

ISSUE BRIEF

SENATE POLICY DEVELOPMENT AND RESEARCH OFFICE

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Natural Gas Production from the Marcellus Shale

Natural gas production from the Marcellus Shale could place Pennsylvania in the vanguard of energy suppliers in the 21st century. With the potential of the Marcellus Shale, its still abundant anthracite and bituminous coal resources, and its proximity to national and international markets, Pennsylvania is poised to be the epicenter of a domestically-based, resurgent energy industry. Ray Walker, Vice President of Range Resources - Appalachia attests: "The oil and gas industry was born in Pennsylvania 150 years ago and ushered in an unprecedented period of world-wide economic growth. The Marcellus Shale opportunity could return Pennsylvania to the energy leadership role it held over a century ago, creating a hundred thousand jobs, or more, and providing a tremendous supply of reliable, clean-burning ... natural gas to our country."



Background

Northeastern and southwestern Pennsylvania is in the midst of a [major natural gas play](#) (exploration and extraction of natural gas from a region) involving the Marcellus Shale. Although the Marcellus Shale has been known to host natural gas for years, conventional recovery technologies limited profitable production. Now, with application of horizontal drilling and hydraulic fracturing methods, the [technically recoverable resource](#) may be 262 trillion cubic feet, enough gas to meet US demand for a decade (US consumption was 23 trillion cubic feet in 2007, according to the Energy Information Administration). In addition, the Marcellus play is ideally sited for supplying natural gas to high-demand northeastern markets.

Dr. John Harper, a geologist with the Pennsylvania Geological Survey, wrote a comprehensive article on the [Marcellus Shale in Pennsylvania](#) for the Spring 2008 issue of *Pennsylvania Geology*. He observed, "The true value of the Marcellus organic-rich shale as a gas reservoir has yet to be determined. Cabot Oil and Gas Corporation, which is leasing and drilling in northeastern Pennsylvania, has been quoted as saying its wells are testing between 800,000 and 1,000,000 cubic feet per day ... It is possible that the Marcellus will ultimately turn out to be the great gas reservoir everyone is fussing about."

The fuss may be warranted. In mid-July 2008, Range Resources provided an [update](#) on its activities in the Marcellus play. Through the first quarter of 2008, Range announced results for 15 horizontal wells, with its last 10 yielding an average initial production rate of 4.1 million cubic feet of natural gas per day. Range has since updated results through the third quarter of 2008, with the latest 18 horizontal wells averaging 4.1 million cubic feet per day. According to the Energy Information Administration, average natural gas well productivity peaked at 435,000 cubic feet per day in 1971.

On November 20, 2008, Range [announced](#) its production from the Marcellus Shale had reached 30 million cubic feet of natural gas per day from seven wells tied-in to its recently completed gas processing facility. By year-end 2009, Range expects to produce 80-100 million cubic feet per day from the Marcellus Shale. Range expects gathering and processing capacity to reach 60 million cubic feet per day in the first quarter of 2009 and to increase to 180 million cubic feet per day by late 2009 or early 2010.

On December 19, 2008, Atlas Energy Resources [announced](#) completion of a vertical well in the Marcellus Shale that produced five million cubic feet of gas in 24 hours, and about 81 million feet over 25 days, for an average of

approximately 3.2 million cubic feet per day. Overall, Atlas has completed more than 100 vertical Marcellus Shale wells, and is also engaged in a horizontal drilling program.

Permitting Activity

Since development of the Marcellus Shale began in 2005, and as of mid-November 2008, the Department of Environmental Protection has issued 566 permits to drill exclusively in the Marcellus Shale. Drilling activities have occurred at 341 Marcellus Shale well sites, which accounts for 60 percent of the issued permits. As of mid-November 2008, the Department had issued 328 drilling permits for exploration in the Marcellus Shale in 2008, with another 137 under review. Thus, 58 percent of the permits issued to drill in the Marcellus Shale have been issued in 2008, while 42 percent were issued in the three prior years combined. Clearly, interest in the Marcellus Shale is on the rise.

Economic Opportunity

Current Oil and Gas Industry

Pennsylvania's oil and gas industry generated approximately \$7.1 billion in economic output in 2007, according to a [report](#) commissioned by the [Marcellus Shale Committee](#) and completed by the Pennsylvania Economy League of Southwestern Pennsylvania in November 2008. The \$7.1 billion comprised:

- \$4.7 billion in direct economic impact, via oil and gas drilling, extraction, and support activities; and
- \$2.4 billion in ripple effects, that is, economic activity created by the oil and gas industry in Pennsylvania, through expenditures for commodities such as food, shelter, clothing, education, and health care.

Importantly, the preceding statistics reflect the industry essentially without any contribution from deep Marcellus Shale gas production (shallow Marcellus production has occurred for years near Lake Erie). In 2007, Pennsylvania was host to roughly 68,000 active oil and gas wells, a total eclipsed only by three states: Texas, Oklahoma, and Kansas. Roughly 2,000 companies operated at least one well in the Commonwealth, with about 200 or 10 percent of them operating at least 100 wells in the Keystone State.

In addition, the state's oil and gas industry pays more than \$200 million annually in royalties to landowners. The Energy Information Administration defines a royalty as "a contractual arrangement providing a mineral interest that gives the owner a right to a fractional share of production or proceeds therefrom, that does not contain rights and obligations of operating a mineral property, and that is normally free and clear of exploration, developmental and operating costs, except production taxes."

Finally, and on an overall basis, Pennsylvania's oil and gas industry engendered more than 26,500 full and part-time jobs in 2007, with jobs in the oil and gas extraction sector paying \$83,065 on average per year, or 47 percent more than the average private sector salary.

Impact of Natural Gas Production from the Marcellus Shale

In May 2008, the Institute for Public Policy & Economic Development (formerly the Joint Urban Studies Center), in Wilkes-Barre, issued a report entitled, [The Economic Impact of Marcellus Shale in Northeastern Pennsylvania](#). In this report, the Institute examined the impact of the relatively mature Barnett Shale natural gas play in Texas, the developing Fayetteville Shale play in Arkansas, and the emergent Marcellus Shale play in (northeastern) Pennsylvania.

In the Dallas/Forth Worth area of Texas, the Institute found the Barnett Shale has had a \$10.1 billion dollar impact on the economy annually, affecting all area industries; and has resulted in 55,000 permanent jobs. In Denton County, one of the Texas counties where the Barnett play is most active, the population was 317,850 in 1995 and 528,950 in 2004; the number of gas wells was 156 in 1995 and 1,460 in 2004; and county mineral revenue was \$88,786 in 1995 and \$2.7 million in 2004. These figures yield the following increases: population, 66 percent; number of gas wells, 836 percent; and mineral revenue, 2,976 percent.

In Pennsylvania, the Institute found:

... many residents indeed have leasing agreements with natural gas companies, that many of these companies have obtained state drilling permits, and that some companies have already begun drilling. Today, 93 drilling permits have been issued and 18 wells drilled in Bradford, Lycoming, Susquehanna and Wayne Counties. Currently, Lackawanna County neither has any drilling permits issued nor wells drilled; however, county records indicate that as of 2008, there are 85 leasing agreements in place. Likewise, Wyoming County does not have any permits issued or wells drilled; there are, however, 594 lease agreements in place with nine energy companies. At the time of this study's completion, there was no data available on how much natural gas the region was producing.

[The Institute] examined the potential cash flow of a typical Pennsylvania well and calculated potential royalties a landowner may receive ...us[ing] Barnett Shale production rates as a base for estimates:

If you own 100 acres of gas-producing land, and you receive a royalty of 15 percent, and natural gas is priced at \$10 per unit [thousand cubic feet], and the daily production rate is 2 million cubic feet ... (a conservative estimate), then [the] total royalty would be \$1,095,000 per year.

Few can predict a well's output ... – especially so early in the Marcellus Shale play ... It is also important to note that output declines quickly at first, but such decline slows towards the well's half life. A well's production typically lasts 20 - 30 years ...

It is very early in the Marcellus Shale play to make any predictions as to how much natural gas production may occur in the region. Many experts [the Institute] spoke to suggested that the play is only in its infancy, but they acknowledge that it has even more potential than either the Barnett or Fayetteville plays. If these predictions hold true, there is the possibility of unprecedented wealth, employment jumps, and significant population increases throughout the region.

Between 2008 and 2011, researchers at Penn State University [estimate](#) every additional \$1 billion in royalty income will generate approximately 7,900 new jobs, more than \$500 million in new Gross State Product, and an increase in real disposable personal income in excess of \$1 billion. According to Ray Walker, Vice President of Range Resources - Appalachia, "More than \$2 billion has already been invested in Pennsylvania during [2008] for lease acquisition and drilling. A similar amount may be invested in 2009, probably with less emphasis on lease acquisition and more on drilling, which means more jobs and economic growth."

Regulation

Current Regulatory Structure

The Commonwealth has regulated the gas (and oil) industry for at least 50 years. The Commonwealth currently regulates the oil and gas industry primarily through the [Bureau of Oil and Gas Management](#) in the Department of Environmental Protection. The Bureau is responsible for:

statewide oil and gas conservation and environmental programs to facilitate the safe exploration, development, [and] recovery of Pennsylvania's oil and gas reservoirs in a manner that will protect the Commonwealth's natural resources and the environment. The bureau develops policy and programs for the regulation of oil and gas development and production pursuant to the [Oil and Gas Act](#), the [Coal and Gas Resource Coordination Act](#), and the [Oil and Gas Conservation Law](#); oversees the oil and gas permitting and inspection programs; develops statewide regulation[s] and standards; conducts training programs for industry; and works with the [Interstate Oil & Gas Compact Commission](#) and the [\[Oil and Gas\] Technical Advisory Board](#).

The Department of Environmental Protection also regulates the oil and gas industry under the Clean Streams Law, the Dam Safety and Encroachments Act, the Solid Waste Management Act, and the Water Resources Planning Act.

In addition, the Department of Labor and Industry regulates certain aspects of drilling under a portion of the Worker and Community Right to Know Act.

County conservation districts, the Fish and Boat Commission, the Delaware and Susquehanna river basin commissions, and the US Fish and Wildlife Service monitor and regulate the effects of drilling on water quality and aquatic life.

Permit Fee Increase

On December 16, 2008, the Environmental Quality Board [approved](#) a fee increase to support costs of permitting and inspecting Marcellus Shale well permits. The existing fee of \$100 had been in force for nearly 25 years. The new fee structure will set a base fee of \$900 with an additional \$100 per 500 feet of well bore drilled past 1,500 feet.

Water Withdrawals

The Susquehanna River Basin Commission regulates water withdrawals of 100,000 or more gallons per day and consumptive uses of water of 20,000 or more gallons per day, based on a 30-day average. (Hydraulic fracturing in a gas well is considered to be a consumptive use.) As of October 15, 2008, all natural gas well development projects in the Basin targeting the Marcellus Shale and involving the withdrawal or consumptive use of water are subject to Commission review and approval. Also, on October 15, the following regulatory approach was recommended to the Commission for deliberation at its meeting on December 4, 2008:

- all requests for consumptive use approvals would go through the administrative Approval by Rule process, rather than the Commission's standard consumptive use application and docketing process;
- the current Approval by Rule process would be expanded by allowing project sponsors to utilize a broader range of water sources as part of their approvals, including public water supplies, discharges from wastewater treatment facilities and other lesser quality water sources, and withdrawals from other sources approved separately by the Commission;
- projects would be regulated on a drilling pad basis, versus the current docket approvals that address consumptive use on a company lease-area basis (the current, more limited Approval by Rule process also employs the drilling pad concept);
- all projects would be required to demonstrate compliance with all state and federal laws for the treatment and disposal of flow-back or produced fluids, including brines;
- regulatory thresholds would be removed, thereby making all Marcellus Shale development activity subject to review; and.
- approvals would be for five years.

On December 4, 2008, the Commission [approved](#) the preceding regulatory changes.

The Delaware River Basin Commission will also play a role in regulating water use within its jurisdiction; however, Marcellus Shale [activity](#) within the Delaware River Basin is limited at this time, with some action in Wayne County.

Legislation

[House Bill 2453](#) (Major-R) was the only Marcellus Shale-related bill introduced in the 2007-08 session of the Pennsylvania General Assembly. Among other provisions, this bill would have amended the Oil and Gas Conservation Law by adding and clarifying definitions and by requiring horizontal wells into the Marcellus Shale to be drilled only in areas where appropriate oil and gas leases exist. House Bill 2453 was referred to the House Environmental Resources and Energy Committee on June 4, 2008.

Potential Policy Considerations

Oil and Gas Conservation Commission

Given the apparent promise of the Marcellus Shale, the time may be right to re-commission an Oil and Gas Conservation Commission. A Commission was established in the Commonwealth by Act 358 of 1961, with powers and duties defined by the Oil and Gas Conservation Law (Act 359 of 1961). It was abolished by [Act 275 of 1970](#), the statute that created the Department of Environmental Resources (since superseded by the Department of Environmental Protection).

A resurrected Oil and Gas Conservation Commission could operate in a manner similar to the [Railroad Commission of Texas](#) and the [Alaska Oil & Gas Conservation Commission](#), to name two examples. The Railroad Commission of Texas has primary regulatory jurisdiction over the oil and natural gas industry, pipeline transporters, the natural gas and hazardous liquid pipeline industry, natural gas utilities, the LP-gas (liquefied petroleum gas, principally propane, used as a vehicle fuel) industry, and coal and uranium surface mining operations. The Alaska Oil & Gas Conservation Commission is an independent, quasi-judicial agency that oversees oil and gas drilling, development and production, reservoir depletion and metering operations on all lands subject to Alaska's police powers; and acts to prevent waste, protect correlative rights, improve ultimate recovery, and protect underground freshwater.

To advance reconstitution of an Oil and Gas Conservation Commission, the Commonwealth may wish to consider the [Model Oil and Gas Conservation Act](#), offered by the Interstate Oil and Gas Compact Commission. The model statute can be a guide in drafting comprehensive oil and gas conservation laws. In addition, it supplies language for centralizing oil and gas conservation regulations in one state agency, with the exception of certain clean air, water permitting, and land use requirements.

Severance Tax

A severance tax, also known as a depletion tax or an extraction tax, is a levy on the value of raw materials, such as minerals and fossil fuels, when they are extracted from the Earth. With the exception of Pennsylvania, states that are major oil and natural gas producers impose a severance tax; these states include Alaska, California, Colorado, Kansas, Louisiana, New Mexico, Oklahoma, Texas, Utah, and Wyoming. Additional taxes imposed on producers in these states include corporate income, property, and sales. In Alaska, producers pay eight state taxes, namely, production, net royalties, corporate income, property, royalties (oil and gas bonuses, rents, interest), royalties to the state's Permanent Fund and School Fund, settlements to Alaska's Constitutional Budget Reserve Fund, and National Petroleum Reserve – Alaska royalties, rents, and bonuses. Taxes paid by producers in Alaska constitute 88 percent of state government revenue.

In its Policy Brief, [Balancing Budgets by Raising Depletion Taxes](#), the New Rules Project posits “adoption of a market-based depletion tax, which applies a tax rate on the value of the resources as opposed to production volume,” could yield \$840 million annually, just by taxing natural gas produced from the Marcellus Shale.

For perspective and cumulatively as of 2007, 8,960 natural gas wells were completed in the Barnett Shale of Texas (the first well was completed in 1982). Total production was 3.690 trillion cubic feet in 2007. The wellhead value of this gas, at \$5.97 per thousand cubic feet, was \$22.029 billion. The severance tax yield, at 7.5 percent, was \$1.652 billion. In fact, the *Book of the States 2008* reported Texas collected \$3.2 billion in severance taxes in 2006 (this collection includes revenues from extraction of crude oil, sulfur, and other commodities in addition to natural gas).

At this time, whether the Marcellus Shale will be developed to the extent of the Barnett Shale is an open question. One truth, however, is the Marcellus Shale natural gas resource is much larger than that of the Barnett Shale; the Marcellus Shale is conservatively estimated to contain as much as 262 trillion cubic feet of technically recoverable natural gas, nearly six times more than the Barnett Shale at 44 trillion cubic feet.

Although ostensibly attractive as a new state revenue source, a severance tax is not without pitfalls. Revenue from such a tax can be inconsistent and unpredictable due to changing commodity prices. A paramount consideration in this discussion will be adopting tax policies that ensure the competitiveness of Pennsylvania's natural gas industry.

Conclusion

Natural gas production from the Marcellus Shale presents Pennsylvania with a singular opportunity to once again become a leader in producing both energy and energy technologies. In response to this emerging opportunity, in November 2008, the Senate Majority Policy Committee held a [Public Hearing on the Marcellus Shale](#) to gather testimony from representatives of the natural gas industry, academia, regulatory agencies, and local government.

Based on the testimony of these interested parties, other considerations to spur natural gas production from the Marcellus Shale include:

- streamlining the permitting process, by synchronizing permit approvals and issuing permits on a drilling pad (several wells in one small area) as opposed to individual well basis;
- managing water so that water sources are protected while also making water available to the industry;
- ensuring waste water is handled effectively from both environmental and economic standpoints;
- deploying enough inspectors to keep the industry in compliance with environmental regulations;
- developing infrastructure that enables natural gas to flow from the wellhead to the market place as rapidly and as economically as possible;
- fostering expanded markets for natural gas, for example, in transportation and electricity generation;
- instituting timely and convenient public availability of well production and other pertinent records to ensure mistakes are not repeated and stakeholders are compensated and taxed fairly; and
- enacting tax policies that preserve the competitiveness of Pennsylvania's natural gas industry.