Marcellus Shale: Workforce Needs Assessment
Southwest Pennsylvania
Counties: Beaver, Washington, Greene, Fayette, and Westmoreland

SW PA Oil & Gas Industry Partnership & Marcellus Shale Education and Training Center

September 23, 2010
Brief Background

- SW PA Oil & Gas Industry Partnership
- Marcellus Shale Education and Training Center (MSETC)
  - Formed November, 2008
- Funding for this project was provided by:
  - The Pennsylvania Department of Labor and Industry through the Southwest Pennsylvania Oil & Gas Industry Partnership, on behalf of the Southwest Corner Workforce Investment Board and the Westmoreland-Fayette Workforce Investment Board

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Presentation Outline

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

Engaged to complete Southwest Marcellus Shale Workforce Needs Assessment
Refined Occupational Matrix
Industry Interviews

Per-well Full Time Equivalent (FTE)
Rig Projection Research
Initial Development Scenarios
Online Assessment Responses Solicited

High BTU Gas Tour and Matrix Development
Online Assessment Responses Completed
Refine Development Scenarios

Draft SW PA Workforce Needs Assessment

Final SW PA Workforce Needs Assessment Report
Specific Geography
Where it all started..

Extraction Timeline
Lifespan totaling approximately 30-50 years

<table>
<thead>
<tr>
<th>Permitting</th>
<th>Pipeline Construction</th>
<th>Natural Gas Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2 mos.</td>
<td>Construction time depends on pipeline length</td>
<td>Wells can be productive over a 30-50 year period</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-Drilling</th>
<th>Drilling &amp; Completion</th>
<th>Post-Drilling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology Studies</td>
<td>Staking Well</td>
<td>Reclaiming</td>
</tr>
<tr>
<td>Up to six months</td>
<td>30-60 days</td>
<td>1 month +</td>
</tr>
<tr>
<td></td>
<td>Fracing &amp; Completion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-2 wks.</td>
<td></td>
</tr>
</tbody>
</table>

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Jonah/Anticline Fields Phases of 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, surveys, 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>Pre-Drilling</th>
<th>Associated Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geological Studies</td>
<td>Cartographer</td>
</tr>
<tr>
<td></td>
<td>Geologists &amp; Geophysicists</td>
</tr>
<tr>
<td></td>
<td>GIS Technicians</td>
</tr>
<tr>
<td></td>
<td>Hydro Geologist</td>
</tr>
<tr>
<td></td>
<td>Petroleum Chemists</td>
</tr>
<tr>
<td></td>
<td>Petroleum Engineers</td>
</tr>
<tr>
<td>Seismic</td>
<td>CDL Drivers</td>
</tr>
<tr>
<td></td>
<td>Helicopter Pilot/Crew</td>
</tr>
<tr>
<td></td>
<td>Landman</td>
</tr>
<tr>
<td></td>
<td>Project Management</td>
</tr>
<tr>
<td></td>
<td>Seismic Crew</td>
</tr>
<tr>
<td>Public Land Only</td>
<td>Archeologist</td>
</tr>
<tr>
<td></td>
<td>Biologist</td>
</tr>
<tr>
<td></td>
<td>Forester</td>
</tr>
<tr>
<td></td>
<td>Lawyers</td>
</tr>
<tr>
<td></td>
<td>Water Management</td>
</tr>
<tr>
<td></td>
<td>Landman</td>
</tr>
</tbody>
</table>
Model Methodology

- Per well and Per mile
- Conducted interviews
- Confirmed numbers with 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 imputations of requirements
• 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
• Allows for triangulation of multiple data sources
Limitations

- Workplace location (well site vs business office)
- A specific calculation or definition of indirect or induced economic or workforce impacts
- Indirect or supply-chain industries or workforces
- No business-specific information such as name, size, location, etc...
- Not all workers/contactors (such as contracted legal services)
Key Assumptions:

- Full time equivalent (FTE) is defined at 260 workdays/year
- The average drilling rig will drill approximately 10 wells per year.
- Each well will require, on average, 1 mile of pipeline construction.
- One compressor station will be constructed, on average, for every 20 wells.
- Companies’ current drilling rig projections are relatively accurate (for the ‘likely’ scenarios)
Key Assumptions:

- Production facility capacity and staffing is approximately one FTE for every 7.5 million cubic feet of gas processed per day.
- Each well will follow an average production curve of Year 1: 4MMcf/d; Year 2: 1.2MMcf/d; Year 3: 900Mcf/d; Year 4: 800Mcf/d; Year 5: 700Mcf/d.
- Approximately 60% of wells drilled in the Southwest region will require processing.
Online Workforce Assessment...

- Purpose
  - Reaffirm key occupations and FTE Assumptions
  - Reaffirm Drilling Activity
  - Obtain workforce Recruiting and Training Needs
- 30 company participants
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
- On-line Workforce Assessment
Potential Expectations

• Short-term (2010) leveling off of development in SW PA
  ▪ 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
**Recent Drilling History**

<table>
<thead>
<tr>
<th>County/State</th>
<th>Permits</th>
<th>Wells</th>
<th>Rigs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beaver</td>
<td>0</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Fayette</td>
<td>35</td>
<td>88</td>
<td>49</td>
</tr>
<tr>
<td>Greene</td>
<td>43</td>
<td>182</td>
<td>115</td>
</tr>
<tr>
<td>Washington</td>
<td>92</td>
<td>209</td>
<td>204</td>
</tr>
<tr>
<td>Westmoreland</td>
<td>28</td>
<td>89</td>
<td>55</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>198</td>
<td>574</td>
<td>426</td>
</tr>
<tr>
<td>% yr to yr change</td>
<td>190%</td>
<td>11%</td>
<td>279%</td>
</tr>
</tbody>
</table>

Note: Permits and wells for 2010 year to year change is projected for the year based on the first eight months actual activity and assumes no significant shift in activity for the remainder of the year.
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

Year

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

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

What does this mean in terms of Jobs?

Year

Number of Workers

2009 2010 2011 2012 2013 2014

Pre-Drilling
Drilling
Production
What does this mean in terms of Jobs?

High Scenario: SW PA Marcellus Shale Workforce Requirements By Phase

- Pre-Drilling
- Drilling
- Production

Number of Workers

Year

2009 2010 2011 2012 2013 2014

2000 4000 6000 8000 10000 12000 14000

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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**

<table>
<thead>
<tr>
<th>Year</th>
<th>Pre-Drilling</th>
<th>Drilling</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>500</td>
<td>3000</td>
<td>500</td>
</tr>
<tr>
<td>2010</td>
<td>1000</td>
<td>2000</td>
<td>1000</td>
</tr>
<tr>
<td>2011</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td>2012</td>
<td>2000</td>
<td>1000</td>
<td>2000</td>
</tr>
<tr>
<td>2013</td>
<td>2500</td>
<td>5000</td>
<td>2500</td>
</tr>
<tr>
<td>2014</td>
<td>3000</td>
<td>6000</td>
<td>3000</td>
</tr>
</tbody>
</table>
Direct Workforce Requirements of Marcellus Shale development in the Southwest

Size of workforce will depend on number of wells drilled each year.

More wells drilled per year

No change in wells drilled per year

Less wells drilled per year
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%
- Cartog/GIS: 1%
- Paralegal: 1%
- Geologists: 3%
- Lawyers: 4%
- Inspectors: 1%
- Engineers: 3%
- Landmen/Realty: 5%
- Supervisors: 5%
- 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%
- Cartog/GIS: 1%
- Paralegal: 1%
- Geologists: 3%
- Lawyers: 4%
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

2010
2011
2012
2013
2014

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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>322.8</td>
<td>7.5</td>
<td>7.5</td>
<td>330.3</td>
</tr>
<tr>
<td>2011</td>
<td>50</td>
<td>645.5</td>
<td>15.0</td>
<td>22.5</td>
<td>668.0</td>
</tr>
<tr>
<td>2012</td>
<td>75</td>
<td>968.3</td>
<td>22.5</td>
<td>45.0</td>
<td>1013.3</td>
</tr>
<tr>
<td>2013</td>
<td>100</td>
<td>1291.0</td>
<td>30.0</td>
<td>75.0</td>
<td>1366.0</td>
</tr>
<tr>
<td>2014</td>
<td>100</td>
<td>1291.0</td>
<td>30.0</td>
<td>105.0</td>
<td>1396.0</td>
</tr>
<tr>
<td>2015</td>
<td>100</td>
<td>1291.0</td>
<td>30.0</td>
<td>135.0</td>
<td>1426.0</td>
</tr>
<tr>
<td>2016</td>
<td>100</td>
<td>1291.0</td>
<td>30.0</td>
<td>165.0</td>
<td>1456.0</td>
</tr>
</tbody>
</table>
Biggest Workforce Challenges

- Workers willing to do the work and/or work the hours needed (56%)
- Workers with the Experience Needed (78%)
- Workers with Technical Skills (78%)
Yes, we use primarily privately provided training programs (35%)

Yes, we use primarily publically provided training programs (35%)

Yes, we use a mix of publically and privately provided training programs (25%)

No, we do not use publically or privately provided training programs (6%)
Workforce

• 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 150 different occupations/jobs
    - Each well requires 12.91 full time equivalent workers & .18 full time production jobs
    - High BTU gas processing increases production related employment from .18 to .38 full time equivalent workers
    - Approximately 7,360 - 12,266 pre-drill & drilling FTE jobs by 2014
    - Approximately 801 - 1,293 FTE production jobs
Questions???

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