Policy Matters Ohio

Tax Policy
December 19, 2011

Beyond the Boom

Ensuring adequate payment for mineral wealth extraction

Wendy Patton

Executive Summary

The oil and gas industry is anticipating a boom in natural gas and possibly oil production in Ohio. The mineral wealth that lies under the land can create great private wealth, but in Ohio the one tax that specifically captures a share of that wealth for the people of the state – the severance tax – is low. Ohio ranks 19th among natural gas-producing states and 17th among oil-producing states in production, yet ranked 25th among 35 states in severance tax collections in 2010. Ohio's rate on gas and oil is the lowest among neighboring states with a similar tax, and among the lowest of states with viable shale formations, or plays, that levy a severance tax.

Key findings

- Ohio has one of the lowest severance tax rates among states with a severance tax and with potential for shale oil and/or gas production;
- Stronger severance tax could raise half-billion dollars without undercutting Ohio's ability to benefit from shale gas boom;
- Public costs include road repair and maintenance, schools, fire and police, and social services;
- Public costs of environmental damages are potentially high.

Oil and gas extraction firms pay the commercial activity tax and local property taxes like other firms; their employees pay income and payroll taxes. These are ordinary costs of doing business and in Ohio, business taxes have been substantially lowered since 2005. The oil and gas industry has the potential to create jobs, enrich owners and investors, and add to the tax base. In so doing, it uses up Ohio's natural resources, which will then no longer be available to future investors or citizens. It also has the potential to cause public expenditure – on roads, worker training, environmental clean-up and public services. As industry representatives predict a drilling boom, we need to consider the special costs drilling could impose and the special responsibilities this industry has because of its reliance on natural resources that will be depleted. The wealth that lies under the land should be adequately taxed to pay for costs associated with drilling and to lay the groundwork for a better future for residents of the state.

Would taxation policy similar to that in other states ruin Ohio's chances for oil and natural gas production? Activity in other states indicates it would not. North Dakota's oil production averaged over 460,000 barrels per day in September 2011, more than four and one-half times its September 2005 level, although the severance tax rate is 11.5 percent. Shale gas production is growing in Texas, where the severance tax rate on natural gas is 7.5 percent; Oklahoma, where the rate is 7 percent and Arkansas, where the rate is 5 percent. West Virginia, with a severance tax rate of 5 percent, saw more wells drilled in 2010 than in the biggest year forecast for Ohio between now and 2015.

The up-front costs associated with a drilling boom go beyond the road maintenance and repair issues under debate in Columbus. While the up-front costs of new or burdened roads is a

pressing problem even now in some Ohio counties, other costs can include traffic control, building and zoning services, schools, water and sewer, social services, fire and police. In Ohio, with recent budget cuts to local governments and schools, meeting the up-front demands for a rapid development schedule could be tough. Protecting quality of life could be tougher.

Moreover, this drilling boom brings unusual concerns about environmental impact. Today's drilling involves pumping millions of gallons of water laced with chemicals and other additives into the well ('hydrofracturing' or 'fracking'). Fracking has been exempted from federal safe drinking water standards, but chemicals used in the process have been found in an aquifer that supplies drinking water in Wyoming, where the technique has been used for some time. There are also concerns about toxic emissions.

Pollution brings risk of public costs. In some cases, private drilling firms now provide drinking water to homes where the water supply has been spoiled. If the private firm enters bankruptcy, who provides water? If the groundwater of a city is polluted, and that pollution has lasting impact, how does that population get water to drink? If people are sickened on a widespread basis, how are medical expenses financed? Ohio needs to charge more than it currently does for the oil and gas that will be extracted from the land to prepare for these new, unusual risks.

In this report, Policy Matters Ohio makes the following recommendations to boost the state and provide for the future:

Increase Ohio's severance tax - The state of Ohio implemented the severance tax in 1972 on a mature oil and gas industry. As the industry ramps up for robust expansion, the state can expect new costs at a time when existing public services have been deeply cut and need to be restored. With a five percent severance fee on shale gas, Ohio could see increased revenues of $538 million - just on *new* natural gas production as forecast by industry over the four years between 2012 and 2015. Oil reserves in the shale have not been quantified so projections of revenue are not possible, but the severance tax on oil should be the same as for gas.

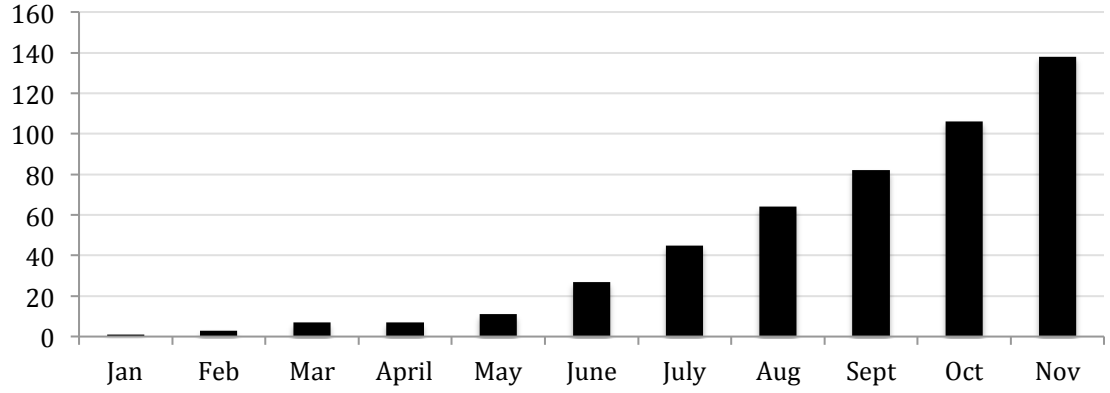
Establish a severance tax trust fund: Seven producing states have established trust funds based on severance or royalty earnings to build sustainable wealth for communities today and into the future. In the case of Ohio, taxes on new oil and gas development could assist with the up-front infrastructure needs associated with drilling, restore some of the cuts to education and otherwise help communities prepare for the realities they will face after the oil boom. Earnings on the funds could support economic development planning for a diversified, post-boom economy in Ohio's communities, particularly those impacted by the drilling and its related industries.

Introduction

The oil and gas that lies deep in shale rock ("shale plays") underneath half of Ohio may boost the economy in the short run, but much of the wealth extracted from the land will leave the state. It is the job of the state to retain an appropriate share of that wealth for the people of the state: to restore services decimated in the most recent budget, to pay for costs associated with local impact of the booming growth forecast by industry, and to build long-term opportunity for quality of life, good public services, clean parks, good schools, affordable colleges and universities, and diverse economic prospects. Ohio's severance tax, the mechanism used to recoup payment for permanent extraction of valuable minerals, is among the lowest of the oil- and gas- producing states. Preparation for the boom should include an increase in the severance tax to help the state recover from the recession, to pay for a transition to a diversified economic future and to cover financial risk associated with new drilling technologies.

On October 11, 2011, the Energy Information Administration (EIA) of the United States government highlighted escalating interest in oil and gas drilling in Ohio. Under a chart illustrating a twenty-fold increase in horizontal drilling permits, the EIA detailed massive land purchases and impressive projections by the State's Department of Natural Resources of oil and gas reserves that could boost Ohio's production.[1]

Figure 1: Cumulative increase in horizontal drilling permits in the Utica and Marcellus Shale Plays through November 27, 2011



Source: Ohio Department of Natural Resources at http://ohiodnr.com/oil/shale/tabid/23174/Default.aspx

Ohio's history in oil and gas production – and looking into the future

Ohio has a long history in oil production, starting in 1814 when oil found in salt brine wells was bottled and sold as medicine.[2] By 1868 the firm of Rockefeller, Andrews and Flagler ran the

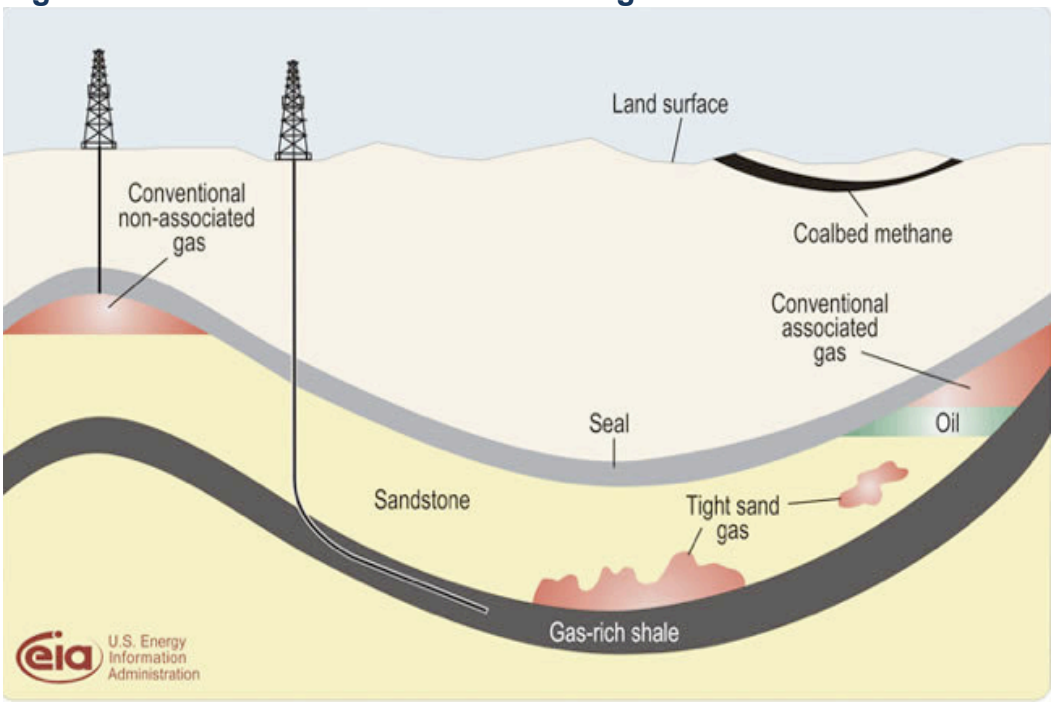
[1]Energy Information Administration, "Oil and natural gas drilling in Ohio on the rise," Today in Energy, September 2011. http://205.254.135.24/todayinenergy/detail.cfm?id=3430. See also Bob Downing, "Gas exploration sparks economic surge in Carroll County," Ohio.com, 12/11/2011. http://www.ohio.com/news/local-news/gas-exploration-sparks-economic-surge-in-carroll-county-1.249839 "*Ohio has a very confusing counting method, and one must be careful in assessing the numbers. In most cases, two state permits are needed for each well: one for the vertical shaft and one for the horizontal shaft…"*

[2] Federal Writers Project, "West Virginia: A guide to the Mountain State" at http://books.google.com/books/index

largest refinery in the world in Cleveland; in 1870 it became Standard Oil.[3] Ohio's peak oil production occurred in 1896, with a yield of 23.9 million barrels. Refineries that served the giant Lima-Indiana oilfield (discovered in 1885) sprang up in Northwestern Ohio; Marathon Oil is still in Findlay. Today the remains of a mature petroleum production, processing, and distribution industry stretch across the Ohio landscape (as well as under it), although production is much diminished. Most of Ohio's 64,378 active wells are classified as "stripper" wells that produce less than 10 barrels of oil or less than 60 thousand cubic feet (mcf) of gas per day.[4] In 2009, Ohio ranked 19th out of 32 natural gas-producing states identified by the EIA and produced .41 percent of national production. It ranked 17th among the 31 oil-producing states, with .30 percent of national production (Appendix, Table 1A).

Today, new drilling techniques and technologies allow access to concentrated reserves in shale formations deep underground. Horizontal boring permits greater collection through a single drilling effort. A technique known as hydrofracturing ("fracking") pumps millions of gallons of pressurized water laced with chemicals and other additives into the bore to fracture the rock and release trapped oil and gas (Figures 2 and 3). Great well productivity is possible when the two techniques are used together.

Figure 2: Illustration of horizontal drilling

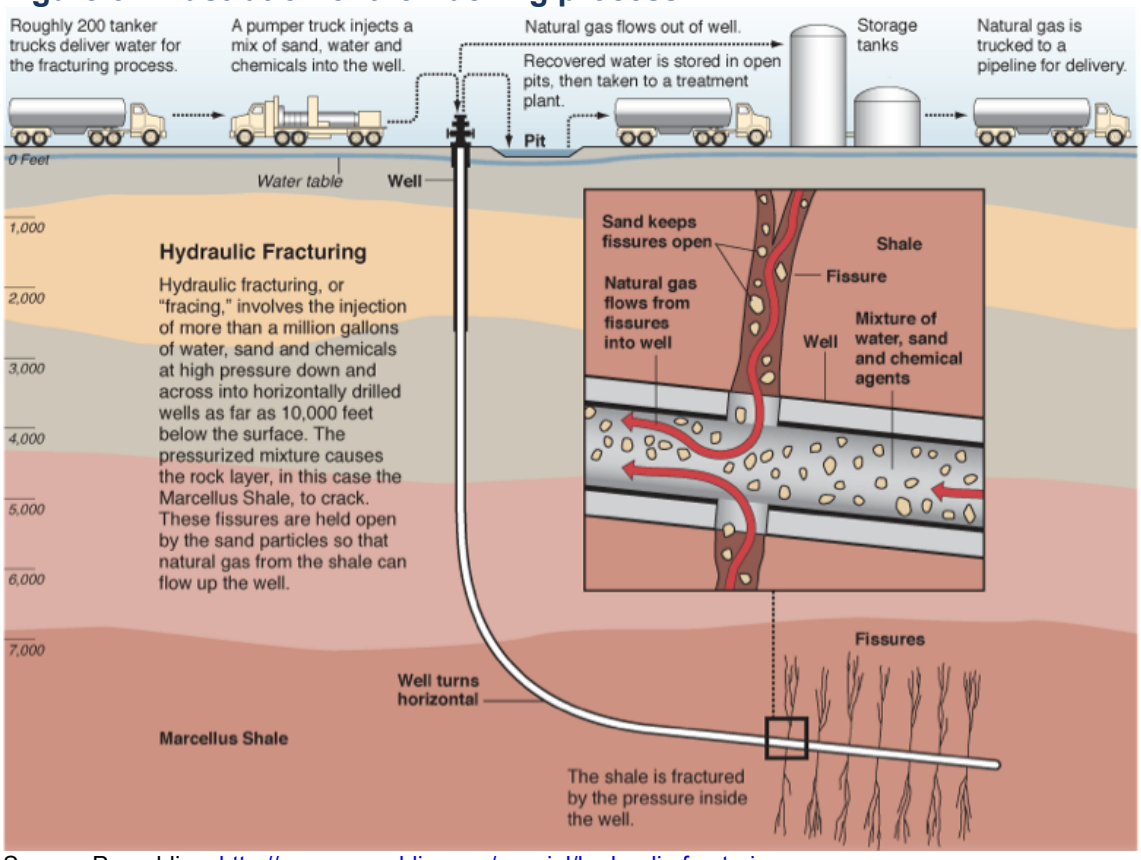


Source: US Energy Information Administration

Figure 2 shows the layer of shale that lies deep underground; Figure 3 illustrates how it is mined.

[3] Public Broadcasting Station (PBS Home), "John D. Rockefeller Senior: 1839-1937" at http://www.pbs.org/wgbh/amex/rockefellers/peopleevents/p_rock_jsr.html (10/18/2011)
[4] Ohio Department of Natural Resources, Oil and Gas Program History at http://www.ohiodnr.com/mineral/program/tabid/17865/default.aspx

Figure 3: Illustration of the fracking process



Source: Propublica, http://www.propublica.org/special/hydraulic-fracturing

Shale is the oldest source of oil, noted in records dating back to the 10th century.[5] The Office of the Naval Petroleum and Oil Shale Reserves was established in the United States in 1927.[6] Throughout the century the federal government worked closely with industry to develop a commercially viable way to tap the resources in shale, even trying a nuclear explosion to access natural gas reserves. [7]

Shale plays in Ohio

According to the Energy Information Administration's "Annual Energy Outlook for 2011," production of natural gas from underground shale formations in the United States grew by an average of 17 percent per year from 2000 to 2006, and by an average of 48 percent annually from 2006 to 2010. Further increases in shale gas production are expected, with total production growing almost threefold from 2009 to 2035.[8] Oil production from shale has also grown

[5] International Society for Analytical and Molecular Morphology, "History of the Oil Shale Industry at http://www.isamm.org/shale-oil-extraction.htm

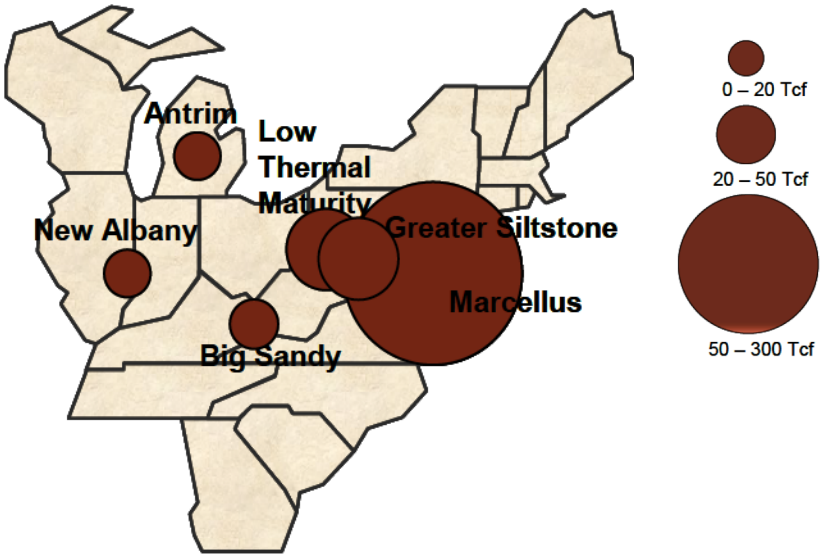
[6] The Naval Petroleum and Oil Shale Reserves – 90 Years of Ensuring the National Security at http://fossil.energy.gov/programs/reserves/npr/npr-90years.html

[7] United States Department of Energy, Office of Environmental Management, "Rulison Site," at http://www.em.doe.gov/SiteInfo/RulisonSite.aspx?PAGEID=PRJ

[8] Energy Information Administration, Annual Energy Outlook 2011, http://www.eia.gov/forecasts/aeo/chapter_executive_summary.cfm#domestic

rapidly,[9] although this is a more recent development and there is less certainty around projections of reserves.[10] Ohio is at the center of a region with significant potential for shale production (Figure 4).

Figure 4: Shale plays and production potential, Northeast Region



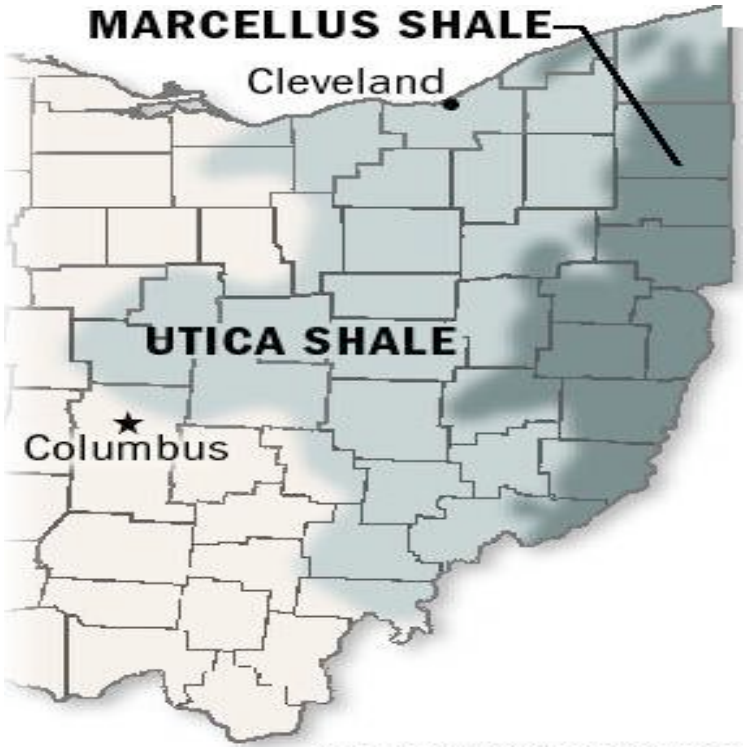
Source: Energy Information Administration, Review of Emerging Resources, US Shale Gas and Shale Oil Plays, July 2011 ftp://ftp.eia.doe.gov/natgas/usshaleplays.pdf Note: Tcf is Trillion Cubic Feet.

A small portion of the Marcellus shale play (See the largest circle in Figure 4) lies under eastern Ohio and most of West Virginia, Pennsylvania and New York; the Utica shale play lies under the Marcellus (Figure 5).

[9] Energy Information Administration, "Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays," July 8, 2011, http://www.eia.gov/analysis/studies/usshalegas/ (accessed 10/18/2011)

[10] Energy Information Administration, Annual Energy Outlook 2011. "…*The combination of two technologies—horizontal drilling and hydraulic fracturing—made it possible to produce shale gas economically, and from 2006 to 2010 U.S. shale gas production grew by an average of 48 percent per year. Further increases in shale gas production are expected, with total production growing almost threefold from 2009 to 2035 in the AEO2011 Reference case. However, there is a high degree of uncertainty around the projection, starting with the estimated size of the technically recoverable shale gas resource."*

Figure 5: Utica and Marcellus Shale Plays in Ohio



Source: Taken from Google web images – The Columbus Dispatch – from Spencer Hunt, "Oil-Gas Land Leases: Owners Unite, Hire Lawyers," The Columbus Dispatch, November 13, 2011.

Opportunity underground

In Ohio, drilling has been concentrated in eastern counties, in the Marcellus region. Less is known about the Utica shale play, which extends to central Ohio. Forecasts for the Utica have not yet been published by the EIA, but Ohio's Department of Natural Resources (ODNR) has published its own estimates of reserves and production potential, which suggest a recoverable reserve potential of between 1.3 and 5.5 billion barrels of oil and 3.8 to 15.7 trillion cubic feet of natural gas.[11] On the low end, this indicates more oil and gas remain in Ohio's shale reserves than all that has been extracted to date in the state.

Shale is a concentrated resource and the new drilling techniques, which combine horizontal drilling and hydrofracturing, allow for much greater productivity. A "typical" conventional gas well in the Appalachian Basin produces 100–500 thousand cubic feet (MCF) of gas per day and 200–500 million cubic feet (MMCF) in its life, earning $2,000,000 (500 MMCF x $4/MCF*= $2M gross revenue.) A horizontal Marcellus (or Utica) well may produce around 2–10 MMCF of gas per day and are projected to average around 4 billion cubic feet (BCF) of gas over their life, per well, earning $16,000,000 (4 BCF x $4/MCF*= $16M gross revenue.) [12]

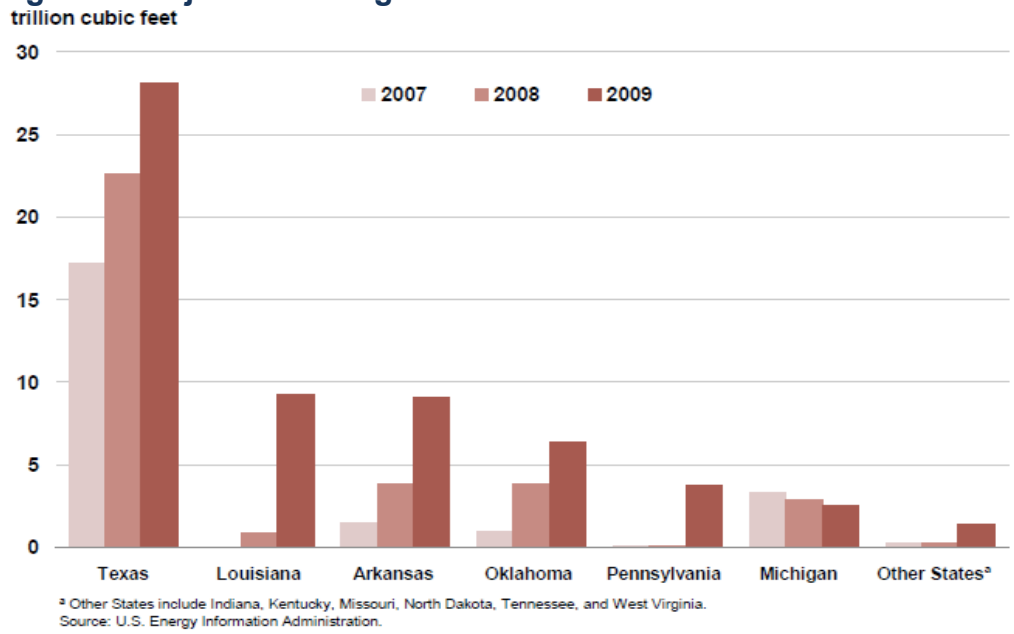
[11] Larry Wickstrom, Chris Perry, Matthew Erenpreiss and Ron Riley, "The Marcellus and Utica Shale Plays in Ohio: Geology, History and Oil and Gas Potential in Ohio", March 2010, at www.ooga.org/docs/2011WinterMeeting/2011WMPresentations/11WM-LWickstromPresentation.pdf.

[12] Chris Perry and Larry Wickstrom, "The Marcellus Shale Play: Geology, History, and Oil & Gas Potential in Ohio", Ohio Geological Survey, October 2010 at www.dnr.state.oh.us/Portals/10/Energy/Marcellus/The_Marcellus_Shale_Play_Wickstrom_and_Perry.pdf

Industry interest in Ohio is signaled by active land acquisition. In September, Hess Corporation announced its $750 million acquisition of Marquette Exploration LLC, which included a 100% interest in 85,000 acres. The Marquette purchase followed another deal in which Hess paid $593 million to CONSOL Energy for a 50% stake in about 200,000 acres. Hess' deals follow a series of transactions though which Chesapeake Energy amassed 1.25 million acres at a reported cost of between $1.5 billion and $2 billion.[13]

Ohio is one of several states with shale formations (Appendix, Figure 1A). The EIA has identified a dozen states with potential for significant increase in production of shale gas: Texas, Louisiana, Arkansas, Oklahoma, Pennsylvania, Michigan, Indiana Kentucky, Missouri, North Dakota, Tennessee and West Virginia (Figure 6).

Figure 6: Major Producing States in Shale Gas



Source: The Energy Information Administration, U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Proved Reserves, 2009, http://www.eia.gov/oil_gas/natural_gas/data_publications/crude_oil_natural_gas_reserves/cr.html

The transfer of fracking technology from gas to oil was considered doubtful at one time, but demand drove innovation; the National Petroleum Council suggests (in careful terms) production of oil from domestic shale plays could grow to three million barrels a day.[14] Key shale oil producing states identified by the EIA include Texas, North Dakota and Pennsylvania; in addition, shale oil production may increase in Texas, Montana, Wyoming, Oklahoma, Colorado,

[13] Energy Information Administration, Oil and Gas Drilling Activity in Ohio on the Rise, "Today in Energy," October 11, 2011.

[14] National Petroleum Council Resource Study, "Prudent Development: Realizing the potential of North America's Abundant Oil and Gas Reserves, " (Approved Draft), September 15 2011 at http://www.npc.org/ : "*Tight oil, such as that produced in the North Dakota/Montana Bakken play, is an emerging resource type, which has ramped up to about 0.4 million barrels per day within the past three or four years. This type of production is likely to grow to between 2 and 3 million barrels per day depending on access to new plays and continued technology development, and the pace at which new drilling can offset decline rates of existing production.*"

California, Ohio, Michigan, Nebraska and Kansas.[15] It is worth noting that the potential of shale oil production is less certain than that of natural gas,[16] although shale oil production is robust in some places.

As Ohio contemplates a drilling boom, opportunities and dangers should be assessed. Price drives drilling activity, particularly in natural gas (Appendix, Figure 2A). Employment in the sector is tied to production, which can change rapidly (Appendix, Figure 3A). This creates the boom-and-bust economic conditions that may prevent an area from stabilizing and benefitting from local wealth creation.[17] In the case of shale rock extraction, risk is heightened because of uncertainty around environmental and public health impacts of the new drilling techniques.

The Boom: Industry projections, possible costs

In September of 2011, the Ohio Oil and Gas Energy Education Program (OOGEEP) forecast economic impact of oil and gas exploration and production in the Utica Shale play, which lies under the Marcellus shale play and reaches to central Ohio. Their forecast, for natural gas production alone, predicts 4003 wells will be drilled in Ohio between 2011 and 2015 (Table 1).

Table 1: Natural gas wells projected in the Utica shale play in Ohio, 2011-2015

Year	Wells drilled	Thousands of cubic feet of gas produced
2011	27	---
2012	161	17,053,411
2013	785	116,357,749
2014	1386	591,406,043
2015	1644	1,269,345,132

Source: Kleinhenz and Associates,"Ohio's Natural Gas and Crude Oil Exploration and Production Industry and the Emerging Utica Gas Formation Economic Impact Study," Ohio Oil and Gas Energy Education Program, September 2011.

Recent drilling in the Marcellus shale has occurred in West Virginia (1,896 new wells in 2010) and Pennsylvania (833 new wells drilled in 2010).[18] The industry projects Ohio's pace of drilling will approach that of West Virginia by 2015. A survey of communities with wells recently drilled in Pennsylvania found population growth, increased demand for services, infrastructure impact and both rising and falling property values. Forty-three percent of respondents reported an increase in population and 39 percent saw higher school enrollment. Use of public services increased: for example, 30 percent saw a rise in use of emergency services. Road maintenance

[15] Institute for Energy Research, Turning Tide for World Oil Supplies, November 8 2011 at http://www.instituteforenergyresearch.org/2011/11/08/the-turning-tide-for-world-oil-supplies/ and EIA, United States: Oil production from shale formations, 2005-1010, May 6 2011 at http://petroleuminsights.blogspot.com/2011/05/united-states-oil-production-from-shale.html

[16] Headwater Economics: "Oil Shale in the West: 14 unanswered questions about shale oil," a synopsis of the literature, 2010 at http://headwaterseconomics.org/pubs/energy/14Questions_2010.pdf (accessed 10/21/2011)

[17] Sean O'Leary and Ted Boettner, "Booms and Busts: The Impact of West Virginia's Energy Economy (Section Two: Booms & Busts: The Imapct on Mining Counties),' West Virginia Center on Budget and Policy, July 2011

[18] Pennsylvania Budget and Tax Policy Center, "West Virginia Led the Nation in New Gas Wells Drilled in 2010," State Budget and Tax News, 4/11/2011 at http://pennbpc.org/fact-check-west-virginia-led-nation-new-gas-wells-2010

increased for 65 percent of responding communities. Conflict was up in some places (21 percent); crime rose in some (17 percent), property values fell in 9 percent of communities and didn't change in 43 percent. Environmental issues around problems in water quality (17 percent) and air quality (13 percent) and other issues (17 percent) were reported.[19]

New investment and economic activity generates new local revenues, but local tax collections lag changes in the economy. Costs associated with up-front needs in rapid growth of drilling include construction and maintenance of roads and bridges,[20] traffic control, need for additional personnel in police, fire, EMS, building code and planning, and expansion of schools and other services. Ohio's local governments, cut by a billion dollars in the recent state budget, could have difficulties coping with increased demands. Energy communities that protected quality of life and amenities in the drilling boom of the 1970s fared better after the boom than those that did not.[21] Given Ohio's very tight local government finances, few communities have extra funds to lay the foundation for later prosperity through a planning process that includes a focus on building and zoning codes as well as studying impacts and establishing ground rules for drillers up front.

The risks mentioned to this point have been to local government finances, but there are also financial risks for the state due to uncertainty in environmental impact. Horizontal drilling and fracking entails the use of millions of gallons of water and additives, including chemicals - some carcinogenic – as well as thickening agents and sand.[22] Unlike other industrial injection processes, fracking has been exempted from the federal Safe Drinking Water Act. However, the Environmental Protection Agency (EPA) says it is studying the issue and investigating complaints. On December 8 of this year, EPA released a draft report on findings from monitoring wells in the aquifer near Pavillion, Wyoming, a community close to fracking activity. According to the release: "*The draft report indicates that ground water in the aquifer contains compounds likely associated with gas production practices, including hydraulic fracturing*."[23] Toxicity in emissions are a source of concern as well.[24] Air emission standards have not yet

---

[19] Marcellus Shale Education and Training Center (MSETC), "Natural Gas Drilling Effects on Municipal Governments in the Marcellus Shale Region (Part IV) Local Government Survey Results from Clinton and Lycoming Counties," http://extension.psu.edu/naturalgas/news/2011/10/natural-gas-drilling-effects-on-municipal-governments-in-the-marcellus-shale-region-part-iv-local-government-survey-results-from-clinton-and-lycoming-counties (accessed 12/07/2011)

[20] "*Energy development has significant impacts on municipal and regional infrastructure, for example. Heavy drilling-related truck traffic brought the small town of Parachute, Colo. - with an annual budget of less than $1 million at the start of the boom - to its knees. Only with a grant of $8 million in severance-tax revenue was it able to tackle the problem by building a new highway interchange.* " – Julia Haggerty, "How to get through the gas boom," *The Philadelphia Inquirer,* January 6, 2011.

[21] Headwater Economics, "Fossil Fuel Extraction and Western Economies," April 2011 at http://headwaterseconomics.org/wphw/wp-content/uploads/Fossilfuel_West_Report.pdf (accessed 11/15/2011)

[22] Deborah Solomon, "SEC Bears Down on Fracking," *Wall Street Journal*, August 25, 2011 at http://online.wsj.com/article/SB10001424053111904009304576528484179638702.html

[23] United States Environmental Protection Agency, "EPA Releases Draft Findings of Pavillion, Wyoming Ground Water Investigation for Public Comment and Independent Scientific Review," news release of 12/8/2011 at http://yosemite.epa.gov/opa/admpress.nsf/1e5ab1124055f3b28525781f0042ed40/ef35bd26a80d6ce3852579600065c94e!OpenDocument

[24] "*In Texas, which now has about 93,000 natural-gas wells, up from around 58,000 a dozen years ago, a hospital system in six counties with some of the heaviest drilling said in 2010 that it found a 25 percent asthma rate for*

been set; final decisions are due out in 2012.

Concerns about pollution and negative environmental impacts are well placed. The Columbus Dispatch reports that Ohio has found 4,681 environmental violations at oil and gas well sites since 2001, including 1,615 for "operations causing pollution and contamination." State officials in Pennsylvania have cited energy companies for more than 2,500 violations associated with fracturing practices and collected $25.7 million in fines since 2008.[25]

Mitigation of environmental damage to individual lessors is governed by lease agreement. Recent scrutiny by the New York Times of more than 111,000 oil and gas leases in several states, including Ohio, found less than half the leases examined require companies to compensate landowners for water contamination after drilling begins.[26] The costs of environmental impact to families and communities from drilling may be greater than anticipated to-date. This could have implications for state government finances in medical, public health and even infrastructure costs.

The severance tax

Oil and gas extraction companies pay the severance tax, the commercial activity tax, which Ohio levies instead of a corporate income tax, and local property taxes. According to the Ohio Department of Taxation, collections of taxes from oil and gas extraction companies in 2010 totaled $9.4 million, which included $2.6 million in severance taxes, $5.1 million in property taxes and $1.7 million in Commercial Activity Tax.[27]

The severance tax, levied on the value (or volume) of the oil and gas as it is extracted from the ground or at the point of first sale, is the main form of taxation on natural resource extraction. In addition to being a robust source of revenue, severance taxes are considered desirable because they shift the weight of the tax to buyers from other states. Since they are deductible from federal corporate income taxes, each dollar in state severance tax is offset by the effective federal rate of the producer (the nominal federal tax rate is 35 percent, so this is, in nominal terms, a $.35 cent deduction against federal taxes.) Figure 7 shows total severance tax collections in states that levy this type of tax. Ohio ranks 25th among the 35 states with a severance tax in terms of total collections.

---

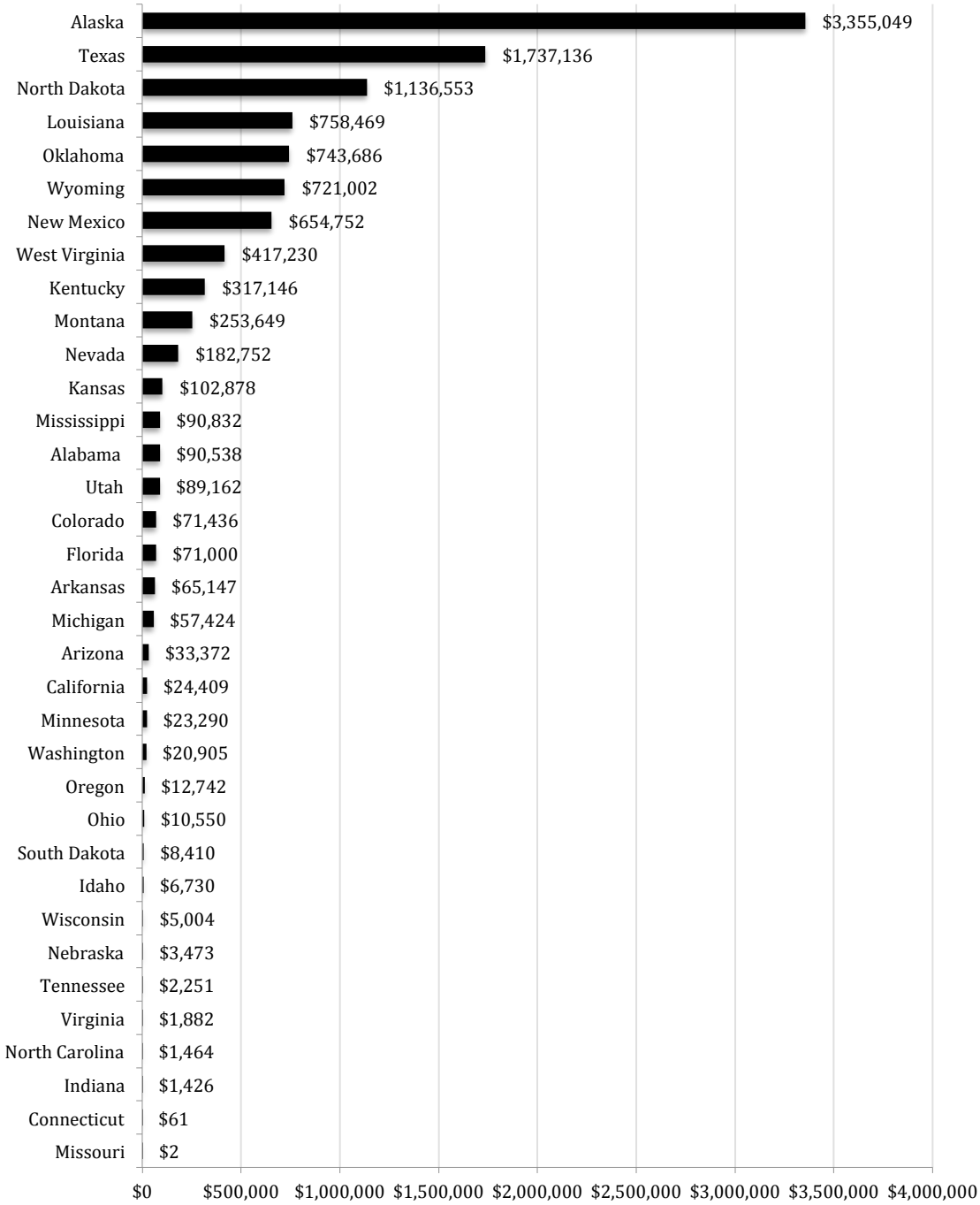
young children, more than three times the state rate of about 7 percent." –Ian Urbina, "Regulation lax as gas wells tainted water hits wells," *The New York Times,* 2/26/2011.

[25] Spencer Hunt, "Fracking Future," *The Columbus Dispatch*, 9/25/2011

[26] Ian Urbina and Jo Craven McGinty, "Learning too late of the perils in gas well leases," *New York Times,* December 1, 2011.

[27] E-mail from Fred Church of the Ohio Department of Taxation; according to the Ohio Department of Taxation, there were 421 firms classified in oil and gas extraction (NAIC 211110) that paid $1.7 million in CAT in 2010.

Figure 7: Severance tax collections ranked by state, 2010 ($millions)



Source: Policy Matters Ohio, based on data from the United States Census of Governments 2010; includes taxes on all minerals, not just oil and gas.

The severance tax is Ohio's primary form of state tax to which mineral wealth is subject.[28] Ohio's collections of oil and gas severance taxes for the past decade are shown in Table 2. Ohio's rate on natural gas is $.025 per thousand cubic feet (mcf), a flat rate levied on volume. An additional fee of $.005 per mcf was added for a conservation fund with the passage of Senate Bill 165 in 2010. As in other states, this increment is structured like the severance tax, but is differentiated because it is dedicated to a conservation fund. The severance tax rate on oil is $.10 per barrel, a flat fee on production volume. An additional $.10 per barrel was recently added for land reclamation.

Table 2: Oil and gas production and severance tax collections in Ohio

	Natural gas		Oil	
Fiscal Years	Production (mmcf)	Severance tax collection	Production (000/bbl)	Severance tax collection
2011	n/a	$2,055,583	n/a	$474,886
2010	78,122	$2,067,986	4,785	$487,166
2009	88,824	$2,084,400	5,009	$505,428
2008	84,858	$1,973,148	5,554	$528,280
2007	88,095	$1,945,713	5,455	$505,876
2006	86,315	$2,023,076	5,422	$530,817
2005	84,135	$2,104,101	5,652	$510,481
2004	90,301	$2,155,185	5,785	$535,399
2003	93,641	$2,251,683	5,647	$570,225
2002	97,154	$2,245,761	6,004	$553,643
2001	98,255	$2,322,192	6,050	$561,682

Source: Policy Matters Ohio, based on data from Ohio Department of Natural Resources and Ohio Department of Taxation. Note: MMCF is per million cubic feet; BBL is per barrel. Data on production is based on calendar year. Severance tax collections are taken on fiscal year collections. Conservation fees are not reflected in this table.

Ohio's ratio of severance tax collections to the value of production is very small. During the past decade this ratio has averaged .37 percent of market value of natural gas and .19 percent of the market value of oil (Table 3).

[28] Reserves are subject to the local property tax.

Table 3: The severance tax: Ohio's effective tax rate (ETR) on natural gas, and oil, annual and average over the past decade.

Year	Market value of natural gas	Natural gas severance tax collections	ETR on natural gas	Market value of crude oil	Oil severance tax collection	ETR on crude oil
2001	$441,164,950	$2,055,583	0.47%	$132,132,000	$561,682	0.43%
2002	$345,868,240	$2,067,986	0.60%	$135,090,000	$553,643	0.41%
2003	$552,481,900	$2,084,400	0.38%	$156,083,080	$570,225	0.37%
2004	$577,123,783	$1,973,148	0.33%	$219,858,464	$535,399	0.24%
2005	$759,739,281	$1,945,713	0.26%	$299,709,916	$510,481	0.17%
2006	$668,942,025	$2,023,076	0.30%	$338,507,571	$530,817	0.16%
2007	$651,901,017	$2,104,101	0.32%	$369,223,837	$505,876	0.14%
2008	$829,126,591	$2,155,185	0.26%	$520,949,200	$528,280	0.10%
2009	$387,166,839	$2,251,683	0.58%	$278,272,810	$505,428	0.18%
2010	$362,000,440	$2,067,986	0.57%	$356,089,056	$487,166	0.14%
Total	**$5,575,515,066**	**20,728,861**	**0.37%**	**$2,805,915,934**	**$5,288,997**	**0.19%**

Sources: Policy Matters Ohio, based on data from Ohio Department of Natural Resources and Ohio Department of Taxation. Market value for 2004-2010 taken from the Summary of Oil and Gas Activities for each year. 2001-2003 are calculated from wellhead prices given in the Summary. Market value is on a calendar year basis and tax collecions are on a fiscal year basis.

Ohio's severance tax rate on natural gas is the lowest of states with shale gas potential that have a severance tax. While not all states with shale gas potential have such a tax (Pennsylvania, New York and Missouri do not), among those that do, Ohio has the lowest (Table 4). The same is true of oil: of states with shale oil potential that levy a severance tax, Ohio's is the lowest (Table 5).

Table 4: Gas severance tax rates in Ohio and states with shale gas potential

State	Nominal rate
Texas	7.5 percent
Oklahoma	7 percent
Arkansas	5 percent
Michigan	5 percent
West Virginia	5 percent
Kentucky	4 percent
Tennessee	3 percent
Louisiana	$0.16/mcf
Indiana	1 percent
North Dakota	$0.11/mcf
Ohio	$0.025/mcf
Pennsylvania	0
Missouri	0

Source: Policy Matters Ohio, based on Society of Petroleum Evaluation Engineers at http://www.spee.org/images/PDFs/ReferencesResources/SPEETaxes_11_2011.pdf, Intelliconnect.
Notes: MCF is per thousand cubic feet. In ND, LA and OH, the rate is based on volume. LA effective tax rate based on data from the PA Budget and Policy Center; OH effective tax rate based on Table 3, above; IN rate is the greater of $.03 per mcf or 1 percent of value, 1 percent is used in this table; PA and MO do not levy a severance tax on natural gas; NY lies over the Marcellus Shale but a moratorium on drilling related to ground water concerns takes them out of consideration at present. Figures do not include conservation fees.

Table 5. Oil severance tax rates in Ohio and states with shale oil potential

State	Nominal rate
North Dakota	11.5 percent
Montana	9.26 percent
Kansas	8 percent
Oklahoma	7 percent
Wyoming	6 percent
Michigan	5 percent
Colorado*	5 percent
Texas	4.5 percent
Nebraska	3 percent
California	$0.11/bbl
Ohio	$0.10/bbl
Pennsylvania	0

Source: Policy Matters Ohio. Policy Matters Ohio, based on Society of Petroleum Evaluation Engineers at http://www.spee.org/images/PDFs/ReferencesResources/SPEETaxes_11_2011.pdf, Intelliconnect,
Notes: BBL is per barrel. CA allows local severance taxes in addition to state tax; OH effective tax rate based on Table 4, above; CO has three brackets, 5 percent is on earnings over $300,000; MT rate of 9.26 percent is on working interests, state has a top rate of 15.26 percent on non-working interests. Figures do not include conservation fees.

Table 6 compares regional severance tax rates and looks at revenues that could be raised for Ohio's production of natural gas under the severance tax rates of neighboring states in the Midwest. At current rates, Ohio's severance tax would collect $340,727 from the new shale gas production on industry gross receipts of $92 million in 2012.[29] Collections would rise year over year, for total severance tax collections over the four-year period of $39.8 million on industry gross receipts of $10.7 billion. At the severance tax rates of West Virginia or of Michigan - 5 percent on natural gas – Ohio would collect $538 million from production projected by the industry for 2012 to 2015. Kentucky's rate of 4.5 percent would yield $484 million; Tennessee's 3 percent rate, $323 million; even Indiana's rate, the higher of $.03 per mcf or one percent of value would see over $100 million, assuming a tax rate of one percent of value.

Revenue related to oil production is not considered here because the industry and the government have not yet published projections.

Table 6: Hypothetical collection of severance taxes on shale gas production projected for the state, 2012-2015: using the rates of surrounding states

	2012	2013	2014	2015	Total
Production	*17,053,411*	*116,357,749*	*591,406,043*	*1,269,345,132*	*1,994,162,335*
Gross Receipts	*$92,088,419*	*$628,331,845*	*$3,193,592,632*	*$6,854,463,713*	*$10,768,476,609*
WV - 5%	$4,604,421	$31,416,592	$159,679,632	$342,723,186	$538,423,830
MI - 5%	$4,604,421	$31,416,592	$159,679,632	$342,723,186	$538,423,830
KY - 4.5%	$4,143,979	$28,274,933	$143,711,668	$308,450,867	$484,581,447
TN - 3%	$2,762,653	$18,849,955	$95,807,779	$205,633,911	$323,054,298
IN - 1%	$920,884	$6,283,318	$31,935,926	$68,544,637	$107,684,766
OH - .37%	$340,727	$2,324,828	$11,816,293	$25,361,516	$39,843,363

Source: Policy Matters Ohio, based on data from the Ohio Oil and Gas Energy Education Program study (footnote 30).

The Federal Reserve Bank of Kansas examined the impact of the Great Recession on energy states and details the advantages and disadvantages a robust energy sector bestows on a regional economy.[30] For Ohio, it makes sense to base a greater share of public finance on the energy sector. The problem for the economies of top-tier energy states is vulnerability to price swings in natural resource industries, which are highly sensitive to price. When prices are low, mining lags, employment declines and revenues sag. The advantage is that severance taxes provide support to revenue collection that lags recessionary downswings. Because Ohio's economy is large and diverse, we will not be as vulnerable to industry swings. There are several other advantages to a more robust severance tax for Ohio: one, federal deductibility reduces the impact on producers; two, the tax is borne by end-users out of state when production is exported; three, this is a new source of contribution by a reinvigorated industry and finally, the tax revenue itself could stabilize public finances in a recession.

But industry seeks lower taxes. In Arkansas, a battle rages over efforts to raise the severance tax

[29] These calculations are based on data from the industry report on economic impact: Kleinhenz & Associates, "Ohio's Natural Gas and Crude Oil Exploration and Production Industry and the Emerging Utica Gas Formation Economic Impact Study," Ohio Oil and Gas Energy Education Program, September 2011. Market rate in this study is $5.40/mcf. Production figures are given; they are also included in Table 1, herein.
[30] Mark Snead, "Are the energy states still energy states?" Federal Reserve Bank of Kansas, Vol. 94, 2009.

rates to help with post-recession budget deficits. In Texas, a temporary exemption for high cost wells, initiated in the 1990s when such wells accounted for five percent of production and quietly made permanent in 2003, provides significant subsidies to more than half of all production today; the $1.2 billion tax expenditure contributes to huge budget deficits. In Pennsylvania, the Pennsylvania Budget and Policy Center's tax counter keeps a running tally of the hundred of millions of dollars – growing every second - the commonwealth loses by failing to tax the growing shale gas exploitation. [31] In North Dakota, shale oil extraction expands vigorously, regardless of one of the highest state severance taxes in the nation.

The oil and gas extraction industry is investigating opportunities in geographically diverse locations. These opportunities have significant differences in productivity, potential, access, location, infrastructure, market access, logistics and so forth. Julia Haggerty of Headwater Economics emphasizes what her research has found over the years:

> *"It's important to note that taxes do not deter fossil-fuel development. They are only one of many factors affecting companies' decisions about where to focus their activity. While Wyoming taxes gas production more aggressively than Colorado does, the recent recession had energy companies withdrawing from Colorado's Piceance Basin more quickly than they did from Wyoming's Green River Basin, and they returned to Colorado more slowly".* – Julia Haggerty, "How to get through the gas boom," *The Philadelphia Enquirer,* January 6, 2011.

The common industry practice of playing region against region, state against state and county against county for tax breaks on investment escalates during tough economic times. Yet mineral production is not footloose like factories: production depends on the nature of the resource underground. The supply chain above ground impacts profitability as well. In places without gas transmission infrastructure, natural gas is flared in the oil fields. Ohio, on the other hand, with complex upstream and downstream suppliers, significant transmission capacity, a vast market in-state and close proximity to industrial markets in the east and Midwest, offers unique advantages from many different perspectives.[32]

Studies of state taxes in have shown that severance tax rates have little effect on production.[33] A University of Wyoming study found that a two percentage point reduction in the state's oil severance tax would increase production by only 0.7 percent over 60 years while dramatically decreasing government revenue. However, the study also found that raising taxes had a negligible effect on production, and that "the main effects of the tax increase would be to dramatically increase Wyoming's severance tax revenues and to reduce federal corporate income taxes paid by producers."[34]

A study in Utah found similar results; that even significant changes to severance tax rates had

[31] The Pennsylvania Budget an Policy Center at http://pennbpc.org/gas-drilling-tax
[32] Ohio Business Development Coalition, "Marcellus and Utica shale gas supply chain, " white paper, 2011.
[33] This section draws on the work of Sean O'Leary and Ted Boettner of the West Virginia Budget and Policy Center, Marshall University Natural Gas Study Proves Virtually Nothing, *Fiscal Policy Memo*. 10/19/2011.
[34] Shelby Gerking, et al, "Mineral Tax Incentives, Mineral Production and the Wyoming Economy," December 2000.

large impacts on government revenue, but very little impact on industry production.[35]

A Penn State study found that every $100 million in severance tax imposed on oil and natural gas companies would create a "net gain" of more than 1,100 jobs and would slightly boost gross state product. The study found this was largely because the negative effects of the imposed severance tax on employment, output, and income did not offset the increased spending of severance tax revenue by state and local government. [36]

Ohio has an industrial structure ideally suited for oil and gas production, with suppliers, distribution infrastructure, and a vast market. Business taxes have been dramatically cut in the past five years. There is no corporate income tax; the commercial activity tax is low and does not apply to out-of-state sales.[37] Increasing the severance tax to a level similar to neighboring states will not harm Ohio's oil and gas development opportunities, although the industry may be expected to make such claims, and it can help boost opportunity in other ways. Economic history shows natural resource booms do not necessarily leave regions better off. A newly released report by Ohio State University economists Amanda Weinstein and Mark Partridge opens with a warning from the history of natural resource economies:

> *"Economists have 150 years of experience in examining energy booms and busts throughout the world to form their expectations of how energy development affects regional economies. Generally, economists find that energy development is associated with small or even negative long-run impacts. They refer to a 'natural resources curse' phenomenon associated with the surprisingly poor performance of resource abundant economies. There appear to be more examples like Louisiana, West Virginia, Venezuela, and Nigeria of energy economies seemingly underperforming and few examples of places such as Alberta and Norway of relative over performance. This backdrop needs to be considered in forming good policy in Ohio in order to avoid being in the former group."* (Weinstein and Partridge, "The Economic Value of Shale Gas in Ohio, The Ohio State University, December 2011.)

Weinstein and Partridge's report found that the industry study of natural gas potential over the next four years in Ohio had inflated assumptions about employment while ignoring costs that a boom in drilling could have on other sectors.[38]

---

[35] Gabriel Lozada and Michael Hogue, "The Effect of Proposed 2009 Tax Changes on Utah's Oil and Gas Industry," University of Utah, December 18, 2008.
[36] Rose M. Baker and David L. Passmore, "Benchmarks for Assessing the Potential Impact of a Natural Gas Severance Tax on the Pennsylvania Economy," Penn State Institute for Research in Training & Development, September 2010.
[37] Ohio Business Development Coalition, Ohio Business Development Coalition, "Marcellus and Utica shale gas supply chain," 2011
[38] Kleinhenz and Associates, "Ohio's Natural Gas and Crude Oil Exploration and Production Industry and the Emerging Utica Gas Formation Economic Impact Study," Ohio Oil and Gas Energy Education Program, September 2011.

Summary and recommendations

Oil and gas drilling techniques used in new ways (combined) and new places (shale formations) open the opportunity for new energy development in Ohio. Buoyant optimism around shale production is driven by a powerful public/private partnership institutionalized in the federal government throughout much of the past century. Government has played a big role, including underwriting of the development of horizontal drilling and hydrofracturing technology through the Eastern States Shale Initiative. There are powerful forces pushing the drilling boom forward. Yet there are risks. Federal studies of health and environmental impact have not been completed. Federal laws are not in place to ensure responsible practices at each well; states, communities and landowners are on their own to negotiate with some of the world's largest corporations. This mismatch in negotiation power intensifies financial risk, along with the risks of pollution and the need for remediation in the future. Health and the environment could be harmed and the public sector could face increased health, medical and infrastructure expenses.

The risk of fracking is a new element in drilling. However, there are other concerns already well known to areas impacted by a drilling boom. The experience of mining states demonstrates that swings in price can destabilize local economies, preventing wealth accumulation at the family or community level. The enormous wealth generated in a boom is private wealth that leaves the mines, wells and communities around them. The people of a state and community need to keep a share of that wealth to build a future for themselves. The following policies will help Ohio and its communities to benefit from this industry:

Increase Ohio's severance tax to provide adequate revenues for the boom.
The state of Ohio implemented the severance tax in 1972 on a mature oil and gas industry. As the industry ramps up for expansion, the state and local communities can expect known, up-front costs of rapid industrial development as well as unknown costs associated with possible mitigation of air and water pollution. At a 5 percent severance fee on shale gas, Ohio should see increased revenues of $538 million just on new production – the shale gas production forecast by the end of 2015 by the industry – to help with these costs.

Establish a severance tax trust fund.
Seven producing states and the Navajo Nation have established trust funds based on severance or royalty earnings to help states convert depleting natural resources into a source of sustainable wealth for communities; to even out the fluctuations of the boom-bust natural resource – based economy, and to diversify and expand local economies. Existing funds include: [39]

- Alaska Permanent Fund (established in 1976);
- Montana Coal Severance Tax Trust Fund (1976);
- New Mexico Severance Tax Permanent Fund (1973);
- North Dakota Coal Development Trust Fund (1979);
- Texas Permanent Oil Tax Trust Fund; (1997) Legacy Fund (2010);
- Utah Permanent Trust Fund (2008);
- Wyoming Permanent Mineral Trust Fund (1974); and
- The trust fund of the Navajo Nation (est. 1985).

[39] West Virginia Budget and Policy Project, "Creating a Severance Tax Permanent Fund in the Mountain State," (power point presentation), June 13, 2011 at http://www.wvpolicy.org/downloads/Eco_Div061611.pdf

The most frequent uses of permanent funds are: General fund expenditures (NM, WY, ND); education (NM, ND); infrastructure projects (NM, MT); reinvestment in fund corpus for growth and inflation-proofing (several); investment in Lignite Research, Development & Marketing Program (ND Coal Development Trust Fund); "Permanent Fund Dividend Program," (AK); economic development grants & loans including funds targeted to mining communities (MT, NM, UT) and remediation of impacts of mining (ND).

Mineral wealth belongs to the people; the state owes it to the residents to ensure a share of the wealth is retained to build a better future. Over time, funds from minerals severed from the land could be dedicated to a permanent fund dedicated to ensuring ongoing opportunity by restoring funding to schools, for remediation of environmental impacts of drilling and mining and for assistance with infrastructure, workforce training, and other needs of communities in the phase of rapid development (boom) as well as economic development planning and strategies for economic diversification in counties where the minerals have been depleted (bust).

Author

Wendy Patton is the senior project director for the state fiscal project. She has a B.A. from Kent State University and a master's degree from the University of California at Berkeley, where she studied regional economics. Wendy has worked for AFSCME International, the Ohio Department of Development, the Columbus Urban Growth Corporation and the Ohio Employee Ownership Center. At Policy Matters, Wendy works on budget and tax issues as part of the State Fiscal Analysis Initiative.

Acknowledgements

The author wishes to thank Sharon Ward and Michael Wood of the Pennsylvania Budget and Policy Center and Ted Boettner of the West Virginia Center on Budget and Policy for advice and review. All content, errors and omissions are the sole responsibility of the author.

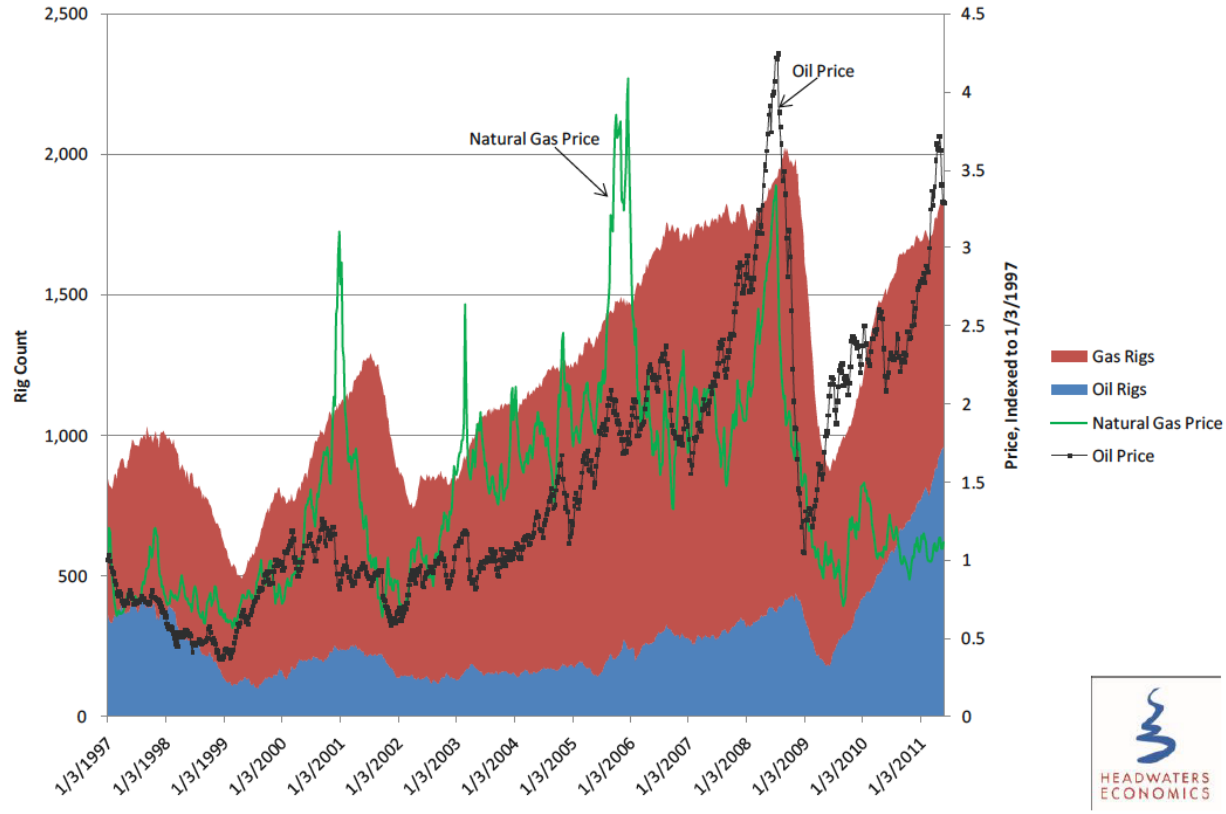
Appendices

Figure 1A: Major shale plays in the United States
Figure 2A: Prices and drilling activity
Figure 3A: Volatility in US energy sector employment

Table 1A: Natural gas and oil producing states ranked by production, 2009
Table 2A: Oil Production in Ohio, 1876 to present (Barrels of Oil)
Table 3A: Natural Gas Production in Ohio, millions of cubic feet

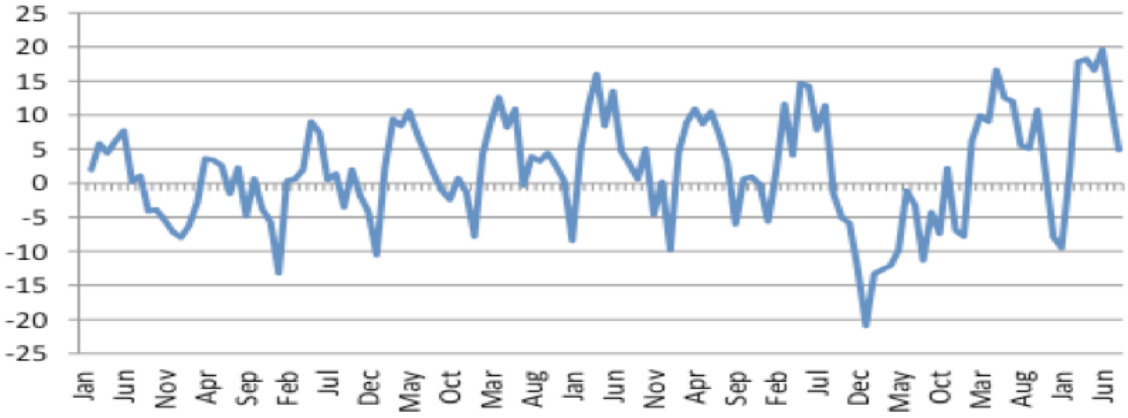
Figure 1A: Major shale plays in the lower 48 states

Figure 2A: Prices and Drilling Activity – rig count by target and natural gas and oil prices. (weekly, Jan. 3, 1997 through May 27, 2011, land and offshore rigs)



Source: Headwater Economics, "Drilling Rig Activity Nears Twenty-Year High," June 2011 at http://headwaterseconomics.org/wphw/wp-content/uploads/RigCounts.pdf

Figure 3A: Volatility in U.S. energy sector employment – employment difference (in thousands) in mining from prior month. January 2001 to August 2011



Source: Headwater Economics, U.S. Energy Sector Employment and Trends, September 2011 at http://headwaterseconomics.org/wphw/wp-content/uploads/Status_Energy_Industry_September2011.pdf

Table 1A – Natural gas and oil producing states ranked by production, 2009

	Natural gas			Oil		
	Jurisdiction	**Production**	**Percent of total**	**Jurisdiction**	**Production**	**Percent of total**
	United States	**21,604,155**	**100%**	**United States**	**1,956,597**	**100%**
1	Texas	7,284,520	33.72%	Louisiana	585,378	29.92%
2	Louisiana	3,332,956	15.43%	Texas	456,364	23.32%
3	Wyoming	2,335,328	10.81%	Alaska	235,500	12.04%
4	Oklahoma	1,857,777	8.60%	California	228,994	11.70%
5	Colorado	1,499,070	6.94%	North Dakota	79,736	4.08%
6	New Mexico	1,383,004	6.40%	Oklahoma	67,018	3.43%
7	Arkansas	679,952	3.15%	New Mexico	61,146	3.13%
8	Utah	444,162	2.06%	Wyoming	51,333	2.62%
9	Alabama	415,049	1.92%	Kansas	39,464	2.02%
10	Alaska	397,077	1.84%	Colorado	28,324	1.45%
11	Kansas	354,440	1.64%	Montana	27,692	1.42%
12	California	276,575	1.28%	Mississippi	23,232	1.19%
13	Pennsylvania	273,869	1.27%	Utah	22,927	1.17%
14	West Virginia	264,436	1.22%	Illinois	9,099	0.47%
15	Michigan	153,736	0.71%	Alabama	7,248	0.37%
16	Virginia	140,738	0.65%	Michigan	5,900	0.30%
17	Kentucky	113,300	0.52%	Ohio	5,834	0.30%
18	Montana	98,245	0.45%	Arkansas	5,781	0.30%
19	Ohio	88,824	0.41%	Pennsylvania	3,541	0.18%
20	Mississippi	88,157	0.41%	Kentucky	2,609	0.13%
21	North Dakota	59,369	0.27%	Nebraska	2,239	0.11%
22	New York	44,849	0.21%	West Virginia	1,864	0.10%
23	Tennessee	5,478	0.03%	Indiana	1,804	0.09%
24	Indiana	4,927	0.02%	South Dakota	1,658	0.08%
25	Nebraska	2,908	0.01%	Florida	696	0.04%
26	South Dakota	2,129	0.01%	Nevada	455	0.02%
27	Illinois	1,443	0.01%	New York	339	0.02%
28	Oregon	821	0.00%	Tennessee	268	0.01%
29	Arizona	712	0.00%	Missouri	94	0.00%
30	Florida	257	0.00%	Arizona	46	0.00%
31	Maryland	43	0.00%	Virginia	14	0.00%
32	Nevada	4	0.00%			

Source: Energy Information Administration, Table P4. Energy Production Estimates in Physical Units, Ranked by State, 2009, http://www.eia.gov/state/state-energy-profiles-more-reserves.cfm

Table 2A: Oil production in Ohio, 1876 to present (barrels of oil)

Year	Amount	Year	Amount	Year	Amount
1876	31,763	1921	7,335,000	1966	10,899,199
1877	29,888	1922	6,781,000	1967	9,924,639
1878	38,179	1923	7,085,000	1968	11,204,457
1879	29,112	1924	6,811,000	1969	10,971,559
1880	38,940	1925	7,212,000	1970	9,864,101
1881	33,867	1926	7,272,000	1971	8,286,099
1882	39,761	1927	7,593,000	1972	9,358,046
1883	47,632	1928	7,015,000	1973	8,796,332
1884	90,081	1929	6,743,000	1974	9,088,169
1885	650,000	1930	6,486,000	1975	9,578,053
1886	1,782,970	1931	5,327,000	1976	9,994,453
1887	5,018,015	1932	4,644,000	1977	10,358,833
1888	10,010,868	1933	4,235,000	1978	11,154,473
1889	12,471,466	1934	4,234,000	1979	11,954,595
1890	16,124,656	1935	4,082,000	1980	12,927,837
1891	17,740,301	1936	3,847,000	1981	13,551,354
1892	16,362,921	1937	3,559,000	1982	14,570,517
1893	16,249,769	1938	3,298,000	1983	14,971,072
1894	16,792,154	1939	3,156,000	1984	15,271,100
1895	19,545,233	1940	3,052,000	1985	14,987,592
1896	23,941,169	1941	3,547,000	1986	13,442,162
1897	21,560,515	1942	3,664,000	1987	12,152,567
1898	18,738,708	1943	3,442,000	1988	11,710,728
1899	21,142,108	1944	3,053,000	1989	10,218,674
1900	22,362,730	1945	3,012,000	1990	10,008,263
1901	21,648,083	1946	3,508,000	1991	9,158,332
1902	21,014,231	1947	3,618,000	1992	9,196,711
1903	20,480,286	1948	3,906,000	1993	8,282,023
1904	18,876,631	1949	3,485,000	1994	8,757,872
1905	16,346,660	1950	3,314,000	1995	8,257,621
1906	14,787,763	1951	3,141,000	1996	8,305,366
1907	12,207,448	1952	3,350,000	1997	8,593,359
1908	10,858,797	1953	3,695,000	1998	6,541,307
1909	10,623,793	1954	3,887,000	1999	5,968,342
1910	9,916,730	1955	4,327,000	2000	6,573,881
1911	8,817,112	1956	4,739,000	2001	6,049,524
1912	8,969,007	1957	5,556,000	2002	6,004,345
1913	8,781,468	1958	6,524,515	2003	5,647,275
1914	8,536,352	1959	5,978,280	2004	5,785,338
1915	7,825,326	1960	5,405,304	2005	5,651,705
1916	7,744,511	1961	5,638,838	2006	5,422,194
1917	7,750,540	1962	5,835,339	2007	5,454,629
1918	7,285,005	1963	7,053,213	2008	5,554,235
1919	7,736,000	1964	15,858,784	2009	5,008,609
1920	7,400,000	1965	12,908,459	2010	4,784,690
				TOTAL	**1,136,934,513**

Source: Ohio Department of Natural Resources, e-mail dated 10/17/2010

Table 3A: Natural Gas Production in Ohio, millions of cubic feet

Year	Amount	Year	Amount	Year	Amount
1952	32,500	1972	90,487	1992	144,815
1953	31,280	1973	94,121	1993	135,935
1954	31,531	1974	94,376	1994	130,855
1955	35,081	1975	85,810	1995	126,336
1956	31,727	1976	89,770	1996	120,444
1957	32,261	1977	99,656	1997	117,408
1958	33,875	1978	115,239	1998	108,542
1959	36,311	1979	124,665	1999	103,541
1960	39,309	1980	138,856	2000	98,551
1961	38,941	1981	141,134	2001	98,255
1962	37,330	1982	138,391	2002	97,154
1963	38,500	1983	151,300	2003	93,641
1964	37,713	1984	186,480	2004	90,301
1965	40,123	1985	182,245	2005	84,135
1966	43,568	1986	182,072	2006	86,315
1967	42,500	1987	166,593	2007	88,095
1968	42,673	1988	166,690	2008	84,858
1969	51,443	1989	159,730	2009	88,824
1970	73,759	1990	154,619	2010	78,122
1971	82,678	1991	147,651	**TOTAL**	**5,519,115**

Source: Ohio Department of Natural Resources, e-mail dated 10/17/2010

Bibliography

Baker, Rose M. and David L. Passmore, "Benchmarks for Assessing the Potential Impact of a Natural Gas Severance Tax on the Pennsylvania Economy," Penn State Institute for Research in Training & Development, September 2010.

Downing, Bob, "Gas exploration sparks economic surge in Carroll County," Ohio.com, 12/11/2011. http://www.ohio.com/news/local-news/gas-exploration-sparks-economic-surge-in-carroll-county-1.249839

Energy Information Administration, "Domestic oil production reversed decades-long decline in 2009 and 2010," (Figure 2) 5/6/2011. This Week in Petroleum, 4/27/2011 http://205.254.135.7/oog/info/twip/twiparch/110427/twipprint.html

Energy Information Administration, "Oil and natural gas drilling in Ohio on the rise," Today in Energy, 9/2011 at http://205.254.135.24/todayinenergy/detail.cfm?id=3430 .

Energy Information Administration, "Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays," 7/8/ 2011 at http://www.eia.gov/analysis/studies/usshalegas/ .

Energy Information Administration, Annual Energy Outlook 2011, at http://www.eia.gov/forecasts/aeo/chapter_executive_summary.cfm#domestic .

Federal Writers Project, "West Virginia: A guide to the Mountain State" at http://books.google.com/books/index .

Gerking, Shelby, William Morgan, Mark Kunce, Joe Kerkvliet, "Mineral Tax Incentives, Mineral Production and the Wyoming Economy," University of Wyoming, December 1, 2000 at http://wyofile.com/wp-content/uploads/2011/04/Gerking.StateReport.pdf

Haggerty, Julia "How to get through the gas boom," *The Philadelphia Inquirer*, 1/6/ 2011 at http://headwaterseconomics.org/wphw/wp-content/uploads/How%20to%20get%20through%20the%20gas%20boom.pdf

Headwater Economics, "Drilling Rig Activity Nears Twenty-Year High," June 2011 at http://headwaterseconomics.org/wphw/wpcontent/uploads/RigCounts.pdf

Headwater Economics, "Fossil Fuel Extraction and Western Economies," 4/2011 at http://headwaterseconomics.org/wphw/wp-content/uploads/Fossilfuel_West_Report.pdf.

Headwater Economics: "Oil Shale in the West: 14 unanswered questions about shale oil," 2010 at http://headwaterseconomics.org/pubs/energy/14Questions_2010.pdf .

Headwater Economics, U.S. Energy Sector Employment and Trends, 9/2011 at http://headwaterseconomics.org/wphw/wpcontent/uploads/Status_Energy_Industry_September2011.pdf

Hunt, Spencer. "Fracking Future," *The Columbus Dispatch*, 9/25/2011.

Institute for Energy Research, "Turning Tide for World Oil Supplies," 11/8/2011 at http://www.instituteforenergyresearch.org/2011/11/08/the-turning-tide-for-world-oil-supplies/

International Society for Analytical and Molecular Morphology, "History of the Oil Shale Industry" at http://www.isamm.org/shale-oil-extraction.htm.

Kleinhenz and Associates, "Ohio's Natural Gas and Crude Oil Exploration and Production Industry and the Emerging Utica Gas Formation Economic Impact Study," Ohio Oil and Gas Energy Education Program, 9/2011.

Lozada, Gabriel and Michael Hogue, "The Effect of Proposed 2009 Tax Changes on Utah's Oil and Gas Industry," University of Utah, 12/18/2008.

Lustgarten, Abraham. "EPA Finds Compound Used in Fracking in Wyoming Aquifer," *Propublica*, 11/10/2011 at http://www.propublica.org/article/epa-finds-fracking-compound-in-wyoming-aquifer.

Marcellus Shale Education and Training Center (MSETC), "Natural Gas Drilling Effects on Municipal Governments in the Marcellus Shale Region (Part IV) Local Government Survey Results from Clinton and Lycoming Counties," at http://extension.psu.edu/naturalgas/news/2011/10/natural-gas-drilling-effects-on-municipal-governments-in-the-marcellus-shale-region-part-iv-local-government-survey-results-from-clinton-and-lycoming-counties .

National Petroleum Council Resource Study, "Prudent development: Realizing the potential of North America's abundant oil and gas reserves, " (Approved Draft), September 15 2011 at http://www.npc.org/

O'Leary, Sean and Ted Boettner, "Booms and Busts: The Impact of West Virginia's Energy Economy (Section Two: Booms & Busts: The Impact on Mining Counties),' West Virginia Center on Budget and Policy, 7/2011

O'Leary, Sean and Ted Boettner, "Marshall University Natural Gas Study Proves Virtually Nothing" (Fiscal Policy Memo), West Virginia Budget and Policy Center 10/19/2011.

Ohio Business Development Coalition, "Marcellus and Utica shale gas supply chain," white paper, 2011.

Ohio Department of Natural Resources, Oil and Gas Program History at http://www.ohiodnr.com/mineral/program/tabid/17865/default.aspx.

Pennsylvania Budget and Tax Policy Center, "West Virginia Led the Nation in New gas Wells Drilled in 2010," State Budget and Tax News, 4/11/2011 at http://pennbpc.org/fact-check-west-virginia-led-nation-new-gas-wells-2010.

Perry, Chris and Larry Wickstrom. "The Marcellus Shale Play: Geology, History, and Oil & Gas Potential in Ohio, Ohio Geological Survey," 10/2010 at Public Broadcasting Station, "John D. Rockefeller Senior: 1839-1937" at http://www.pbs.org/wgbh/amex/rockefellers/peopleevents/p_rock_jsr.htm.

Snead, Mark. "Are the energy states still energy states?" Federal Reserve Bank of Kansas, Volume 94, 2009 at http://www.kansascityfed.org/PUBLICAT/ECONREV/pdf/09q4Snead.pdf .

Solomon, Deborah. "SEC Bears Down on Fracking," Wall Street Journal, 8/25/2011 http://online.wsj.com/article/SB10001424053111904009304576528484179638702 .

The Pennsylvania Budget and Policy Center at http://pennbpc.org/gas-drilling-tax .

United States Atomic Energy Commission et.al., The Bronco Oil Shale Study, 10/13/1967 at http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA397416 .

United States Department of Energy, Office of Environmental Management, "Rulison Site," at http://www.em.doe.gov/SiteInfo/RulisonSite.aspx?PAGEID=PRJ

United States Environmental Protection Agency, "EPA Releases Draft Findings of Pavillion, Wyoming Ground Water Investigation for Public Comment and Independent Scientific Review," news release of 12/8/2011 at http://yosemite.epa.gov/opa/admpress.nsf/1e5ab1124055f3b28525781f0042ed40/ef35bd26a80d6ce3852579600065c94e!OpenDocument

Urbina, Ian and Jo Craven McGinty, "Learning too late of the perils in gas well leases," *New York Times*, 12/01/2011.

Urbina, Ian. "Regulation lax as gas wells tainted water hits wells," The New York Times, 2/26/2011.

Weinstein, Amanda and Partridge, Mark. "The Economic Value of Shale Natural Gas in Ohio," The Ohio State University, College of Food, Agriculture and Environmental Sciences, December 2011.

West Virginia Budget and Policy Project, "Creating a Severance Tax Permanent Fund in the Mountain State." 6/13/2011 at http://www.wvpolicy.org/downloads/Eco_Div061611.pdf.

Wickstrom, Larry and Chirs Perry, Matthew Erenpreiss and Ron Riley, "The Marcellus and Utica Shale Plays in Ohio: Geology, History and Oil and Gas Potential in Ohio," 03/2010, at http://www.ooga.org/docs/2011WinterMeeting/2011WMPresentations/11WM-LWickstromPresentation.pdf.

Policy Matters Ohio is a non-profit, non-partisan research institute dedicated to researching an economy that works for all in Ohio. Policy Matters seeks to broaden the debate about economic policy by providing research on issues that matter to Ohio's working people and their families. Areas of inquiry for Policy Matters include work, wages, and benefits; education; economic development; energy policy; and tax and budget policy. Generous funding comes from the Joyce, Ford, Cleveland, George Gund, Sisters of Charity, St. Luke's, and Raymond John Wean foundations, as well as the Center on Budget and Policy Priorities, Greater Cleveland Community Shares and the Economic Policy Institute. To those who want a more prosperous, equitable, sustainable and inclusive Ohio… **Policy Matters**.

3631 Perkins Avenue, Suite 4C-E • Cleveland, Ohio 44114

85 E. Gay Street, Suite 802 • Columbus, Ohio 43215