PPI | The Public Policy Institute of New York State, Inc.

Drilling for Jobs

What the Marcellus Shale could mean for New York

July 2011

Table of Contents

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Executive Summary

There are very few opportunities available to New York State with the same job-creating potential as exploring and developing the Marcellus Shale formation. The safe and sustainable development of the Marcellus can help to transform the economy in New York's Southern Tier. The effects of the recent global recession are still resonating in much of the state, and it would be unreasonable to disregard the substantial economic benefits that would come with utilizing this valuable natural resource. We need only to look south into Pennsylvania, where 48,000 private sector jobs in Marcellus Shale-related sectors were created in 2010, to see how development of this resource has positively affected their citizens and businesses.

If New York fails to allow the development of this resource, the state stands to lose over $11 billion in economic output and thousands of private sector jobs between 2011 and 2020.[i] By conservative estimates the development of the Marcellus has the potential to create 37,572 new jobs each year in New York,[ii] jobs that may pay over $79,184 annually — over double the average private sector wage upstate.

The Public Policy Institute (PPI) report builds off the findings of earlier studies and examines the economic impact and potential private sector job creation that developing the Marcellus Shale would have in New York State. It compares recent job growth in Pennsylvania to counties in New York (outside of the New York City watershed) where Marcellus Shale development is expected.

This report compares how individual counties in both states have been affected by Marcellus Shale development. It examines employment statistics in Tioga County, New York and Bradford County, Pennsylvania — which had the most wells drilled in 2010 and also the second lowest unemployment rate in Pennsylvania in March 2010.

The availability of abundant natural gas and electricity could spur new industrial development and lead to gains in employment, economic output and tax revenues.

Once Marcellus Shale development begins, the following economic achievements are projected:

- In a five-county area outside of the New York City watershed, with 500 wells drilled per year, Marcellus Shale development could result in a total of more than 15,500 direct jobs and an additional 47,120 jobs by applying the 3.04 RIMS II multiplier, for a total of 62,620 jobs.
- Even with a moratorium in place, New York landowners are seeing income from leasing the drilling rights to their land. Once development begins, many will see royalties from producing wells. In Pennsylvania some landowners have seen signing bonuses as high as $2,000 per acre and a royalty rate of 12.5 percent.
- Local, state and federal tax revenues could increase by more than $214 million (in 2010 dollars) in 2015.[iii]

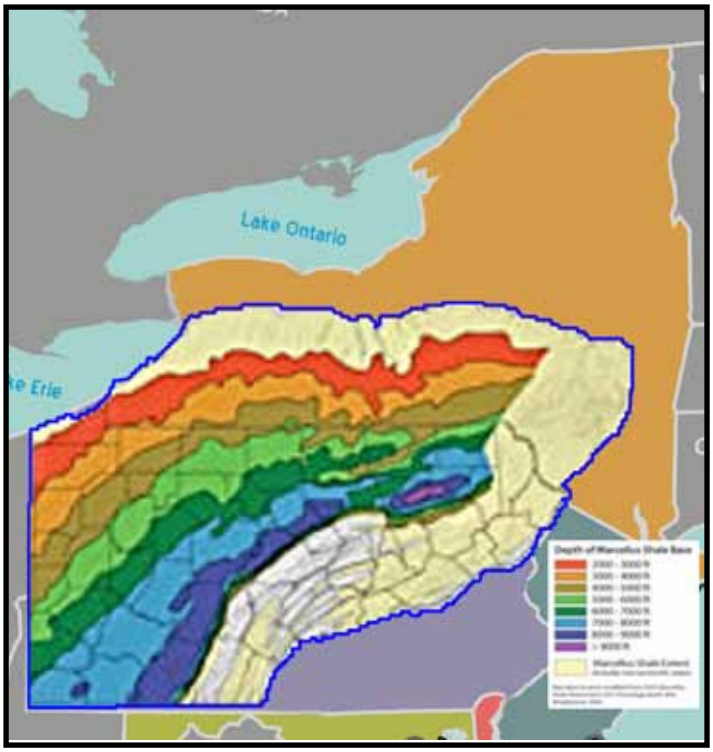
Anti-drilling apprehension has delayed shale gas exploration in New York State, despite recent advances in wastewater technology[iv] and support from diverse sources, including the U.S. Environmental Protection Agency.[v] Although PPI's report focuses solely on non-environmental matters, it's important to note that natural gas is a clean burning fossil fuel which emits 60 percent less carbon than coal.[vi] Additionally, New York has some of the most strict environmental standards in the nation — typically exceeding other states' and federal standards — and the implementation of a new regulatory regime governing high-volume hydraulic fracturing will continue this trend.

After analyzing the economic impact and private sector job creation associated with the development of the Marcellus Shale, PPI concludes that New York must move swiftly to take advantage of the transformative opportunity that has been documented below the state line in Pennsylvania.

New York has a great opportunity to continue its long history of exploration and development of natural gas resources and pursue an extraordinary economic opportunity for upstate regions.

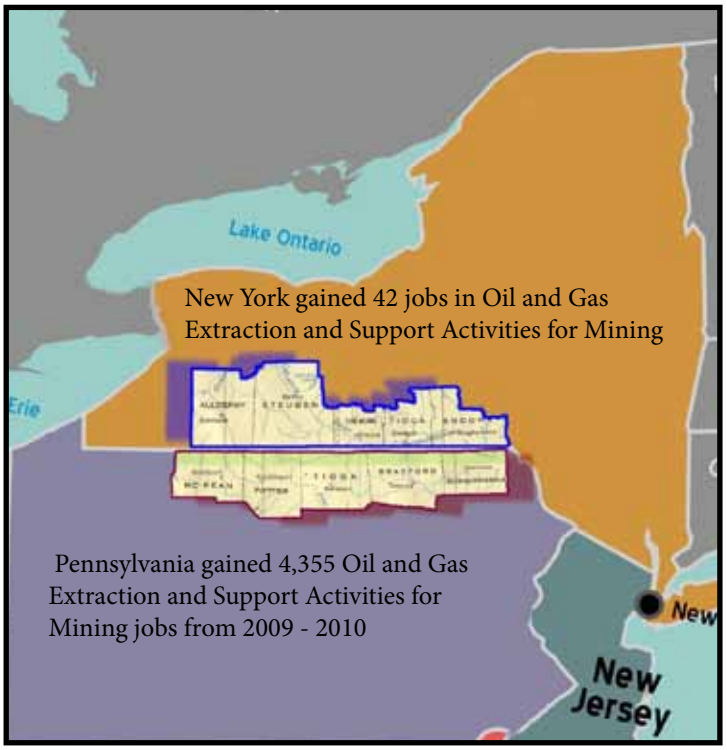
Introduction

Anywhere from 168 trillion to 516 trillion cubic feet of natural gas exists[vii] in the Marcellus Shale, a 95,000 square mile black shale formation spanning from Ohio and West Virginia into Pennsylvania and southern New York. While exposed at the ground surface in certain regions, the Marcellus formation runs over 7,000 feet deep in the Delaware River Valley along the Pennsylvania border.



The Marcellus Shale spans the length of the Southern Tier in New York State, from Chautauqua to Greene and Ulster Counties. For this report, PPI assumes no drilling will occur in and around the New York City watershed.

The recent improvements in drilling technology have greatly increased the viability of exploring the Marcellus Shale; namely, the combination of horizontal drilling and hydraulic fracturing (the latter involves pumping a mixture of water, sand and chemicals down the well under high pressure to create fractures in the gas-bearing rock). The fractures are held open by the propping material, and additional gas is then able to escape into the well. Fracking fluid is 99 percent water and contains small amounts of chemical additives including friction reducers, bactericides and emulsion elements. New York, along with other states, generally require the disclosure of chemical additives to its environmental regulatory agencies, with public disclosure of non-trade secret information.



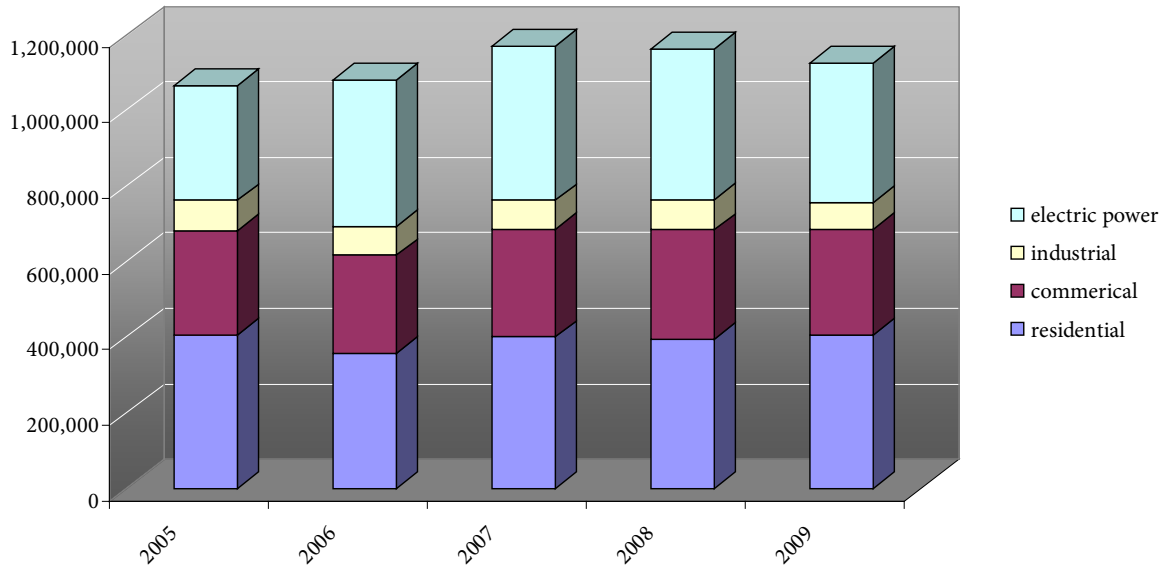
It's also critical to note the importance of continual drilling, since natural gas wells tend to have steep production decline curves (although they continue to produce for 30-50 years, some even longer). A certain number of wells must be drilled each year in order to continue extracting a high volume of natural gas.

Now that the New York State Department of Environmental Conservation (DEC) has updated current drilling standards to avoid adverse environmental impacts of shale gas exploration, it is important to examine the economic advantages that natural gas drilling will have in terms of private sector job growth and increased tax revenue for New York.

The Importance of Developing Natural Gas Resources

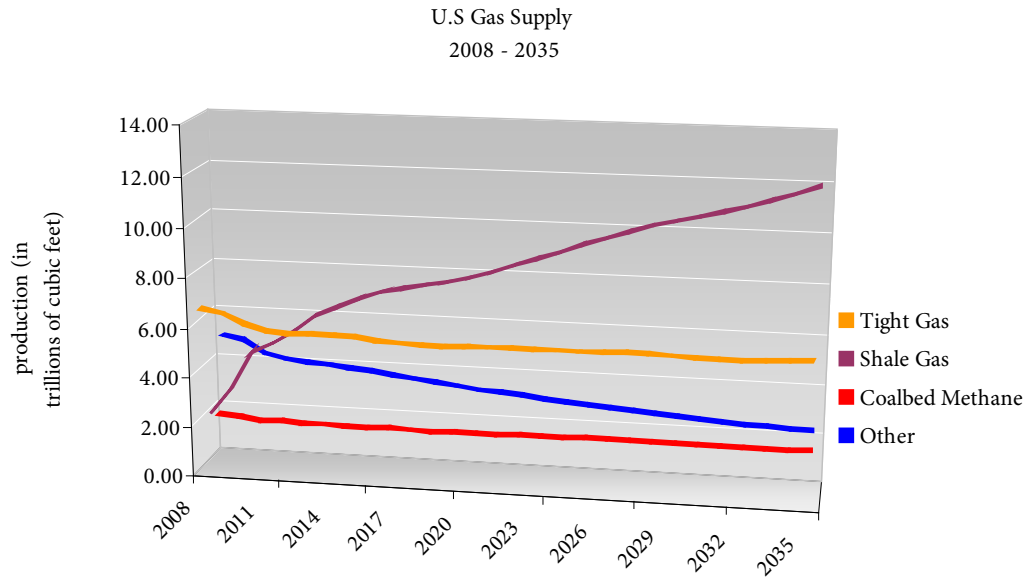
Estimates vary on the amount of recoverable gas in the Marcellus Shale — a 20 percent recovery rate would place it at 489 trillion cubic feet.[viii] Average natural gas consumption in New York State is 1.1 trillion cubic feet per year, according to the Department of Environmental Conservation. Given this figure, utilizing the natural gas resource right in our own backyard would be advantageous for residential, commercial, industrial and electrical needs. Residential consumption made up 36 percent of total natural gas consumption in New York State in 2009, followed by electric generation, which accounted for 31 percent of in-state consumption. Although New York accounted for 5 percent of total U.S. gas consumption in 2009, it produced only 0.2 percent of the nation's total. Pennsylvania consumed 3.5 percent of natural gas in the U.S. and produced 1.3 percent of the nation's total.

New York natural gas delivered to consumers (in millions of cubic feet), 2005-2009

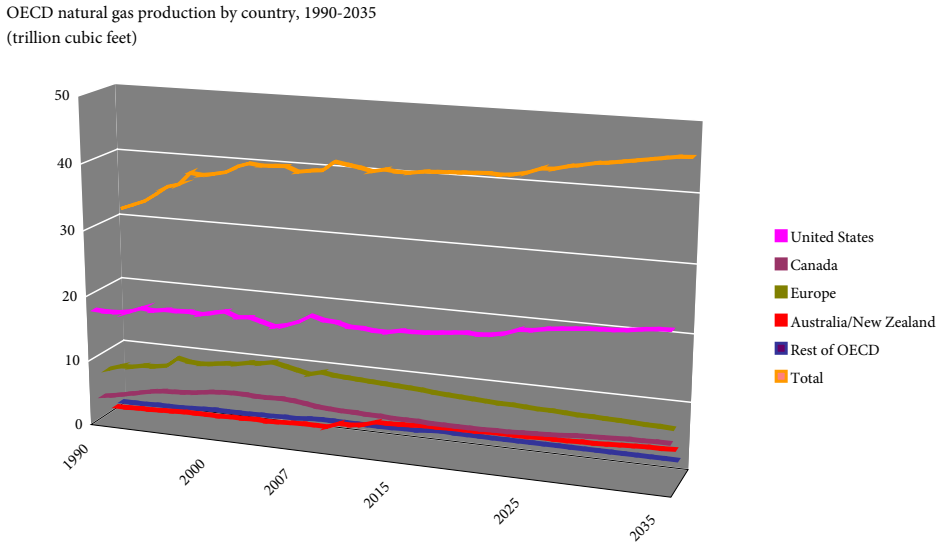


Source: U.S. Energy Information Administration

Between 2006 and 2010, U.S. shale gas production grew by an average of 48 percent per year, up from an average of 17 percent annual yearly growth rate from 2000 to 2006. Projections for natural gas production estimate that by the year 2035, the U.S. will be producing 23.4 trillion cubic feet of gas annually, far exceeding other Organization for Economic Cooperation and Development (OECD) countries.



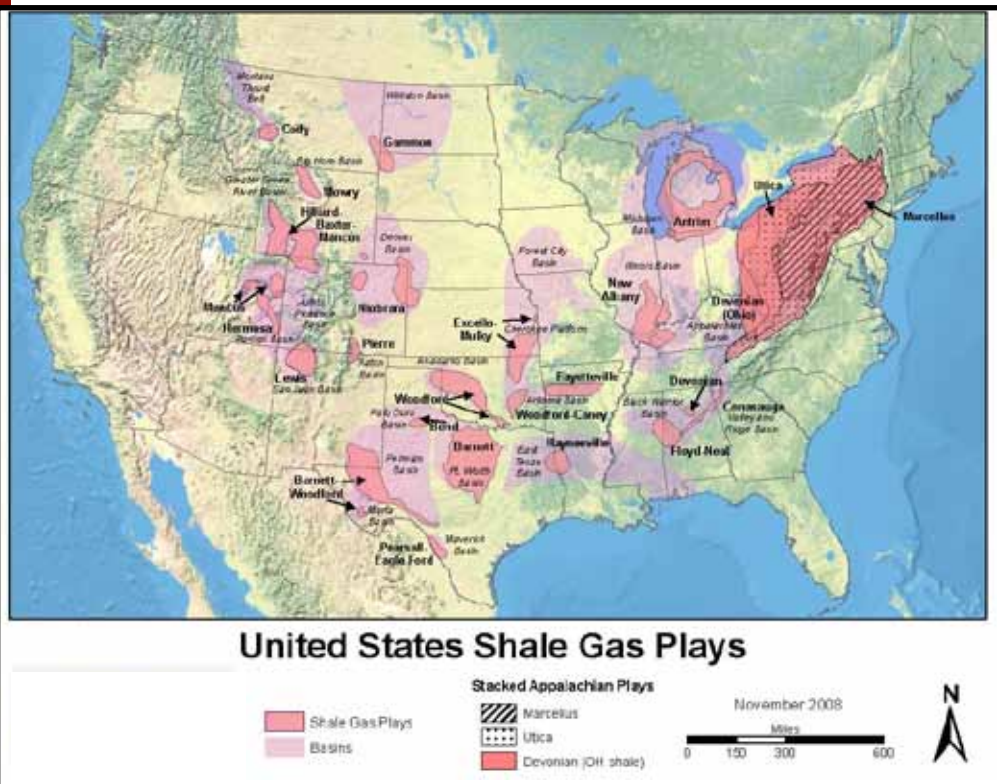
Source: U.S. Energy Information Administration



Source: U.S. Energy Information Administration

The Marcellus and Other Shale Plays

While the Marcellus is the largest shale formation in the United States at 95,000 square miles, other shale plays in the nation are generating sizable revenue, output and permanent jobs.

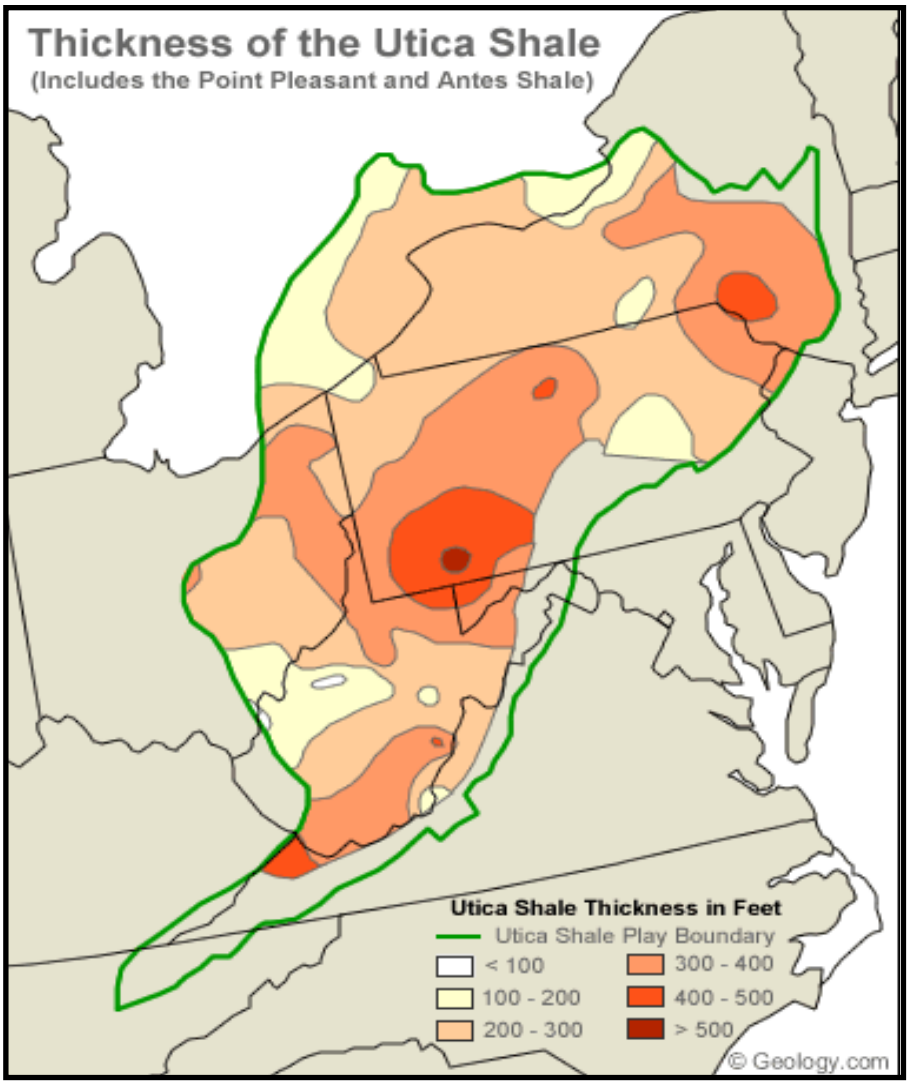


Source: U.S. Energy Information Administration

The Barnett Shale in Texas, which covers approximately 5,000 sq. miles, is responsible for $5.2 billion in annual output and approximately 55,385 permanent jobs.[ix] Projections made to the year 2015 estimate that the effects of the Barnett Shale would result in over 108,000 jobs and $10.4 billion in output per year.[x]

The Marcellus is the largest known shale formation in the United States, at 95,000 square miles.

The Utica Shale exists several thousand feet below the Marcellus, and lies beneath parts of Kentucky, Maryland, New York, Ohio, Pennsylvania, Tennessee, West Virginia and Virginia, as well as Lake Ontario, Lake Erie and a section of Ontario, Canada.[xi] At this time there is still limited information regarding the development of the Utica Shale, although some experts believe that the Utica Shale in Pennsylvania — with its extreme depths, and subsequent high temperatures — will most likely convert the natural gas to carbon dioxide, making production unlikely.[xii] In Ohio and New York, however, there may be greater development potential. As evidence of the potential of the Utica Shale, Range Resources has drilled horizontal wells in the Utica Shale and has stated that they plan to drill additional wells.[xiii]



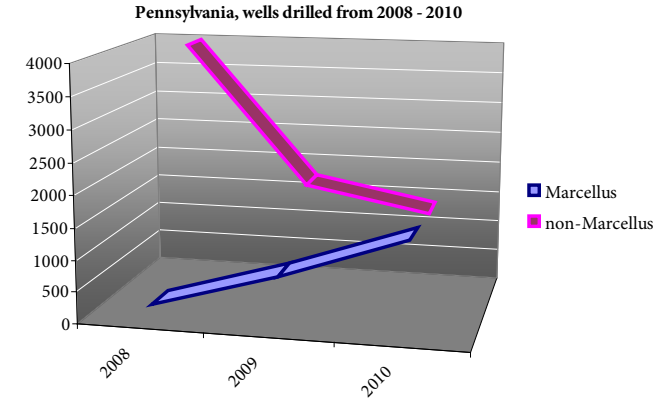
Recent Activity in Pennsylvania and New York

Pennsylvania has seen a surge in Marcellus Shale drilling in recent years. A total of 2,851 wells were drilled in Pennsylvania in 2010, approximately half of them in the Marcellus Shale. Counties with the most active Marcellus drilling last year were Bradford, Lycoming, Tioga and Washington. Over the past decade, a total of 31,914 natural gas wells were drilled in Pennsylvania.

Wells drilled in select PA counties, 2010

County	Marcellus	non-Marcellus
Bradford	386	0
McKean	15	199
Potter	33	19
Susquehanna	92	0
Tioga	266	0
Washington	139	30
Lycoming	107	0

Source: PA Department of Environmental Protection



Source: PA Department of Environmental Protection

Gas wells drilled in select NY counties, 2006-2010

County	2006	2007	2008	2009	2010	TOTAL
Allegany	0	0	2	0	0	2
Broome	0	1	2	0	0	3
Chautauqua	129	120	104	22	18	393
Chemung	6	8	10	1	5	30
Erie	44	64	69	61	42	280
Steuben	13	5	5	0	0	23
Tioga	0	8	1	0	1	10

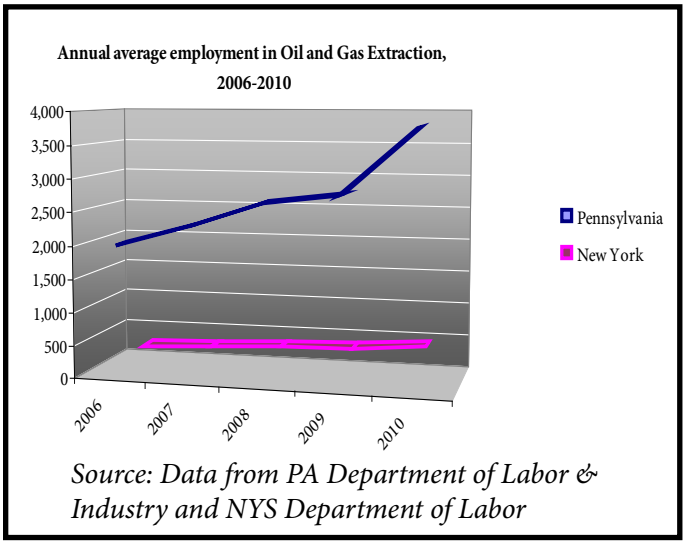
Source: NYS DEC, downloadable well data

Since the William Hart Natural Gas Well was dug in Fredonia, NY, in 1821,[xiv] New York has seen over 75,000 oil and gas wells drilled and, according to the DEC, approximately 14,000 of them are still active. New York has seen recent natural gas drilling activity, although at a much slower rate than Pennsylvania, and without any horizontal drilling in the Marcellus Shale formation. Between 2006 and 2010, the largest number of gas drilled wells drilled was in Chautauqua and Erie Counties.

Economic Impact of the Marcellus in Pennsylvania

There are six core Marcellus Shale North American Industry Classification System (NAICS) industries that have been indentified by the Pennsylvania Department of Environmental Protection: Crude Petroleum & Natural Gas Extraction; Natural Gas Liquid Extraction; Drilling Oil & Gas Wells; Support Activities for Oil & Gas Operations; Oil & Gas Pipeline & Related Structures Construction; and Pipeline Transportation of Natural Gas. There are also 21 Ancillary Shale industries.

During the lowest economic point of the recent recession, private sector employment in Pennsylvania fell sharply between 2008 and 2009, yet certain Marcellus Shale industries held steady, with Oil and Gas Extraction actually gaining jobs during that time period.



Source: Data from PA Department of Labor & Industry and NYS Department of Labor

Marcellus Shale industries enjoy a significant advantage over the average private sector weekly wage. In Pennsylvania, the average annual wage in the six core Marcellus Shale industries was $73,159 in 2010, $27,400 greater than the average wage for all industries statewide.[xv] The Standard Occupation Classification (SOC) salary ranges for jobs within the core Shale industries indicate annual salaries ranging from $27,997 for Oil & Gas Roustabouts, to $95,659 for Petroleum Engineers. The salary range is even greater for ancillary Shale industries, from $38,938 for Heavy & Tractor Trailer Truck Drivers to $108,014 for Engineering Managers.[xvi]

In New York State Oil and Gas Extraction, a Marcellus Shale-related industry, has a significant wage advantage. The average annual wage for Oil and Gas Extraction is $93,722, which is 139 percent higher than the average private sector wage in upstate New York of $39,157. In Chemung County the average wage for this sector is $115,387, which is over three times the county's private sector wage of $37,648.

Based on data from the 4th quarter of 2006 through the 4th quarter of 2010, select Shale industries in Pennsylvania enjoyed sizable increases in average employment:

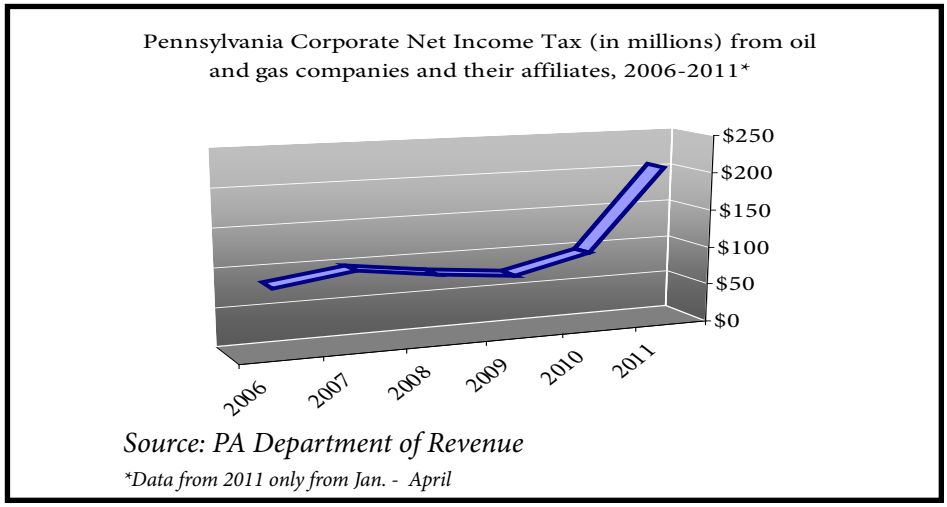
- Oil and Gas Pipeline Construction employment increased by 47.2 percent;
- Sewage Treatment Facilities employment increased by 43.2 percent;
- Support Activities for Mining, which encompasses the core Shale industry Support Activities for Oil and Gas Operations, saw a 172.3 percent increase in employment, gaining 7,126 jobs — In New York, this sector saw only 1.2 percent growth, or an increase of eight jobs; and
- Oil and Gas Extraction gained 2,055 jobs (98.2 percent growth); while in New York it grew by only 227 new jobs.

Other Shale sectors with employment gains in Pennsylvania include:

- Pipeline Transportation of Natural Gas (6 percent);
- Water Supply and Irrigation Systems (10.7 percent);
- Other Specialized Trucking, Local (14.5 percent);
- Heavy Machinery Rental and Leasing, which encompasses the core Shale sector Construction, Mining & Forestry Machinery and Equipment Rental and Leasing (19 percent);
- Engineering Services (5.1 percent);
- Testing Laboratories (9.3 percent); and
- Environmental Consulting Services (9.7 percent).

In addition, Pennsylvania has enjoyed substantial tax benefits from Marcellus Shale drilling. Data from the Pennsylvania Department of Revenue indicates that the industry paid over $1.1 billion in state taxes since 2006. In terms of Corporate Net Income Tax, figures for the first four months of 2011 alone are over double what they were in 2010.

Another economic benefit from hydraulic fracturing is the revenue paid to landowners through leases and royalties. Signing bonuses of over

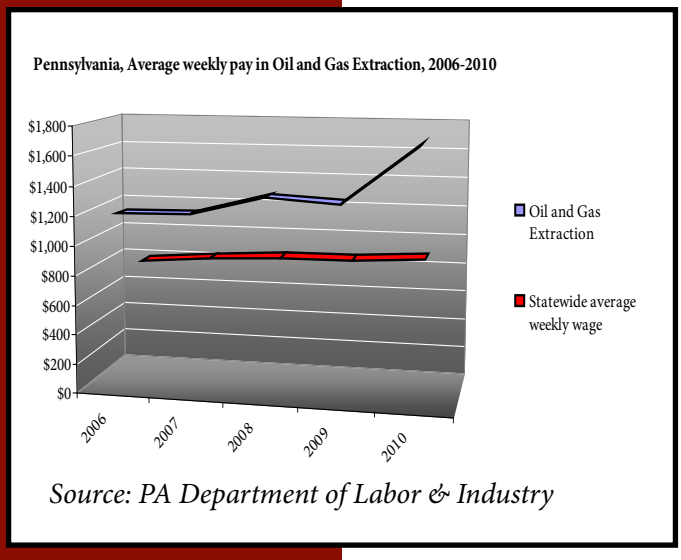


Source: PA Department of Revenue

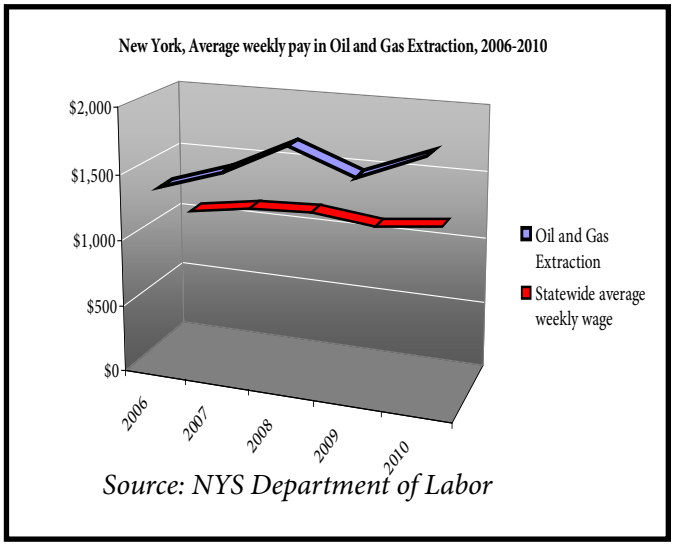
**Data from 2011 only from Jan. - April*

$2,000 per acre were not unusual[xvii] after new drilling technologies made shale gas extraction more financially viable. Also — after the drilling begins — property owners can receive royalties as a percentage of the natural gas yield. The typical royalty rate is 12.5 percent. If New York were to lift the moratorium on hydraulic fracturing in the Marcellus Shale, landowners in the Southern Tier could enjoy these royalties as a supplement to their regular income.

A recent study indicates that the total economic impact, by value added, of Marcellus Shale-related industries in Pennsylvania was $3.87 billion in 2009 alone, and that Marcellus natural gas producers in Pennsylvania planned to spend over $8.7 billion in 2010.[xviii] This is exactly the type of investment and economic activity that upstate New York needs in order to recover from the economic recession.



Source: PA Department of Labor & Industry



Source: NYS Department of Labor

Real Property Tax Benefits

Many gas-producing states levy a severance tax on gas production. New York does not have a specific gas severance tax, but instead has a significant property tax based upon the value of gas production. Gas severance taxes are generally based on either the volume or value of the gas production. To understand why New York does not have a traditional severance tax it is important to understand the history of New York's real property tax assessment.

As a result of increased oil and gas prices, exploration and production activity intensified in the mid 1970s and early 80s. Initially, this phenomenon was due to increased prices paid for domestic oil and gas as a result of higher demand, deregulation and rising foreign price levels. As a result of the increased production, laws were enacted in the 1980's to regulate the activities of the industry and govern the assessment of oil and gas producing properties. At the time it was understood that additional tax revenue derived from oil and gas production should stay with the locality.

Prior to the reforms, assessments of oil and gas producing properties were not uniform throughout the state. Specifically, the legislation required the separate assessment of oil and gas economic units for producing wells.

The estimated value of all oil and gas wells in New York State is based upon the annual production multiplied by the Unit of Production Value (UPV). The UPV is the value of each MCF (one thousand cubic feet of gas) produced in the production year. In determining unit of production values, the New York State Office of Real Property Tax Services uses a discounted net cash flow approach to reflect the following: depreciation; depletion; income and other taxes; capital investments; royalty interests not retained by producer; operating and maintenance expenses; other pertinent costs; and a rate of capitalization that shall not be less than 17.5 percent.

On April 1, 2011, the state board of Real Property Tax Services established the final 2011 oil and gas UPV's. The values are as follows:

Medina Region 1 - $11.32
Medina Region 2 - $11.32

Estimated Real Property Tax Payments			
Estimated Annual Production (AP) 500 mmcf			
Estimated Unit Production Value (UPV) $9.80 per mcf			
Estimated Market Value of Well $ 4,900,000			
Town of Owego Equalization Rate 81			
Est. Assessed Value Of Marcellus Well $3,920,000	2011 Tax rate per 1,000 of AV	Est. AV of Well (in 1,000's of $'s)	Est. Property Tax dollars
County Taxes	$10.85	$3,920.00	$42,516.32
Town of Owego	$2.95	$3,920.00	$11,564.82
Solid Waste	$0.45	$3,920.00	$1,775.76
Fire District	$2.02	$3,920.00	$7,923.64
School	$71.75	$3,920.00	$281,244.38
Total			$345,024.92

Medina Region 3 - $11.32
Medina Region 4 - $11.32
Onondaga Reef and Oriskany Sandstone Formation - $9.80
Trenton Black River - $12.12
Formations other than Medina, Onondaga & Oriskany - $9.80

To understand the cost of the delayed production on real property tax collection it is important to estimate the real property tax benefits associated with a Marcellus well. In the interest of illuminating the effects one Marcellus well has upon a specific locality, the following estimates are based upon the best available information.

It is estimated that one Marcellus well in the town of Owego, in the County of Tioga, would generate $345,025 in combined real property tax revenue for the county, town and school districts. It was estimated that during the first year of full production an average Marcellus well will produce 500 million cubic feet (mmcf) of natural gas.

Currently there is no established unit production value for a Marcellus well. It is highly likely that the UPV will be greater for a Marcellus well than the currently published UPV for formations other than Medina, Onondaga and Oriskany.

If the UPV for Marcellus was closer to Trenton Black River the well would generate $432,038 in combined real property tax revenue for the county, town and school districts.

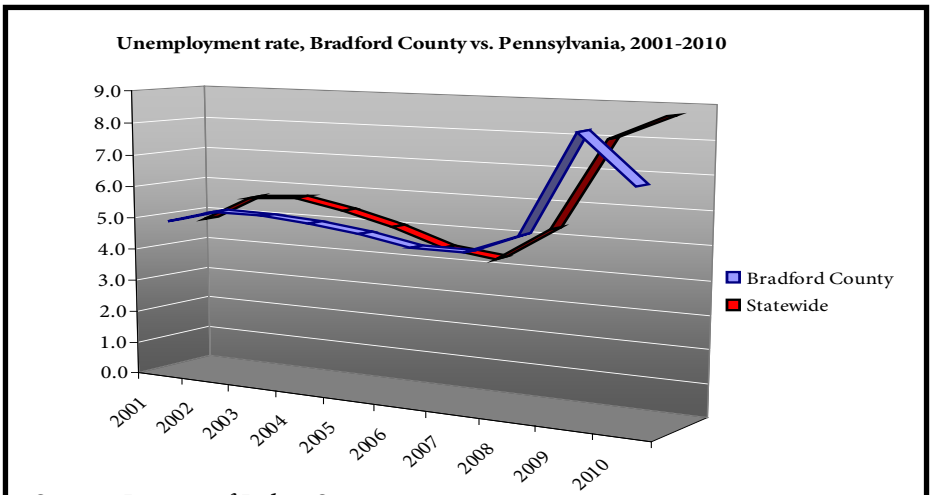
Marcellus Shale Drilling: Effects on the County Level

Bradford County sits among the Endless Mountain Range in northeastern Pennsylvania. It has 61,276 residents, ranking it 41st in the state in terms of population. The county recently enjoyed the lowest unemployment rate and the highest private sector job growth in the state. This moderately-sized rural area, however, has not always enjoyed such an economic edge.

In 2001, Bradford ranked 26th in terms of unemployment rate, with an average slightly below that of Pennsylvania as a whole. Five years later, in 2006, Bradford ranked 27th.

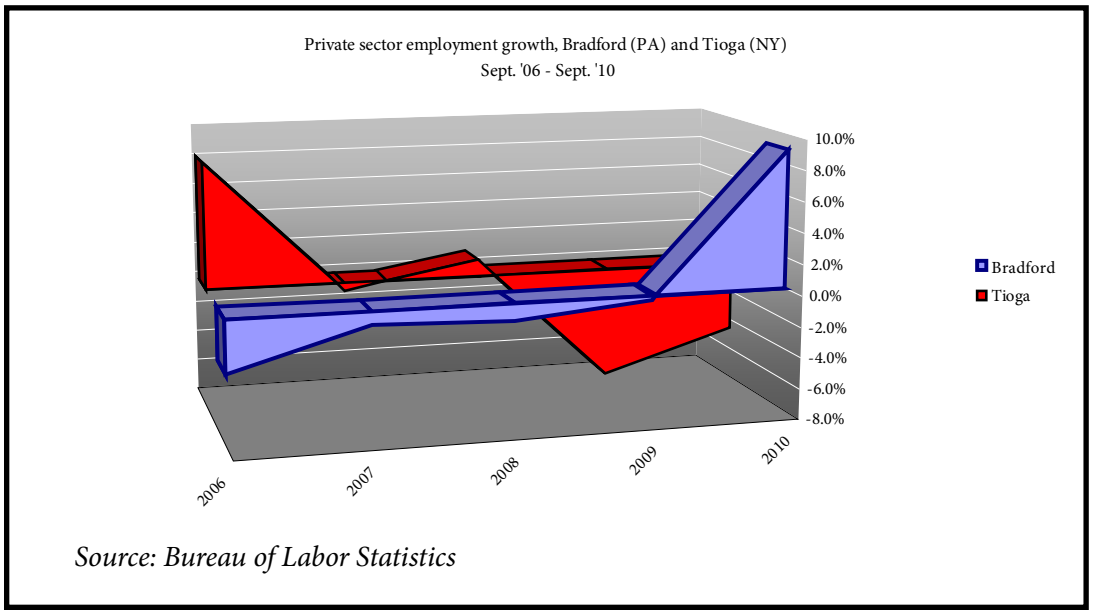
This changed as hydraulic fracturing became more and more prevalent in the county. Bradford had the most Marcellus Shale wells drilled in 2010 (386), and the second lowest unemployment rate in the state in March 2011 (5.9 percent).

Bradford County gained 1,632 private sector jobs between Sept. 2009 and Sept. 2010, representing 8.9 percent growth, while Tioga County (PA),which had the second most wells drilled in 2010, saw a 3.4 percent increase in private sector growth.



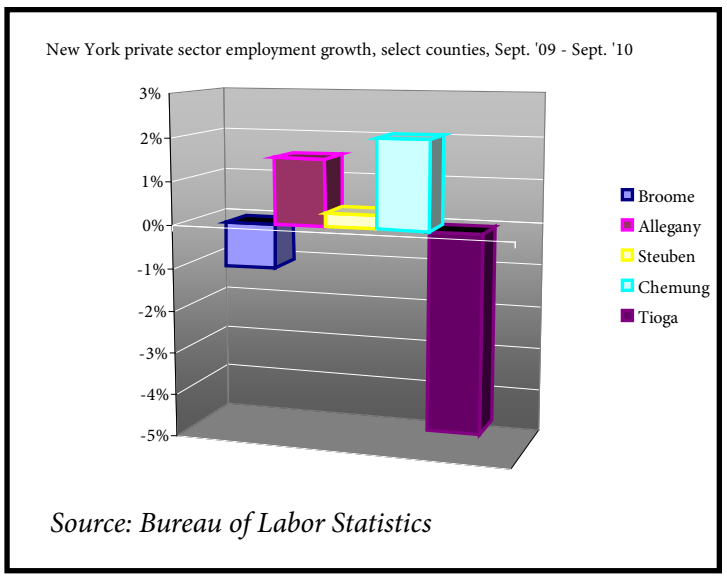
Source: Bureau of Labor Statistics

Comparing Bradford County to one of its neighbors across the state line, Tioga County (NY), we find that year-to-year private sector employment growth has steadily increased from Sept. 2006 in Bradford, while the private sector growth rate has steadily declined in Tioga. Tioga (NY) has a population of 49,610, according to recent census estimates, and in March 2011, had an unemployment rate of 8.1 percent. Between Sept. 2009 and Sept. 2010, private sector employment declined by 4.6 percent. According to NYS DEC data, Tioga (NY) only had one gas well drilled in 2010.

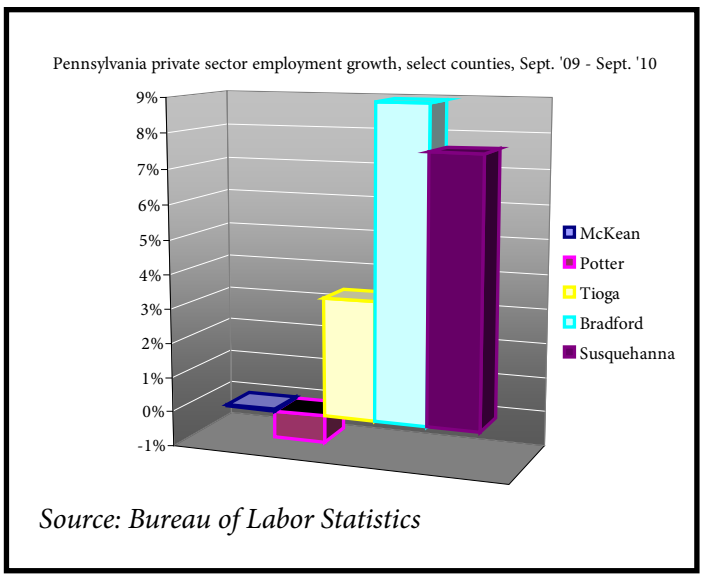


Source: Bureau of Labor Statistics

In comparing McKean, Potter, Susquehanna, Bradford and Tioga counties in Pennsylvania to Allegany, Steuben, Chemung, Tioga and Broome counties in New York, we find that between 2009 and 2010, private sector employment grew in the five-county Pennsylvania region by 4.7 percent, or 2,425 jobs, while average private sector employment in the New York region fell by -0.3 percent, a loss of 389 jobs. The counties in Pennsylvania also saw a drop in the unemployment rate from 9.2 percent to 8.4 percent during that same time period, while the New York State region experienced, as an aggregate, a 0.2 percent rise in unemployment.



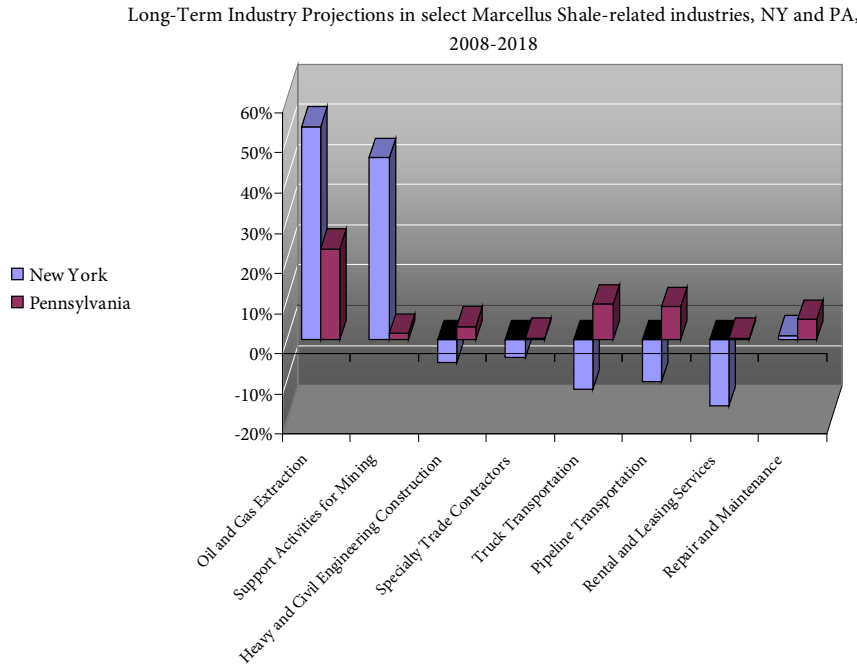
Source: Bureau of Labor Statistics



Source: Bureau of Labor Statistics

Economic Development with and without a Moratorium

Limited gas-related job growth would be excepted in New York State over the next decade had a moratorium on shale gas development remain in place. For example, under current conditions, data for the crude petroleum and natural gas extraction sector in New York State points to an increase of only 180 jobs between 2008 and 2018. While in Pennsylvania, this industry is expected to grow by 22.5 percent, for an increase of 600 jobs during this time period.



Source: NYS Department of Labor, PA Dept. of Labor & Industry

The natural gas-related industry experiencing the second greatest expected job growth in New York is Support Activities for Mining at 410 new jobs. Projected growth for these industries is almost exclusively in the Southern Tier and Western New York. (It's important to note that the NYS DOL takes into account national trends and historical data to determine the expected growth rates, and in the case of Marcellus Shale-related industries, the moratorium on hydraulic fracturing was considered when calculating employment projections).

Employment declines, however, are expected in other sectors that encompass Marcellus industries. Heavy and Civil Engineering Construction loses 1,710 jobs; Specialty Trade Contracting sees 10,660 jobs lost from 2008 to 2018. Truck Transportation and Rental and Leasing Services lose 5,000 jobs and 4,130 jobs, respectively.

Despite the NYS DOL's predictions for growth in Oil and Gas Extraction and Support Activities for Mining, if the moratorium on hydraulic fracturing continues, New York will lose out on an estimated 31 (direct) jobs, $2,267,929 in employee wages, $5.46 million in value added and $2 million in federal, state and local taxes per well.[xix]

In contrast, using this same data, we can predict the economic impact of hydraulic fracturing in New York State if the moratorium were lifted and Marcellus Shale development was permitted. Based on a projection of 500 wells, the Empire State could gain 62,620 jobs, $2.7 billion in value added and $1 billion in local, state and federal taxes. PPI arrives at the number for jobs by using the 31 direct jobs-per-well estimate and applying the 3.04 multiplier for this sector of the economy. Employment multipliers vary greatly by sector: the Milken Institute, using the BEA's models, has assumed a 9.20 multiplier for cutting-edge biotechnology and nanotechnology firms[xx], while the construction sector has a multiplier of 1.89.[xxi]

Not only will developing the Marcellus Shale result in increased revenue and private sector job growth, it will remove some individuals from unemployment rolls and expand the tax base, helping to ease the burden on state government and taxpayers.

Hydraulic fracturing scenario for New York State

Wells drilled/year	Jobs created directly	Jobs created through multiplier effect	Total jobs created	Value added	Tax revenue
100	3,100	9,424	12,524	$546 million	$200 million
200	6,200	18,848	25,048	$1.1 billion	$400 million
300	9,300	28,272	37,572	$1.6 billion	$600 million
400	12,400	37,696	50,096	$2.2 billion	$800 million
500	15,500	47,120	62,620	$2.7 billion	$1 billion

Source: Projections based on data from The Economic Opportunities of Shale Energy Development (2011)
**RIMS II multiplier*

If 500 wells were drilled each year, the Empire State could gain 62,620 jobs, $2.7 billion in value added and $1 billion in local, state and federal taxes.

Conclusion

The Public Policy Institute concludes that, in evaluating the potential development of Marcellus Shale gas, it is crucial for New York State to consider the signficant economic potential of this natural resource, in addition to the environmental and public health aspects. Significant economic benefits achieved in Pennsylvania provide clear evidence of the investment and job growth related to shale development. It would be unreasonable for New York state government to disregard the economic benefits that are being achieved below the state line in Pennsylvania.

We recognize that protection of public health and environmental resources – especially public water supplies – will be a crucial element of the state's regulatory program for shale gas exploration. However, given New York's history of adopting some of the most strict environmental standards in the nation, we expect the state's regulation to assure the safe development of hydraulic fracturing in New York's Southern Tier. New York has a great opportunity to expand its historic exploration and development of natural gas resources, capture an extraordinary economic opportunity for depressed regions of upstate New York and help fuel the future of New York and the nation.

Natural gas is a clean-burning energy source and drilling in shale plays throughout the U.S. has become more economically viable with well-drilling technology. Exploring this technology will help reduce our dependence on foreign energy resources, create a more robust business climate and increase individual wealth, tax revenues and create jobs.

This report has examined the impressive private sector job growth in Pennsylvania, a state which is at the forefront of Marcellus Shale development, and found that counties which utilize the natural gas resource have benefited economically. Bradford County had the highest number of Marcellus wells drilled in 2010, along with significant job growth (8.9 percent between Sept. 2009 and Sept. 2010) and one of the lowest unemployment rates in the state. After examining five counties in the Southern Tier (Allegany, Broome, Chemung, Steuben and Tioga) and five counties just south of the New York State border (Bradford, McKean, Potter, Steuben and Tioga), we found that the region in Pennsylvania experienced a 4.7 percent increase in private sector employment during 2006-2010, or 2,425 jobs, while the private sector job growth in the New York region was -0.3 percent, representing a loss of 389 jobs.

In addition, Marcellus Shale industries enjoy a significant wage advantage. In New York, the aggregate average annual wage for Oil and Gas Extraction and Support Activities for Mining is $79,184, which is over double the average private sector wage in upstate New York of $39,157. In Pennsylvania, the average annual wage in the six core Marcellus Shale industries was $73,159 in 2010 — $27,400 greater than the average wage for all industries statewide — according to the Pennsylvania Department of Labor & Industry.

Pennsylvania has already experienced over $1 billion in tax revenue from oil and gas companies and their affiliates since 2006.

In a time when New York's economy is slowly returning to fiscal stability after the devastating global recession, such tax benefits would be invaluable to the Empire State.

Data from the NYSDOL indicates that Shale-related industries will enjoy significant growth through 2018, taking into account the possibility of a continued moratorium. However, using data from the Manhattan Institute study we find that by banning exploration of this valuable resource, we lose out on an average of 31 (direct) jobs and $5.46 million in value added per well.

Restricting the development of natural gas in the Southern Tier would be detrimental to reviving our state's economy and a disservice to New Yorkers who want to see good-paying jobs and investment in the Empire State. Based on the private sector job growth potential and tax revenues, PPI fully supports lifting the current restriction on hydraulic fracturing in the Marcellus Shale and moving forward with a balanced regulatory program allowing exploration and production in the Marcellus Shale formation.

List of Charts

Endnotes

i. pg. 37 of The Economic Impacts of the Marcellus Shale

ii. Data based on 31 direct jobs-per-well estimate used in The Economic Opportunities of Shale Energy Development plus 3.04 multiplier

iii. pg. 28 of The Economic Impacts of the Marcellus Shale

iv. According to the Department of Energy's National Energy Technology Laboratory, a new water cleaning technology currently being tested has been found to remove over 99 percent of oil and grease, over 90 percent of dissolved BTEX (benzene, toluene, ethylbenzene and xylenes) and significant amounts of production chemicals

v. Lisa Jackson touted natural gas as a cleaner alternative to other fossil fuels in her testimony to the House Oversight and Government Reform Committee

vi. The Economic Impacts of the Marcellus Shale (2010), Intro

vii. NYS DEC

viii. The Economic Impacts of the Marcellus Shale, intro

ix. Bounty from Below, pg. 7

x. Bounty from Below, pg. 8

xi. www.geology.com/articles/utica-shale/

xii. www.citizensvoice.com/news/expert-finding-natural-gas-in-utica-shale-is-unlikely-more-overcooked-than-marcellus-1.1143799#axzz1PJj6fJK5

xiii. The Economic Impacts of the Marcellus Shale, pg. 27

xiv. www.nyserda.org/programs/Environment/EMEP/conference_2009/presentations/Martin_Dahl.pdf

xv. Marcellus Shale Fast Fasts, pg. 2

xvi. Marcellus Shale Fast Facts, pg. 9

xvii. Pennsylvania's Buried Treasure

xviii.The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update , pg. 10-11

xix. The Economic Opportunities of Shale Energy Development, pg. 6

xx. Let's Make It Here: Keys to a Manufacturing Resurgence in New York, pg. 8

xxi. RIMS II multiplier, www.maine.gov/labor/cwri/publications/pdf/GreenEconomyReport.pdf

Bibliography

The Manhattan Institute, The Economic Opportunities of Shale Energy Development, May 2011

The Public Policy Institute, Let's Make it Here: Keys to a Manufacturing Resurgence in New York, May 2011

Timothy Considine, Robert Watson and Seth Blumsack, The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update, May, 2010

Considine, Timothy, The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia, July 2010

Bounty from Below: The Impact of Developing Natural Gas Resources Associated with the Barnett Shale on Business Activity in Forth Worth and the Surrounding 14-County Area, The Perryman Group, May 2007

Walker, Deborah and Sonora, Robert. The Economic Impact of the Natural Gas Industry in La Plata County, 2003 - 2004, November 2005

National Energy Technology Laboratory (Department of Energy), Breakthrough Water Cleaning Technology Could Lessen Environmental Impacts from Shale Production: DOE-funded Laboratory Testing Leads to Multiple Field Demonstrations, April 28, 2011

www.geology.com, Utica Shale - The Natural Gas Giant Below the Marcellus?

Skrapits, Elizabeth, Expert: Finding natural gas in Utica Shale is unlikely; more 'overcooked' than Marcellus, May 9, 2011

Pennsylvania Department of Labor & Industry, Marcellus Shale Fast Facts, June 2011 Edition

Environmental Protection Agency, Administrator Lisa P. Jackson Testimony before the U.S. House Oversight and Government Reform Committee

New York State Department of Environmental Conservation

New York State Department of Labor

Pennsylvania Department of Labor & Industry, Center for Workforce Information and Analysis

Pennsylvania Department of Environmental Protection

Bureau of Economic Analysis

U.S. Energy Information Administration (EIA)
Annual Energy Outlook 2011, U.S. EIA

Utica Shale – The Natural Gas Giant Below the Marcellus? Stacked plays in the Appalachian Basin produce multiple natural gas play zones, www.geology.com

Grant, Stephen, Pennsylvania's Buried Treasure, Spring 2010 (http://pabook.libraries.psu.edu/palitmap/Marcellus.html)

Maine Department of Labor, Maine's Green Economy: An Overview of Renewable Energy and Energy Efficiency Sectors, February 2010

Martin, John, Marcellus Shale Natural Gas: The Resource, New York State Energy Resarch and Development Authority, October 15, 2009

Maine Department of Labor, Maine's Green Economy: An Overview of Renewable Energy and Energy Efficiency Sectors, February 2010

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Drilling for Jobs

What the Marcellus Shale could mean for New York