Brief Background

- Marcellus Shale Education and Training Center (MSETC)
  - Formed in November 2008

- Funding for project(s) was provided by:
  - Pennsylvania Department of Labor and Industry (Industry Partnership Funding through Southwest Oil & Gas Industry Partnership)
  - Pennsylvania Department of Labor & Industry (Industry Partnership Funding through the Central Pennsylvania Workforce Development Corporation and the Northern Tier Regional Planning and Development Commission)
  - Pennsylvania College of Technology
  - Penn State Cooperative Extension
Presentation Outline

- Background (Review)
- Model Results
- Analysis
- Summary
- Discussion
1st Marcellus Workforce Assessment Released (14-county study area in central & northern PA)

Marcellus Shale Partnership Meeting

Develop/Refine Occupational Matrix

Industry Interviews

Per-well Full Time Equivalent (FTE)

Rig Projection Research

Initial Development Scenarios

Online Workforce Assessment Responses Solicited

Online Workforce Assessment Responses Completed

Refine Development Scenarios

Draft Workforce Needs Assessment

Final Workforce Needs Assessment Report
Specific Geography

Pennsylvania Workforce Investment Board Regions

- Northwest
- Northcentral
- Northern Tier
- Central
- Northeast
- Southcentral
- Southeast

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Where it all started..

Extraction Timeline
Lifespan totaling approximately 30-50 years

- **Pipeline Construction**
  - Permits: Up to 2 mos.
  - Construction time depends on pipeline length

- **Drilling**
  - 30-45 days

- **Natural Gas Production**
  - Wells can be productive over a 30-50 year period

- **Pre-Drilling**
  - Geology Studies: Up to six months
  - Staking Well: 30-60 days

- **Drilling & Completion**
  - Fracing & Completion: 1-2 wks.

- **Post-Drilling**
  - Reclaiming: 1 month +

Mineral Rights
Maintenance over the life of the Mineral Extraction Process

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Phases of the Workforce Timeline Example:

Graph: Ecosystem Research Group/Jacquet
The play is in its infancy
Marcellus Gas Infrastructure is being developed
  - Businesses are still moving in
  - Extreme amount of complexity with overall industry Supply Chain
Interviews, online assessments, experience, and other unconventional plays have provided a guide to occupations
Estimates on the number rigs deployed and the number of wells to be drilled
The model connects jobs to a per well basis or per mile of pipeline
Drilling Down (The Matrix)

<table>
<thead>
<tr>
<th>Geological Studies</th>
<th>Associated Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geologists</td>
<td>Geologists</td>
</tr>
<tr>
<td>Petroleum Engineers</td>
<td>Petroleum Engineers</td>
</tr>
<tr>
<td>Computer tech</td>
<td>Computer tech</td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management</td>
</tr>
<tr>
<td>CDL Drivers</td>
<td>CDL Drivers</td>
</tr>
<tr>
<td>Seismic</td>
<td>Seismic</td>
</tr>
<tr>
<td>Hydro Geologist</td>
<td>Hydro Geologist</td>
</tr>
<tr>
<td>Helicopter Pilot/Crew</td>
<td>Helicopter Pilot/Crew</td>
</tr>
<tr>
<td>Cartographer</td>
<td>Cartographer</td>
</tr>
<tr>
<td>GIS Technicians</td>
<td>GIS Technicians</td>
</tr>
<tr>
<td>Archeology</td>
<td>Archeology</td>
</tr>
<tr>
<td>Petroleum Chemists</td>
<td>Petroleum Chemists</td>
</tr>
<tr>
<td>Water Management</td>
<td>Water Management</td>
</tr>
<tr>
<td>Biologist</td>
<td>Biologist</td>
</tr>
<tr>
<td>Geophysicists</td>
<td>Geophysicists</td>
</tr>
</tbody>
</table>
Model Methodology

- Per well and Per mile
- Conducted interviews with industry representatives
- Confirmed those numbers with other sources with similar capabilities
- Confirmed some occupations with other research or legacy knowledge of the industry
- Further confirmed with online assessment data
Advantages and Limitations of this Model

Advantages

• More specific occupational description than merely “industrial classification”
• Does not include/exclude based on industrial classifications
• Uses direct worker requirements, not complex I/O economic modeling
• Does not include/exclude based on the geographic locations of business offices
• Does not rely on sampling or response rates (such as surveys)
• Can easily be changed as development scenarios fluctuate
Advantages and Limitations of this Model

Limitations

- Worker’s permanent residency
- Indirect or induced economic impact
- Model depends on the accuracy of development projections
- No company-specific information such as name, size, location, etc.
- Limited indirect impacts (i.e. pipe, steel, replacement parts, legal services, catering, etc.)
- Does not include induced job creation (restaurant servers, vehicle sales, retail clerks, etc...)
Where did we base the Initial Well Predictions?

- Personal contact with industry representatives
- Investor reports for active Marcellus companies and the areas that they hold acreage and are actively drilling
- Public meetings and newspaper accounts
### Recent Drilling History

<table>
<thead>
<tr>
<th></th>
<th>Permits</th>
<th></th>
<th></th>
<th>Wells</th>
<th></th>
<th></th>
<th>Rigs</th>
<th></th>
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<tr>
<td>Beaver</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<tr>
<td>Fayette</td>
<td>35</td>
<td>88</td>
<td>31</td>
<td>18</td>
<td>55</td>
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<tr>
<td>Greene</td>
<td>43</td>
<td>182</td>
<td>71</td>
<td>18</td>
<td>91</td>
<td>37</td>
<td>8</td>
<td></td>
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<tr>
<td>Washington</td>
<td>92</td>
<td>209</td>
<td>134</td>
<td>32</td>
<td>138</td>
<td>82</td>
<td>8</td>
<td></td>
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</tr>
<tr>
<td>Westmoreland</td>
<td>28</td>
<td>89</td>
<td>26</td>
<td>19</td>
<td>46</td>
<td>13</td>
<td>2</td>
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</tr>
<tr>
<td>Total</td>
<td>198</td>
<td>574</td>
<td>265</td>
<td>87</td>
<td>330</td>
<td>142</td>
<td>20</td>
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<tr>
<td></td>
<td>190%</td>
<td>11%</td>
<td></td>
<td>279%</td>
<td>3%</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Pennsylvania</td>
<td>521</td>
<td>1985</td>
<td>1272</td>
<td>196</td>
<td>763</td>
<td>564</td>
<td>84</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>281%</td>
<td>54%</td>
<td></td>
<td>289%</td>
<td>77%</td>
<td></td>
<td>110%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What does this mean in terms of Wells?

Actual/Projected SW PA Marcellus Wells Drilled Per Year

- **Actual**
- **High**
- **Likely or Medium**
- **Low**

Wells Drilled Per Year

What does this mean in terms of Jobs?

Medium or 'Likely' Scenario: Estimated SW PA Marcellus Shale Workforce Requirements By Phase

Number of Workers

- Pre-Drilling
- Drilling
- Production

Year
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014

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What does this mean in terms of Jobs?

High Scenario: SW PA
Marcellus Shale Workforce Requirements By Phase

Year
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014

Number of Workers

- Pre-Drilling
- Drilling
- Production

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What does this mean in terms of Jobs?

Low Scenario: Estimated SW PA
Marcellus Shale Workforce Requirements By Phase

- Pre-Drilling
- Drilling
- Production

Number of Workers

Year

2009 2010 2011 2012 2013 2014

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Direct Workforce Requirements of Marcellus Shale Development in the Southwest

Size of workforce will depend on number of wells drilled each year.
What specific jobs are required?

Natural Gas Workforce Requirements By Category

- General Office: 20%
- CDL: 10%
- Gen. Labor: 20%
- Heavy Equipment: 17%
- Semi-Skilled Tech.: 6%
- Landmen/Realty: 5%
- Supervisors: 5%
- Inspectors: 1%
- Engineers: 3%
- Welders: 3%
- X-Ray: 1%
- Timber Logging: 1%
- Lawyers: 4%
- Paralegal: 1%
- Geologists: 3%
- Landmen/Realty: 5%
- Semi-Skilled Tech.: 6%
- Natural Gas Workforce: 5%
Specific requirements for Southwestern PA

Estimated SW PA Occupational Requirements 2010-2014

LIKELY DEVELOPMENT SCENARIO

- Welders & helpers
- X-Ray & tech
- CDL
- Gen. Labor
- Heavy Equipment
- Geologists
- Lawyers
- Paralegal
- Cartog/GIS
- Timber
- Logging
- Engineers
- Inspectors
- Supervisors
- Semi-Skilled Tech.
- General Office
- Landmen/Realty

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## Example of Natural Gas Workforce Growth Over Time

<table>
<thead>
<tr>
<th>Year</th>
<th>Wells Drilled</th>
<th>Total Drilling Phase Workforce</th>
<th>New Production Phase Workforce Each Year</th>
<th>Total Combined Production Phase Workforce</th>
<th>Workforce Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>25</td>
<td>322.75</td>
<td>8</td>
<td>7.50</td>
<td>330</td>
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<tr>
<td>2011</td>
<td>50</td>
<td>645.50</td>
<td>15</td>
<td>22.50</td>
<td>668</td>
</tr>
<tr>
<td>2012</td>
<td>75</td>
<td>968.25</td>
<td>23</td>
<td>45.00</td>
<td>1013</td>
</tr>
<tr>
<td>2013</td>
<td>100</td>
<td>1291.00</td>
<td>30</td>
<td>75.00</td>
<td>1366</td>
</tr>
<tr>
<td>2014</td>
<td>100</td>
<td>1291.00</td>
<td>30</td>
<td>105.00</td>
<td>1396</td>
</tr>
<tr>
<td>2015</td>
<td>100</td>
<td>1291.00</td>
<td>30</td>
<td>135.00</td>
<td>1426</td>
</tr>
<tr>
<td>2016</td>
<td>100</td>
<td>1291.00</td>
<td>30</td>
<td>165.00</td>
<td>1456</td>
</tr>
</tbody>
</table>
Potential Expectations

- Short-term (2010) leveling off of development
  - Economy
  - Processing capacity
  - Increase interest in production of natural gas and liquids
- As infrastructure develops, expectations are for Southwest Shale development to continue to expand
- Location of Marcellus Basin headquarters
  - More local jobs

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Workforce

- Cultural Characteristics
  - Strong Work Ethic/Mechanical Aptitude
  - Basic knowledge of natural gas production
  - Pass a drug test
- Predominantly blue collar
- Reliance on On-The-Job Training
  - Internal hiring/development practices
- Training responses
  - Customized training
  - Connect education and training providers with industry
  - Begins to provide a foundation for program development
In Summary..

- The direct job opportunities will likely increase dramatically
  - Most of them will be “Blue Collar”
  - Based on current estimates
    - Workforce required to drill a single well will require 420 individuals working across 228 different occupations/jobs
    - Each well requires 12.91 full time equivalent workers & .18 full time production jobs
    - High BTU Gas Processing requires roughly 1 FTE per 7.5 Mmcf or .2 FTE’s over per high BTU gas well over the next 5-years
    - Approximately 7,360 - 12,266 pre-drill & drilling FTE jobs by 2014
    - Approximately 801 – 1,293 FTE production jobs
Questions???

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