ECONOMIC & COMMUNITY IMPLICATIONS OF MARCELLUS SHALE

Timothy W. Kelsey, Ph.D.
tkelsey@psu.edu
A Few Background Concepts

• Scale of this is **BIG**
  – Second largest natural gas field in the world (USGS)
  – Hundreds of thousands of acres
  – ~$1 trillion recoverable gas in PA
    (PA economy is $355 billion as measured by earnings)
  – ~$1 to 2 million ‘landowner’ share per well
    (80 acre spacing)

• Resource-based economic development; when it’s gone, it’s gone

• Local impact- multiplier effects if keep dollars local

• Lots of uncertainty
Marcellus Shale Wells
60 wells in 2007
Percent Change in Population, 2000-2007

- Fast Growth: 7.2% and over
- Slow Growth: 3.6 to 7.1%
- Very Slow Growth: 0.0 to 3.5%
- Very Slow Decline: -0.1 to -3.5%
- Slow Decline: -3.6 to -7.1%
- Fast Decline: -7.2% and over

Source: Alter et al., Pennsylvania Road to Growth, Penn State 2009
WHAT AFFECTS ECONOMIC IMPACTS?
1. Timing, Scale & Pace Drive Impacts

Three Phases of Natural Gas Development

**Development Phase** (Short Lived/Labor Intensive)
- Well-pad and Access Road Construction
- Local collection pipeline Construction
- Drilling of the Well
- Fracturing of the Well
- Reclaiming some Disturbance

**Production Phase** (Long lived/Small & Steady Labor Force)
- Trucking Water and condensate from Well Site
- Monitoring Production
- Occasional Well Work-Overs (partially re-drill/re-frac)

**Reclamation Phase**
- Dismantle and Reclaim well-sites

Source: Jacquet
PA Statewide Possible Direct Workforce, by Phase

Assumes 30 year active life per well
2,500 wells drilled/year pace. Labor requirements based upon MSETC per well workforce estimates

If 30 years of active drilling

If 50 years of active drilling

Wells drilled a year start to decline

Year

Number of Workers

= Development phase jobs

= Production phase jobs

Duration?

Likely shorter in individual communities

Source: Kelsey, 2011
Gas development is more than just wells

• Multiple well pads — *intense activity, but short run until well is drilled*

• Multiple supporting locations — *intense activity, lasts until all wells in area are completed*

• Multiple specialized companies & workers. Massive coordination task.

• Changing transportation patterns

• Communication
Spatial activity

• “Long Run” facilities
  – Staging areas
  – Worker housing
  – Office areas
  – Pipe, sand and other storage
  – Maintenance facilities
  – Compressor stations
  – Water withdrawal sites
  – Water treatment
  – Etc.

• “Short run” facilities
  – Well pads
What we’re seeing in Pennsylvania

PENNNSYLVANIA’S ECONOMIC EXPERIENCE
Pennsylvania’s Economic Experience through 3/2012

• Lots of hype – and political argument
• Lots and lots of activity at local level
• Secondary data show more hiring, lower unemployment, higher average wages in Marcellus counties
• Impacts are across all sectors
• Higher state tax collections (sales tax, income tax)
• Higher state gov’t costs (though no estimate)
• Little change in local government tax collections
• Higher local government costs
Employment Trends, 2001 to 2010

Source: U.S. Bureau of Labor Statistics
Leasing & Royalty Dollars

Marcellus Land Ownership in Pennsylvania

<table>
<thead>
<tr>
<th>Owner</th>
<th>Proportion of Marcellus Land</th>
</tr>
</thead>
<tbody>
<tr>
<td>County residents</td>
<td>50.6%</td>
</tr>
<tr>
<td>Residents elsewhere in PA</td>
<td>24.7%</td>
</tr>
<tr>
<td>Commonwealth/other public</td>
<td>17%</td>
</tr>
<tr>
<td>Non-Pennsylvanians</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

How the dollars are used by residents
- 55% of leasing dollars are saved
- 66% of royalty dollars are saved

How is the Commonwealth using its dollars?
- General Fund for annual budget?
- Legacy or other fund?

Source: Kelsey et al 2011
Can be a Two-Edged Sword

Can be very high cost of living:
- Inflation rates higher than the national average
- Average rentals increase due to housing demand

Non-Gas field businesses can struggle:
- Lose employees to the gas industry?
- Commercial space can become very expensive

Long run competitiveness?
Major Economic Impact Questions

• Who is benefitting?
  – Where are the jobs located? How much economic benefit remains in communities with drilling vs. going elsewhere? What can communities do to capture the benefits? (mineral rights; hiring; purchasing; companies)

• Who is bearing the costs?
  – What are the costs? (no good studies so far)
    (environmental costs; government costs; social costs; property values; workforce retention & impacts on other businesses; opportunity costs; etc)

• What happens after the ‘Boom’? (e.g. ‘long run implications’)

MARCELLUS AND LANDOWNERS
Who Owns the Mineral Rights?

• Surface and mineral rights can be severed
  – Relatively common in counties with past coal or gas development
  – Counties track land ownership... mineral right ownership tracked deed-by-deed

• If owned separately; surface owner has to allow development

‘Reasonable accommodation’ of surface uses by owner of mineral rights
Impacts on Lessors Near Active Wells in Tioga and Bradford Counties

<table>
<thead>
<tr>
<th>What has been the impact of Marcellus Shale gas drilling on you personally?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive impact on them personally</td>
<td>52%</td>
</tr>
<tr>
<td>Negative impact on them personally</td>
<td>17%</td>
</tr>
<tr>
<td>Both positive and negative impacts on them personally</td>
<td>4%</td>
</tr>
<tr>
<td>Not sure whether the impacts are positive or negative</td>
<td>28%</td>
</tr>
</tbody>
</table>

Survey of 1,000 landowners within 1,000 feet of active wells. 51% response rate. Funded by PA Dept of Community & Economic Development. Source: Kelsey & Ward, 2011.
### Change in Number of Cows, by Number of Cows and Marcellus Drilling Activity, 2007 to 2010

<table>
<thead>
<tr>
<th>Marcellus Drilling Activity Within the County</th>
<th>Number of Cows in the County</th>
<th>Percent Change (number of counties)</th>
<th>State Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than 5,000 cows</td>
<td>5,000 to 9,999 cows</td>
<td>10,000 cows +</td>
</tr>
<tr>
<td>No Marcellus wells</td>
<td>-2.2% (8)</td>
<td>-3.6% (11)</td>
<td>2.7% (9)</td>
</tr>
<tr>
<td>1 to 9 wells</td>
<td>-13.1% (7)</td>
<td>-20.3% (1)</td>
<td>4.8% (3)</td>
</tr>
<tr>
<td>10 to 149 wells</td>
<td>-16.2% (8)</td>
<td>2.8% (3)</td>
<td>-13.8% (1)</td>
</tr>
<tr>
<td>150 or more wells</td>
<td>-19.0% (1)</td>
<td>-25.4% (1)</td>
<td>-16.3% (3)</td>
</tr>
<tr>
<td>State Average</td>
<td>-10.7% (24)</td>
<td>-4.8% (16)</td>
<td>-1.5% (16)</td>
</tr>
</tbody>
</table>

*Does not add to 67 counties due to missing data for some counties

Source: Adams and Kelsey, 2012
Significant Community Issues

Demographics
- Population change
  - Housing needs
  - Schools
  - Other infrastructure
- Population composition & diversity
- Youth migration?

Family
- Child care implications
- Intergenerational relationships/equity
- Family well-being
- Health, substance abuse, etc
Significant Community Issues

Local infrastructure

- Roads
- Highway safety
- Housing
- Sewerage & water
- Police
- Emergency services
- Schools
- Human services
Traffic Changes – Bradford County

5-Year Daily Average vs. 2010 Daily Average

Source: PennDOT Engineering District 3-0
Significant Community Issues

Community & Social

• Social service demands
• Social equity
• Haves & have-nots
• Newcomers & old timers
• Year ‘round residents & seasonal residents
• Social cohesion & community identity
• Diversity and potential conflict
• Local power structure
• Social problems
Significant Community Issues

Local Government
- Impact on services & revenues
- Quality of life, environment, community, health & safety
- Local control (tools? Ability to use?)
- Local capacity for being proactive (much less responding)
- Coordination between governments

State & Local Policy
- Local versus state control (versus no control)
- Regulation, incentives, investment, subsidies, taxation
- Monitoring & oversight
- Influence of gas dollars on the political process?
Market Value Change & Marcellus Wells, 2007 to 2009

Data source: PA STEB and DEP; in Kelsey, Adams & Milchak, 2012
### Municipal Level Average Change in Market Value, By Marcellus Wells, 2007 to 2009

<table>
<thead>
<tr>
<th>Marcellus Activity in Municipality</th>
<th>Average Change in Market Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 or more wells</td>
<td>15.8%</td>
</tr>
<tr>
<td>10 to 19 wells</td>
<td>13.5%</td>
</tr>
<tr>
<td>1 to 9 wells</td>
<td>12.4%</td>
</tr>
<tr>
<td>No Marcellus wells</td>
<td>12.2%</td>
</tr>
<tr>
<td>State average change by Municipality</td>
<td>12.2%</td>
</tr>
</tbody>
</table>

*These averages do not address how values are changing adjacent to well sites*

Data source: PA STEB and DEP; in Kelsey, Adams & Milchak, 2012
2011 Survey of Municipal Governments

Counties where municipalities were surveyed
### Impacts of Marcellus on Pennsylvania Local Governments

<table>
<thead>
<tr>
<th></th>
<th>Change in Services</th>
<th>Change in Costs</th>
<th>Change in Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased</td>
<td>28% (35)</td>
<td>26% (33)</td>
<td>18% (24)</td>
</tr>
<tr>
<td>Decreased</td>
<td>4% (5)</td>
<td>1% (1)</td>
<td>1% (1)</td>
</tr>
<tr>
<td>No Change</td>
<td>67% (84)</td>
<td>70% (89)</td>
<td>75% (97)</td>
</tr>
<tr>
<td>Don’t Know</td>
<td>2% (2)</td>
<td></td>
<td>6% (8)</td>
</tr>
</tbody>
</table>


Source: Kelsey & Ward, 2011
### Impact of Marcellus Shale Development' on Municipalities and Communities

<table>
<thead>
<tr>
<th>Area</th>
<th>Percent of Local Officials Selecting Response (Number Selecting Response)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Increased</td>
</tr>
<tr>
<td>Population</td>
<td>25% (31)</td>
</tr>
<tr>
<td>Road Maintenance</td>
<td>58% (73)</td>
</tr>
<tr>
<td>Road Construction</td>
<td>24% (29)</td>
</tr>
<tr>
<td>Tourism</td>
<td>7% (8)</td>
</tr>
<tr>
<td>School Enrollment</td>
<td>19% (23)</td>
</tr>
<tr>
<td>Property Values</td>
<td>38% (47)</td>
</tr>
<tr>
<td>Crime</td>
<td>17% (19)</td>
</tr>
<tr>
<td>Emergency Services</td>
<td>23% (28)</td>
</tr>
<tr>
<td>Community Conflict</td>
<td>31% (37)</td>
</tr>
</tbody>
</table>
## Impact of Marcellus Shale Development' on Environment

<table>
<thead>
<tr>
<th>Area</th>
<th>Increased</th>
<th>Decreased</th>
<th>No Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Use/Disposal</td>
<td>48% (58)</td>
<td>0 (0)</td>
<td>52% (64)</td>
</tr>
<tr>
<td>Water Quality</td>
<td>2% (2)</td>
<td>18% (22)</td>
<td>80% (96)</td>
</tr>
<tr>
<td>Air Quality</td>
<td>2% (2)</td>
<td>12% (15)</td>
<td>86% (105)</td>
</tr>
<tr>
<td>Storm Water Runoff</td>
<td>20% (25)</td>
<td>2% (2)</td>
<td>78% (97)</td>
</tr>
<tr>
<td>Other Environmental Issues</td>
<td>13% (10)</td>
<td>0 (0)</td>
<td>88% (70)</td>
</tr>
</tbody>
</table>

Local Control?
Opportunities and Challenges

ENVIRONMENTAL IMPACTS
Water & Natural Resource Issues

- Water use
- Protection of private wells & springs
- Wastewater treatment & disposal
- Habitat fragmentation and disturbance
- Spread of invasive species
- Air quality
- Negative effects on recreation and aesthetics
Opportunities and Challenges

TAKING ACTION LOCALLY TO SHAPE IMPACTS
What Does This Potentially Mean?

- Focus needs to be on future AFTER the boom, *not just the present*

- Focus needs to be on development in its entirety, not just well sites

- View Marcellus as a potential means to improve economy, social organization, human capital, physical infrastructure – *it is not an end in itself*

- Need public engagement, social networks, collaboration, and communication to address the Long Run, and how Marcellus fits
Penn State Cooperative Extension Resources

• Website & e-newsletter
  www.naturalgas.psu.edu

• Primers
  – Marcellus Shale: What Local Government Officials need to Know
  – Natural Gas Exploration: A Landowner’s Guide to Leasing Land in Pennsylvania

• Short Fact Sheets

• Webinars (general; business; other)