2018 Downstream Challenges and Opportunities

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2018 Downstream Challenges and Opportunities

Iryna V. Lendel, Ph.D.
Director, Center for Economic Development
Cleveland State University

Utica Summit VI
October 10, 2018
Production by Play

- Dry shale gas production in U.S. up **10 billion** cf per day since last August
- Distribution of plays hasn’t changed

- Top Four (EIA estimates)
  - Marcellus: 36.3%
  - Permian: 12.7%
  - Haynesville: 12.0%
  - Utica: 11.3%
Downstream: Gas-Fired Power Plants

- Ohio’s natural gas consumption for electricity generation increased 37% (EIA) from last year.
- In June 2018, majority of electricity generation is still by coal (45%), but gap is closing.
- **11 gas-fired plants** either under construction, planned, or newly built.

[Generation of Electricity by Source, Ohio]

- Natural Gas-Fired, 36%
- Coal-Fired, 45%
- Nuclear, 17%
- Nonhydroelectric Renewables, 2%
• Expansion of ethane cracker plants into Appalachian region beginning
• Shell U.S. ethane cracker in PA currently on schedule for early 2020s
• Planning, approval and construction typically takes 7-10 years
• National and global ethane processing capacity going up
• Connected to increasing NGLs and ethane
• US expecting about 48% increase in ethylene
Developing a Petrochemical Hub
Are We Building a HUB?

• **Industry hubs** are cities or regions where specific types of businesses are clustered

• “Being faster than your competitors. Developing products more flexibly. Being the first to put complex innovations on the market.” (HighTechCampus)

• “regions are the place to work on technology-based development and that regions need to be anchored by hubs of collaborative R&D where industry can work with academia and government to solve tough problems and foment technology gains.” (Brookings)
- 68.3% of the national downstream industries employment within 500 miles of Appalachian crackers
- 58.0% of national total of downstream industries GDP within 500 miles of Appalachian crackers
Downstream Industries

- NAICS 3251 Basic Chemical Manufacturing
- NAICS 3252 Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing
- NAICS 3255 Paint, Coating, and Adhesive Manufacturing
- NACIS 3261 Plastics Product Manufacturing
- NACIS 3259 Other Chemical Product and Preparation Manufacturing
- NACIS 3253 Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing

<table>
<thead>
<tr>
<th>2017 Employment (thousands)</th>
<th>GDP ($K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within 500 miles of Appalachian crackers</td>
<td>698</td>
</tr>
<tr>
<td>68.3% of national total</td>
<td>58.0% of national total</td>
</tr>
<tr>
<td>Within 500 miles of Norco, Louisiana</td>
<td>418</td>
</tr>
<tr>
<td>40.9% of national total</td>
<td>50.2% of national total</td>
</tr>
</tbody>
</table>
Is Ohio Beefing up Downstream Supply Chain?

- Defined downstream sector by industries

<table>
<thead>
<tr>
<th>NAICS</th>
<th>Industry Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>3251</td>
<td>Basic Chemical Manufacturing</td>
</tr>
<tr>
<td>3252</td>
<td>Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing</td>
</tr>
<tr>
<td>3255</td>
<td>Paint, Coating, and Adhesive Manufacturing</td>
</tr>
<tr>
<td>3261</td>
<td>Plastics Product Manufacturing</td>
</tr>
<tr>
<td>3259</td>
<td>Other Chemical Product and Preparation Manufacturing</td>
</tr>
<tr>
<td>3253</td>
<td>Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing</td>
</tr>
</tbody>
</table>

- Looked at “backward” and “forward” linkages along the supply chain:
  - The backward linkages describe the process of how a company purchases its goods, products, or supplies from a company in a different sector; these are called inputs (suppliers)
  - Forward linkages describe the process of how a company sells its goods, products, or supplies to a company in a different sector; these are called outputs (customers)
  - Crackers are looking for both suppliers and customers
Supply Chain Gaps

<table>
<thead>
<tr>
<th>IMPLAN Sector</th>
<th>NAICS</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>161</td>
<td>32511</td>
<td>Petrochemical manufacturing</td>
</tr>
<tr>
<td>156</td>
<td>32411</td>
<td>Petroleum refineries</td>
</tr>
<tr>
<td>166</td>
<td>325211</td>
<td>Plastics material and resin manufacturing</td>
</tr>
<tr>
<td>165</td>
<td>32519</td>
<td>Other basic organic chemical manufacturing</td>
</tr>
<tr>
<td>395</td>
<td>42</td>
<td>Wholesale trade</td>
</tr>
<tr>
<td>461</td>
<td>55</td>
<td>Management of companies and enterprises</td>
</tr>
<tr>
<td>49</td>
<td>22112</td>
<td>Electric power transmission and distribution</td>
</tr>
<tr>
<td>164</td>
<td>32518</td>
<td>Other basic inorganic chemical manufacturing</td>
</tr>
<tr>
<td>50</td>
<td>2212</td>
<td>Natural gas distribution</td>
</tr>
<tr>
<td>409</td>
<td>482</td>
<td>Rail transportation</td>
</tr>
<tr>
<td>411</td>
<td>484</td>
<td>Truck transportation</td>
</tr>
<tr>
<td>20</td>
<td>211111</td>
<td>Extraction of natural gas and crude petroleum</td>
</tr>
<tr>
<td>188</td>
<td>32611</td>
<td>Plastics packaging materials and un laminated film and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sheet manufacturing</td>
</tr>
<tr>
<td>163</td>
<td>32513</td>
<td>Synthetic dye and pigment manufacturing</td>
</tr>
<tr>
<td>149</td>
<td>32221</td>
<td>Paperboard container</td>
</tr>
</tbody>
</table>

2015 Largest Gaps

- Petroleum Refineries
- Plastic Material and Resin Manufacturing
- Other Basic Organic Chemical Manufacturing
- Plastic Packaging Materials and Unlaminated Film and Sheet Manufacturing

Source: IMPLAN data
27 Petrochemical/Downstream-Related Industries

- Petrochemical manufacturing
- Industrial gas manufacturing
- Synthetic dye and pigment manufacturing
- Other basic inorganic chemical manufacturing
- Other basic organic chemical manufacturing
- Plastics material and resin manufacturing
- Synthetic rubber manufacturing
- Artificial and synthetic fibers and filaments manufacturing
- Nitrogenous fertilizer manufacturing
- Phosphatic fertilizer manufacturing
- Fertilizer mixing
- Pesticide and other agricultural chemical manufacturing
- Paint and coating manufacturing
- Adhesive manufacturing

- Printing ink manufacturing
- Explosives manufacturing
- Custom compounding of purchased resins
- Photographic film and chemical manufacturing
- Other miscellaneous chemical product manufacturing
- Plastics packaging materials and un laminated film and sheet manufacturing
- Un laminated plastics profile shape manufacturing
- Plastics pipe and pipe fitting manufacturing
- Laminated plastics plate, sheet (except packaging), and shape manufacturing
- Polystyrene foam product manufacturing
- Urethane and other foam product (except polystyrene) manufacturing
- Plastics bottle manufacturing
- Other plastics product manufacturing
2018 Supply Chain of the Petrochemical Industry (Downstream) in Ohio

• On average, 27 petrochemical industries buy 29% of their supplies in Ohio, equivalent of $12.6 Bill

• Top industries selling supplies to the downstream:
  • Wholesale trade – 14%
  • Management of companies and enterprises – 14%
  • Petroleum refineries – 6%
  • Electric power transmission and distribution – 5%
  • Natural gas distribution – 5%
  • Truck transportation – 4%
  • Plastics material and resin manufacturing – 4%

70% of downstream supplies are still bought outside Ohio
## From What Industries the Downstream Buys in Ohio

<table>
<thead>
<tr>
<th>IMPLAN Sector</th>
<th>Total Supplies Purchased in Ohio</th>
<th>% of Supplies purchased in Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholesale trade</td>
<td>$1,820,210,475</td>
<td>14%</td>
</tr>
<tr>
<td>Management of companies and enterprises</td>
<td>$1,787,094,582</td>
<td>14%</td>
</tr>
<tr>
<td>Petroleum refineries</td>
<td>$703,071,371</td>
<td>6%</td>
</tr>
<tr>
<td>Electric power transmission and distribution</td>
<td>$591,267,168</td>
<td>5%</td>
</tr>
<tr>
<td>Natural gas distribution</td>
<td>$573,461,846</td>
<td>5%</td>
</tr>
<tr>
<td>Truck transportation</td>
<td>$543,388,696</td>
<td>4%</td>
</tr>
<tr>
<td>Plastics material and resin manufacturing</td>
<td>$442,199,585</td>
<td>4%</td>
</tr>
<tr>
<td>Rail transportation</td>
<td>$350,239,412</td>
<td>3%</td>
</tr>
<tr>
<td>Lessors of nonfinancial intangible assets</td>
<td>$260,330,697</td>
<td>2%</td>
</tr>
<tr>
<td>Nitrogenous fertilizer manufacturing</td>
<td>$254,917,801</td>
<td>2%</td>
</tr>
<tr>
<td>Synthetic dye and pigment manufacturing</td>
<td>$251,554,292</td>
<td>2%</td>
</tr>
<tr>
<td>Paperboard container manufacturing</td>
<td>$232,590,785</td>
<td>2%</td>
</tr>
<tr>
<td>Waste management and remediation services</td>
<td>$200,105,884</td>
<td>2%</td>
</tr>
<tr>
<td>Other basic organic chemical manufacturing</td>
<td>$192,811,440</td>
<td>2%</td>
</tr>
<tr>
<td>Maintenance and repair - nonresidential</td>
<td>$192,772,568</td>
<td>2%</td>
</tr>
</tbody>
</table>
### Top 30 Industries Supplying 79% of All Purchases Made in Ohio

<table>
<thead>
<tr>
<th>IMPLAN Sector</th>
<th>Total Supplies Purchased in Ohio</th>
<th>% of Supplies purchased in Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial gas manufacturing</td>
<td>$176,951,137</td>
<td>1%</td>
</tr>
<tr>
<td>Architectural, engineering, and related services</td>
<td>$160,219,322</td>
<td>1%</td>
</tr>
<tr>
<td>Other local government enterprises</td>
<td>$160,105,001</td>
<td>1%</td>
</tr>
<tr>
<td>Monetary authorities and credit intermediation</td>
<td>$154,024,283</td>
<td>1%</td>
</tr>
<tr>
<td>Plastics packaging materials</td>
<td>$142,229,094</td>
<td>1%</td>
</tr>
<tr>
<td>Marketing research and other technical services</td>
<td>$113,211,465</td>
<td>1%</td>
</tr>
<tr>
<td>Other basic inorganic chemical manufacturing</td>
<td>$97,101,783</td>
<td>1%</td>
</tr>
<tr>
<td>Grain farming</td>
<td>$88,871,882</td>
<td>1%</td>
</tr>
<tr>
<td>Custom compounding of purchased resins</td>
<td>$84,814,731</td>
<td>1%</td>
</tr>
<tr>
<td>Services to buildings</td>
<td>$84,157,850</td>
<td>1%</td>
</tr>
<tr>
<td>Commercial and industrial machinery</td>
<td>$79,543,559</td>
<td>1%</td>
</tr>
<tr>
<td>Air transportation</td>
<td>$76,750,377</td>
<td>1%</td>
</tr>
<tr>
<td>Petrochemical manufacturing</td>
<td>$72,102,998</td>
<td>1%</td>
</tr>
<tr>
<td>Limited-service restaurants</td>
<td>$71,894,068</td>
<td>1%</td>
</tr>
<tr>
<td>Other plastics product manufacturing</td>
<td>$67,419,129</td>
<td>1%</td>
</tr>
</tbody>
</table>
Checking the Dynamics of the Downstream GDP/GRP of Downstream Sector

2010-2017
- US grew 19%*
  - LA declined 1%
  - TX grew 23%
- Tri-State grew 26%
  - OH – 31%
  - PA – 26%
  - WV – 5%

2017-2020
- US is projected to grow 16%:
  - LA – 15%; TX – 17%
- Tri-state is projected to grow 12%:
  - OH – 12%
  - PA & WV – 11%

*numbers are not adjusted for inflation

Source: Moody’s Economy.com
Checking the Dynamics of the Downstream Employment of Downstream Sector

**2010-2017**
- US grew 10%:
  - LA -- 10%
  - TX -- 9%
- Tri-State grew 9%
  - OH – 11%
  - PA – 10%
  - WV declined 6%

**2017-2020**
- US is projected to decline 1%:
  - LA to grow 1%; TX – 1%
- Tri-state is projected to decline 2%:
  - OH decline 2%
  - PA -- 2%
  - WV – 1%

Source: Moody’s Economy.com
Remaining Challenges of the Petrochemical and Downstream Industries

• Tri-state region is competing with global petrochemical producers – vertically integrated, capital-intensive, high-barrier-to-entry

• Moving towards the completion of Pennsylvania Shell ethylene cracker plant may attract other global companies and JVs

• Research, business services, and workforce may provide a competitive advantage for a region in addition to the feedstock and energy
  • Can this become a competitive advantage for the tri-state region?
For More Information

See Our Reports on Utica Shale in Ohio:

1) Economics of Utica Shale in Ohio: Workforce Analysis

2) Economics of Utica Shale in Ohio: Supply Chain Analysis
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