OHIO STATE UNIVERSITY EXTENSION

Building Sustainable Communities in Ohio's Shale Region:

Leveraging Manufacturing Clusters and Local Assets with Strategic Planning

2015 Eastern Ohio 25 County Regional Report

Community and Energy Series Technical Report 16-01

THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

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Acknowledgments

A special thank you to the following team members for their contributions to the development of this report.

Nancy Bowen, OSU Extension Field Specialist, Community Economics

Eric Romich, OSU Extension Field Specialist, Energy Development

David Civittolo, OSU Extension Field Specialist, Community Economics

Contents

EDA Shale Energy Grant

Project Background and Overview

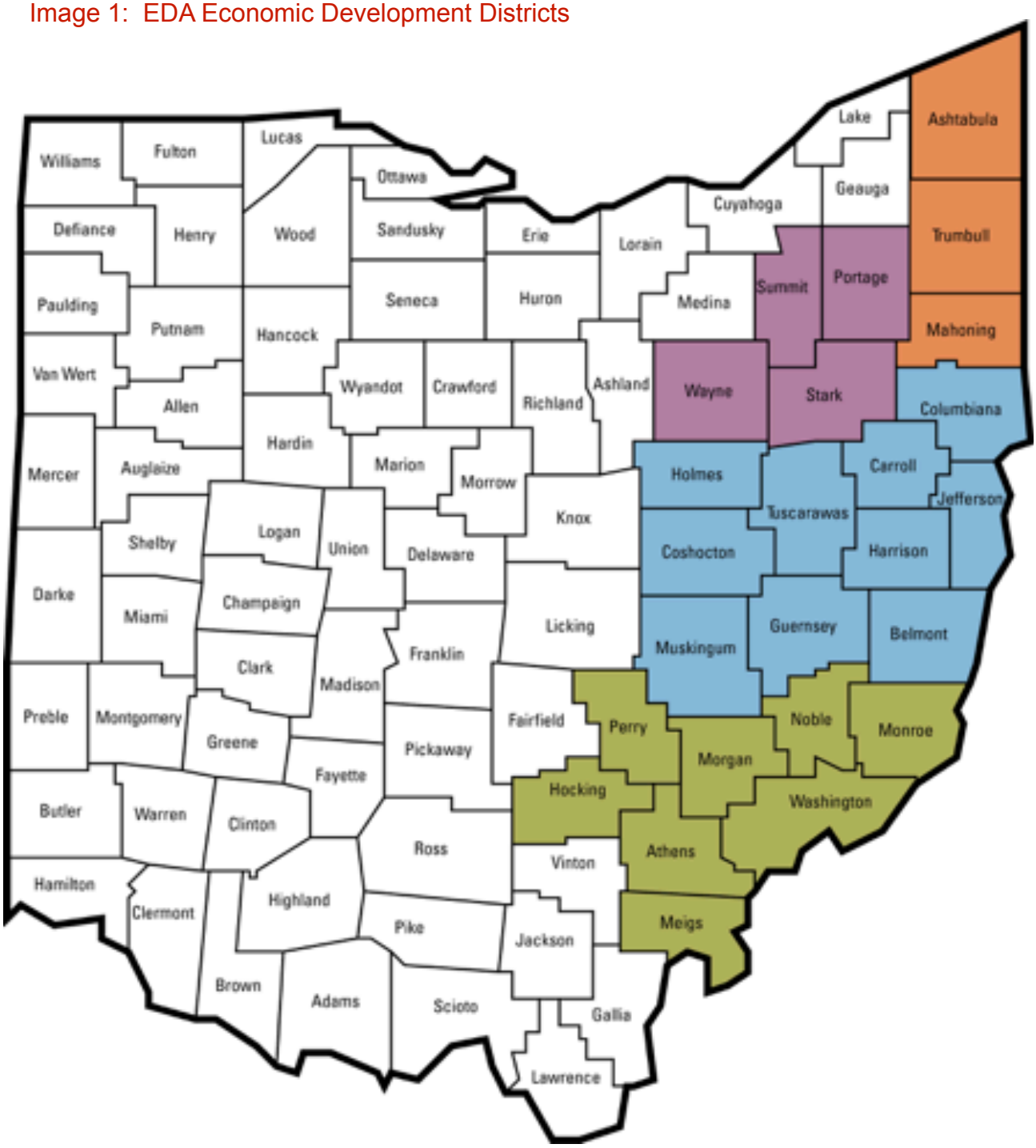
This Economic Development Administration (EDA) grant funded project is a collaborative initiative between Ohio State University Extension, Eastgate Regional Council of Governments, Northeast Ohio Four County Regional Planning and Development Organization, Ohio Mid-Eastern Governments Association, and the Buckeye Hills-Hocking Valley Regional Development District (Image 1). The project is designed to connect the four regional economic development stakeholders with economic research related to the current oil and gas boom in Ohio to inform the development of long term planning strategies that support long-term economic viability and community sustainability.

To achieve these goals, the project partners are focusing on the following objectives:

1) Developing a collaborative multi-disciplinary team of researchers and community stakeholders
2) Conducting research based on private and public data sources to measure change
3) Developing a replicable sustainable strategic shale energy planning process
4) Establishing implementation strategies

The primary objective of this research project is to promote long-term community sustainability and economic diversity. This can be accomplished by countering the permanent reduction of non-renewable natural resource (extraction) by proactively developing a sustainable plan to increase human capital, environmental capital, and infrastructure or built capital. This project will demonstrate a model, which leverages the advancement of innovation, entrepreneurship, cluster development, and sustainable strategic planning to promote economic diversity and viability.

Image 1: EDA Economic Development Districts



Eastgate Regional Council of Government

Northeast Ohio Four County Regional Planning and Development Organization

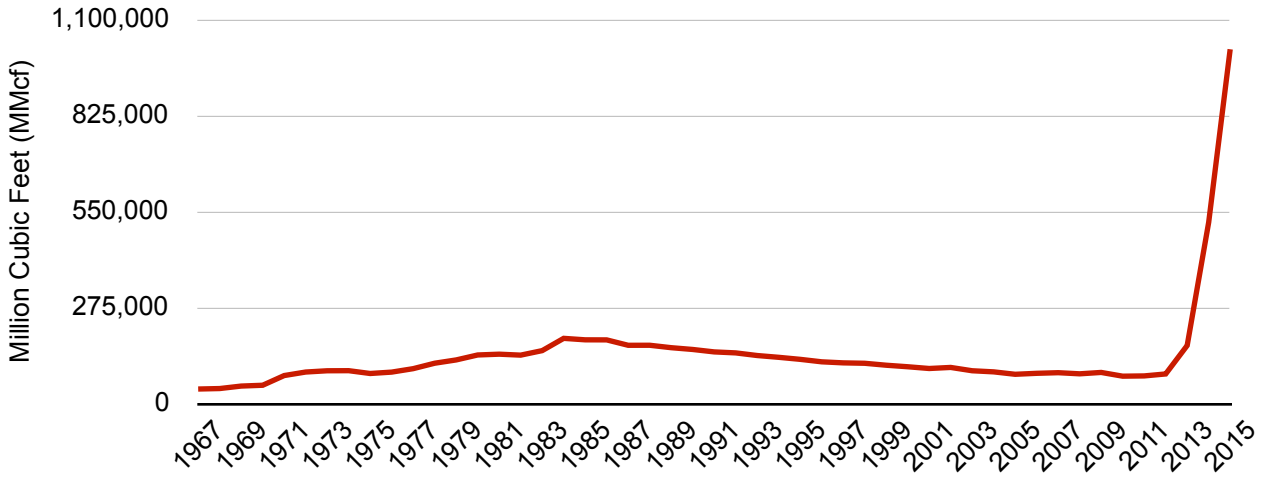
Ohio Mid-Eastern Governments Association

Buckeye Hills-Hocking Valley Regional Development District

Ohio Oil and Gas Production

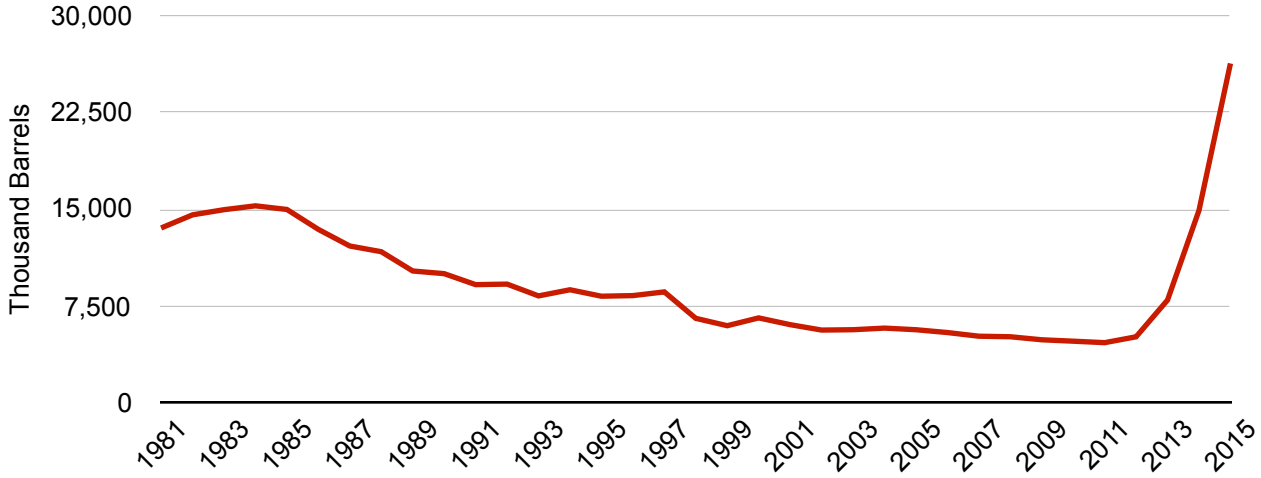
Oil and gas development in Ohio has been primarily concentrated on a narrow strip in eastern Ohio extending from Carroll County to Noble County. As wells were drilled, the region also experienced rapid development of midstream processing and fractionation plants designed to clean and remove the "wet" components from the rich gas found in the region. As these plants come on line, it is likely that more wells will be drilled and a network of pipelines will be installed throughout the region and across the state to move the product from the wellhead, to midstream operations, and ultimately the end use consumers. In 2014 and 2015, the state reported significant increases in the production of both crude oil and natural gas (Chart 1 and Chart 2).

Chart 1: Ohio Natural Gas Annual Gross Withdrawals



Source: U.S. DOE Energy Information Administration, 2/29/2016

Chart 2: Ohio Annual Field Production of Crude Oil



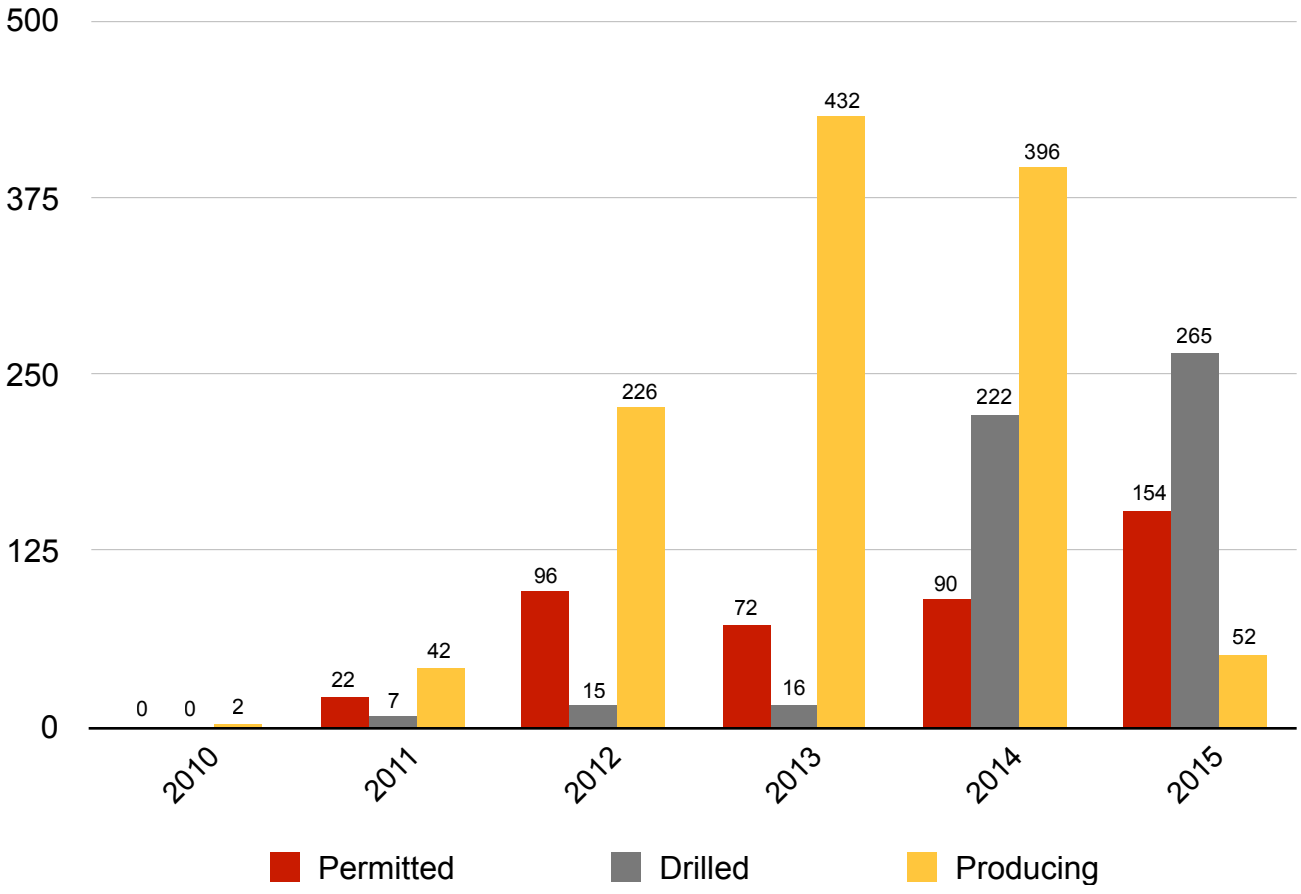
Source: U.S. DOE Energy Information Administration, 2/29/2016

Utica/Point Pleasant Shale

Development Overview

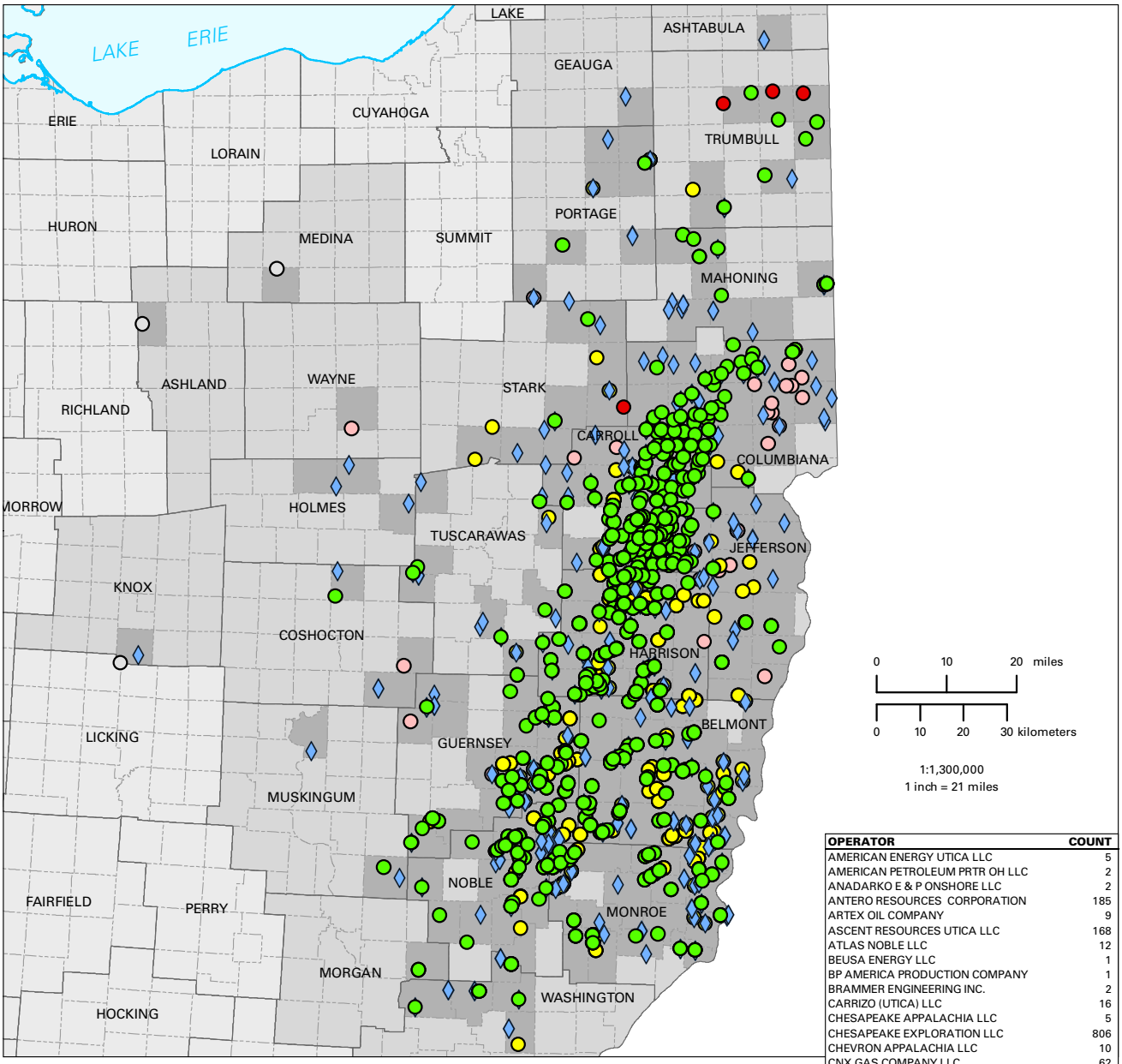
Starting in 2010, Ohio began to experience an increase in shale activity including well permits, drilling activity, and producing wells in the Utica/Point Pleasant formation. Chart 3 below summarizes the number of permits issued, wells drilled, and operating wells in the Utica/Point Pleasant by year. The total number of horizontal permits has increased from zero in 2010 to more than 2,133 in February 2016. Between 2010 and 2016 there has been a total of 1,678 horizontal wells drilled in Ohio. In 2013, Ohio experienced the highest annual number of producing horizontal wells with a total of 432 wells. By February 2016 the cumulative total of producing horizontal wells in Ohio reached 1,150.

Chart 3: Status of Utica/Point Pleasant Shale Wells by Year



Source: Ohio Department of Natural Resources, 2015, Horizontal Utica-Point Pleasant Well Activity in Ohio: Cumulative Permitting Activity Through 2/6/2016.

Image 2: Horizontal Utica - Pt. Pleasant Well Activity in Ohio



EXPLANATION

Horizontal well status as of 2/6/2016

- PERMITTED-(Permitted; Not Drilled; Canceled) (454)
- DRILLED-(Drilling; Well Drilled) (457)
- PRODUCING-(Producing; Plugged Back) (1,156)
- INACTIVE-(Drilled Inactive; Shut in) (33)
- Lost Hole or Final Restoration (28)
- Dry and Abandoned (3)
- Plugged and Abandoned (1)

Well permit information from the ODNR Division of Oil and Gas Resources Management

Recommended citation:
Ohio Department of Natural Resources, 2015, Horizontal Utica-Point Pleasant Well Activity in Ohio: Columbus, scale 1:1,300,000, revised 2/8/2016.

OPERATOR	COUNT
AMERICAN ENERGY UTICA LLC	5
AMERICAN PETROLEUM PRTR OH LLC	2
ANADARKO E & P ONSHORE LLC	2
ANTERO RESOURCES CORPORATION	185
ARTEX OIL COMPANY	9
ASCENT RESOURCES UTICA LLC	168
ATLAS NOBLE LLC	12
BEUSA ENERGY LLC	1
BP AMERICA PRODUCTION COMPANY	1
BRAMMER ENGINEERING INC.	2
CARRIZO (UTICA) LLC	16
CHESAPEAKE APPALACHIA LLC	5
CHESAPEAKE EXPLORATION LLC	806
CHEVRON APPALACHIA LLC	10
CNX GAS COMPANY LLC	62
DEVON ENERGY PRODUCTION CO.	13
ECLIPSE RESOURCES I LP	129
EM ENERGY OHIO LLC	11
ENERVEST OPERATING LLC	22
EQT PRODUCTION COMPANY	8
GULFPORT ENERGY CORPORATION	267
HALCON OPERATING COMPANY INC.	13
HESS OHIO DEVELOPMENTS LLC	89
HESS OHIO RESOURCES LLC	1
HG ENERGY LLC	7
HILCORP ENERGY COMPANY	38
MOUNTAINEER KEYSTONE LLC	8
NGO DEVELOPMENT CORP.	1
PDC ENERGY INC.	42
PROTEGE ENERGY III LLC	1
R E GAS DEVELOPMENT LLC	48
RICE DRILLING D LLC	49
SIERRA RESOURCES LLC	3
STATOIL USA ONSHORE PROP INC.	18
SWEPI LP	1
TRIAD HUNTER LLC	23
XTO ENERGY INC.	54
TOTAL	**2,132**

Demographic

Demographics for Table 1 below were obtained from STATSAmerica for the 25 county region, the 4 respective regions (Buckeye, Eastgate, NEFCO, and OMEGA), and each county making up the 25 county region. Demographics researched included population, per capita income, poverty rate, and unemployment rate (Table 1).

Table 1: Ohio and Regional Demographic

	Population		Per Capita Personal Income		Poverty Rate		Labor Force		Unemployment Rate (Seasonally Adjusted)	
County	2014	2010	2014	2010	2014	2010	2014	2010	2014	2010 (Sept)
Ohio	11,570,808	11,536,503	41,049	38,799	0.159	0.098	5,765,704	5,340,860	0.074	0.105
25 County Region	2,575,298	2,594,677	38,193	27,294			1,124,012	1,305,298	0.054	0.104
Buckeye Region	257,465	260,084	32,128	21,957			111,992	119,930	0.061	0.113
Eastgate Region	537,554	550,627	36,717	26,869			246,243	269,642	0.059	0.13
NEFCO Region	1,195,098	1,193,306	41,685	30,118			608,411	628,889	0.05	0.105
OMEGA Region	585,181	590,660	35,086	24,369			271,749	281,776	0.055	0.119
Source: Stats America, March, 2016										

Demographic Trends

- In 2014, the 25 County Region total population of 2,575,298 was about 22.2% of the State of Ohio's total population (11,507,808).

- The NEFCO Region had the largest population at 1,195,098, followed by Omega (585,181) and Eastgate (537,554). The Buckeye Region had the least population at 257,465, which made up only 10% of the total population in the 25 county region in 2014.

- While the State of Ohio's population increased slightly between 2010 and 2014, the 25 County Region showed a slight decrease in terms of total population. Of the 4 Regions, only the NEFCO Region showed a slight increase in population. In terms of actual population numbers, the Eastgate Region lost the most population (from 550,627 in 2010 to 537,554 in 2014).

- While the per capita income in Ohio was $41,049 in 2014, the 25 County Region had a per capita income of $38,193, which was almost $3,000 less than the State of Ohio's. Of the four regions, the NEFCO was the only region above the State of Ohio's per capita income. In 2014, the NEFCO Region had a per capita income of $41,685, almost $700 above the State of Ohio's per capita income. The Buckeye Region had the lowest per capita income in 2014 at $32,198, almost $9,000 less than the State of Ohio's.

- While the State of Ohio had a labor force of 5,765,704 in 2014, the 25 County Region had 1,124,012, which made up almost 20% of the total labor force in Ohio. While the labor force in Ohio actually increased between 2009 and 2014, the 25 County Region saw a decrease. For example, in the Eastgate Region, the labor force shrank by over 16,000 people between 2009 and 2014.

- The Unemployment Rate in the State of Ohio in 2014 was 7.4%. The 25 County Region had an unemployment rate of 5.4% during the same time frame. In fact, all 4 Regions were below that State Of Ohio's unemployment rate with the lowest found in the NEFCO region (5.0%), followed closely by OMEGA (5.5%) and Eastgate (5.9%).

Economic Impact Analysis

Methodology

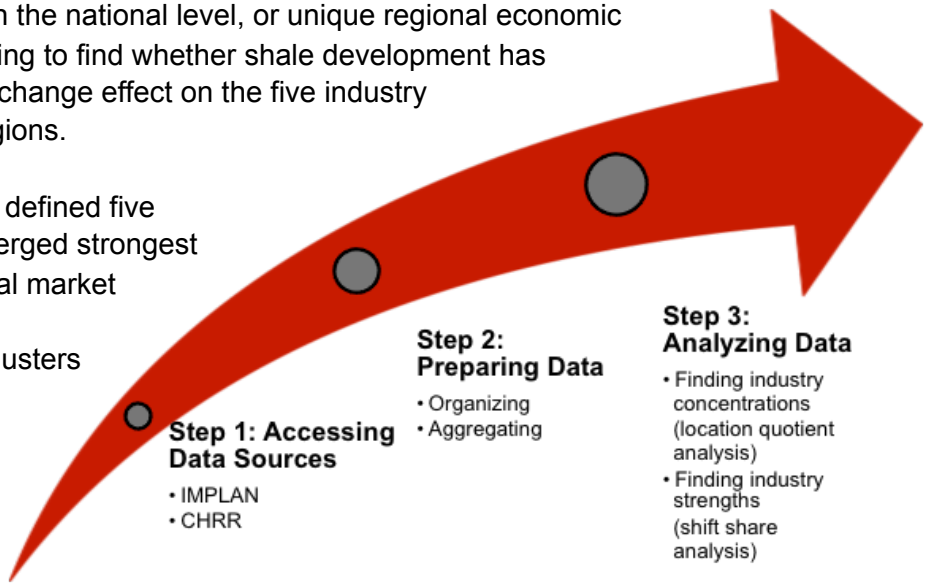
The research focused on the economy. It was a quantitative longitudinal study to track employment levels over time, measuring changes in the economy using employer enterprise data from the Quarterly Census of Employment and Wages (QCEW). This data was accessed through the Ohio Longitudinal Data Archive (OLDA), managed at the Ohio State University's Center for Human Resource Research (CHRR).

The QCEW data was aggregated for the top five industry clusters by change in employment for each region. The data was aggregated to the cluster level (with each cluster including many sectors), to ensure confidentiality to avoid disclosing the identity of employers.

Researchers focused on identifying the manufacturing sectors and occupations that are most impacted by the shale gas industry. The longitudinal approach, to track cluster changes over time, determined whether certain clusters increased, decreased or stayed relatively the same. Researchers conducted a Location Quotient (LQ) and Shift Share analyses to measure the relative concentration and strength in manufacturing sectors.

Shift Share is comprised of three components: 1) national share, 2) industrial mix, and 3) regional shift. While LQ measures the relative concentration of an industry, shift share explains the reason for the concentration, whether it is due to national economic growth, growth of the industry cluster on the national level, or unique regional economic changes. This analysis is seeking to find whether shale development has had a positive or negative jobs change effect on the five industry clusters within the four EDD regions.

Further aggregation of the data defined five manufacturing clusters that emerged strongest as a result of regional or national market confluences related to shale development. The five broad clusters were: 1) machinery, 2) metals, 3) chemicals, 4) energy, and 5) wood. The specific steps to assess, prepare and analyze the data are illustrated in the model on the right.



Occupational Clusters and Trends (OES)

Occupational clusters were explored using an online resource, StatsAmerica. For the 25 county region and each of the four subsequent economic development districts, the occupational concentration were highest in Metals Manufacturing and Chemicals and Chemical-Based Products. Despite the shale development in eastern Ohio, the energy concentration was the lowest in every region with the exception of the Buckeye Hills-Hocking Valley Region where the energy cluster ranked third with a concentration of 1.4 representing 4,353 jobs.

Table 2: Industry Cluster Employment Location Quotient (2012)

Area/Cluster	Concentration (LQ)	Employment
25-County Region		
Metals Manufacturing	4.18	34,114
Chemicals and Chemical-Based Products	2.04	28,274
Machinery Manufacturing	1.63	9,767
Wood and Forest Manufacturing	1.31	11,762
Energy	0.88	38,281
NEFCO		
Metals Manufacturing	3.66	19,971
Chemicals and Chemical-Based Products	2.11	15,308
Machinery Manufacturing	1.63	5,292
Wood and Forest Manufacturing	1.03	4,826
Energy	0.73	18,277
Eastgate		
Metals Manufacturing	4.9	6,529
Chemicals and Chemical-Based Products	1.33	3,796
Machinery Manufacturing	1.3	1,656
Wood and Forest Manufacturing	0.96	1,772
Energy	0.59	5,270
OMEGA		
Metals Manufacturing	5.1	6,547
Chemicals and Chemical-Based Products	2.27	6,301
Wood and Forest Manufacturing	2.46	4,422
Machinery Manufacturing	2.25	2,419
Energy	1.19	10,381
Buckeye Hills-Hocking Valley		
Metals Manufacturing	3.63	1,067
Chemicals and Chemical-Based Products	2.91	2,869
Energy	1.4	4,353
Wood and Forest Manufacturing	1.16	742
Machinery Manufacturing	1.01	400

Total 25 County EDA Region

Location Quotient

Location quotients, as mentioned earlier, show the strength and concentration of industry sectors relative to the U.S. economy based on employment. While all five clusters showed a strong LQ of over one, the Machinery Manufacturing cluster had the highest percent change in the 25 county region of 53%. Even though the Chemicals and Chemical Based Products and Energy clusters showed a negative change, these clusters in the 25 county region were extremely strong relative to the U.S. with LQ's much greater than one.

Location quotient, simply referred to as LQ, shows local or regional strengths based on employment.

Table 3: Total 25 County Region Manufacturing Clusters by Location Quotient

Cluster Description	2010 LQ	2014 LQ	% Change
Metals Manufacturing	3.33	3.43	0.03
Chemicals & Chemical Based Products	2.56	2.38	-0.07
Machinery Manufacturing	1.25	1.92	0.53
Energy	1.71	1.61	-0.06
Forest and Wood Products	1.42	1.48	0.04
Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive			

Shift Share

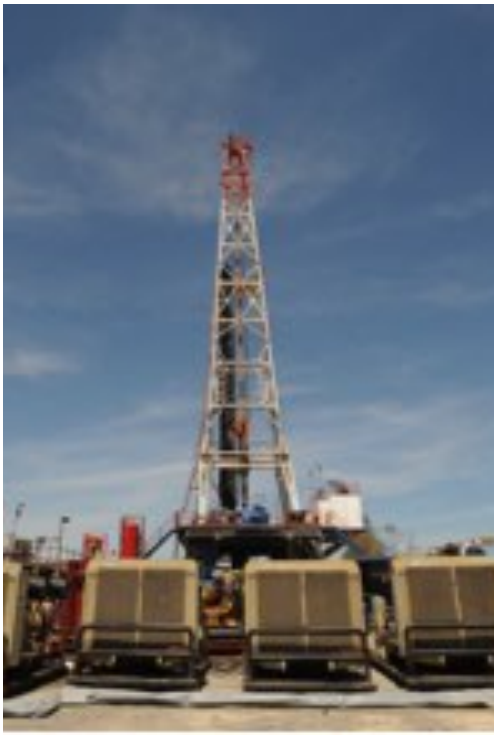
Shift share is an analytical tool used to determine how much job growth can be attributed to regional factors.

Table 4 shows the results of the shift share analysis for the 25-county region. Significant job growth took place in all five clusters, clusters that account for the majority of manufacturing jobs in the region between 2010-2014. The cluster with the largest increase in jobs during this period was the Machinery Manufacturing cluster. This cluster is comprised of NAICS category 333, a broad group which includes agriculture, construction, mining, and commercial and industrial machinery. The group also includes HVAC machinery, and engine, turbine and power equipment machinery manufacturing. With the region's strong concentration in manufacturing jobs, this cluster is comprised of important processes used in manufacturing, such as welding and assembling parts, skills that support a growing manufacturing base. With over 90% of the job creation in the five clusters occurring as a result of regional factors, researchers conclude that much of the positive changes, although potentially short term, took place due to some unique competitive advantage, such as shale development. As seen in Table 5, the regional effect was positive for all five clusters within the 25-county region, even as industry mix factors in three of the clusters are negative.

Table 4: Total 25 County Region Manufacturing Clusters by Shift Share Analysis

Cluster Description	National Share	Industry Mix	Regional Shift	Total Change (2010 - 2014)
Machinery Manufacturing	1,544	308	26,562	28,413
Chemicals & Chemical Based Products	823	-77	14,220	15,043
Energy	1,051	-343	6,832	7,540
Metals Manufacturing	2,404	-39	21,978	24,343
Forest and Wood Products	31	27	5,782	5,840
Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive				

Buckeye Hills-Hocking Valley



Location Quotient

Table 5 below illustrates the change in LQ between 2010 and 2014 for the Buckeye Hills-Hocking Valley region. All five clusters showed a very strong percent change of LQ between 2010 and 2014. Four of the clusters that experienced growth consist of LQ's that are well above one, indicating the region was extremely strong relative to the U.S. economy. The remaining cluster, Machinery Manufacturing had the highest percent change in the region of 307%. Although Machinery Manufacturing recorded the highest percent change, in 2010 the LQ was only 0.11 indicating this was a new emerging cluster in the region.

Table 5: Buckeye Hills-Hocking Valley Manufacturing Clusters by Location Quotient

Cluster Description	2010 LQ	2014 LQ	% Change
Energy	1.03	2.74	1.66
Chemicals & Chemical Based Products	0.77	2.28	1.94
Metals Manufacturing	0.42	1.22	1.91
Forest and Wood Products	0.87	1.19	0.37
Machinery Manufacturing	0.11	0.45	3.07
Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive			

Shift Share

Table 6 shows the results of the shift share analysis. While the LQ analysis shows concentration of clusters in a region, shift share delineates whether the concentration is due to regional or national economic changes, or due to fluctuations in the industry itself. Table 5 lists the five industry clusters for the Buckeye-Hills-Hocking Valley region and clearly demonstrates that all five clusters have expanded employment and that the growth of all five was due largely to regional changes in the economy. For instance, of the 547 jobs created in the Machinery Manufacturing cluster between 2010-2014, the vast majority, 530, were created as a result of regional changes and only 22 were attributed to the national share. Industry-wide, there was actually a negative impact of 5 jobs, an indication that between 2010-2014, the industry was contracting somewhat. Of the five industry clusters being analyzed, Chemicals and Chemical-Based Products showed the most significant change, with a total change of 1,478 jobs. Almost all of the positive change growth in this cluster can be attributed to regional shift. Energy was the only cluster that was growing, in small part, due to national share and industry mix factors, with 102 and 107 jobs attributable to these two measures, respectively.

Shift share has three components: 1) industrial mix, 2) national growth effect, and 3) regional growth effect. Industrial mix effect represents the share of job growth that is due to growth of the industry at the national level.

Table 6: Buckeye Hills-Hocking Valley
Manufacturing Clusters by Shift Share Analysis

Cluster Description	National Share	Industry Mix	Regional Shift	Total Change (2010 - 2014)
Machinery Manufacturing	22	-5	530	547
Chemicals & Chemical Based Products	40	-47	1,484	1,478
Energy	102	107	1,036	1,245
Metals Manufacturing	49	-12	753	789
Forest and Wood Products	3	3	164	169
Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive				

Eastgate Regional Council of Government

Location Quotient

Table 7 below illustrates the change in LQ between 2010 and 2014 for the Eastgate Regional Council of Government region. This was the only region to experience a negative percentage of change from 2010 to 2014 in three of the five clusters. While the Chemicals and Chemical Based Products cluster experienced a negative change of 32%, this cluster still recorded a strong LQ of 1.67 in 2014. In addition the Eastgate region posted the highest LQ for the Metals Manufacturing cluster and the Machinery Manufacturing cluster when compared to the other three economic development districts. Perhaps the greatest positive change was in the Machinery Manufacturing cluster which experienced the largest percentage change of 169% posting an LQ of 3.12 in 2014.

The LQ calculation is a division problem, finding whether the percentage of total employment in a particular sector exceeds the state or national percentage in that same sector.

Table 7: Eastgate Regional Council of Government Manufacturing Clusters by Location Quotient

Cluster Description	2010 LQ	2014 LQ	% Change
Metals Manufacturing	3.68	4.25	0.15
Machinery Manufacturing	1.16	3.12	1.69
Chemicals & Chemical Based Products	2.45	1.67	-0.32
Forest and Wood Products	0.99	0.71	-0.28
Energy	0.49	0.41	-0.17
Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive			

National growth effect explains how much of the regional growth is due to overall national economic growth.

Shift Share

As shown in Table 8 below, of all four EDD regions, the Eastgate region had the greatest positive effect in the Machinery Equipment Manufacturing cluster with a total change of 11,550 jobs. Over 95% of the jobs in this cluster were attributable to regional factors. Growth in the national economy was a positive factor in all five clusters, but more so in the Machinery and Metals Manufacturing clusters. Metals Manufacturing, a historically strong cluster for this region and comprised of iron and steel mills, steel and aluminum product manufacturing and nonferrous metal processing, also experienced significant job growth between 2010-2014. Both the Wood Products and Energy clusters have a much lesser economic profile in Eastgate than the Machinery, Metals and Chemicals and Chemical-Based Products clusters.

Table 8: Eastgate Regional Council of Government
Manufacturing Clusters by Shift Share Analysis

Cluster Description	National Share	Industry Mix	Regional Shift	Total Change (2010 - 2014)
Machinery Manufacturing	274	2	11,273	11,550
Chemicals & Chemical Based Products	151	85	1,538	1,604
Energy	58	1	359	419
Metals Manufacturing	510	1	6,809	7,320
Forest and Wood Products	4	5	423	432
Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive				

Northeast Ohio Four County Regional Planning and Development

Location Quotient

Table 9 below illustrates the change in LQ between 2010 and 2014 for the Northeast Ohio Four County Regional Planning and Development Organization region. It appears this region experienced steady and consistent growth anchored by the Metals Manufacturing and Chemicals and Chemical Based Products clusters. While it was the only region that did not have a cluster enjoy a percentage growth change of more than 100%, all five of the clusters analyzed yielded an LQ greater than one in 2014. Furthermore, even though the Chemicals and Chemical Based Products cluster indicated a negative change of 11%, this cluster still had an LQ of 2.54 which was extremely strong relative to the U.S. economy.

Do-it-yourself LQ calculators are available on the internet, on the Bureau of Labor Statistics website, or StatsAmerica (www.statsamerica.org), which is a service of the Indiana Business Research Center.

Table 9: Northeast Ohio Four County Regional Planning and Development Organization Manufacturing Clusters by Location Quotient

Cluster Description	2010 LQ	2014 LQ	% Change
Metals Manufacturing	3.07	3.73	0.22
Chemicals & Chemical Based Products	2.84	2.54	-0.11
Machinery Manufacturing	1.49	1.57	0.05
Energy	1.28	1.55	0.21
Forest and Wood Products	1.01	1.09	0.08

Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive

Shift Share

Table 10 shows the top five clusters and total employment change for the NEFCO region. As with the Eastgate region, NEFCO saw the greatest change in jobs within the Machinery and Metals clusters, although significant positive change could be seen in all five. Only the Energy cluster showed a negative industry mix relative to overall effect including both the national economic growth and regional factors. The industrial mix effect represents the share of the regional industry growth explained by the growth of the industry nationwide. With a net positive change of 15,903 jobs during the four year period between 2010-2014, NEFCO's top cluster was Metals Manufacturing. Occupations in the metalworking machinery manufacturing cluster, according to the Bureau of Labor Statistics, are projected to decline by 10,600 jobs, or by 5.8%, between 2014-2024. This region, in addition to the Eastgate region, may have a sufficient concentration necessary to leverage growth in this cluster despite national growth projections.

If regional growth is not due to either national trends in the industry or the economy as a whole, then the growth can be explained as a result of some unique competitive advantage that the region possesses; the regional growth effect.

Table 10: Northeast Ohio Four County Regional Planning and Development Organization Manufacturing Clusters by Shift Share Analysis

Cluster Description	National Share	Industry Mix	Regional Shift	Total Change (2010 - 2014)
Machinery Manufacturing	957	305	9,176	10,438
Chemicals & Chemical Based Products	475	64	7,815	8,354
Energy	409	-140	4,378	4,648
Metals Manufacturing	1,151	49	14,702	15,903
Forest and Wood Products	12	7	2,368	2,387

Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive

Ohio Mid-Eastern Governments Association

Location Quotient

Table 9 below illustrates the change in LQ between 2010 and 2014 for the Ohio Mid-Eastern Governments Association region. Of the four regions analyzed, the Ohio Mid-Eastern Governments Association region appears to have experienced the most significant growth between 2010 and 2014. In fact, four of the five clusters recorded a percentage of change increase of 120% or greater. In addition the region also posted the highest LQ for the Energy (3.71), Chemicals and Chemical Based Products (3.37), and Forest and Wood Products (3.66) clusters when compared to the other three economic development districts.

Table 11: Ohio Mid-Eastern Governments Association Manufacturing Clusters by Location Quotient

Cluster Description	2010 LQ	2014 LQ	% Change
Energy	1.24	3.71	1.99
Forest and Wood Products	1.54	3.66	1.38
Metals Manufacturing	1.77	3.43	0.93
Chemicals & Chemical Based Products	1.33	3.37	1.53
Machinery Manufacturing	0.73	1.61	1.2
Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive			

Shift Share

The OMEGA region experienced positive job change in all five clusters somewhat equally, i.e., not one cluster stood out as being that much more significant than another. That said, the Energy cluster, as would be expected, showed a more significant employment increase than other EDD regions due to the concentration of shale gas drilling and extraction in the OMEGA region. As most of the shale activity took place in this region during the 2010-2014 time period, it would be expected that job growth in the Energy cluster would also be stronger relative to the other regions. In fact, almost all of the job growth in energy, 3,924, was due to unique regional factors, most likely shale development. Forest and Wood products also experienced a significant regional shift component in OMEGA, more so than in the other four regions, with almost all of the job growth due to regional factors. The Forest and Wood cluster is comprised of establishments that make all types of wood products, including wood processing used in the construction of shale extraction pads located throughout the region.

Shift share highlights the uniqueness of a regional economy based on job growth in an industry, but does not indicate why the industry is competitive – that is determined by local leaders and analysts who have knowledge of local conditions.

Table 12: Ohio Mid-Eastern Governments Association Manufacturing Clusters by Shift Share Analysis

Cluster Description	National Share	Industry Mix	Regional Shift	Total Change (2010 - 2014)
Machinery Manufacturing	292	28	2,644	2,965
Chemicals & Chemical Based Products	156	-59	4,667	4,764
Energy	279	-97	3,924	4,107
Metals Manufacturing	468	-18	3,640	4,089
Forest and Wood Products	12	13	2,788	2,813
Source: Quarterly Census of Employment and Wages, accessed from the Ohio Longitudinal Data Archive				

Implications

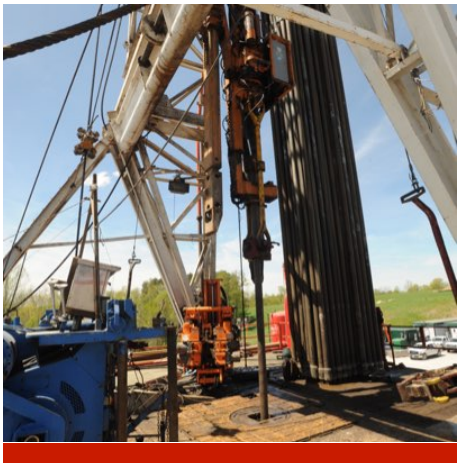
This analysis defines and demonstrates growing clusters and emerging manufacturing linkages that can be related to shale development. These linkages and potential new development activities appear to be more pronounced in the Machinery and Metals Manufacturing clusters. These two clusters together accounted for over 52,000 net new jobs within the 25-county region between 2010-2014. These two clusters were #1 and #2 in total employment change during this period, representing almost half of the total job growth. The shift share analysis indicated that over 95% of the growth was due to the regional shift or unique regional economic changes. Researchers recommend further development or attraction of new or expansion of existing businesses that help to grow regional cluster strengths. Initial strategies may include:

- Detailed mapping of the Metals and Machinery Manufacturing clusters for the 25-county region to identify common inputs and technologies. Mapping will identify potential cluster gaps or opportunities.

- Developing a bank of information and resources for the clusters to provide access to specialized market, technical and competitive information to encourage growth of businesses within the clusters.

- Identifying investments by government that can be made to incentivize additional growth and sustainability. Investments may include specialized infrastructure or educational programs, or access to potential employees trained through local programs.

- Monitoring major investments and developments in the midstream processing (i.e. natural gas processing, fractionation plants, and ethane cracker plants) that could influence the future supply chain of many Ohio manufactures.



Ohio Longitudinal Data Archive Disclaimer

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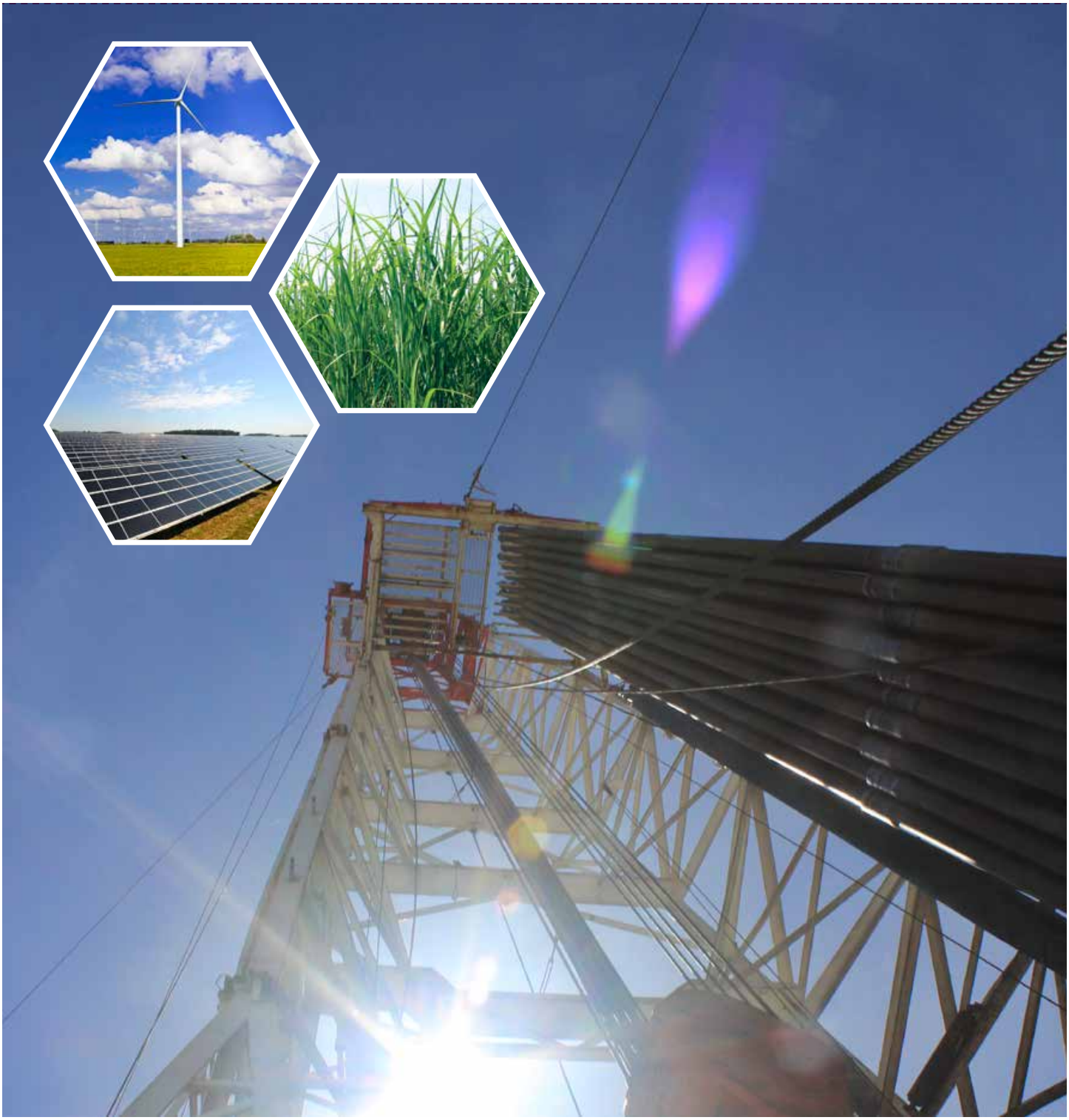

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