

September 23, 2015

A Win-Win Marcellus Shale Tax Incentive

Sean O'Leary

The development of the Marcellus Shale has led to a boom in West Virginia's natural gas production. But aside from the increase in drilling activity and state and local tax revenue, the natural gas boom has not brought with it the jobs and economic growth that many predicted. While the state's natural gas production has increased dramatically over the past several years, West Virginia has lagged behind the rest of the country in terms of job growth and fewer West Virginians are employed today than before the boom. Even in the counties where production has increased the most, job growth has been lackluster.

The capital intensive nature of natural gas drilling can dampen its economic impact, creating fewer jobs than other more labor-intensive industries.[1] However, there may be bigger economic and job opportunities related to chemical-based manufacturing that needs the raw materials found in natural gas liquids, abundant in the Marcellus Shale region.

West Virginia and countless other states have a long history of using tax incentives to boost economic development and jobs. But the impact of the incentives is unclear, including the case of West Virginia's so-called "cracker bill," which failed to encourage the development of an ethane cracker plant or other major downstream activity.

With no large-scale ethane cracker facility and associated chemical-based manufacturing from natural gas liquids produced in West Virginia, other states are profiting on the state's natural resources. As West Virginia Secretary of Commerce Keith Burdette said, after Chesapeake Energy signed a contract to ship 75,000 barrels of ethane a day out of the Marcellus Shale region, "They're shipping out gas that could support investment here." [2]

West Virginia can avoid these past failures while still using tax policy as a tool to encourage economic development. This brief proposes a modification of West Virginia's severance tax that would increase state revenue and also help realize the economic potential of the state's natural gas liquids.

Given that the Marcellus Shale region extends beyond West Virginia, and the overlap of West Virginia's shale economy with those of Pennsylvania and Ohio, policymakers should encourage a three-state dialogue about common severance tax policies that encourage processing within the region.

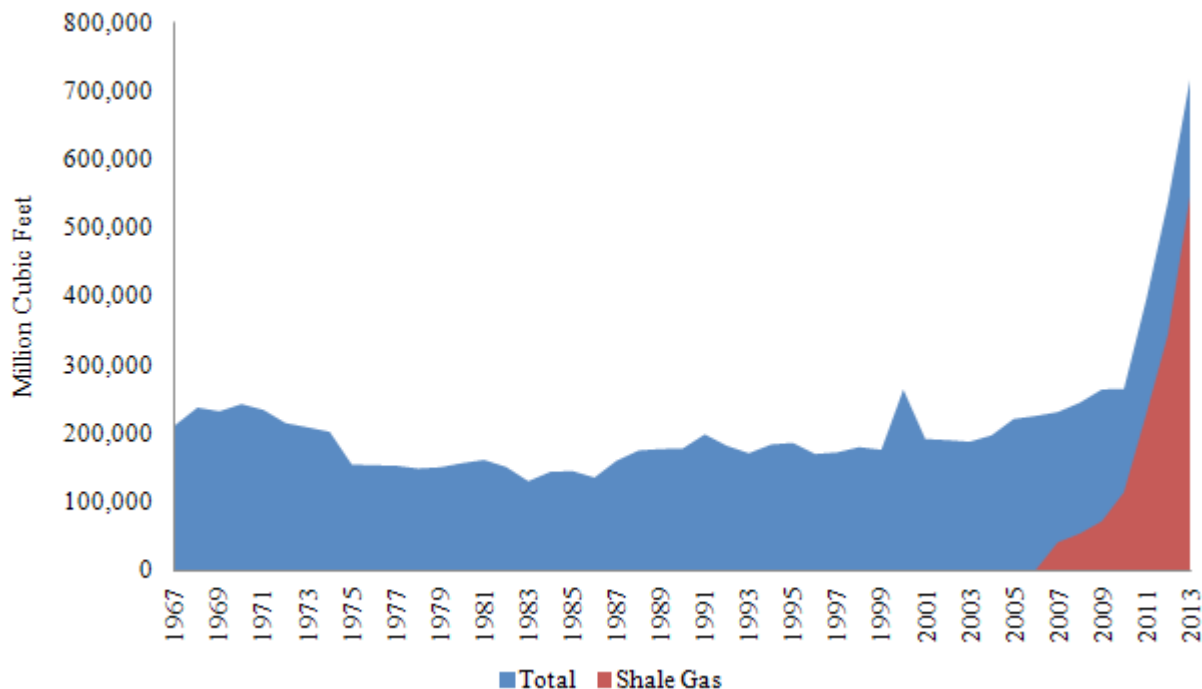
Key Findings

- While natural gas production is booming in West Virginia, the boom has not led to greater economic development. Overall, West Virginia lost jobs during the boom, and growth has been disappointing in the counties that have seen the biggest increase in gas production.
- With little success, West Virginia has offered large tax incentives to encourage chemical-based manufacturing plants to locate in the state and use its natural gas liquids. Instead, companies pipe the liquids out of West Virginia to be used elsewhere, taking jobs and economic growth with them.
- A new severance tax incentive, based on a higher rate for natural gas liquids, with a credit to related in-state industries, may encourage ethane cracking and other chemical manufacturing to create in-state jobs while generating additional tax revenue for investment in infrastructure and human capital.
- If West Virginia increased its severance tax on natural gas liquids from five to ten percent, it would increase revenue by an estimated \$168 million over the next five years.

A Boom Without Development

Tapping the Marcellus Shale has led to an unprecedented boom in natural gas production in West Virginia. While the state has long been a natural gas producer, total production more than tripled in recent years, with more than 742 billion cubic feet of natural gas produced in 2013 (**Figure 1**).

Figure 1
Natural Gas Gross Withdrawals, West Virginia (million cubic feet)



Source: U.S. Energy Information Agency.

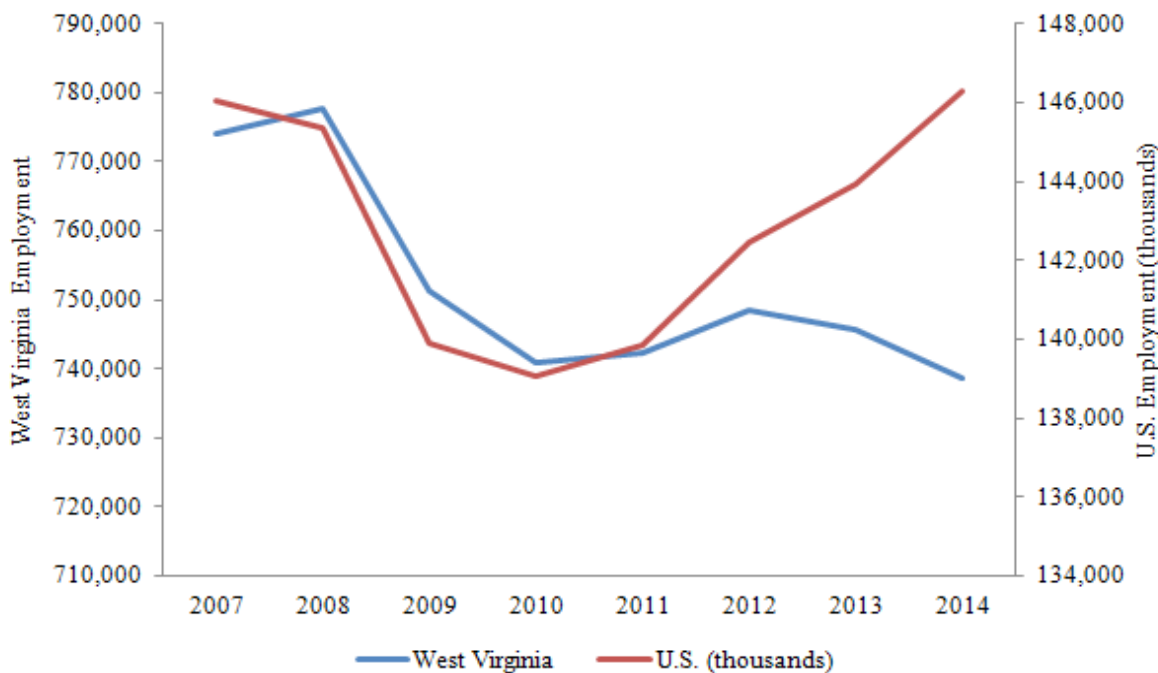
Nearly all of the increase in West Virginia’s natural gas production has come from shale production. Gross natural gas withdrawals from shale gas in West Virginia increased from 40.5 billion cubic feet in 2007 to 547.8 billion cubic feet in 2013, a more than 13-fold increase (**Figure 1**). According to the West Virginia Geological and Economic Survey (WVGES), total natural gas production in 2014 reached 1 trillion cubic feet. Oil production has also grown dramatically from shale development, from 1.3 million barrels (bbl) in 2010 to 7.5 million barrels (bbl) in 2014.

The surge in natural gas production was predicted to bring about a boom in West Virginia’s overall economy. The state’s Real GDP growth topped five percent in 2014, ranking it 4th among the 50 states, and has ranked 10th overall in Real GDP growth since 2007.[3] But that growth has been contained within the natural gas industry, largely without any broader development.

Shale-related employment growth has been strong, but below what some projected, and has not led to overall job growth. In 2010, the American Petroleum Institute (API) predicted that the economic activity from drilling in the Marcellus Shale could generate up to 30,675 jobs in West Virginia by 2015.[4] However, these estimates of shale-related job creation are often exaggerated, with unrealistic assumptions.[5] The job estimates from the API study are twice as high as estimates from other studies. For example, that same year, a study produced by West Virginia University estimated that development in the Marcellus Shale was responsible for 7,600 jobs in 2009, compared to API’s estimate of 13,349.[6]

West Virginia’s shale-related employment increased from just under 900 jobs in 2006 to over 6,000 jobs in 2014.[7] Overall, however, the number of West Virginians working has fallen, with 35,463 fewer people working in 2014 than in 2007. Even with the natural gas boom, West Virginia has yet to gain back the jobs lost during the recent recession. In contrast, the national economy has largely recovered, adding 258,000 jobs since 2007 (**Figure 2**).

Figure 2
Natural Gas Boom Not Fueling Job Growth in West Virginia



Source: Bureau of Labor Statistics, Local Area Unemployment Statistics.

The lack of job growth is a stark reversal of what the natural gas boom was predicted to bring, even from recent forecasts. The 2012 Economic Outlook report from the West Virginia University Bureau of Business and Economic Research forecasted job growth of one percent per year from 2010 to 2015, with natural gas offsetting declines in coal production. Instead, West Virginia's employment declined by 35,000, and its unemployment rate is 7.5 percent, 0.6 points higher than the BBER's forecast.[8]

While the BBER report warned that West Virginia's projected job growth was dependent on the national economy, the nation has largely exceeded the BBER's projections, while West Virginia has fallen short. In 2014, the U.S. exceeded the BBER's projected job growth by 751,000 jobs, and the national unemployment rate is currently 5.3 percent, 1.8 points lower than BBER's forecast.[9]

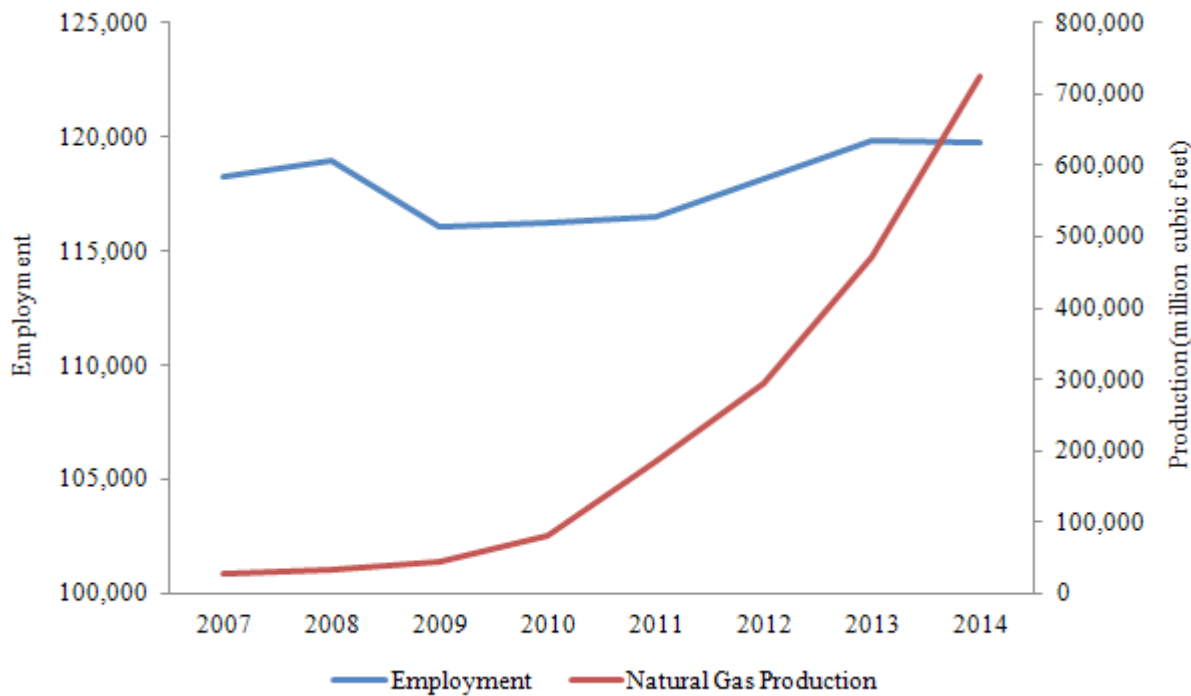
Many shale industry jobs may also be going to workers from other states. According to Mark Partridge, an Ohio State University economist, and Shawn Bennet, with the industry-advocacy group Energy In Depth, an estimated 30 percent of Pennsylvania shale-industry workers are from other states.[10] An August 2015 study in the academic journal *Agriculture and Resource Economics Review* found that only half of Pennsylvania's shale jobs were going to local county residents where the drilling was taking place. The study found that, "shale gas development in the Marcellus has had a modest positive impact on employment in Pennsylvania only in high-activity counties and that a significant amount of any increase in employment from its development likely comes primarily from nonresidents and/or workers temporarily relocating to those counties." [11]

While the number of West Virginia shale jobs has increased, especially in counties with large increases in natural gas production, those jobs are not necessarily going to workers from those counties. The Quarterly Census of Wages and Employment measures employment by employer location, not where employees reside. To get a firmer grasp of how local county residents are affected, it is important to look at the number of employed residents, not short-term workers who do not reside in the county.

The counties in the heart of the drilling boom have seen little job growth. Ten counties in the Marcellus region (Barbour, Doddridge, Harrison, Marion, Marshall, Ohio, Ritchie, Taylor, Tyler, and Wetzel) have accounted for 101 percent of West Virginia's increase in natural gas production since 2007,[12] but their employment growth has been mediocre. While natural gas production in these ten counties has seen a seventeen-fold increase between 2007 and 2014, total employment has grown by only 1.2 percent, for an average annual rate of only 0.18 percent (**Figure 3**).

Figure 3

Boom in Natural Gas Production Not Bringing Promised Jobs



Source: Bureau of Labor Statistics, Local Area Unemployment Statistics, and West Virginia Geological and Economic Survey.

The number of residents who have gained employment in these counties has paled in comparison to the value of natural gas produced there. Between 2007 and 2014, these ten counties produced over \$10.1 billion in natural gas, but have seen a net increase in employment of less than 1,500.

As Figures 2 and 3 show, employment growth in these ten Marcellus Shale counties did begin to accelerate in 2010 as the national economy recovered, even as it declined statewide. However, far from a boom, the growth in these counties lagged behind the nation significantly. Annual employment growth in the ten Marcellus counties has averaged 0.74 percent since 2010, while national employment growth has been nearly twice as fast, at an average annual rate of 1.28 percent.[13]

The minor overall growth experienced by these counties has not lived up to the early promises of the drilling rush of the Marcellus Shale boom. In 2011, when asked about the booms and busts of the coal industry in southern West Virginia, Michael McCown, president of the West Virginia Independent Oil & Gas Association, said the Marcellus Shale boom would be different, stating, “our industry can help other industries grow,” arguing that the natural gas industry would attract other jobs to the Northern Panhandle counties.[14]

But much of the minor job growth experienced by these counties has been in low-paying service jobs. For example, of the 589 jobs added in Ohio County between 2007 and 2013, nearly half were in the accommodation and food service industry, while the county lost 108 manufacturing jobs.[15] Combined, the ten Marcellus Shale boom counties have lost 1,486 manufacturing jobs since 2007, while adding 648 accommodation and food service jobs.[16]

Similarly, in 2012, the Consumer Energy Alliance Mid-Atlantic featured Marshall County in a series on the potential of shale development. The report predicted, “significant manufacturing and economic growth for the area” due to the availability of shale gas resources.[17] But while Marshall County has produced over \$1.1 billion worth of natural gas since

2007, it lost 405 manufacturing jobs and 126 construction jobs, with the shale boom producing only 123 total new jobs added over that time period.

While Marcellus Shale drilling has created some economic growth, as evidenced by West Virginia's recent gross domestic product growth, it has not led to substantial job and income growth for West Virginia or other more permanent development. With the state experiencing anemic job growth in the face of the natural gas boom, policymakers need to look for creative ideas to ensure West Virginia maximizes the benefits of the value of its natural resources.

A Unique Opportunity

The make-up of the natural gas produced in the Marcellus Shale presents a unique opportunity for West Virginia to leverage its natural resources for greater economic gains. Natural gas wells produce what is known as either wet or dry gas. Dry gas consists primarily of methane, while wet gas contains additional "natural gas liquids," such as ethane, butane, propane, and pentane.[18] These natural gas liquids have their own value as a commodity, making wet gas more valuable than dry gas. Much of the Marcellus Shale, and the Utica Shale beneath it, contains wet gas, making it more valuable and creating opportunities for further economic development beyond drilling and transportation.

West Virginia's production of these natural gas liquids is growing along with natural gas production in the Marcellus Shale. In 2012 West Virginia produced 715,639 barrels of natural gas liquids. One year later, in 2013, production was more than six-times higher, with the state producing 4.7 million barrels of natural gas liquids.[19]

The natural gas liquids found in wet gas have a variety of industrial uses, particularly the ethylene that is derived from ethane.[20] There are several steps during which natural gas liquids like ethane can be used by the petrochemical industry. Natural gas liquids are extracted from the ground along with dry natural gas during the drilling and hydraulic fracturing process. The gas extracted at the wellhead is a mix of different liquid and gas hydrocarbons. The gas mixture must then be treated and processed to separate the dry natural gas from the natural gas liquids. Once separated, the dry gas can be delivered to interstate gas pipelines for fuel and other uses.[21]

After the raw natural gas liquids are separated from the dry gas, they are sent to another facility called a fractionator to be further processed, separating the natural gas liquids into their component parts (ethane, propane, butane, etc.). The ethane, once separated, is shipped to a cracker facility, where it is converted into ethylene, which is used in manufacturing and other petrochemical industries.[22]

West Virginia's increase in natural gas liquids production has spurred investment in the processing and fractionation of natural gas liquids in state and throughout the Marcellus region, such as the Majorsville V natural gas processing plant and the Sherwood fractionation plant. However, expansions in chemical based manufacturing, such as ethane cracking and polyethylene manufacturing, have not found their way into West Virginia. Instead, the majority of new large-scale chemical-based manufacturing projects are planned for the Gulf Coast region.[23] While cracker facilities and chemical manufacturing are one of the major sources of jobs and economic development derived from the production of natural gas liquids, West Virginia is largely missing out on this economic opportunity.

Companies are investing billions of dollars in pipelines to move natural gas and its by-products out of the Marcellus Shale region to the Gulf Coast and other areas for processing. Columbia Pipeline Group recently announced plans to spend \$1.75 billion to build and improve pipelines in Ohio and West Virginia, connecting gas wells to pipelines moving natural gas and natural gas liquids to the Gulf Coast, with the potential to pipe 1.5 million cubic feet of gas per day.[24] Another company,

Texas Eastern Transmission LP, plans to build a \$468 million pipeline in the Marcellus Region, with four companies pledging to transport 533 million cubic feet of natural gas per day to The Texas Eastern hub in Louisiana.[25]

The shipping of natural gas and natural gas liquids out of West Virginia is costing jobs and investment, according to state officials. Commerce Secretary Keith Burdette remarked, “Every barrel of ethane shipped out of West Virginia means less and less investment,” in response to a decision by Chesapeake Energy to sign a long-term contract to transport 75,000 barrels of ethane per day from the Marcellus Shale region to Texas.[26] At current prices, 75,000 barrels means West Virginia is losing roughly \$1.875 million in potential investment each day from that one contract alone.

In 2012, West Virginia produced 602.3 trillion British Thermal Units (BTU) of natural gas, including natural gas liquids, but only 138.6 trillion BTU was consumed in West Virginia. Seventy-seven percent of the natural gas and natural gas liquids produced in West Virginia was exported out of the state, and along with it the economic benefits of the natural gas liquids’ midstream and downstream uses.[27]

Existing Incentives for In-State Use

West Virginia has so far pursued a strategy of offering large tax incentives in order to encourage the development of its natural gas liquids. For example, when Shell Oil announced its intention to build an ethane “cracker” plant in the region, the West Virginia legislature quickly passed a \$300 million property tax break to bring the facility here.[28] However, the state’s strategy of offering large tax-giveaways did not paid off. The same is true in Ohio, where aggressive tax incentives have led to “proposed” cracker facilities, [29] but instead companies are building pipelines to ship natural gas liquids to out-of-state plants.[30]

States often offer tax credits or reductions to severance, state and local taxes levied on extractive industries to in order to encourage production. An example is a tax credit for every ton of coal or MCF of natural gas purchased and consumed by an in-state utility. These types of tax credits attempt to increase coal or natural gas production by encouraging electricity producers to purchase coal or natural gas produced in-state, rather than imported from another state.

For example, Virginia’s Coal Employment and Production Incentive Tax Credit offers a \$3 credit against any state tax for every ton of coal mined in Virginia that is purchased and consumed by a Virginia-based electricity generator.[31] The credit, which is offered to the electricity producers, is designed to offset the higher costs of Virginia-produced coal, making it more competitive with lower-cost coal produced in other states. The credit can also be sold to the coal producer if the utility is unable to redeem the credit.

Similar incentives have been introduced in West Virginia. The West Virginia Coal Employment Enhancement Act,[32] introduced during the 2015 Legislative Session, would have created a \$3 severance tax credit for every ton of coal purchased by an in-state utility above a certain baseline. The \$3 credit would, in effect, fully offset the severance tax.[33] However, unlike the Virginia incentive, West Virginia’s proposed credit would apply to the coal producers, who would sell the coal at a reduced price.

Despite their intent, these tax incentives are expensive and ineffective. Virginia’s Coal Employment and Production Incentive Tax Credit cost the state an estimated \$10 million per year, even as the coal industry itself only contributes an estimated \$15 million per year in total direct revenue.[34] While the credit’s costs are substantial compared to the relatively small size of Virginia’s coal industry, and the credit is not an effective boost to the industry. A study from Virginia’s Joint Legislative Audit and Review Commission found that declines in Virginia coal-mining activity has been unaffected by the Coal Employment and Production Incentive Tax Credit and other coal tax incentives, and the incentives are unlikely to

counteract other external factors that drive production, like the thickness of coal seams and transportation costs.[35] A review of West Virginia's proposed Coal Employment Enhancement Act by West Virginia University's Bureau of Business and Economic Research (BBER) came to a similar conclusion, as did the fiscal note for the bill prepared by the State Tax Department. The analyses showed the tax credit could cost the state up to \$15 million, with only a marginal impact on employment and production. They noted that logistical needs of the industry can override price considerations, and when price is a factor, any change in tax policy is unlikely to be large enough to have major impact.[36]

So if tax credits like the Coal Employment Enhancement Act are costly and ineffective, how can they be used to encourage development of industry around the production of natural gas liquids in the Marcellus Shale?

A Win-Win Tax Incentive: Raising Revenue and Maximizing Potential Value-Added Processing

West Virginia currently levies a five-percent severance tax on the gross value of natural gas produced in the state. The severance tax is applied to the value of the gas at the wellhead, before it is transmitted or transported. The severance tax rate of five percent applies to both wet and dry natural gas, and natural gas liquids are not taxed separately.[37]

Both Virginia's Coal Employment and Production Incentive Tax Credit and West Virginia's proposed Coal Employment Enhancement Act are designed to increase production by encouraging existing in-state utilities to use coal produced in their respective states, rather than importing coal produced out of state.

In the case of the natural gas liquids found in the shale gas produced in West Virginia, the scenario is different. The state wished to encourage the use of the natural gas liquids in state, but not as a mechanism to increase production. As Figure 1 shows, natural gas production in West Virginia has grown at an unprecedented rate, and needs no incentive. Instead, it's the use of the natural gas liquids that West Virginia is missing out on.

Like with the Coal Employment and Production Tax Credit, West Virginia could use the severance tax to create an incentive for the downstream use of natural gas liquids produced in West Virginia. But instead of designing the incentive to increase production, the incentive would encourage the chemical industry to locate in West Virginia in order to use the natural gas liquids produced in the state. This would help avoid the shortcomings of West Virginia's proposed coal tax credit and the existing credit in Virginia.

As mentioned above, one major shortcoming of the coal tax credits is that the severance tax and other state taxes don't have a major impact on production, and make little difference in the development of resources in one state over another, [38] weakening the effectiveness of tax incentives.

Offering a severance tax break in order to encourage the use of West Virginia-produced natural gas liquids in West Virginia probably wouldn't work for similar reasons. Currently, West Virginia's severance tax is largely exported onto its out-of-state capital producers. And at its current rate, the severance tax has had no apparent negative impact, as production as skyrocketed. A tax incentive that reduces the severance tax would likely have no effect, other than reducing state revenue.

However, increasing the severance tax on natural gas liquids, and offering an incentive if the liquids are used for chemical manufacturing in West Virginia, would avoid the shortfalls of the coal tax incentives, creating a win-win tax incentive for West Virginia.

Recently, Andy McKenzie, the mayor of Wheeling, located in Ohio County, testified to the Joint Select Committee on Tax Reform about the need for such a tax incentive in West Virginia. While Ohio County has seen great increases in natural gas

production, overall economic growth has not been as stellar. Mayor McKenzie called for increasing the tax on natural gas saying, “We need to tax the extraction of oil/gas at a higher rate in West Virginia, but reward companies for refining what’s extracted with tax credits.”[39]

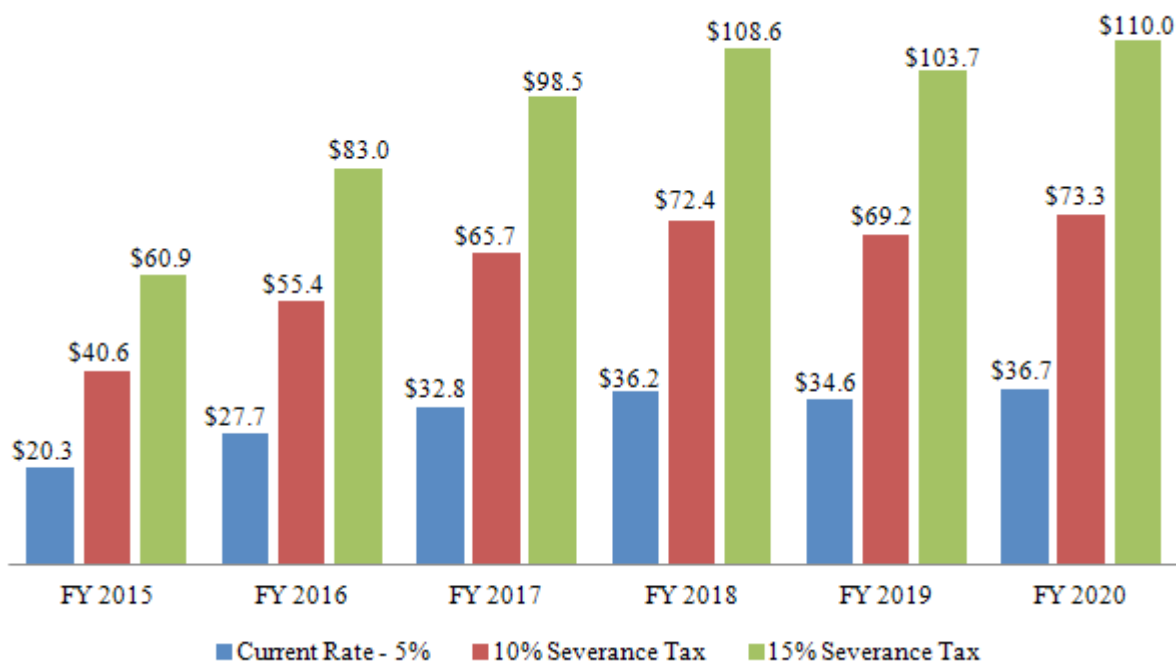
Since West Virginia’s severance tax has been shown to have very little, if any, negative impact on natural gas production in the state, as evidenced by the incredible recent increase in production, the state could feasibly raise the severance tax on just natural gas liquids with little impact on production. The new, higher rate would only apply to the natural gas liquids, and traditional natural gas would be unaffected, further dampening any impact on production. A tax credit could then be offered if the natural gas liquids are used for chemical manufacturing in West Virginia, offsetting the higher tax rate.

This would provide an incentive for industry to set up shop in West Virginia, while creating additional revenue from the natural gas liquids that are currently being exported and used out of state.

For example, West Virginia could raise its severance tax on natural gas from its current rate of five percent to a base rate of 10 or 15 percent, while offering a reduced rate for dry natural gas, keeping it at five percent. Since nearly all of the state’s natural gas liquids are exported, the tax would largely fall on out-of-state producers and consumers,[40] and would likely have little impact on production, particularly since the tax on dry natural gas would stay the same.

In FY 2015, the five-percent severance tax on natural gas liquids generated an estimated \$20.3 million in revenue, and is projected to increase to about \$37 million by FY 2020.[41] Increasing the severance tax on natural gas liquids from five percent to 10 percent could generate an additional \$37 million in severance tax revenue for West Virginia by FY 2020, while a 15-percent rate would generate an additional \$73 million.

Figure 4
Natural Gas Liquids Projected Severance Tax Revenue (millions of dollars)



Source: West Virginia Center on Budget and Policy analysis of West Virginia State Tax Department data.

The state could then offer a tax credit if the natural gas liquids are sold to an in-state cracker facility or other chemical manufacturing facility. At 2014 prices, a \$1.25 to \$2.50 per barrel credit would offset the tax increase.[42] This would make it cheaper for companies who are currently using natural gas liquids produced in West Virginia in their industry to use them at a facility in West Virginia, if the savings from the tax credit are passed on.

While the analysis of the coal tax incentives suggested that the severance tax didn't affect prices enough at five percent for incentives to be effective, at a severance tax rate of 10 or 15 percent, the incentive would likely have a stronger impact.

Further, while the coal tax incentives are costly, this natural gas liquids tax incentive would increase state revenue. The credit would reduce the effective severance tax rate from an increased rate to its current rate of five percent, making it revenue neutral compared to current law. And even if the incentive proves to be ineffective at attracting the chemical manufacturing industry to West Virginia, the state would still enjoy the increased revenue from the higher severance tax rate, making it a win-win for the state. The increase in revenue could then be used to offset some of the negative externalities of natural gas drilling, such as road repairs, as well as other needed investments in the state like workforce development and other infrastructure.

Conclusion

While West Virginia is producing unprecedented amounts of natural gas, the Marcellus Shale boom has not greatly impacted the wider economy. Part of the reason why West Virginia has experienced disappointing development during the boom is because much of the value of the Marcellus Shale is found in the natural gas liquids that are also extracted during the drilling of shale gas. These natural gas liquids are valuable, acting as a feedstock for the chemical manufacturing industry. However, instead of using the liquids here in West Virginia where they are extracted, companies are piping millions of dollars of natural gas liquids out of the state to be used elsewhere, taking jobs and investment with them.

However, by modifying its severance tax, West Virginia could create an incentive to keep the natural gas liquids here, while creating jobs and economic growth in chemical manufacturing and other industries. By increasing the severance tax on natural gas liquids, and offering a credit for in-state use, the state would encourage chemical manufacturing industry to locate here. It would also generate much-needed additional revenue, ensuring West Virginia enjoys some benefits from its natural resources, even when these resources are taken out of the state.

Endnotes

- 1 According to the Bureau of Economic Analysis, in 2013, GDP per worker in the oil and natural gas extraction industry was \$355,154, compared to \$258,347 for mining other than oil and natural gas extraction, \$159,132 for manufacturing, \$66,893 for construction, and \$107,100 for the private sector as a whole.
- 2 Eric Eyre, "Ethane cracker plant cracking up?" *The Charleston Gazette*, November 5, 2011.
- 3 WVCPB analysis Bureau of Economic Analysis data.
- 4 Timothy Considine, "The Economic Impacts of the Marcellus Shale: Implications for New York, Pennsylvania, and West Virginia," (Prepared for the American Petroleum Institute, July 14, 2010).
- 5 Frank Mauro, Michael Wood, Michele Mattingly, and Mark Price, "Exaggerating the Impact of Shale Drilling: How and Why," (Multi-State Shale Research Collaborative, November 2013).
- 6 Amy Higginbotham, Tom Witt, Tami Gurley-Calves, and Adam Pellillo, "The Economic Impact of the Natural Gas Industry and the Marcellus Shale Development in West Virginia in 2009," (Bureau of Business and Economic Research at the College of Business and Economics, West Virginia University, December 2010).
- 7 Mauro, et al. (2013).
- 8 George Hammond, "West Virginia Economic Outlook 2011," (Bureau of Business and Economic Research at the College of Business and Economics, West Virginia University, 2010).
- 9 I bid.

- 10 Spencer Hunt and Dan Gearino, "Fracking: So where's the economic boom that was promised?" The Columbus Dispatch, January 28, 2014.
- 11 Douglas Wren, Timothy Kelsey, and Edward Jaenicke, "Resident vs. Nonresident Employment Associated with Marcellus Shale Development," *Agricultural and Resource Economics Review*, Volume 44, Number 2, (1995).
- 12 WVCBP analysis of WV Geological and Economic Service data - Between 2007 and 2014, total natural gas production in West Virginia increased by 806 billion cubic feet. Over that time period, the ten counties with the biggest increase in production were Barbour, Doddridge, Harrison, Marion, Marshall, Ohio, Ritchie, Taylor, Tyler, and Wetzel. Natural gas production in those five counties increased by 817 billion cubic feet between 2007 and 2014, accounting for 101% of the total state increase in production.
- 13 WVCBP analysis of Bureau of Labor Statistics, Local Area Unemployment Statistics and Current Employment Statistics data.
- 14 Casey Junkins, "Impact of Gas Boom Debated," *The Intelligencer*, July 31, 2011.
- 15 WVCBP analysis of U.S. Bureau of Economic Analysis, Local Annual Personal Income & Employment data.
- 16 WVCBP analysis of U.S. Bureau of Economic Analysis, Local Annual Personal Income & Employment data.
- 17 "Marshall County hailed as counter to ailing economy," *Grounded, A State Journal Energy Blog*, posted October 24, 2012, <http://www.statejournal.com/story/19904284/marshall-county-hailed-as-counter-to-ailing-economy>.
- 18 Penn State Marcellus Center for Outreach and Research, "Resources: Wet-Dry Gas," <http://www.marcellus.psu.edu/resources/maps.php>.
- 19 WV Geological and Economic Survey, 2013 Marcellus Shale Production and Utica Information Summary. Note: The WVDEP Office of Oil and Gas began requiring that natural gas liquids be reported separately from oil production in 2013. According to the WV GES, many operators are still including natural gas liquids in oil production, therefore reported natural gas liquid production figures include reported oil production.
- 20 Corky DeMarco, "God Didn't Want Us to Be Farmers!" (Presentation to Governor Tomblin's Energy Summit, Roanoke, WV, October 2014).
- 21 American Fuel and Petrochemical Manufacturers, "What is a Cracker and Why Should I Care?" AFMP Industry 101, <http://education.afpm.org/petrochemicals/what-is-a-cracker-and-why-should-i-care/>
- 22 Ibid.
- 23 Tom Witt, "Building Value from Shale Gas: The Promise of Expanding Petrochemicals in West Virginia," (Witt Economics LLC and Braskem America Inc, December 2013).
- 24 <http://triblive.com/news/adminpage/6603934-74/columbia-gulf-energy#axzz3kV3lBHFG>.
- 25 Bob Downing, "Texas company plans \$468 million pipeline to ship Utica shale natural gas to Gulf Coast," *Akron Beacon Journal*, February 17, 2014.
- 26 Eyre (2011).
- 27 Christine Risch, "The West Virginia Energy Flow Chart," (Presentation to Governor Tomblin's Energy Summit, Roanoke, WV, October 2014).
- 28 Sean O'Leary, "Cracking the Cracker Bill," (West Virginia Center on Budget and Policy, February 2, 2012).
- 29 Tom Knox, "'Aggressive' incentives helped lure ethane cracker plant to Ohio," *Columbus Business First*, May 26, 2015.
- 30 Bob Downing, "Kinder Morgan planning two natural gas liquids pipelines across northern Ohio," *Akron Beacon Journal*, April 3, 2015.
- 31 VA Code § 58.1-2626.1
- 32 West Virginia Legislature, 2015 Regular Session, HB 2166: West Virginia Coal Employment Enhancement Act.
- 33 Eric Bowen, Christiadi, and John Deskins, "Government Incentives to Promote Demand for West Virginia Coal," (Bureau of Business and Economic Research at the College of Business and Economics, West Virginia University, January 2015).
- 34 Rory McIlmoil et al., "The Impact of Coal on the Virginia State Budget," (Downstream Strategies, December 12, 2012).
- 35 Joint Legislative Audit and Review Commission, "Review of the effectiveness of Virginia tax preferences," (Senate Document 4, Commonwealth of Virginia, January 2012.)
- 36 WV State Tax Department and WVU BBER (2015).
- 37 Sean O'Leary, "Investing in the Future: Making the Severance Tax Stronger for West Virginia," (West Virginia Center on Budget and Policy, December 13, 2011).
- 38 Ibid.
- 39 Mayor Andy McKenzie, "Tax Reform: High Tax. Low Growth." (Presentation to the West Virginia Legislature, Joint Select Committee on Tax Reform, June 9, 2015).
- 40 O'Leary, 2011.
- 41 Email communication with West Virginia Deputy Secretary of Revenue Mark Muchow.
- 42 Natural gas liquids per barrel Average Price http://csimarket.com/stocks/operatingstat_single.php?code=DVN&statistika=stat5.