U.S. and Ohio Midstream Infrastructure Development

Findings and Results from ICF’s Study for American Petroleum Institute, April 2017, U.S. Oil and Gas Infrastructure Investment through 2035 – An Engine for Economic Growth

Presented by:

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- Projected Infrastructure Development across the U.S. and Ohio
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Observations Regarding Oil & Gas Supply and Infrastructure Development

- U.S. oil & gas production is likely to continue to grow significantly with continued development of shale resources.

- Market growth is an important enabler of oil & gas activity – without market growth, production in aggregate would not grow and buildout of infrastructure would be much more modest.

- Export activity is a key driver of U.S. oil & gas production and infrastructure development – healthy global markets are imperative.

- Infrastructure development is an important driver of the U.S. economy adding many jobs and contributing significantly to Gross Domestic and State Products.

- Infrastructure activity fosters development of the most cost-effective oil & gas supplies, potentially saving energy consumers billions of dollars.
Oil Production Continues to Come from Shale Plays

- The cases presented in the API study project that U.S. oil production will average 8 to 12 million barrels per day by 2035.
- Domestic production will displace imports.
- Refinery runs flat to slightly up over time.
- Permian Basin will produce upwards of 4 million barrels per day.
- Production growth will promote significant development of new transport (i.e., rails & pipelines) and oil handling capability.
Natural Gas Production Continues to Grow Robustly

- API’s cases show that U.S. natural gas production will rise to 100 to 130 billion cubic feet per day by 2035.
- Shale resource development will account for over 80 percent of total production.
- Market growth is necessary.
- Significant development of gathering & processing facilities, pipelines, and export terminals will be needed to support this growth.
Natural Gas Market Growth is Vital for the Oil & Gas Business

- API’s cases show that the majority of market growth is in exports (both LNG & Mexican exports).
- LNG exports rise to 10 to 20 billion cubic feet per day.
- Gas-fired power generation up, but uncertain.
- Petrochemical gas use up modestly – NGL use in petrochemical facilities could grow much more robustly.
- Without market growth, supply and infrastructure development would be limited.
Marcellus/Utica – The Juggernaut Continues

Marcellus/Utica production is projected to grow to over 40 billion cubic feet per day by 2025, accounting for nearly 45 percent of total U.S. production.

Last year’s decline in activity does not represent a permanent trend, and robust production growth resumes after this year.

However, market growth, pipeline development, and higher gas prices are required to support production growth.

<table>
<thead>
<tr>
<th>Year</th>
<th>Well Completions</th>
<th>Production (Bcfd)</th>
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</thead>
<tbody>
<tr>
<td>2010</td>
<td>956</td>
<td>2</td>
</tr>
<tr>
<td>2011</td>
<td>1,565</td>
<td>4</td>
</tr>
<tr>
<td>2012</td>
<td>1,797</td>
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<tr>
<td>2013</td>
<td>2,131</td>
<td>11</td>
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<tr>
<td>2014</td>
<td>2,572</td>
<td>14</td>
</tr>
<tr>
<td>2015</td>
<td>2,243</td>
<td>17</td>
</tr>
<tr>
<td>2016</td>
<td>1,450</td>
<td>19</td>
</tr>
<tr>
<td>2017</td>
<td>1,599</td>
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<tr>
<td>2018</td>
<td>2,749</td>
<td>26</td>
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<td>2019</td>
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<tr>
<td>2020</td>
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<td>2023</td>
<td>3,953</td>
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<tr>
<td>2024</td>
<td>3,863</td>
<td>41</td>
</tr>
<tr>
<td>2025</td>
<td>3,665</td>
<td>42</td>
</tr>
</tbody>
</table>

Source: ICF’s Base Case, Q2 2017
Ohio’s Oil & Gas Production Grows Robustly

- Oil & gas production is projected to double by 2025.
- Reduced activity last year does not reflect a longer term trend.
- However, pipeline development and market growth (including petrochemical activity) is imperative to support production growth.

Source: ICF’s Base Case, Q2 2017
Findings Regarding Infrastructure Development in the API Study

1) Robust development of oil and gas from shale plays will continue to promote rapid infrastructure development over a prolonged period of time.

2) Capital expenditures (CAPEX) for oil and gas infrastructure development will range from $56 to $71 billion per year across the U.S, totaling $1.0 to $1.4 billion from 2017 through 2035.

3) Investment in infrastructure will contribute $79 to $100 billion annually to U.S. GDP.

4) Infrastructure development will employ an average of 828,000 to 1,047,000 individuals in the U.S.

5) Regulatory approvals of midstream projects is important.
## Pipeline Capacity Added from 2017-35 in the API Study

<table>
<thead>
<tr>
<th></th>
<th>Base Case</th>
<th>High Case</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil (million bpd)</strong></td>
<td>3.0</td>
<td>5.0</td>
<td>Large amount of capacity added to transport heavy crude from Western Canada into and within the U.S; Permian Basin also a significant focus for development. Most of the new capacity is already under construction.</td>
</tr>
<tr>
<td><strong>Natural Gas (Bcfd)</strong></td>
<td>49.5</td>
<td>67.4</td>
<td>Two-thirds of the capacity originates from the Marcellus/Utica. Southwest also a significant area for development.</td>
</tr>
<tr>
<td><strong>Natural Gas Liquids (NGL; million bpd)</strong></td>
<td>1.8</td>
<td>2.6</td>
<td>Over half of the new capacity originates from the Marcellus/Utica. However, significant capacity is added in the Southwest in close proximity to Mont Belvieu, new ethane crackers, export terminals.</td>
</tr>
</tbody>
</table>
Roughly 20% of the Projected Infrastructure Development from 2017-35 will be Concentrated in the Northeast

**Base Case**
Total Investment = $1,059,686

- Alaska: $6,744 (1%)
- Western: $44,088 (4%)
- Offshore: $177,490 (17%)
- Central: $114,358 (11%)
- Midwest: $79,157 (7%)
- Northeast: $204,273 (19%)
- Southeast: $52,137 (5%)
- Southwest: $381,438 (36%)

**High Case**
Total Investment = $1,342,167

- Alaska: $6,902 (0%)
- Western: $45,479 (3%)
- Offshore: $203,787 (15%)
- Central: $128,678 (10%)
- Midwest: $103,268 (8%)
- Northeast: $277,916 (21%)
- Southeast: $75,598 (6%)
- Southwest: $500,539 (37%)
Breakdown of Oil and Gas Infrastructure Development Associated with Buildout of the Marcellus/Utica Play

- Between $9 and $13 billion per year invested in gathering and processing facilities and pipelines – 86% of the total investment.
- Regulatory approvals of new infrastructure and market development downstream of the area are imperative.
- Major pipeline projects include Rover, NEXUS, Atlantic Sunrise, Atlantic Coast Pipeline, Mountain Valley, Constitution, and Penn East.
Oil and Gas Infrastructure Development is an Engine for Ohio’s Economy

- In the API study, Ohio ranks fifth among U.S. states with O&G infrastructure development accounting for 36,000 to 48,000 jobs and adding $1.5 to $2.0 billion annually to the State’s economy.

- Over the next 20 years, Ohio will add:
  - 500 to 750 O&G wells per year.
  - 2,000 to 3,000 miles of gathering lines.
  - 6 to 7 billion cubic feet per day of new gas processing capability.
  - 200 to 250 thousand barrels per day of fractionation capacity.
  - 2,500 to 3,500 miles of pipeline – Rover is already under construction and NEXUS has received its federal approvals.
So, What Could Go Wrong?

- Environmental catastrophes associated with oil and gas activity.
- Even greater opposition to hydrocarbon development and infrastructure needed for delivery of oil and gas.
- Continued delays and/or denials of permits in the regulatory approvals processes.
- Lack of market development, particularly exports of gas and NGLs.
- Anemic global demand for oil and gas.
- Prolonged reduction of oil and gas prices.
Key Takeaways

- Robust growth of O&G supply likely to continue – Marcellus/Utica will continue to grow at a rapid pace.
- Market growth and regulatory approvals of projects are imperative.
- Ohio will rank fifth among U.S. states for jobs and GSP resulting from O&G infrastructure activity.
- Much new infrastructure is required.
Questions & Contact Information

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