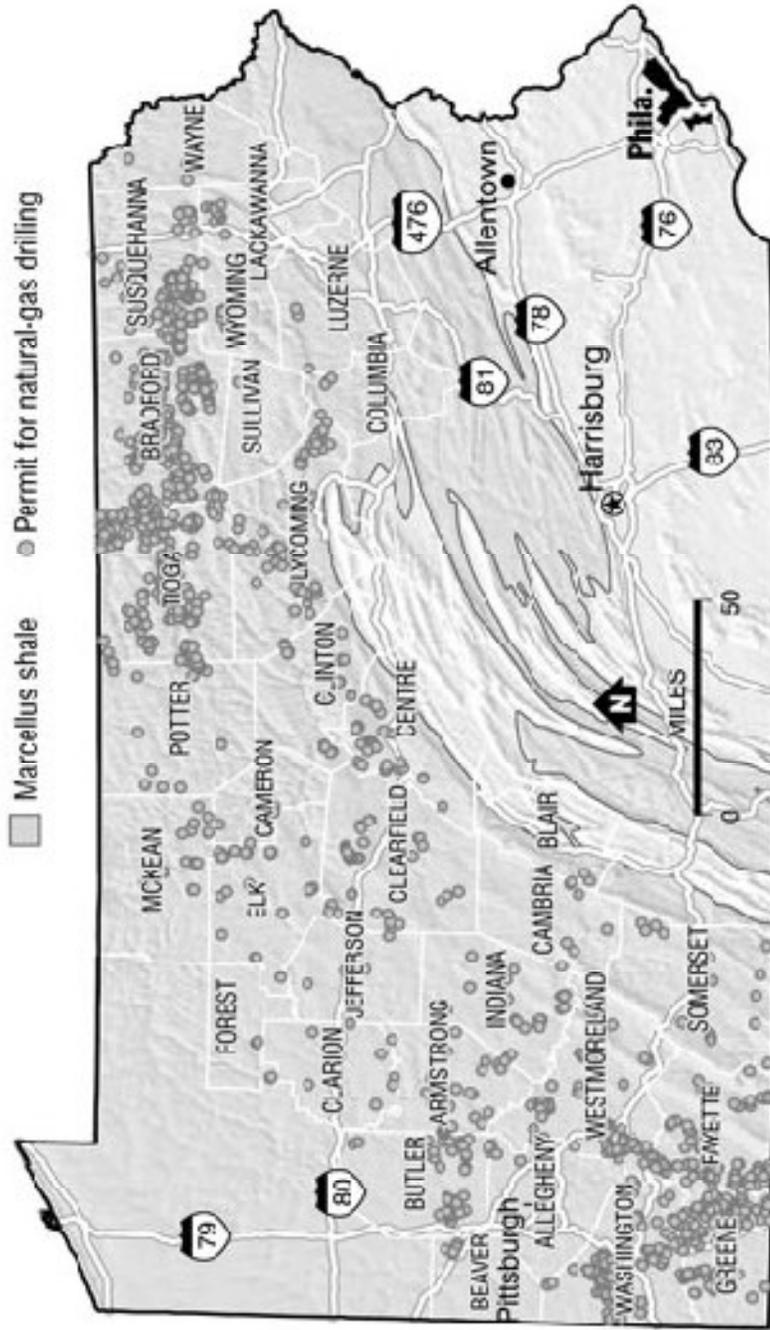
**Appendix I: Map of Marcellus Shale**



Appendix II: Marcellus Shale License Distribution

**License to Drill**

2,655 sites in 32 counties where the state has issued permits to drill for Marcellus gas since 2008.



SOURCE: Pennsylvania Department of Environmental Protection

JOHN TIEFNO / Staff Artist

Philadelphia Enquirer. (Maykuth, 2010)

## Appendix III: Top 20 Players

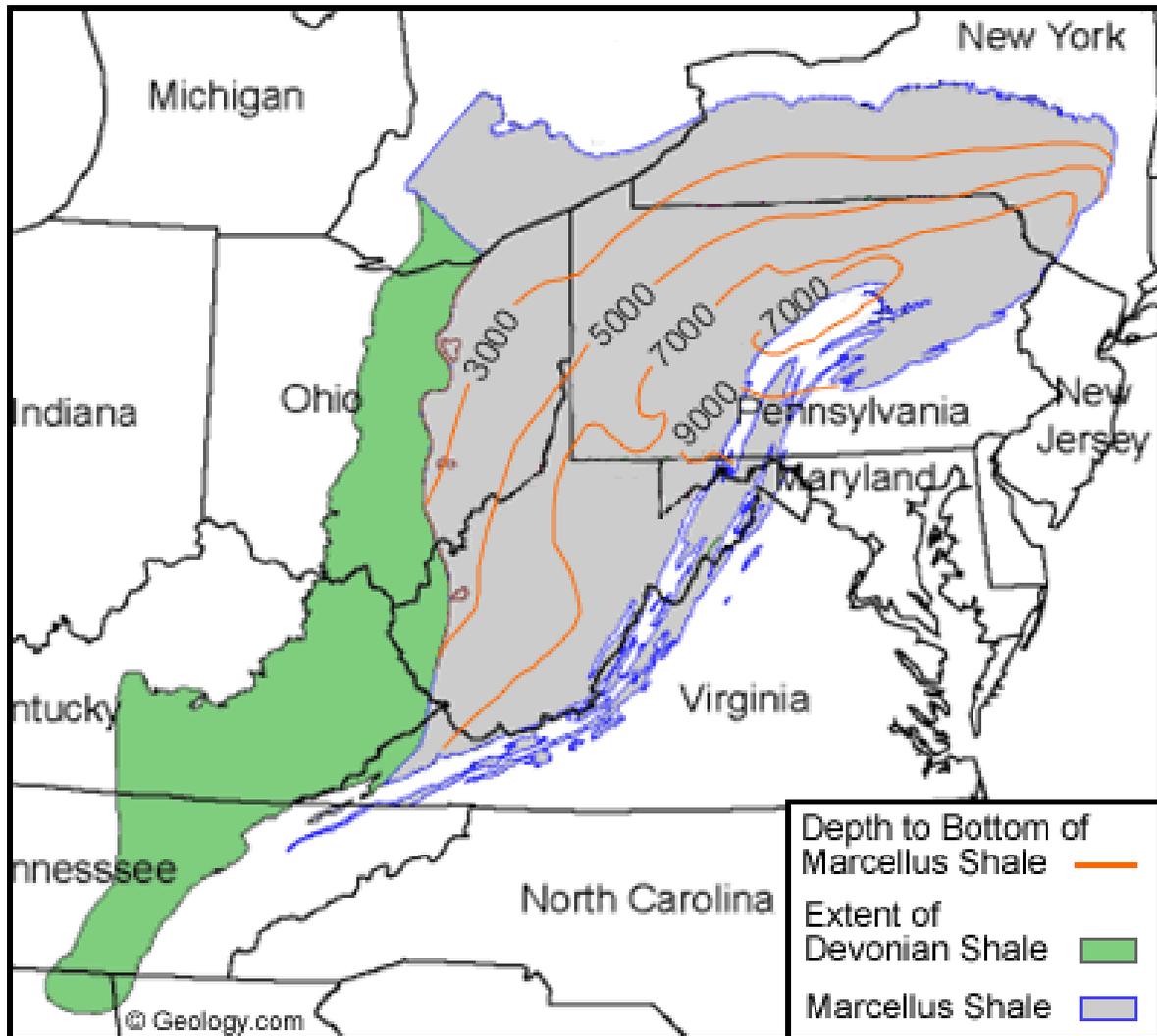
### Top 20 Pennsylvania Marcellus Gas-Well Operators

Company	Permits granted as of Jan. 22, 2010	Wells started as of Feb. 28, 2010	Most active county (wells drilled)
<b>Atlas Energy Inc.</b>	287	172	Fayette (64)
<b>Range Resources Corp.</b>	373	167	Washington (153)
<b>East Resources Inc.</b>	203	112	Tioga (105)
<b>Chesapeake Energy Corp.</b>	327	108	Bradford (87)
<b>Talisman Energy Inc.</b>	245	89	Bradford (59)
<b>Cabot Oil &amp; Gas Corp.</b>	121	54	Susquehanna (53)
<b>EOG Resources Inc.</b>	107	43	Clearfield (25)
<b>Chief Oil &amp; Gas L.L.C.</b>	75	42	Lycoming (19)
<b>Anadarko Petroleum Corp.</b>	78	38	Clinton (18)
<b>EQT Corp.</b>	67	30	Greene (21)
<b>CNX Gas Corp.</b>	80	27	Greene (27)
<b>Rex Energy Corp.</b>	43	26	Westmoreland (13)
<b>Seneca Resources Corp.</b>	54	25	Tioga (14)
<b>Pennsylvania General Energy Co. L.L.C.</b>	42	23	Lycoming (10)
<b>Ultra Petroleum Corp.</b>	73	21	Tioga (13)
<b>Dominion Resources Inc.</b>	36	17	Westmoreland (13)
<b>Snyder Bros. Inc.</b>	27	17	Armstrong (13)
<b>Energy Corp. of America</b>	39	16	Greene (15)
<b>XTO Energy Corp.</b>	41	13	Lycoming (5)
<b>Exco Resources Inc.</b>	79	11	Centre (6)

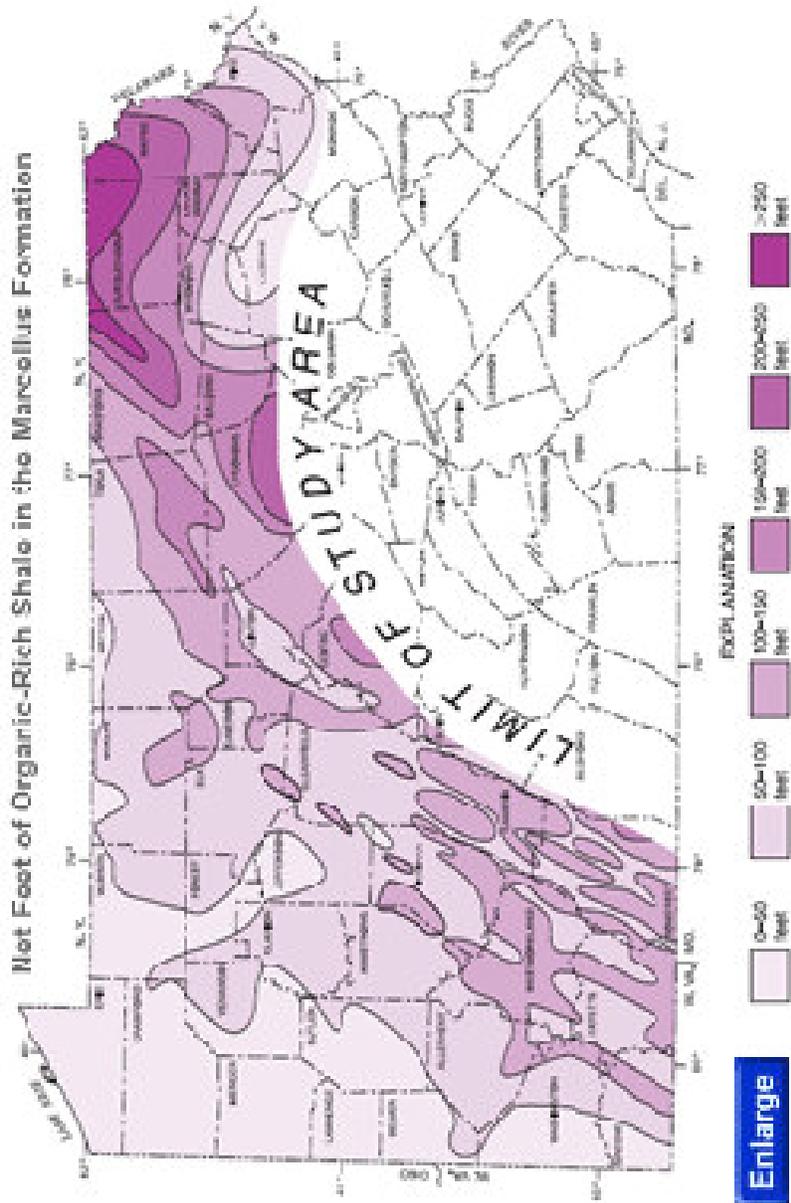
SOURCE: Pennsylvania Department of Environmental Protection

JOHN TIERNO / Staff Artist

## Appendix IV: Marcellus Shale Depth



# Appendix V: Pennsylvania Net Feet of Organic-Rich Shale



Appendix VI: Marcellus Shale Depth Comparison

System	Western Pennsylvania	Northwestern New York	
Middle Devonian	Harrell Shale	Genesee Fm.	
	Tully Limestone	Tully Limestone	
	Mahantango Formation	Moscow Shale	Hamilton Group
		Ludlowville Shale	
		Skaneateles Shale	
	Marcellus Shale	Marcellus Shale Tioga bentonite ✓	
Selinsgrove Limestone	Onondaga Limestone		
Lower Dev.	Needmore Shale	Bois Blanc Fm.	

## Appendix VII: Projected Employment Growth in Six Industries Related to Marcellus Shale Project

Six primary industries, as defined by the North American Industry Classification System (NAICS) have been identified as relevant to the Marcellus Shale Project. These industries are Crude Petroleum and Natural Gas Extraction (211111), Natural Gas Liquid Extraction (211112), Drilling Oil and Gas Wells (213111), Support Activities for Oil and Gas Operations (213112), Oil and Gas Pipeline Construction (237120), and Pipeline Transportation of Natural Gas (486210). The number of establishments, the count of employment, and the annual average earnings per worker can be found in Table 1 below.

**Table 1: Marcellus Shale Industry Establishment & Employment Data (2008 Annual Average)**

Region	Industry		Establishments	Employment	Annual Earnings per Worker
Pennsylvania Statewide	211111	Crude Petroleum & Natural Gas Extraction	189	2,560	\$69,460
	211112	Natural Gas Liquid Extraction	14	109	\$72,700
	213111	Drilling Oil & Gas Wells	75	1,597	\$60,491
	213112	Support Activities for Oil & Gas Operations	125	2,511	\$54,570
	237120	Oil & Gas Pipeline Construction	65	2,170	\$57,928
	486210	Pipeline Transportation of Natural Gas	125	1,341	\$76,656
	<b>Total</b>		<b>593</b>	<b>10,287</b>	<b>\$63,553</b>

Source: Covered Employment - EMSI

**Figure 1: Employers in NAICS 211111, 211112, 213111, 213112, 237120, & 486210**

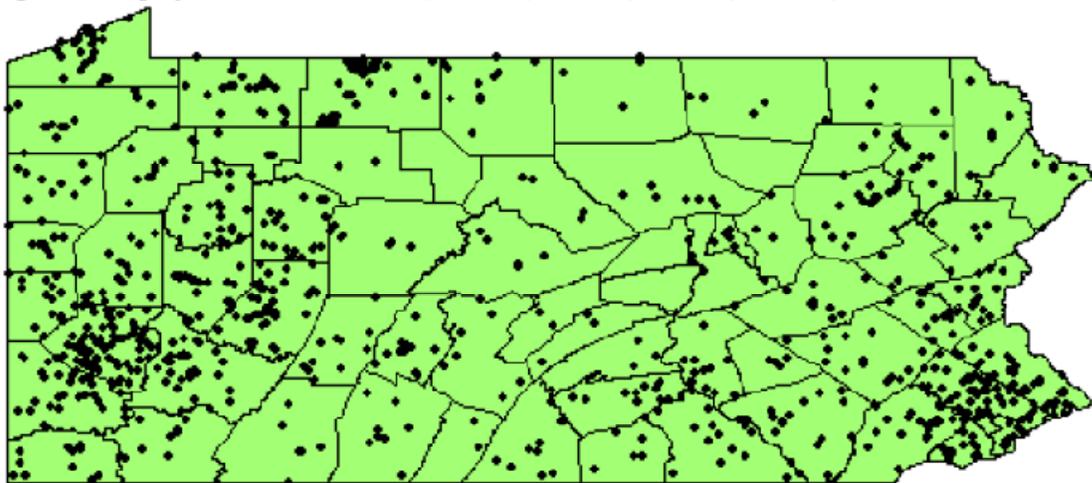


Table 2 below shows the expected change in employment in these six industries from 2006 to 2016. It is predicted that Pennsylvania will gain employment in all 6 industries over this 10-year period.

**Table 2: Marcellus Shale Industry Employment Projections (2006 - 2016)**

Region	Industry		Employment		Change		Avg. Annual Change
			2006	2016	Level	Percent	
Pennsylvania Statewide	211111	Crude Petroleum & Natural Gas Extraction	1,925	4,299	2,374	123.3%	237
	211112	Natural Gas Liquid Extraction	72	203	131	181.9%	13
	213111	Drilling Oil & Gas Wells	1,135	1,787	652	57.4%	65
	213112	Support Activities for Oil & Gas Operations	1,746	2,720	974	55.8%	97
	237120	Oil & Gas Pipeline Construction	1,928	1,942	14	0.7%	1
	486210	Pipeline Transportation of Natural Gas	1,219	1,471	252	20.7%	25
	<b>Total</b>		<b>8,025</b>	<b>12,423</b>	<b>4,397</b>	<b>54.8%</b>	<b>439</b>

Source: Covered Employment - EMSI

**Table 4: Occupational Employment & Projections for Pennsylvania (2006 - 2016)**

Occupation		Employment		Change	
		2006	2016	Volume	Percent
17-2151	Mining & Geological Engineers	927	1,058	131	14.1%
17-2171	Petroleum Engineers	170	214	44	25.9%
19-2042	Geoscientists	606	750	144	23.8%
19-4041	Geological & Petroleum Technicians	187	254	67	35.8%
47-1011	Supervisors/Managers - Construction & Extraction Workers	16,971	15,916	-1,055	-6.2%
47-5012	Rotary Drill Operators - Oil & Gas	720	1,036	316	43.9%
47-5013	Service Unit Operators - Oil, Gas, & Mining	656	890	234	35.7%
47-5071	Roustabouts, Oil & Gas	1,111	1,573	462	41.6%
51-8093	Petroleum Pump Systems Operators, Refinery Operators, & Gaugers	1,965	1,970	5	0.3%
53-7073	Wellhead Pumpers	267	523	256	95.9%
<b>Total</b>		<b>23,580</b>	<b>24,184</b>	<b>604</b>	<b>2.6%</b>

Source: Covered Employment - EMSI

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