



# Shale Energy – An Increasingly Central Part of Economic Growth

**Dr. Iryna Lendel**

*Assistant Director*

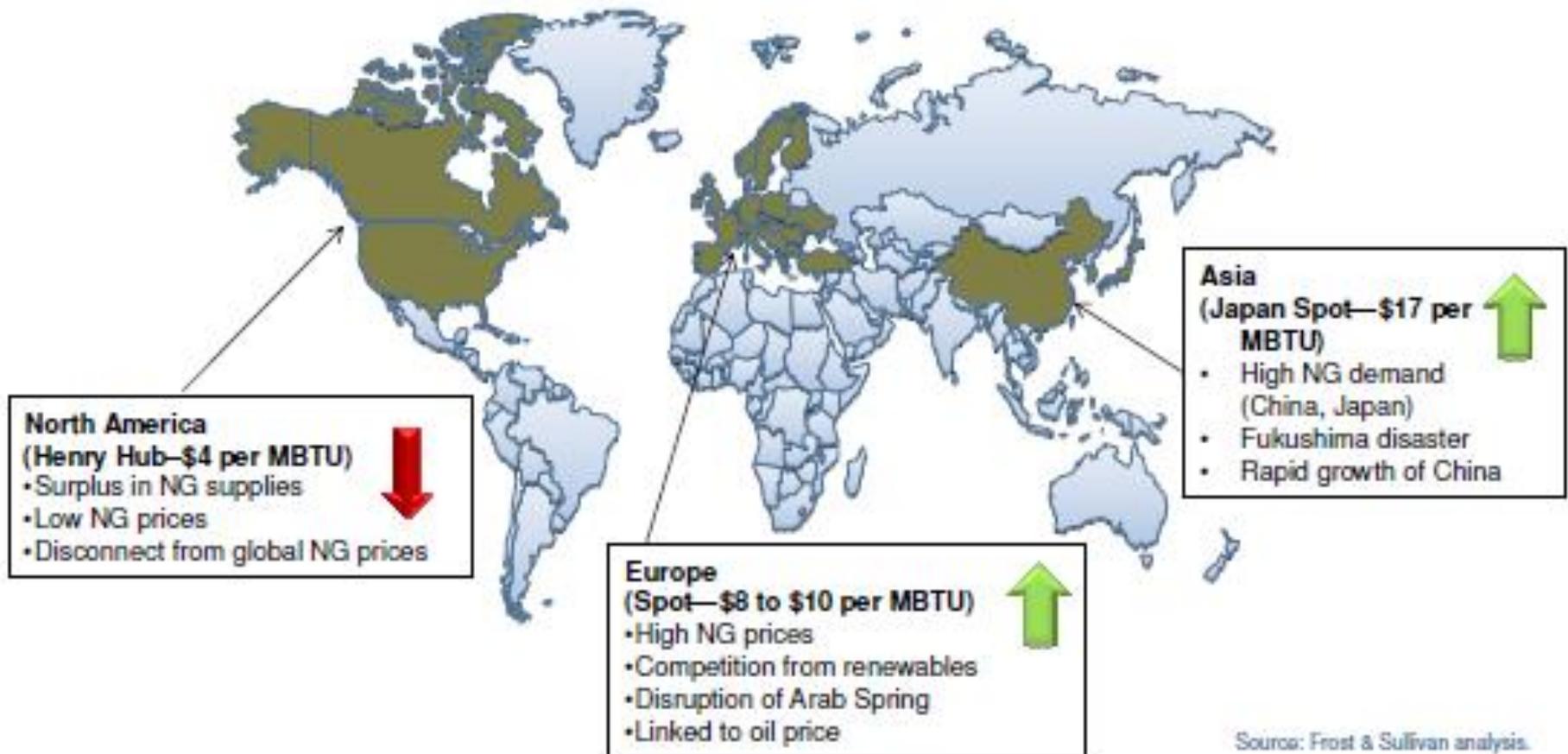
*Center for Economic Development*

*Cleveland State University*

November 25, 2013

# Effect of Shale Production on Natural Gas Prices

A natural gas surplus in the United States has pushed prices down. In other global regions, prices remain high, particularly in Asia, where demand is significant due to growth (China) and the recent nuclear disaster (Japan).



## In 32 Countries Covered in EIA Report

- The initial shale gas technically recoverable resource (TRR) estimates for the 32 countries outside the U.S. is 5,760 Tcf
  - More than six times EIA's 862 Tcf TRR estimate for U.S. shale gas
- Together with U.S. shale gas, world shale gas TRR of 6,622 Tcf raises total estimated world TRR by over 40% to 22,600 Tcf
- These are moderately conservative 'risked' estimates
  - Not probabilistic estimates
  - The methodology employed recognizes the sparseness and uncertainty of the data and includes conservative discounting of the potential resource

# 32 countries covered in the report

- **North America**

- Canada, Mexico

- **South America**

- Colombia, Venezuela, Argentina, Bolivia, Brazil, Chile, Uruguay, Paraguay

- **Australia**

- **Europe**

- Denmark, France, Germany, Netherlands, Norway, Sweden, United Kingdom, Lithuania, Poland, Ukraine, Turkey

- **Africa**

- Algeria, Tunisia, Libya, Morocco, Mauritania, Western Sahara, South Africa

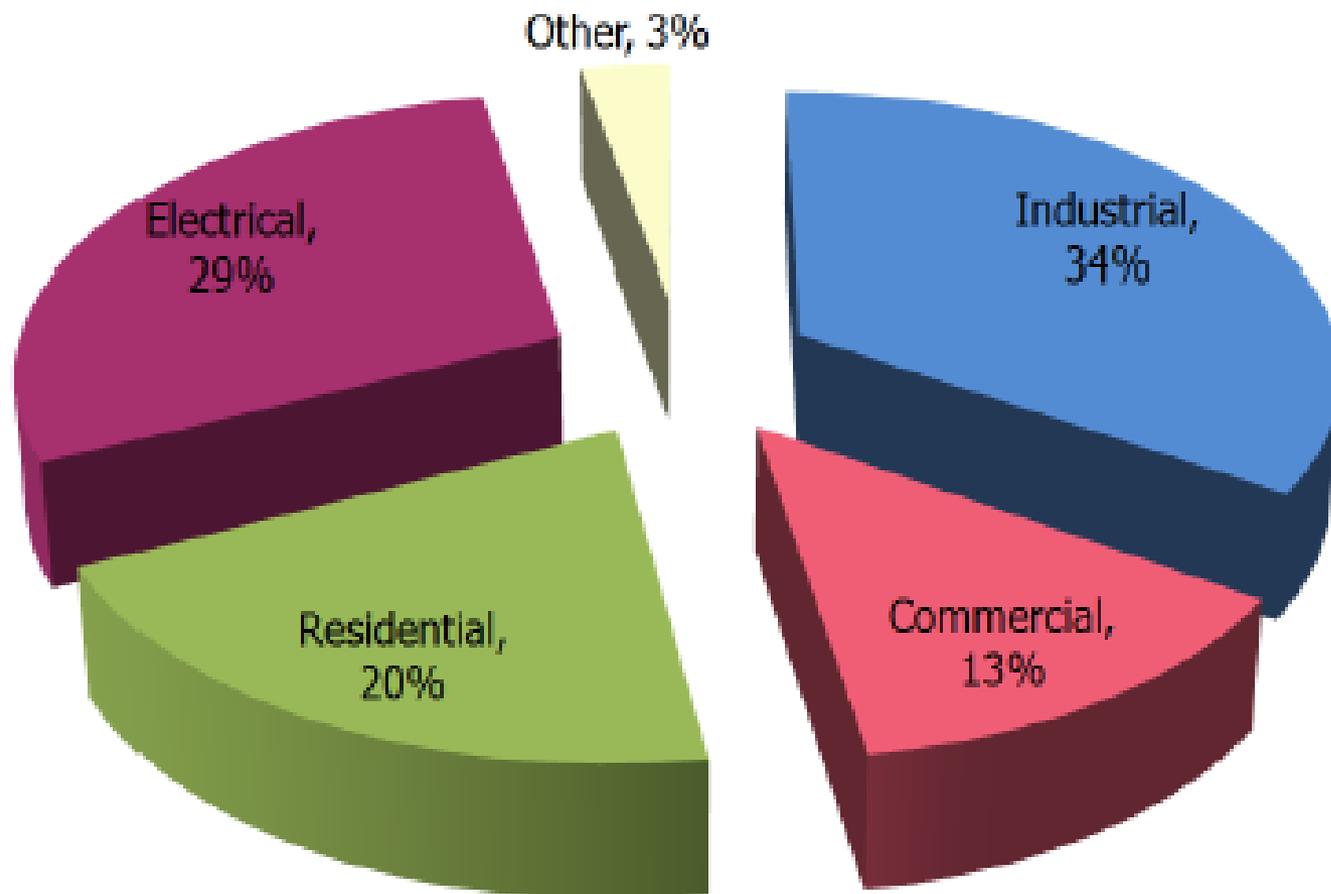
- **Asia**

- China, Pakistan, India

## Two Groups of Countries

- Countries dependent on imports but have significant shale gas resource estimates relative to their production or consumption
  - France, Poland, Turkey, Ukraine, South Africa, Morocco, Chile
- Countries that already produce a substantial amount of natural gas and are currently estimated to have a large amount of shale gas
  - U.S., Canada, Mexico, China, Australia, Libya, Algeria, Argentina, Brazil

# Natural Gas Use by Sector in the U.S.

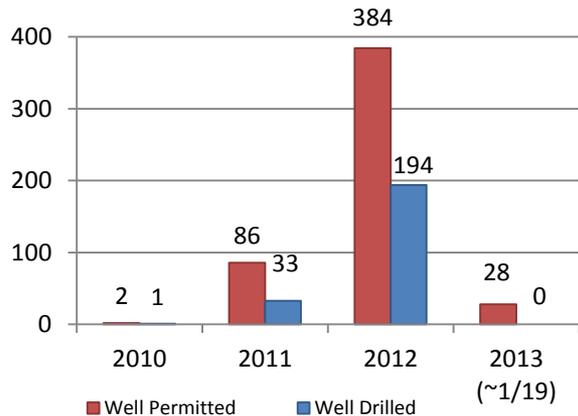


Source: EIA, 2009

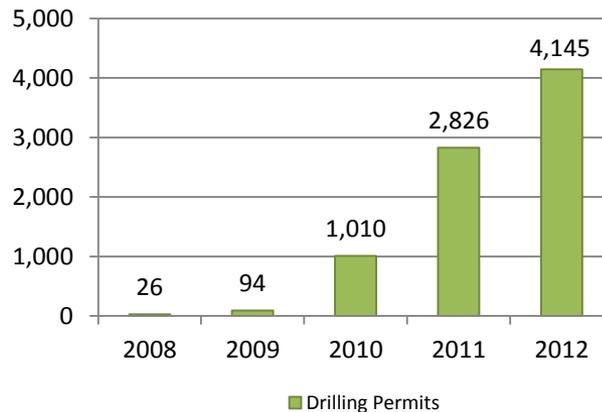
# Speed & Scope of Development is Important: Projected Number of Wells Drilled

Year	Number of Wells	Total In Production
2011 (actual)	33	5
2012	160	193
2013	650	843
2014	1,075	1,918

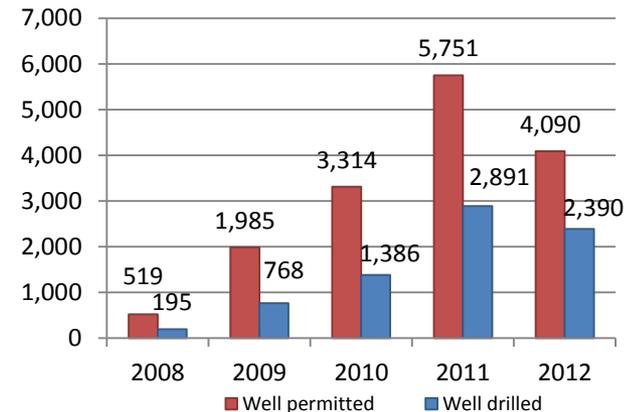
Utica Shale, OH, 2010 - 2012



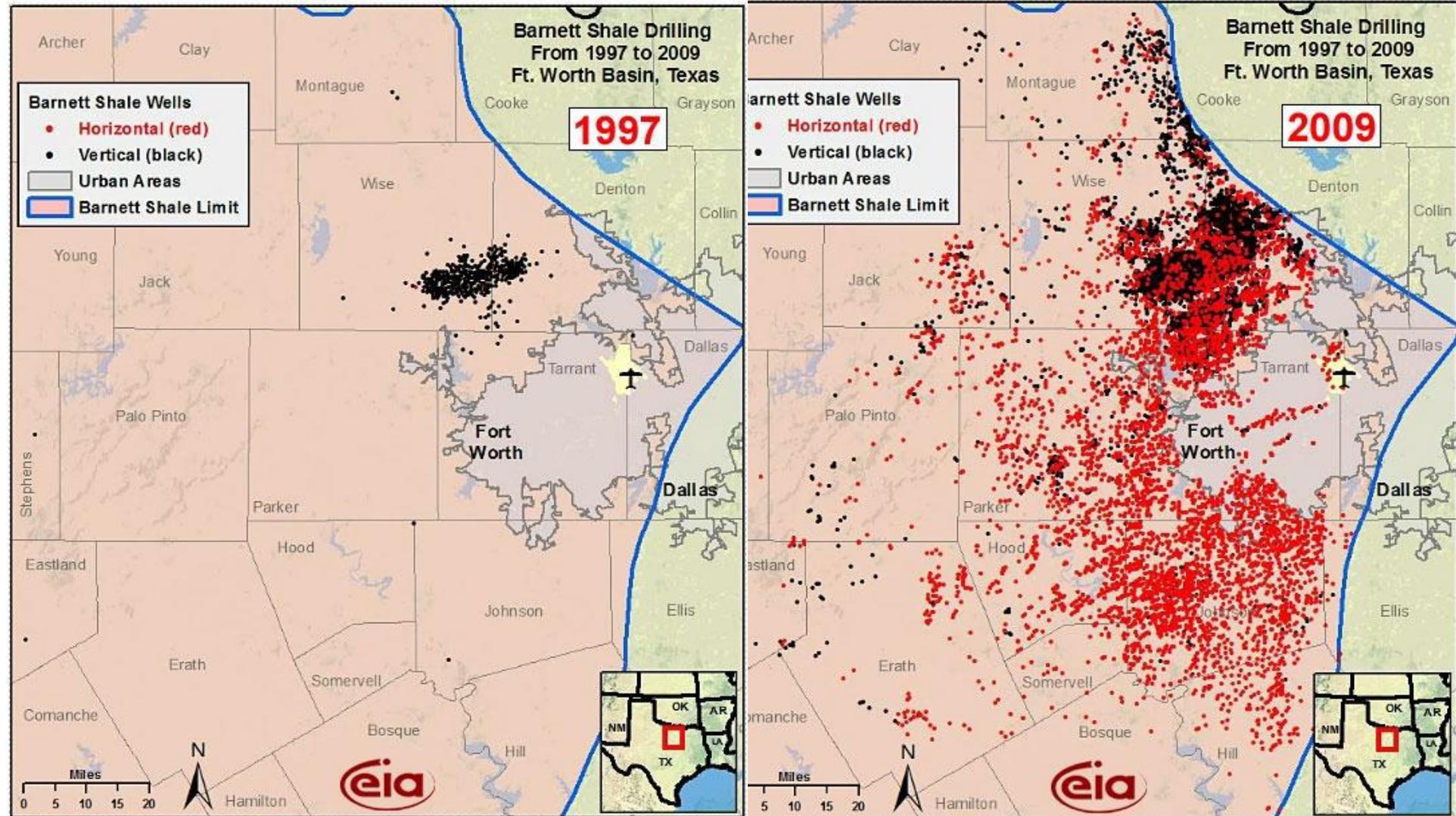
Eagle Ford, TX, 2008 - 2012

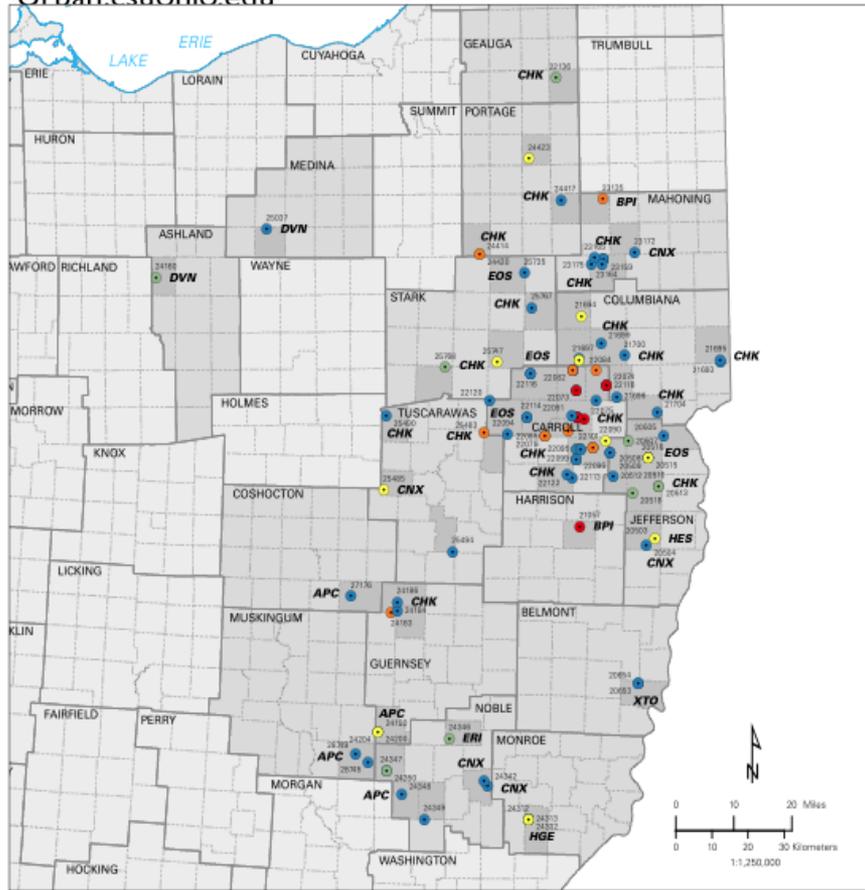


Marcellus, PA, 2008 - 2012



# Since 1997, more than 13,500 gas wells completed in the Barnett shale





**EXPLANATION**

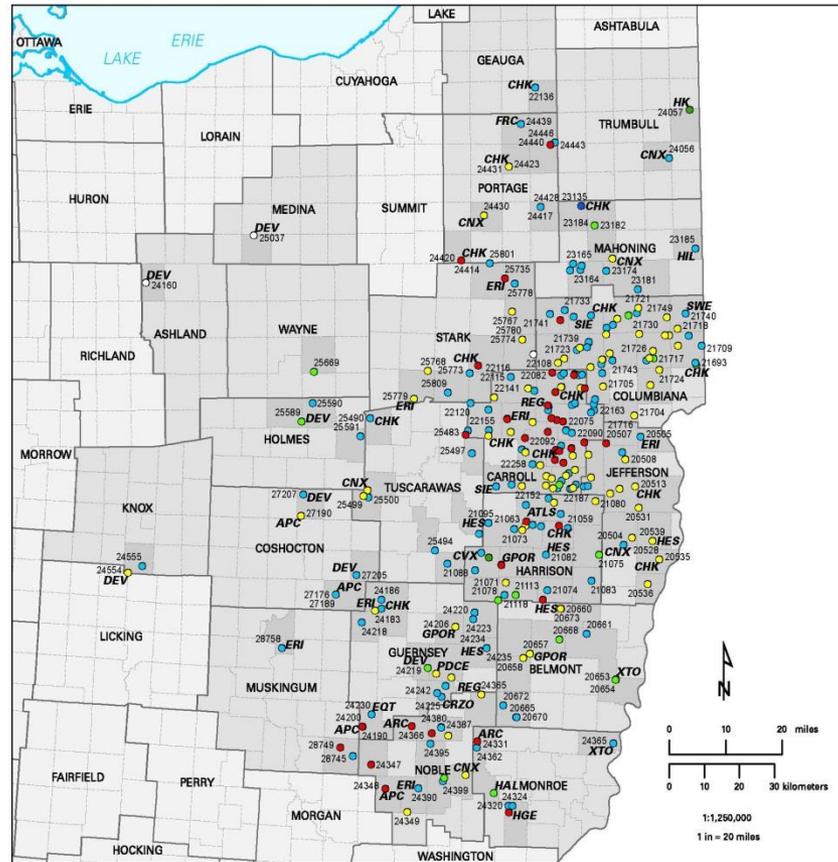
- Horizontal well status  
 Showing wells permitted 2010–Present
- Permitted
  - Drilling
  - Drilled
  - Completed
  - Producing

OPERATOR NAME	MAP LABEL	COUNT
ANADARKO E & P COMPANY LP	APC	10
CHESAPEAKE APPALACHIA LLC	CHK	6
CHESAPEAKE EXPLORATION LLC	CHK	71
CNX GAS COMPANY LLC	CNX	5
DEVON ENERGY PRODUCTION CO	DVN	2
ECLIPSE RESOURCES I LP	ERI	1
ENERVEST OPERATING L	EOS	7
HG ENERGY LLC	HGE	5
MARQUETTE EXPLORATION LLC	HES	1
OHIO BUCKEYE ENERGY LLC	BPI	2
XTO ENERGY, INC.	XTO	2
		112

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

Recommended citation: Ohio Department of Natural Resources, 2012, Horizontal Utica-Point Pleasant Well Activity in Ohio: Ohio Department of Natural Resources, Division of Geological Survey, scale 1:1,250,000.

**HORIZONTAL UTICA-POINT PLEASANT WELL ACTIVITY IN OHIO**



**EXPLANATION**

**Horizontal well status (as of 12/29/2012)**

- Producing (46)
- Drilled (128)
- Drilling (20)
- Permitted (270)
- Plugged (9)
- Not Drilled (6)
- Inactive (4)

OPERATOR	MAP LABEL	COUNT
ANADARKO E & P COMPANY LP	APC	12
ANTONIO REG APALACHIAN CORP	ARC	11
ATLAS NOBLE LLC	ATL	9
CAINCO LUTICAL LLC	CDL	2
CHESAPEAKE EXPLORATION LLC	CHK	318
DEVON APPALACHIA LLC	DEV	2
CXG GAS COMPANY LLC	CXG	18
DEVON ENERGY PRODUCTION CO	DEV	13
ENERVEST OPERATING LLC	ENR	16
EGT PRODUCTION COMPANY	EGT	1
GLUPORT ENERGY CORPORATION	GPOR	26
HALCON OPERATING COMPANY INC	HAL	1
HALL DRILLING LLC OIL & GAS	HAL	1
HES OHIO DEVELOPMENTS LLC	HES	16
HG ENERGY LLC	HGE	16
HOLDIP ENERGY COMPANY	HE	1
MOUNTAINEER KEYSTONE LLC	FRK	7
PDC ENERGY INC	PDC	3
PLS GAS DEVELOPMENT LLC	SIE	3
SEIRA RESOURCES LLC	SRE	1
SNIP LP	SNE	1
XTO ENERGY, INC.	XTO	4
		468

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

Recommended citation: Ohio Department of Natural Resources, 2012, Horizontal Utica-Point Pleasant Well Activity in Ohio: Ohio Department of Natural Resources, Division of Geological Survey, scale 1:1,250,000, revised 12/28/2012.

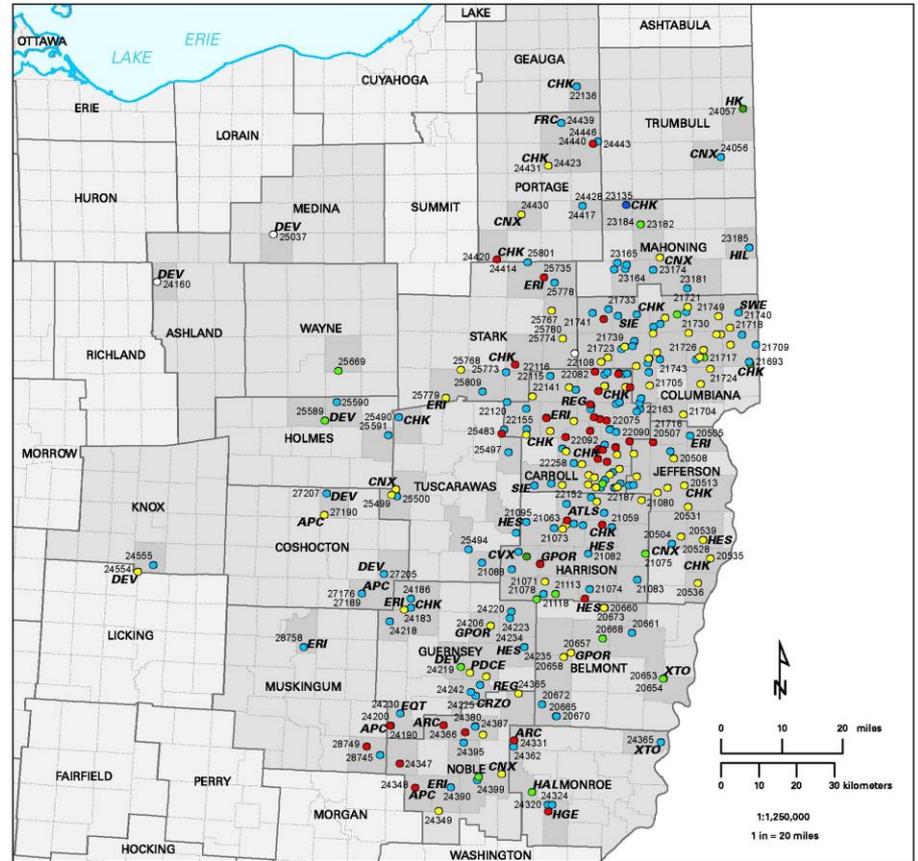
# Drilling activities on 737 wells are located in 23 counties and 140 townships

Township	Well Count	2010 Population
LOUDON	73	1,009
LEE	40	1,087
WASHINGTON	30	1,239
UNION	28	977
EAST	26	843
PERRY	24	996
SENECA	24	486
STOCK	21	478
HANOVER	18	3,296
AUGUSTA	17	1,619

Source: ODNR & U.S. Census Bureau

6/8/2013

## HORIZONTAL UTICA-POINT PLEASANT WELL ACTIVITY IN OHIO



**EXPLANATION**

Horizontal well status (as of 12/29/2012)

- Producing (46)
- Drilled (128)
- Drilling (20)
- Permitted (270)
- Plugged (9)
- Not Drilled (6)
- Inactive (4)

OPERATOR	MAP LABEL	COUNT
ANADARKO E & P COMPANY LP	APC	12
ANTHONY RES APPLACHIAN CORP	ARC	11
ATLAS NOBLE LLC	ATLA	5
CARRIED UTICA LLC	CRDD	2
CHEMUR ENERGY CORPORATION LLC	CHM	378
CHEVRON APPALACHIA LLC	CVX	2
COX GAS COMPANY LLC	COX	18
DEVON ENERGY PRODUCTION CO	DEV	13
ENERGIES OPERATING LLC	ENR	16
EQT PRODUCTION COMPANY	EQT	1
GULFPORT ENERGY CORPORATION	GRPR	26
HALCON OPERATING COMPANY INC	HAL	1
HALL DRILLING LLC (OIL & GAS)	HAL	1
HESSE OIL DEVELOPMENTS LLC	HES	18
HIG ENERGY LLC	HSE	18
WELCOIP ENERGY COMPANY	WEL	1
MOUNTAINEER KEYSTONE LLC	MNT	7
POC ENERGY INC	POC	3
R E GAS DEVELOPMENT LLC	REG	3
SIERRA RESOURCES LLC	SIE	3
SWENY LP	SWN	1
XTO ENERGY INC	XTO	4

Well permit information from the ODNR Division of Oil and Gas Resources Management  
 Recommended citation: Ohio Department of Natural Resources, 2012, Horizontal Utica-Point Pleasant Well Activity in Ohio:  
 Ohio Department of Natural Resources, Division of Geological Survey, scale 1:1,250,000, revised 12/29/2012.



# Projections and Reality

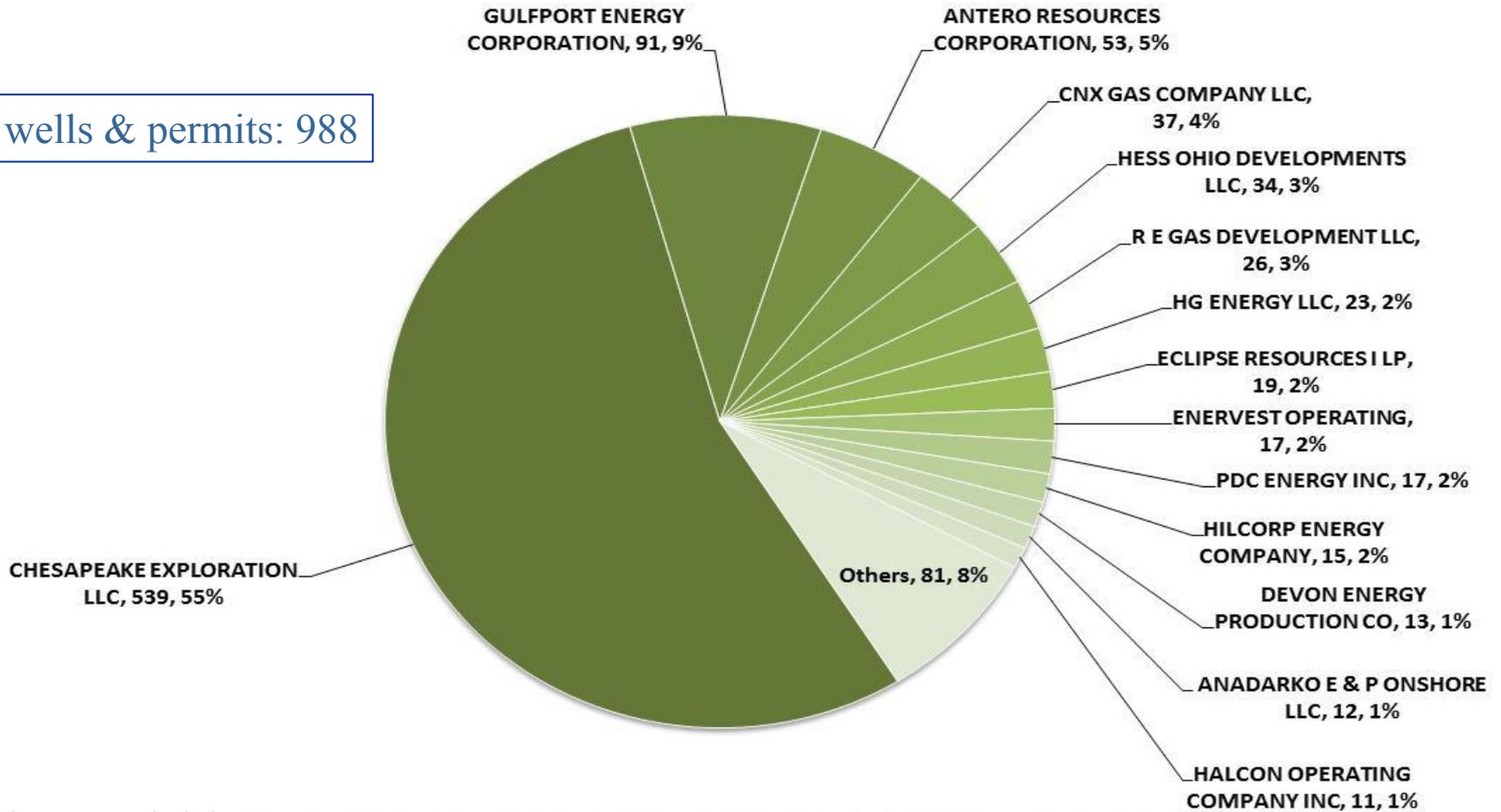
Year	Number of Wells	Total In Production
2011 (actual)	33	5
2012	160	193
2013	650	843
2014	1,075	1,918

In 2012:

- 199 wells were drilled
- 85 wells reported production
  - 63 were commercial producing wells
- Shortage of midstream infrastructure

# Utica: Distribution of Wells & Permits by Operator (updated 11/16/2013)

Total wells & permits: 988



\*Note: Other operators include ATLAS NOBLE LLC, MOUNTAINEER KEYSTONE LLC, CHEVRON APPALACHIA LLC, EQT PRODUCTION COMPANY, HESS OHIO RESOURCES LLC, TRIAD HUNTER LLC, CHESAPEAKE APPALACHIA LLC, HALL DRILLING LLC (OIL & GAS), RICE DRILLING D LLC, XTO ENERGY INC, BP AMERICA PRODUCTION COMPANY, CARRIZO (UTICA) LLC, SIERRA RESOURCES LLC, BRAMMER ENGINEERING INC, BEUSA ENERGY LLC, EM ENERGY OHIO LLC, and SWEPI LP.

### OHIO Utica and Marcellus Shale: Count of Well Permits by County

County	Count of Wells	2012 Population	Area, Sq Miles	People per well	Wells per Sq Mile	# of Townships
CARROLL	280	28,587	394.61	102	0.710	13
HARRISON	104	15,714	402.34	151	0.258	15
COLUMBIANA	73	106,507	531.89	1,459	0.137	13
NOBLE	43	14,579	398.01	339	0.108	9
MONROE	42	14,549	455.72	346	0.092	7
JEFFERSON	38	68,389	408.33	1,800	0.093	11
GUERNSEY	35	39,817	522.25	1,138	0.067	12
BELMONT	31	69,671	532.13	2,247	0.058	8
MAHONING	19	235,145	411.62	12,376	0.046	7
PORTAGE	15	161,451	487.38	10,763	0.031	7
STARK	13	374,868	575.27	28,836	0.023	8
TUSCARAWAS	13	92,392	567.64	7,107	0.023	7
TRUMBULL	8	207,406	618.3	25,926	0.013	6
COSHOCTON	5	36,779	563.91	7,356	0.009	3
WASHINGTON	5	61,475	631.97	12,295	0.008	3
HOLMES	3	43,025	422.53	14,342	0.007	3
MUSKINGUM	3	85,950	664.58	28,650	0.005	2
KNOX	2	60,705	525.49	30,353	0.004	1
ASHLAND	1	52,962	422.95	52,962	0.002	1
ASHTABULA	1	100,389	701.93	100,389	0.001	1
GEAUGA	1	93,680	400.16	93,680	0.002	1
MEDINA	1	173,684	421.36	173,684	0.002	1
WAYNE	1	114,848	554.93	114,848	0.002	1
<b>Grand Total</b>	<b>737</b>	<b>2,252,572</b>	<b>11,615.30</b>	<b>3,056</b>	<b>0.063</b>	<b>140</b>

Source: ODNR & U.S. Census Bureau. 2012 population estimates based on 2010 Census population; U.S. Census Bureau TIGER files

# Significant Local Challenges

- Demographics
- Economic Development and Personal Income
- Changes to the Environment
- Policy and Control



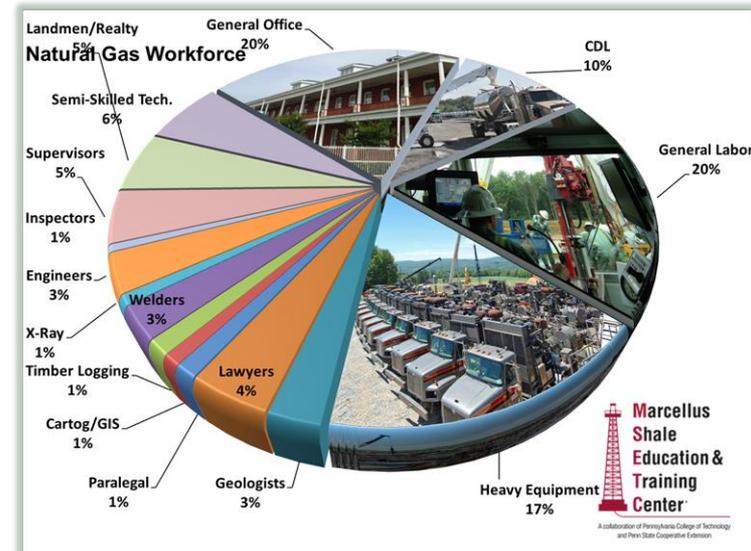
# Demographic Changes

- Population growth and migration
- Housing need
- Physical infrastructure
- Emergency and community services
- Family and social services
- Culture and identity
- Long term prospective



# Economic Development and Personal Income

- Boomtowns: boom, bust, and recovery
- New industries, job opportunities
- Rapid income growth, social equity
- Landowners
- Cost of living
- Existing & new businesses
- Workforce development
- Long term planning



# Social Disruption Models

- Increased stress
- Patterns of interaction within communities
- Community cohesion
- Community's character
- Quality of life
- Social problems



# Changes to the Environment

- New 24/7 business operation
- Water quality and quantity
- Air pollution
- Noise and light
- Increased traffic
- New infrastructure
- Land use



# Policy and Capacity

- Local versus state and federal
- Regulations, taxation and costs
- Investment and incentives
- Political processes
  
- Local capacity
- Local control and monitoring
- Impact on infrastructure
- Transparency and responsiveness
- Coordination and mobilization

# Stakeholders and Leadership

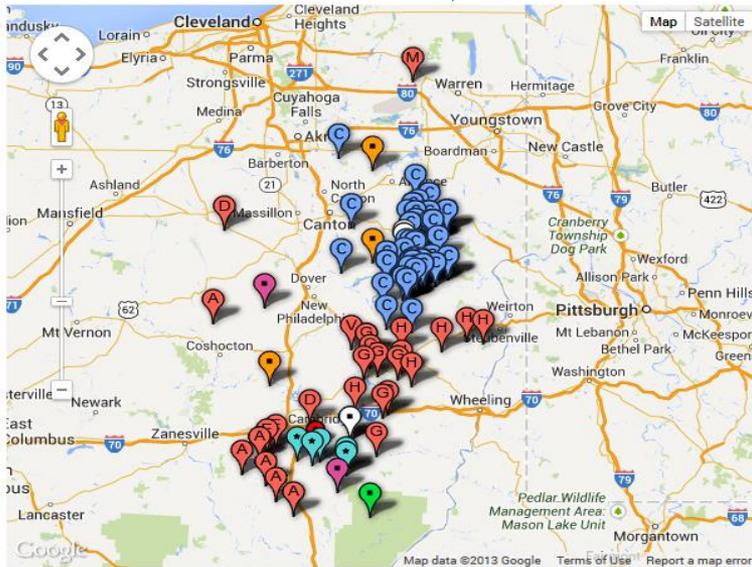
- Different and competing interests
- Regulatory agencies
- Industry contacts
- Business and community organizations
- Means of communication
- Dialog in the community



# Numbers of Production on 85 Wells

2012

Company Name	# of Wells in Production	Av. Oil (Barrels/day)	Best Oil Well (Barrels/day)	Av. Gas (MCF/day)	Best Gas Well (MCF/day)
ANADARKO E & P ONSHORE LLC	7	77	131	229	664
ANTERO RES APPALACHIAN CORP	3 (1)	507	507	1,396	1,396
CHESAPEAKE EXPLORATION LLC	53	100	334	1,865	5,497
CNX GAS COMPANY LLC	1	200	200	200	200
DEVON ENERGY PRODUCTION	5	19	93	0	0
ENERVEST OPERATING LLC	3	107	175	552	804
GULFPORT ENERGY CORP	8	576	872	1,104	4,994
HESS OHIO	2	67	133	4,374	5,664
HG ENERGY LLC	1	0	0	943	943
PDC ENERGY INC	1	525	525	1,310	1,310
REX ENERGY	1	108	108	1,338	1,338



*uticashaleblog.com, Updated August 17, 2013*

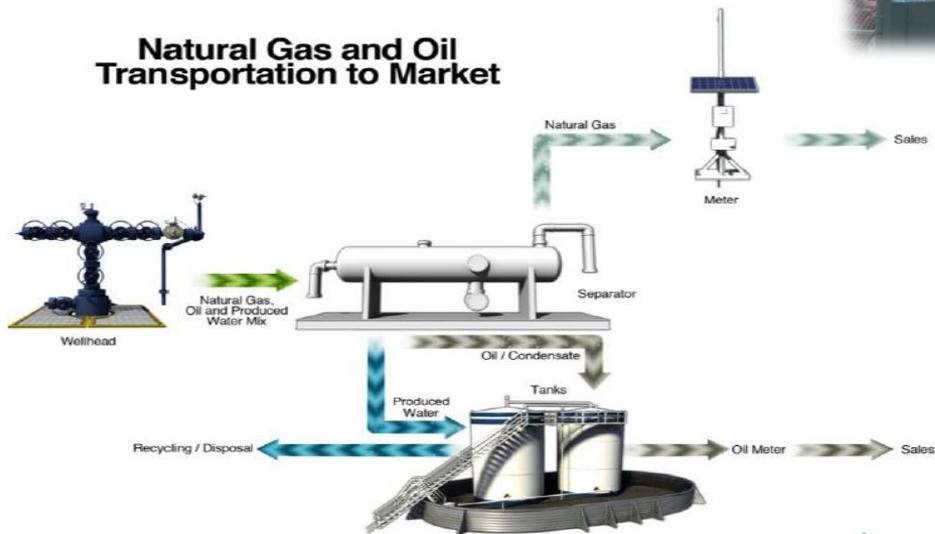
- Production reports were submitted for 85 wells
- 63 were commercial producing wells, 19 were tested and shut-in and 3 were dry and abandoned
- Of the 19 wells that have not been placed into commercial production, 17 did report incidental volumes of crude oil and natural gas that were recovered during flowback of hydraulic fracturing fluids
- None of the wells were producing for the entire year

# Midstream Bottleneck

- Development of midstream industry in 2013-2014 will determine further pace of Utica development
- Different scenarios of processing Utica products
- Potential markets for Utica products



## Natural Gas and Oil Transportation to Market



- Ramping up on pipeline construction
- Readiness of other infrastructure: rail, roads, and water pools
- Conservative estimates of investments in Ohio by 2014: \$6.4 Billion

# Midstream Construction Projects in Ohio (\$12 Billion)

Company	Location	Operations	Estimated Investments
MarkWest	Harrison & Noble counties	G, P, & F	\$1.5 Billion
M3 Midstream Partnership	Columbiana & Harrison counties	G, P, & F	\$1.2 Billion
NiSource	Eastern Ohio	G&P	\$390 Million
Dominion & Caiman*	Eastern Ohio	G&P	\$800 Million
Spectra*	Northern & Eastern Ohio	Natural Gas Pipeline	\$1-2 Billion
Enterprise*	Eastern, Central, & Southwestern Ohio	Ethane Pipeline	\$1 Billion-plus

# Projected Spending in Ohio – 2014 (model input data in 2012\$)



- **Lease Bonuses**
  - \$34,992,551
- **Royalties**
  - \$45,278,948
- **Road & Bridge Construction**
  - \$426,915,817
- **Drilling and Completing Wells**
  - \$4,722,240,422
- **Midstream Infrastructure**
  - \$1,138,004,105
- **Total: \$6,367,431,844**

# Expected Path of Development 2011 to 2014

Returns from Increased Demand in Ohio Due to Utica Shale Development  
in 2012 dollars

	2011	2012	2013	2014
Value Added	\$162,030,036	\$878,982,133	\$2,980,378,198	\$4,857,632,095
Employment	2,275	12,150	40,606	65,680
Labor Income	\$99,758,497	\$571,543,463	\$1,994,216,405	\$3,298,757,195
Output	\$291,574,770	\$1,667,574,417	\$5,823,268,396	\$9,642,544,988
Total State and Local Taxes	\$16,522,865	\$73,422,148	\$271,539,607	\$433,528,922
Average labor income	\$43,850	\$47,041	\$49,111	\$50,225

# Impact of the Utica Shale Development on Ohio's Economy

- 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% 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, from 2000 to 2012 (0.2%).

# Shale Gas Value Chain

After exploration and extraction, the shale gas value chain is similar to conventional gas and can therefore use established infrastructure.

## Shale Gas Market: Value Chain, Global, 2012

### Exploration

- Basin assessment
- Well-pad preparation
- Exploratory drilling

### Extraction

- Well completion
- Hydro-fracking
- Gas flow to processing plants

### Processing

- Separation of gas and fracking fluid
- Removal of contaminants
- Separation of component gases
- Gas compression for transport
- Wastewater treatment and recycling

### Transportation

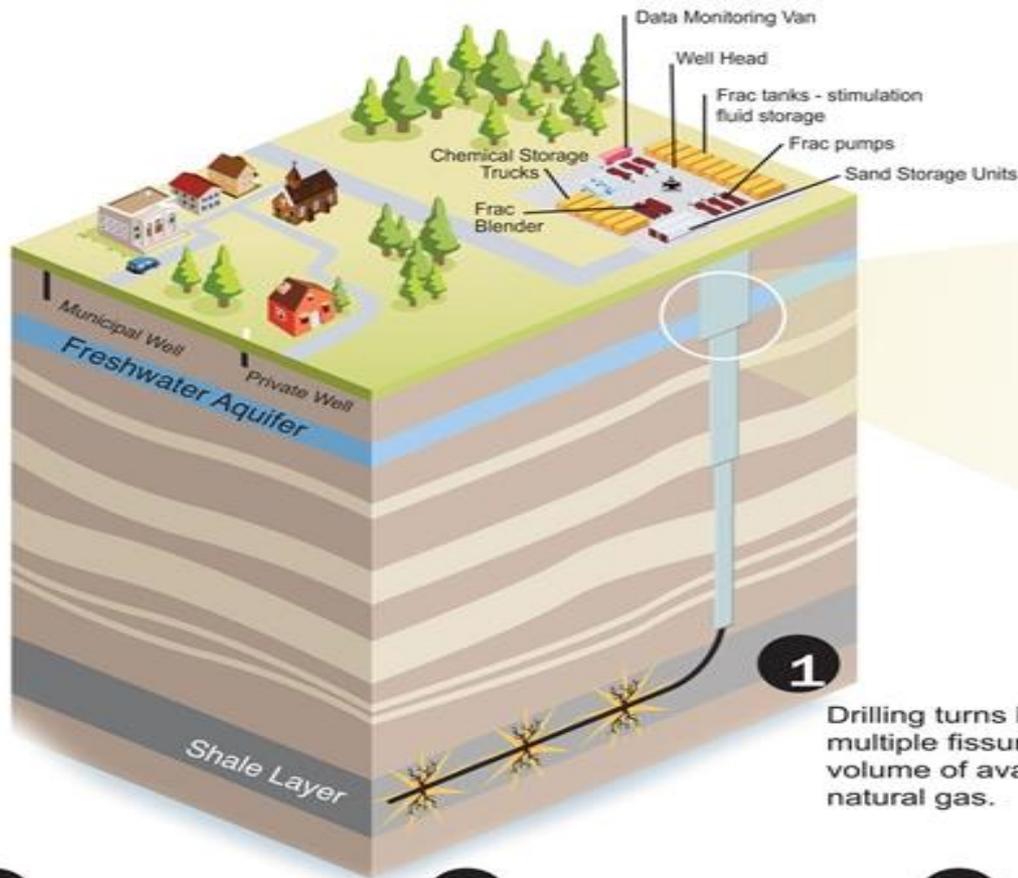
- Pipeline contractors
- Delivery to terminals
- Storage
- Export

### Distribution/ Marketing

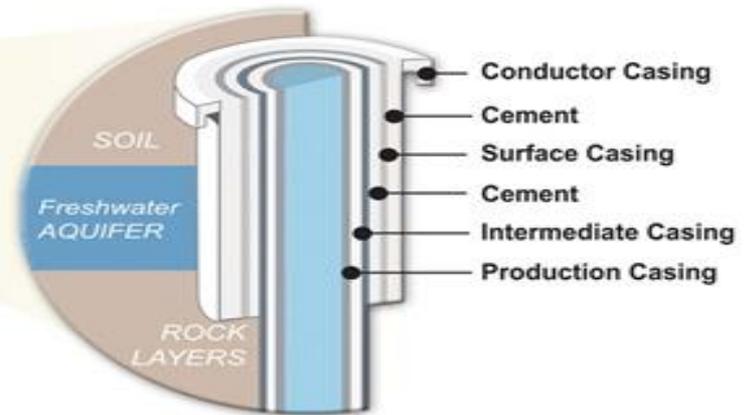
- To vendors:
- Commercial
  - Residential
  - Retail receiver stations

## Efficiency of Land Use

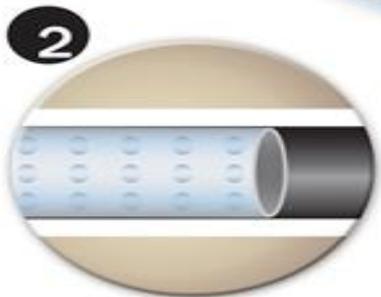
- A typical unit is 640 acres, which is a square mile (it can be more or less area).
- One well pad per square mile would be a reasonable estimate, depending on how many wells are necessary to drain the gas from the formation (1 square mile = 2.6 square km).
- This well pad would likely require multiple wells (4 to 10 or more) off of the same pad to drain the gas within the unit, depending on the length of the well lateral.



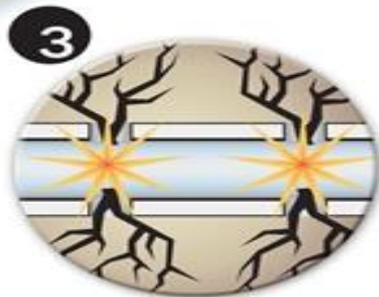
**Cement casing protects aquifer.**



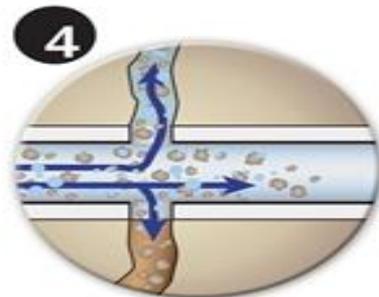
**1** Drilling turns horizontal, hitting multiple fissures and increasing volume of available oil and natural gas.



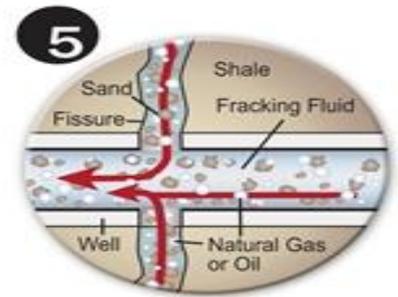
**2** Production casing inserted into borehole, then surrounded with cement.



**3** Casing is perforated blasting small holes through pipe, cement, and shale.

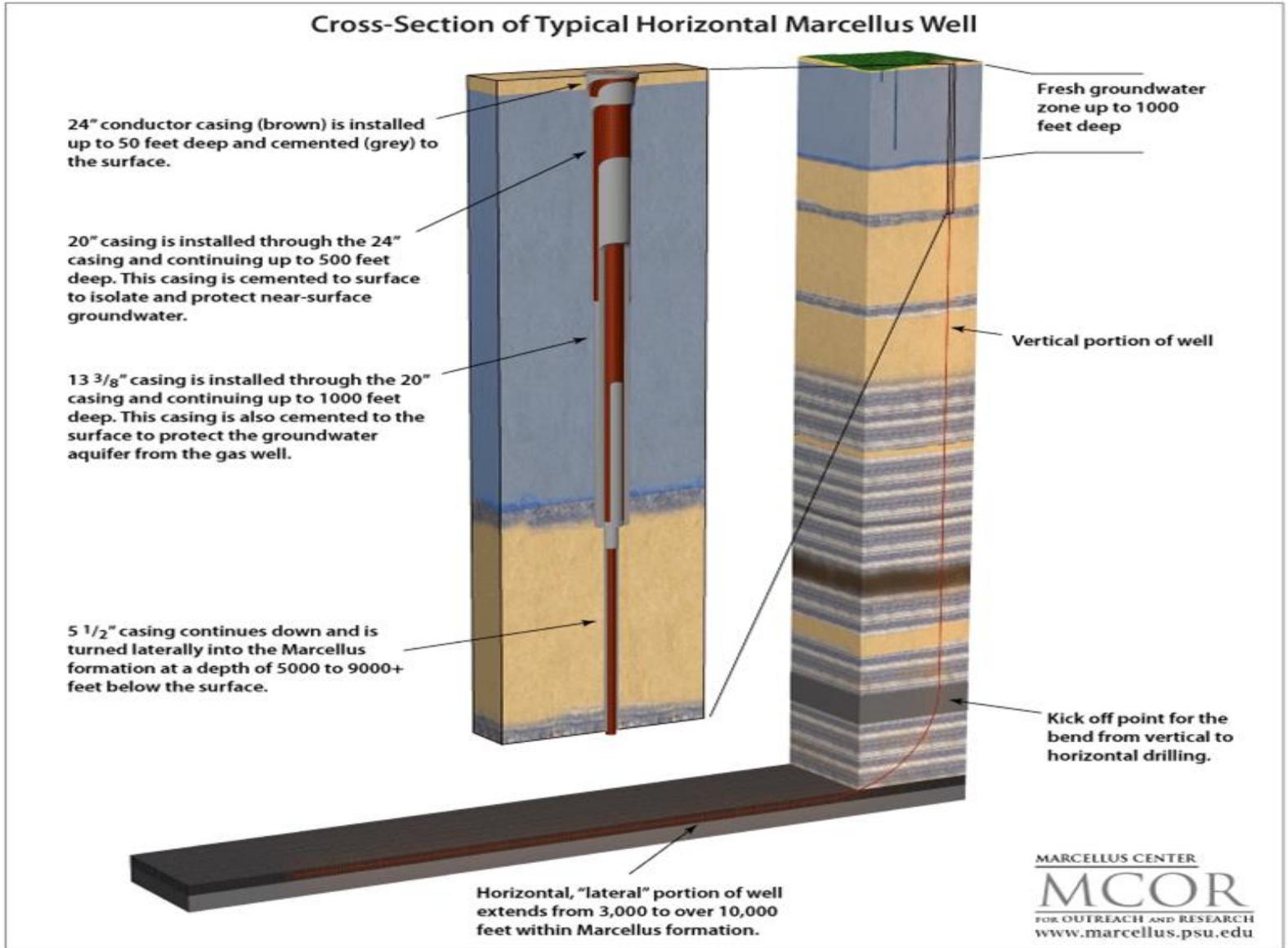


**4** After drilling, the well is hydraulically fractured. A mixture of water, sand, and chemicals (fracking fluid) is pumped into the well at high pressure.



**5** The fluid generates numerous small fissures in the shale, freeing trapped oil and gas that flow back up the pipeline to the wellhead. The sand keeps the fissures open to increase the flow of oil and natural gas.

# Typical Horizontal Well



# Hydraulic Fracturing

Freshwater  
Tanks

Slurry  
Blender

Chemical  
Storage

Pump  
Trucks

Frac Trailer

Company  
Man Trailers



Proppant  
(sand)

Freshwater  
Pit

Freshwater  
Tanks

Wellhead

Wireline Rig

# Data Assumptions Made



- Drilling and Completion
  - \$5.75 million per well
  - 58% of labor and material from Ohio, improving to 70% in 2014
  
- Post production infrastructure build out
  - Gathering pipelines – over \$1 mm/mile
  - Compressors – over \$300,000 each
  - Processing plants – \$400,000/mmcfd
  - Fractionation plants – 36 Mbb/d – \$100 mm
  - Storage facilities – 1BCFD – \$120 mm
  - Railroad terminals – 1 BDFD – \$40 mm

# Opportunities for Manufacturing



## *Become a part of the supply chain*

- *The Raw Steel and Fabricated Metal Product Manufacturing Industry*
- Ohio is second-largest raw steel producing state in the U.S. after Indiana with 12.2% share (*in Thousands of Net Tons*). We are #3 after Indiana and Pennsylvania in terms of 2010 GDP
- This industry grew 25.3% between 2010 and 2011 – largest growth of all states. Six Ohio steel producers are on *Worldsteel's* list of 2010 top world producers
- Steel's value chain: A central part of Ohio's economic infrastructure:
  - Ohio's steel industry directly sold to 69 direct in-state customer industries \$8.6 billion worth of product in 2010 (Raw Steel \$3.8 Bill & Fabricated Metal \$4.9 Bill)
  - Ohio's steel industry spent more than \$10.2 billion in 2010 purchasing goods and services produced in Ohio

# Opportunities for Manufacturing (cont.)



## *Cheaper Energy*

- Ohio is home to 10 *High Energy Intensive* Manufacturing industries that spend 2%-6% of their total expenditures on electricity
- 17 Ohio *Moderate Energy Intensive* Manufacturing industries spend 1%-2% on electricity annually
- 12 of these 27 industries are part of Ohio's economic base
- Electricity-Intensive manufacturing base establishments are heavily concentrated in Northeast Ohio: Cuyahoga, Summit, and Stark counties

*An increase in the industrial electricity price by 1 cent per kilowatt-hour (16.3%) is likely to decrease average manufacturing productivity, on average, by \$2,527 of annual Gross State Product per employee (2.2%)*



# Turning Away From Coal

*Utilities are increasingly looking to natural gas to generate electricity*

By REBECCA SMITH

Power companies are increasingly switching to natural gas to fuel their electricity plants, driven by low prices and forecasts of vast supplies for years to come.

While the trend started in the late 1990s, the momentum is accelerating and comes at the expense of coal. Some utilities are closing coal-fired plants; others are converting them to run on gas.

The switch is occurring globally and is getting a push from regulators who want to limit emissions that contribute to climate change, haze and health problems such as respiratory illness. Though efforts in Congress to pass legislation attaching a price to carbon emissions appear stalled for now, utilities still anticipate eventual carbon restrictions. The Tennessee Valley Authority, for example, recently announced a 20-year development plan that emphasizes nuclear and gas, and includes fewer coal units.

# Ohio Actual Industries Growth in 2012

- Shale-related industries growth is close to projected “Direct” employment
- We cannot attribute ALL growth in these industries to shale development

Core Shale-Related Industries				
NAICS	Title	2011 Q1	2012 Q1	Change
237120	Oil and gas pipeline construction	1,498	2,159	661
213112	Support activities for oil and gas operations	1,165	1,418	253
213111	Drilling oil and gas wells	516	568	52
211112	Natural gas liquid extraction	26	76	50
211111	Crude petroleum and natural gas extraction	2,749	2,790	41
486210	Pipeline transportation of natural gas	309	318	9
	<b>Totals</b>	<b>6,263</b>	<b>7,329</b>	<b>1,066</b>
Some Ancillary Shale-Related Industries				
NAICS	Title	2011 Q1	2012 Q1	Change
541330	Engineering services	26,920	27,777	857
331110	Iron and Steel Mills and Ferroalloy Manufacturing	9,797	10,528	731
423830	Industrial machinery merchant wholesalers	15,107	15,732	625
237310	Highway, street, and bridge construction	10,906	11,503	597
811310	Commercial machinery repair and maintenance	7,014	7,533	519
423810	Construction equipment merchant wholesalers	2,419	2,890	471
484220	Other specialized trucking, local	6,057	6,466	409
484230	Other specialized trucking, long-distance	4,412	4,789	377
238912	Nonresidential site preparation contractors	4,318	4,661	343
221210	Natural gas distribution	3,697	4,029	332
562910	Remediation services	2,222	2,551	329
484110	General freight trucking, local	11,667	11,960	293
237110	Water and sewer system construction	4,167	4,428	261
333132	Oil and gas field machinery and equipment	141	337	196
532412	Other heavy machinery rental and leasing	1,231	1,363	132
541620	Environmental consulting services	1,528	1,644	116
221310	Water supply and irrigation systems	6,007	6,077	70
331210	Iron, steel pipe and tube from purchase steel	3,051	3,114	63
333131	Mining machinery and equipment manufacturing	451	506	55
325120	Industrial gas manufacturing	737	784	47
541360	Geophysical surveying and mapping services	246	281	35
	<b>Totals</b>	<b>155,172</b>	<b>159,981</b>	<b>4,809</b>
<b>Core Industries and Ancillary Industries Totals</b>		<b>161,435</b>	<b>167,310</b>	<b>5,875</b>

Source: ODJFS

# Core Industries' Employment Grew by 17% in Q1 2012 Compared to Q1 2011

## Core Shale-Related Industries

NAICS	Title
237120	Oil and gas pipeline construction
213112	Support activities for oil and gas operations
213111	Drilling oil and gas wells
211112	Natural gas liquid extraction
211111	Crude petroleum and natural gas extraction
486210	Pipeline transportation of natural gas

# Ancillary Industries' Employment Grew by 3.6%

<b>Some Ancillary Shale-Related Industries</b>	
<b>NAICS</b>	<b>Title</b>
541330	Engineering services
331110	Iron and Steel Mills and Ferroalloy Manufacturing
423830	Industrial machinery merchant wholesalers
237310	Highway, street, and bridge construction
811310	Commercial machinery repair and maintenance
423810	Construction equipment merchant wholesalers
484220	Other specialized trucking, local
484230	Other specialized trucking, long-distance
238912	Nonresidential site preparation contractors
221210	Natural gas distribution
562910	Remediation services
484110	General freight trucking, local
237110	Water and sewer system construction
333132	Oil and gas field machinery and equipment
532412	Other heavy machinery rental and leasing
541620	Environmental consulting services
221310	Water supply and irrigation systems
331210	Iron, steel pipe and tube from purchase steel
333131	Mining machinery and equipment manufacturing
325120	Industrial gas manufacturing
541360	Geophysical surveying and mapping services

# Opportunities for Supply Industries

- Pad construction – location liners, limestone, pits, dikes, roads, etc.
- Water – for drilling and fracturing
- Mud – bentonite and barite clay
- Steel pipe (casing)
- Cement (conventional cements not acceptable)
- Sand – clean, well-sorted 20-40 mesh in particular
- Steel tanks, separators, metering equipment, production equipment, etc.
- Compressors
- Pipelines
- Treatment facilities for NGL's, water, and impurity removal

Landmen/Realty

General Office

# Natural Gas Workforce

CDL  
10%

Semi-Skilled Tech.  
6%

Supervisors  
5%

Inspectors  
1%

Engineers  
3%

X-Ray  
1%

Timber Logging  
1%

Cartog/GIS  
1%

Paralegal  
1%

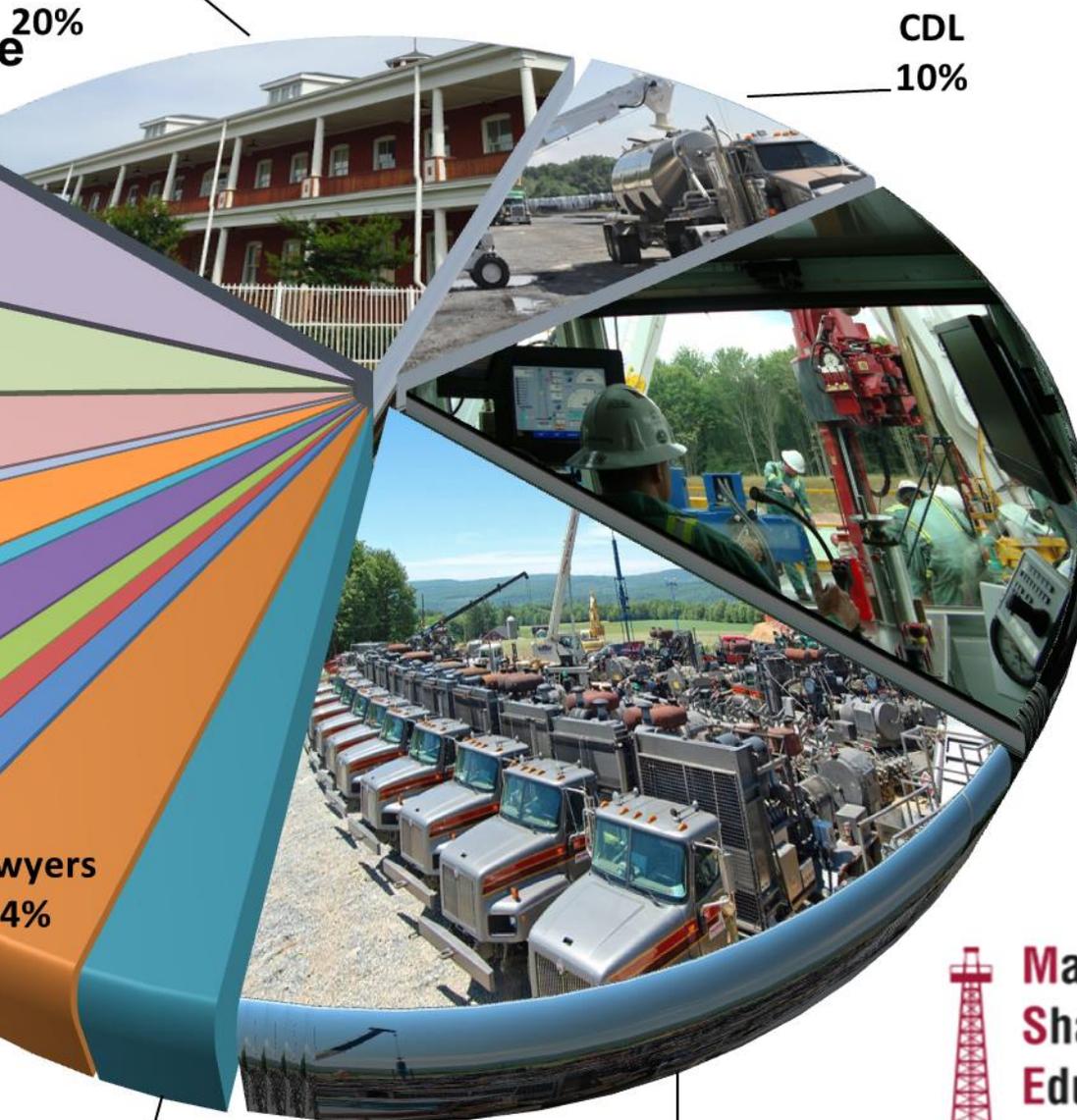
Geologists  
3%

Welders  
3%

Lawyers  
4%

Heavy Equipment  
17%

General Labor  
20%



A collaboration of Pennsylvania College of Technology  
and Penn State Cooperative Extension

# What Industries Will Be Sustained in 2014?

Total employment supported: **65,680**

Average annual income: \$50,225

## (1) Associated with field development 28,100 (\$59,500)

- Support activities oil & gas operations: 10,800
- Construction oil & gas infrastructure: 18,400
- Wholesale trade: 2,200
- Transportation by truck: 1,600
- Service to structures: 740
- Cement manufacturing: 190

## (2) Professional services 5,700 (\$69,200)

- Architecture, engineering & related: 1,500
- Environmental & other technical consulting: 1,020
- Management of companies: 720
- Legal service: 840

# What Industries Will Be Sustained in 2014?

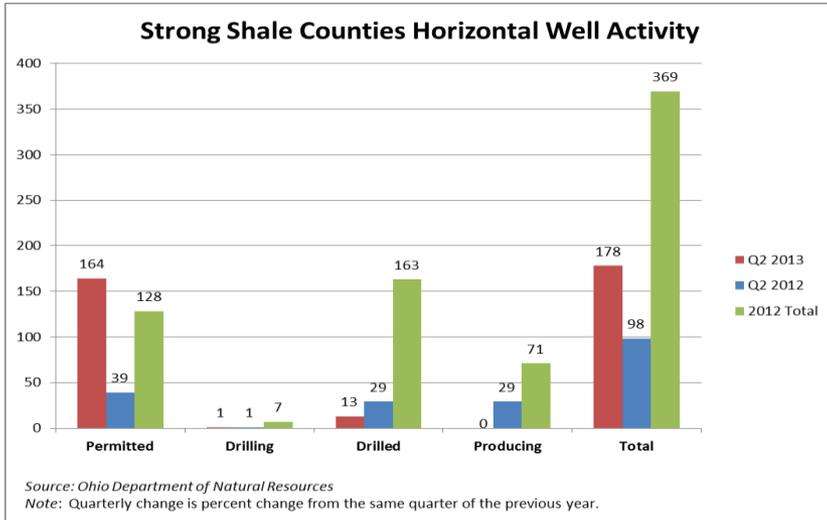
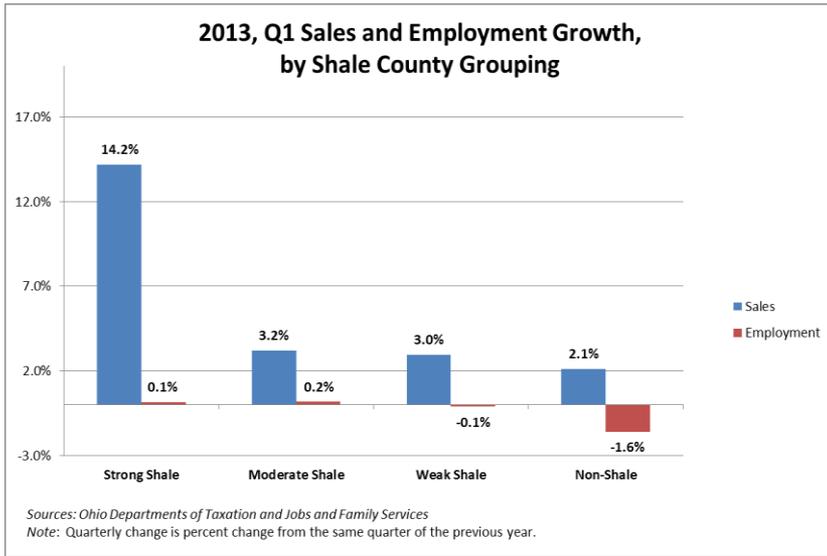
## (3) Mixed services (business & personal) 6,300 (\$38,400)

- Real estate 2,100
- Employment services (temp staffing) 1,100
- Insurance 900
- Investment & related activities 840
- Banking 700

## (4) Personal services 16,100 (\$36,000)

- Retail stores 5,800
- Health care 4,500
- Food service & drinking place 3,900

# First Factual Results



- During the first quarter of 2013, sales receipts in strong shale counties continued growth at rapid pace, increasing by 14.2% (\$4.1 billion) over Q1 2012 (\$3.6 billion)
- Total employment continued to be flat through the first quarter of 2013, increasing by only 0.1% in strong shale counties and by 0.2% in moderate shale counties
- Horizontal well activity in strong shale counties during Q1 and Q2 of 2013 is being driven by a flurry of permitting activity, with 164 permits in Q2 alone, which is more than in all of 2012 (128)
- Citygate natural gas prices (dry gas) in Ohio have remained stable since increases in shale production during the second half of 2011 with average prices falling from \$5.46 in 2011 to \$4.62 in 2012 and dipping slightly in 2013 to \$4.52 (February-April)
- Average prices for natural gas liquids (NGLs) peaked nationally in 2011 at just over \$15 per million BTUs, fell by 27% in 2012 (\$10.98) and by another 12% through May 2013 (\$9.69)

Source: Hill, E. & K. Kinahan. *Ohio Utica Shale Regional Monitor*, August 2013.

## Some Announcements of New Investments and Jobs

- V&M Star, \$650M
- Timken, \$225M
- US Steel, \$240M
- Haliburton, \$150M, 300 jobs
- Schlumberger, \$150 M, 236 jobs
- NiSource (NGT&S) \$300M
- Chesapeake/M3 Midstream/EnerVest, \$900M
- MarkWest, \$500M, 700 jobs
- Exterran, \$13M, 100 jobs
- Select Energy \$10M, 185 jobs

# Risks and Their Mitigation

- Transparency
  - Fracturing chemical disclosure: Wyoming/20/6
  - Other issues: people's complains
- Well integrity
  - Casing of pipes, cement jobs, pressure management
- Air issues
  - Traditional toxic chemicals
  - Methane gas emission
- Water and waste management
  - Geology and proximity (PA)
  - Municipalities sell water
  - Surface water contamination
  - Close-cycle technologies

# Risks and Their Mitigation (cont.)

- Community impact
  - Road damage and construction
  - Traffic safety
  - Boom-bust cycle
- Seismicity and disposal water earthquakes
  - Youngstown – lubrication of old wells
- Radio activity
  - Federal government regulations
  - Methane gas emission
- Environmental bonds

# Shale Development Facts

- *Half of the natural gas consumed today is produced from wells drilled within the last 3.5 years*
- *Unconventional production now accounts for 46% of the total U.S. production*
- ***Average amount of water needed to drill and fracture shale well is about 2 million to 4 million gallons; however, while on average, shale gas wells produced 10 times the amount of wastewater as conventional wells, they also produced about 30 times more natural gas***

## Shale Development Facts

- *By statute, states may adopt their own standards; at least as protective as the federal standards they replace, and may even be more protective in order to address local conditions*
- *The states have broad powers to regulate, permit, and enforce all activities—the drilling and fracture of the well, production operations, management and disposal of wastes, and abandonment and plugging of the well.*

# Shale drillers in Ohio must report toxic chemicals locally



Photographer: WEWS  
Copyright 2012 Scripps Media, Inc. All rights reserved. This material may not be published, broadcast, rewritten, or redistributed.

A A A A

SHARETHIS

Recommend

4 people recommend this. Sign Up to see what your friends recommend.

Tweet 3

+1 0

Posted: 09/30/2013

By: Associated Press

COLUMBUS, Ohio - A list of toxic chemicals used by Ohio shale drillers must be made available locally to governments, first responders and residents under a new state directive.

Ohio officials notified companies that a federal chemical disclosure law trumps a 2001 state law requiring that the information only be filed with the Ohio Department of Natural Resources, The Columbus Dispatch reported Monday. The state gave companies until Sept. 21 to begin complying

# Fractured Well



AN ANALYSIS OF  
THE ECONOMIC POTENTIAL  
FOR SHALE FORMATIONS IN



Cleveland State  
University  
Maxine Goodman Levin  
College of Urban Affairs

Prepared for:  
OHIO STEEL COUNCIL

The State of  
Ohio's Steel  
Industry

Center for  
Economic  
Development

September 2012

Cleveland State  
University  
Maxine Goodman Levin  
College of Urban Affairs

Prepared for:  
OHIO MANUFACTURERS' ASSOCIATION

Prepared by:  
Iryna Lendel, Ph.D.  
Sunjoo Park  
Andrew Thomas

Moving Ohio  
Manufacturing  
Forward:  
Competitive  
Electricity Pricing

Maxine Goodman Levin Col

Ohio Utica Shale Gas Monitor

August 2013

Maxine Goodman Levin College of Urban Affairs

Cleveland State University

**Dr. Iryna Lendel**  
*Assistant Director*  
Center for Economic Development  
Cleveland State University  
***i.lendel@csuohio.edu***

Studies available at:  
[http://urban.csuohio.edu/  
economicdevelopment/  
publications/](http://urban.csuohio.edu/economicdevelopment/publications/)