USAEE Annual Meeting
Austin, TX

SHALE GAS & PETROCHEMICAL INVESTMENT

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Sr. Director, Policy Analysis and Economics
Oil and Natural Gas Prices

$/Barrel

$/mm BTUs

Source: Energy Information Administration
Global Natural Gas Price Trends

$ per million BTUs

Source: EIA, Petrobas, IMF, World Bank, various national statistical agencies
Oil-to-Gas Ratio: A Proxy for US Gulf Coast Competitiveness

When the ratio is above 7, the competitiveness of Gulf Coast-based petrochemicals and derivatives vis-à-vis other major producing regions is enhanced. In the US, nearly 90% of ethylene, for example, is derived from natural gas liquids while in Western Europe, over 85% is derived from naphtha, gas oil and other light distillate oil-based products. Historically, other factors (co-product prices, exchange rates, capacity utilization, etc.) have played a role in competitiveness as well. The current ratio is very favorable for US competitiveness and exports of petrochemicals, plastics and other derivatives.
Global Ethylene Supply Curve
(Petrochemical Production Costs by Country/Region)
North American Thermoplastics Exports and Oil-to-Gas Ratio are Correlated

Note: Thermoplastics includes LDPE, LLDPE, HDPE, PP, and PVC
Petrochemical Competitiveness

**Then...**

USGC petrochemicals competitively disadvantaged

Near top of global cost curve

Major capacity build in the Middle East with stranded ethane from that region

**Now...**

By 2011, USGC cost position had improved that region follows Middle East

Ethane supplies tightening in Middle East; era of low-cost feedstocks is over - some producing nations may ride up the cost curve
Petrochemical Investment

A flood of announced investments by more than a dozen companies to capitalize on new cost advantage

Much of the investment will occur along the US Gulf Coast

However, there will be significant investment in new regions, i.e., Appalachia
Outlook for Chemicals (excluding Pharmaceuticals)

Production Volume Index (Where 2007 = 100)

- Production Volume
- Incremental Volume from New Investments
Outlook for Plastic and Rubber Products

Production Volume Index (Where 2007 = 100)

- Blue bars represent Production Volume.
- Orange bars represent Incremental Volume from New Investments.

Data for years 2003 to 2017 is shown in the chart.
Summary of ACC Analysis on the Impact on Eight Manufacturing Industries
Additional Output of Eight Gas-Intensive Manufacturing Industries from Shale Gas Advantage

Total $121.0 billion

- Plastic & Rubber Products, $33.3 billion
- Fabricated Metal Products, $5.8 billion
- Iron & Steel, $5.0 billion
- Paper, $3.7 billion
- Aluminum, $1.7 billion
- Glass, $0.7 billion
- Foundries, $0.6 billion
- Chemicals, $70.2 billion
Incremental Gain in Shipments of Eight Gas-Intensive Manufacturing Industries

- Paper
- Chemicals (ex. Pharma.)
- Plastic & Rubber Products
- Glass
- Iron & Steel
- Aluminum
- Foundries
- Fabricated Metal Products

- Baseline Shipments
- Gain in Output from Lower Natural Gas Costs
Increased Manufacturing Investment

- Increasing competitiveness boosts output in these eight industries by $121.0 billion (7%).
- To increase production, industries would need to invest to update and expand capacity by $72 billion.
# Economic Impact from Additional Manufacturing Output

<table>
<thead>
<tr>
<th>Impact Type</th>
<th>Jobs</th>
<th>Payroll ($ bill)</th>
<th>Output ($ bill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effect</td>
<td>199,518</td>
<td>$14.6</td>
<td>$121.0</td>
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<tr>
<td>Indirect Effect</td>
<td>462,292</td>
<td>31.7</td>
<td>143.8</td>
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<tr>
<td>Induced Effect</td>
<td>516,719</td>
<td>24.2</td>
<td>76.8</td>
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<tr>
<td>Total Effect</td>
<td>1,178,528</td>
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<td>$341.6</td>
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## Tax Revenues

<table>
<thead>
<tr>
<th></th>
<th>Payroll</th>
<th>Households and Proprietors</th>
<th>Corporations and Indirect Business Taxes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal</td>
<td>$7.1</td>
<td>$4.8</td>
<td>$3.3</td>
<td>$15.2</td>
</tr>
<tr>
<td>State &amp; Local</td>
<td>$0.2</td>
<td>$1.8</td>
<td>$9.0</td>
<td>$11.0</td>
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</table>
# Economic Impact from Investment Phase

<table>
<thead>
<tr>
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<th>Payroll ($ bill)</th>
<th>Output ($ bill)</th>
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<tr>
<td>Direct Effect</td>
<td>286,258</td>
<td>$20.5</td>
<td>$72.0</td>
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<tr>
<td>Indirect Effect</td>
<td>313,371</td>
<td>20.4</td>
<td>68.1</td>
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<tr>
<td>Induced Effect</td>
<td>454,244</td>
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<td>67.5</td>
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<tr>
<td>Total Effect</td>
<td>1,053,872</td>
<td>$62.1</td>
<td>$207.6</td>
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<tbody>
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<td>$6.4</td>
<td>$4.1</td>
<td>$2.1</td>
<td>$12.6</td>
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<tr>
<td>State &amp; Local</td>
<td>$0.2</td>
<td>$1.6</td>
<td>$6.6</td>
<td>$8.3</td>
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</tbody>
</table>
Other Research

• **PWC/NAM** - Lower input costs from affordable energy and demand from the oil and gas sector could generate approximately one million jobs by 2025.

• **Citigroup** also looked at the impact of new energy production and associated activity and found that by 2020, GDP would be boosted by 2.0-3.3% generating 2.7-3.6 million jobs.

• **Boston Consulting Group** looked at a “tipping point” in cost-risk factors among 7 key industries that would encourage industries to return to US-based manufacturing. This would result in $80-$120 billion in output gains and 2-3 million jobs.
Challenges to the Shale Gas Revolution

Environmental concerns regarding hydraulic fracturing (water quality, well site remediation)
Changes to tax, trade, and environmental policies could affect the development of US shale gas
New sources of demand could put pressure on new supplies.
Questions?

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