AN ANALYSIS OF
THE ECONOMIC POTENTIAL
FOR SHALE FORMATIONS IN OHIO

PREPARED BY FACULTY AND STAFF
FROM THE FOLLOWING UNIVERSITIES

SPONSORED BY
Research Team:

Andrew R. Thomas, Principal Investigator, Executive in Residence, Energy Policy Center, Maxine Goodman Levin College of Urban Affairs, Cleveland State University, Cleveland, Ohio.

Iryna Lendel, Ph.D., Co-Principal Investigator, Assistant Director, Center for Economic Development, Maxine Goodman Levin College of Urban Affairs, Cleveland State University, Cleveland, Ohio.

Professor Edward W. Hill, Dean, Maxine Goodman Levin College of Urban Affairs, Cleveland State University, Cleveland, Ohio.

Professor Douglas Southgate, Department of Agricultural, Environmental, and Development Economics, The Ohio State University, Columbus, Ohio.

Professor Robert Chase, Chair, Petroleum Engineering and Geology Department, Marietta College, Marietta, Ohio.

Address Questions to:

Andrew R. Thomas, Executive in Residence, Energy Policy Center, UR 132, 2121 Euclid Avenue, Cleveland, Ohio 44115-2214. Telephone: (216)-687-9304. Email address: a.r.thomas99@csuohio.edu

Linda Woggon, Executive Director, Ohio Shale Coalition, C/O Ohio Chamber of Commerce, 230 East Town Street, Columbus, Ohio 43215. Telephone: (614) 228-4201. Email address: lwoggon@ohiochamber.com
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I. Executive Summary

For the first time in over 100 years, Ohio finds itself on the threshold of not only being self-sufficient in the production of oil and gas, but also possibly even being a hydrocarbon exporter. This dramatic renaissance in Ohio’s oil and gas industry comes courtesy of new drilling and completion technologies that has enabled oil and gas producers to extract hydrocarbons from shale reservoirs that heretofore were considered uneconomical to produce, due to the impermeability of the shale formations.

The new technologies that have enabled the rapid growth of shale development – horizontal drilling and improved hydraulic fracturing techniques – will require considerable investment by producing companies in Ohio. The first major investment to be made is the acquisition of mineral rights. Mineral leases are currently being acquired with bonus and royalty rates never before seen in Ohio. Notwithstanding these very high rates, leasing has been robust, with some 3 million plus acres of mineral rights acquired in the last several years, and ongoing land operations show no immediate sign of abatement. Lease bonuses have averaged around $2500/acre, and royalty rates have averaged around 15%, although both have been higher in the most prospective areas of Ohio.

The second major investment that will be made in Ohio relates to road and bridge upgrades associated with drilling wells. The heavy equipment needed to bring in drilling equipment and to haul water and other materials requires heavy-duty roads to be built and maintained. An estimated $1.1 million dollars is likely to be expended, on average, by producing companies in road and bridge upgrades for each drilling location. Producing companies will use “pads” from which they will drill as many as six to eight wells each. Road upgrades will be required for each pad, and probably multiple times. Construction jobs for road upgrades are expected to go predominantly to Ohio suppliers and laborers.

Drilling and completing wells will comprise the third, and most significant, expenditure by oil and gas companies in Ohio. Wells are expected to cost between $5 million

Background

Cleveland State University, Ohio State University and Marietta College (the “Study Team”) were jointly asked by the Ohio Shale Coalition, led by the Ohio Chamber of Commerce, to investigate the nature and amount of economic activity that is likely to be spurred by this development. The Study Team undertook to evaluate the economic impact by collecting data, preparing models, and implementing the most commonly accepted software in economic development circles for studying economic impact. Since drilling and production data from the Utica shale is at the time of this publication unavailable, the Study Team relied upon a combination of interviews with industry experts and executives, the examination of prior studies in other shale plays, and interviews with government executives to build a model for likely development scenarios in Ohio. The study looks at the economic impact of shale development for the years 2011 to 2014.

Because data are just beginning to become available, the Study Team has generally been conservative in its estimates. As more and better data become available, the models can be updated, and a more accurate view of the economic activity associated with shale formation can be developed.
and $6 million each to drill and complete. Drilling started off slowly in Ohio in 2011, with 33 total wells drilled, and only 4 placed into production. However drilling is expected to ramp up quickly, with over one thousand wells a year being drilled by 2014. This means that by 2014, over $6 billion dollars will be spent on drilling and completing wells in Ohio. Ohio’s service industry will need time to catch up with Pennsylvania and other oil and gas producing states, so Ohio will likely see no more than 50% of this investment stay in Ohio during the early stages of the Utica Shale development.

The fourth and final aspect of expenditure in Ohio to be considered in this study was for the post-production stage of development. Once the production is placed on line, there must be a “midstream” infrastructure in place to transport the hydrocarbons to a processing facility, or directly to a market. One feature of the Utica Shale is that, unlike the nearby Marcellus Shale, it produces both liquids and natural gas. Even the natural gas produced contains large volumes of liquids contained in suspension in the gas stream. These liquids are valuable and can be separated from the “dry” gas (methane) through processing and fractionation procedures. All of this requires building an elaborate gathering pipeline system, compressors, processing plants, fractionation plants, storage facilities, and railroad loading terminals. Most of this will be done in Ohio. However only portions of the materials and labor for this construction will be Ohio-based. Only those portions that are estimated to be Ohio-based were used in the modeling. It was assumed for estimating midstream build out that by 2014 there would be a need for infrastructure sufficient to handle a throughput of 1.5 billion cubic feet of natural gas per day in Ohio from the Utica.

The Study Team modeled production of both liquids and natural gas produced at the well for royalty and tax purposes. Production was modeled based upon a combination of estimates for drilling and production rates for the Utica, relying upon geological and petroleum engineering experts at Marietta College and from the State of Ohio Geological Survey. Estimates were based upon an average of the likely mixture of liquids and natural gas produced at the well, understanding that these mixtures are likely to vary significantly from well to well.

Based upon the anticipated spending in Ohio for leasing, road construction, drilling and completing wells, and building of post-production natural gas infrastructure, the Study Team modeled a likely economic development impact for the State of Ohio as a result of the development of the Utica Shale for the years 2011-2014. The results of this model are set forth in the following table:

<table>
<thead>
<tr>
<th>Economic Impact due to Increased Demand in Ohio as a Result of Utica Shale Development</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Added</td>
<td>$162,030,036</td>
<td>$878,982,133</td>
<td>$2,980,378,198</td>
<td>$4,857,632,095</td>
</tr>
<tr>
<td>Employment</td>
<td>2,275</td>
<td>12,150</td>
<td>40,606</td>
<td>65,680</td>
</tr>
<tr>
<td>Labor Income</td>
<td>$99,758,497</td>
<td>$571,543,463</td>
<td>$1,994,216,405</td>
<td>$3,298,757,195</td>
</tr>
<tr>
<td>Output</td>
<td>$291,574,770</td>
<td>$1,667,574,417</td>
<td>$5,823,268,396</td>
<td>$9,642,544,988</td>
</tr>
<tr>
<td>Total State and Local Taxes</td>
<td>$16,522,865</td>
<td>$73,422,148</td>
<td>$271,539,607</td>
<td>$433,528,922</td>
</tr>
</tbody>
</table>
The output measures the total value added by increased economic activity as a result of the shale development, plus the value of intermediary goods. The output is the economic development number most policy makers look to for guidance as to the economic impact of a particular industry. The calculations include not only the direct effects of the expenditures, but also the indirect (subsequent business) and induced (household spending) effects. The models indicate that outputs are expected to amount to nearly ten billion dollars per year by 2014, with another $500 million in tax revenue generated. It is expected that these numbers are likely to continue in this range in the years following 2014, although leasing and midstream infrastructure activity will significantly slow down.

The $229.6 million investment in oil and gas development in the Utica play in 2011 had an immediate impact on Ohio’s economy, resulting in the state’s Gross Product, as measured by Value Added, increasing by $162 million in that year. This translated into 2,275 jobs, and nearly $100 million in increased labor income. By 2014 the incremental economic activity in the state of Ohio from that year’s expected expenditure of $6.4 billion in oil and gas field development is expected to result in 65,680 jobs and $3.3 billion in labor income, or an average income of $50,225 per job. The model shows average labor income rising over time as the work shifts from leasing and road construction to drilling and infrastructure maintenance.

Nearly 17 percent of the increase in the number of jobs triggered by the development of Ohio’s Utica Shale deposits will come from oil and gas field service companies, with employment doubling between 2013 and 2014. The average earnings for this group are $69,000 per year. The largest growth in employment will be in construction-related trades as wells are drilled and midstream facilities are constructed. Nearly 11,000 local construction jobs will be created as new manufacturing facilities and other nonresidential structures are constructed, which includes midstream infrastructure, as well as pipelines and roads and bridges. These will pay an average of $48,000 per position. Truck drivers will be in great demand as servicing companies, wholesalers, delivery services, and construction companies ramp up their employment to meet demand. Expected average labor income is nearly $53,000.

The model estimates that by 2014 over 1,500 jobs for engineers and architects will be established, as will 1,000 environmental compliance technicians. There will be demand for more than 1,800 office workers along with nearly 500 technical consultants. The leasing and contracting work will help turn around a soft market for attorneys, with nearly 841 positions expected to open. The highest paid in this sector are the managers, with average labor income of $109,000, followed by those who provide consulting services at $75,000. A related source of employment will be of “landmen,” a career unique to the oil and gas and mining industries. More than 2,100 people in the real estate industry, with average incomes of nearly $70,000, will be engaged as a result of the Utica development.

The development of the Utica formation will also result in increased land and property values throughout the region. This will not only be due to the direct economic activity triggered by drilling and building out supporting infrastructure, but will also be due to the increased value of housing and general commercial structures throughout the eastern half of the state as employment increases and wages and incomes rise.

Gross State (or Domestic) Product is expected to increase by $4.9 billion in 2014.
due to the development of the Utica formation as an energy resource. This is equal to a 1 percent increase in the real value of Ohio’s Gross State Product – greater than the average annual growth rate in Ohio for the past 13 years (0.6%).

The oil and gas “downstream” industry – that industry that relates to the consumption of hydrocarbons -- was not modeled in this study. However the Study Team did examine generally downstream opportunities for Ohio as a result of the Utica Shale development, and includes herewith a discussion.

Because Ohio’s shale industry is in its early stages, data is incomplete. It is expected that as data becomes available, the models may be updated to reflect the better data and to provide a more accurate picture of the economic impact the development of the Utica Shale in Ohio. It is also important to note that the study term only goes to 2014, at which time the industry will likely yet be growing in Ohio. Accordingly, a significant part of the economic development growth may occur after the study date conclusion.