USA & Canada Chemical Industry Outlook

Presented By:
Trey Hamblet – VP of Research, Chemical Processing
Industrial Info Resources, Inc.

June 8, 2018
Complete Industrial Market Coverage

**Power**
- Electric Power Generation and Transmission & Distribution

**Energy**
- Terminals
- Pipelines
- Production
- Alternative Fuels
- Petroleum Refining

**Industrial Infrastructure**
- Industrial Manufacturing
- Chemical Processing
- Pulp, Paper & Wood
- Metals & Minerals
- Food & Beverage
- Pharmaceutical & Biotech
Globally we are tracking:

157,000 projects globally
189,000 plants globally
285,000 installed unit assets
51,000 future offline events
Plus much more: boilers, turbines, compressors

Total Investment Value
Project Status (Planning, Engineering, Under Construction)
Project Milestones (AFE, RFQ, Bid Doc, KO, Completion)
Project Scope & Key Equipment Needs
Key Personnel Contacts – Plant Owners, Plant Operators & Contractors

Capital Expenditures
[Grassroot, Unit Additions, Expansions]

Maintenance, Repairs &
Overhaul Spending

400+ researchers
Chemical Processing Industry
More than 1,100 chemical types across the supply chain

- **Base Chemicals**
  - Petrochemicals: Ethylene, Methanol, Propylene, Cyclohexane, Ethylbenzene, Cumene, Phthalic Anhydride, Butadiene, Phenol
  - Plastics & Rubbers: Polyethylene, Polypropylene, Polyvinyl Chloride, Styrene-Butadiene Rubber
  - Specialty Chemicals: Sulfuric Acid, Peroxides, Sulfide and Sulfate compounds
  - AG Chemicals: Ammonia, Urea, Nitric Acid, UAN Solutions
  - Chlor-Alkali: Chlorine, Alkalis not produced at a mine
  - Industrial Gases: Oxygen, Nitrogen, Argon, Hydrogen, Helium
  - Pigments: Titanium Dioxide, Iron and Lead Oxide Pigments, Inorganic Pigments
  - Fibers: Polyester Fibers, Nylon Fibers, Acrylonitrile Fibers, Acrylic Fibers, Elastomeric Fibers
  - Surfactants: Emulsifiers, Surface Active Agents, Sodium Hypochlorite (bleach)
  - Other Chemicals: Carbon Black, Explosives, Drilling Mud

- **Intermediates**
  - Petrochemicals: Ethylene Oxide/Glycol, Acetic Acid, VCM, Acrylonitrile, Adipic Acid, Alcohols, Vinyl Acetate, Acrylic Acid, EDC, Propylene Oxide, Aniline, Benzene, Isocyanates, Maleic Anhydride, Nitrobenzene, Styrene, Toluene, TDI, MDI, Styrene Monomer, LAB, Isocyanurates
  - Specialty Chemicals: Chemical Catalysts, Perchloric Acid, Nickel Carbonate, Sulfur Dioxide, Sodium Phosphate, Compounds of Potassium, Nickel, Lithium, Magnesium, Sodium; Sodium Cyanide, Zinc Chloride, Sodium Hydride, Sulfur Dioxide, Calcium Sulfate
  - AG Chemicals: Ammonium Nitrate, Aqua Ammonia, Phosphoric Acid, Ammonium Phosphates, Diammonium Phosphates, Mixed Fertilizers, Herbicides, Fungicides, Pyrethrin Concentrates, Plant Hormones, Lime Solutions, Ag Disinfectants, Rodent Poisons
  - Chlor-Alkali: Sodium Hydroxide (caustic soda), Soda ash, not produced at a mine, Potassium Hydroxide, Potassium Carbonate, Sodium Carbonate, Chlorine packaging/Pool Chemicals, Washing Soda
  - Industrial Gases: Nitrous Oxide, Carbon Dioxide, Carbon Monoxide, Dry Ice, Acetylene
  - Pigments: Barium Sulfate, Ferric Oxide, Metallic Pigments, Mineral Colors and Pigments, Zinc Oxide
  - Fibers: Nitrocellulose Fibers, Fluorocarbon Fibers, Non-cellulosic Yarn, Vinyl Fibers, Cigarette Tow, Acetate Fibers
  - Surfactants: Detergents, Polishes and Waxes, Finishing Agents (textile & Leather), Cleaning Compounds, Disinfectants, Foam Control Agents, Sulfonated Greases, Engine Treatment Chemicals, Soaps

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Natural Gas and NGLs maintain their strong advantage over the price of Crude Oil, making them the feedstock of choice for USA petrochemical producers.
U.S. & Canada Chemical Industry
The Feedstock Advantage and Influence

Oil-to-Gas Ratio

May 2014: 23:1
Jan 2016: 12:1
May 2018: 24:1

Source: Petrochem Wire

NGL Prices

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Ethane - Propane - Butane - Isobutane

Source: Petrochem Wire
$7.2 billion in new ammonia capacity

$12 billion in ethylene projects; 16 billion Lbs by 2018
U.S. & Canada Chemical Industry
Comparison of Construction Starts by Year

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Source: IIR PECWeb

- 2013: $7.2 billion in new ammonia capacity
- 2014: $12 billion in ethylene projects; 16 billion Lbs by 2018
- 2015: $9.5 billion in ethylene and polyethylene capacity projects
- 2016: $5.5 billion in derivative spending begins construction
- 2017: $10 billion in ethylene, methanol & derivatives

Project Count

- 5-year avg

$ in millions

Year


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U.S. & Canada Chemical Industry

Comparison of Construction Starts by Year

2015 $9.5 billion in ethylene and polyethylene capacity projects
2016 $5.5 billion in derivative spending begins construction
2017 $10 billion in ethylene, methanol & derivatives
2018 $20 billion in ethylene, PDH, methanol & derivatives (PE, MDI, EO)
2019 $21 billion in ethylene, PDH, methanol & derivatives (PE, PP)

Source: IIR PECWeb
2018 and 2019 Construction Starts

Source: IIR Geolocator
U.S. & Canada Chemical Industry

2018 Construction Starts by Probability Factor

May 2018

$42 Bn

$13.5 billion
$20.5 billion
$8.2 billion

High
Medium
Low

Probability Factor

Key Commodities

<table>
<thead>
<tr>
<th>Commodity</th>
<th>$ in millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylene</td>
<td>$5,800</td>
</tr>
<tr>
<td>Polyethylene</td>
<td>$2,000</td>
</tr>
<tr>
<td>Ethylene Oxide</td>
<td>$2,000</td>
</tr>
<tr>
<td>Methanol</td>
<td>$1,375</td>
</tr>
<tr>
<td>Ammonia</td>
<td>$1,121</td>
</tr>
</tbody>
</table>

Source: IIR PECWeb
$42 Bn

High
$13.5 billion

Medium
$20.5 billion

Low
$8.2 billion

May 2018

Key Commodities

<table>
<thead>
<tr>
<th>Key Commodity</th>
<th>$ in millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanol</td>
<td>$2,900</td>
</tr>
<tr>
<td>Ammonia</td>
<td>$1,800</td>
</tr>
<tr>
<td>Ethylene</td>
<td>$850</td>
</tr>
</tbody>
</table>

Source: IIR PECWeb
U.S. & Canada Chemical Industry
Future Outlook on spending by Sector

Projects with a **High** & **Medium** Probability planned for construction start in 2018

2018  $34 billion in potential spending

- **Petrochem**: $19.5 b
- **Plastics**: $6.1 b
- **Ag Chemicals**: $4.7 b
- **Chlor-Alkali**: $.6 b
- **Specialty Chemicals**: $.8 b
- **Pigments-Fibers**: $.4 b
- **Industrial Gases**: $.4 b
- **Other**: $1.5 b

Source: IIR PECWeb
U.S. & Canada Planned Ethylene Capacity

44 billion pounds of additional capacity planned

**Oil-to-Gas Ratio**

<table>
<thead>
<tr>
<th>Wave</th>
<th>Capacity</th>
<th>Online by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Wave</td>
<td>16.7 billion Lbs/yr</td>
<td>4Q18</td>
</tr>
<tr>
<td>2nd Wave</td>
<td>10.3 billion Lbs/yr</td>
<td>4Q20</td>
</tr>
<tr>
<td>3rd Wave</td>
<td>7.1 billion Lbs/yr</td>
<td>4Q22</td>
</tr>
<tr>
<td>4th Wave</td>
<td>9.9 billion Lbs/yr</td>
<td>2023+</td>
</tr>
</tbody>
</table>

- **1st Wave**
  - CP Chem
  - ExxonMobil
  - Formosa
  - Ingleside (Oxy)
  - Dow Chemical
  - Shintech
  - Indorama
  - Sasol

- **2nd Wave**
  - LACC (Lotte)
  - Dow Chemical
  - DowDuPont
  - INEOS
  - Shell
  - Lyondell
  - Total
  - Siluria

- **3rd Wave**
  - Exxon/Sabic
  - Formosa
  - Shintech

- **4th Wave**
  - Motiva
  - Formosa
  - CP Chem

**Source:** IIR PECWeb

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U.S. & Canada Chemical Industry
The Feedstock Advantage and Influence

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May 2014: 23 : 1
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May 2018: 24 : 1

Ethylene & Derivative Prices

Source: Petrochem Wire
Natural gas promotes world scale ammonia capacity

Petrochem capacity MEG, Methanol, Ethylene

Exxon/Sabic in South Texas
Inter Pipeline PDH in Alberta
Wanhua MDI in Louisiana
Midwest Fertilizer in Iowa

Source: IIR PECWeb
Low cost NGLs promote confidence for capacity additions

Investments in derivatives begin to take shape

Nova Chemical PE in Ontario
Methanex methanol in Alberta
Formosa EO/EG in Louisiana
In Plant Capital

$ in millions


$0 $500 $1,000 $1,500 $2,000 $2,500 $3,000 $3,500

Projects

2011 to 2015
Strong exit from recession
Confidence in demand

2016 to 2017
Economic uncertainties
slow progress

2018 to 2019
Demand remains strong
Operating rates are high

High & Medium Probability planned for 2018

<table>
<thead>
<tr>
<th>Project Type</th>
<th>Projects</th>
<th>TIV in $’s millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conversion</td>
<td>2</td>
<td>$480</td>
</tr>
<tr>
<td>Debottleneck</td>
<td>5</td>
<td>$204</td>
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<tr>
<td>Enviro Compliance</td>
<td>9</td>
<td>$55</td>
</tr>
<tr>
<td>Equipment Addition</td>
<td>27</td>
<td>$1,002</td>
</tr>
<tr>
<td>Modernization</td>
<td>6</td>
<td>$122</td>
</tr>
<tr>
<td>Refurbishment</td>
<td>2</td>
<td>$300</td>
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<tr>
<td>Replacement</td>
<td>50</td>
<td>$127</td>
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<tr>
<td>Revamp</td>
<td>7</td>
<td>$182</td>
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<tr>
<td>Storage Addition</td>
<td>9</td>
<td>$14</td>
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<tr>
<td>Upgrade</td>
<td>90</td>
<td>$287</td>
</tr>
<tr>
<td>Closure</td>
<td>17</td>
<td>$60</td>
</tr>
<tr>
<td>Grand Total</td>
<td>224</td>
<td>$2,833</td>
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Source: IIR PECWeb

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Maintenance Turnaround spending continues to rise

Historical Plant Maintenance T/A activity

- 875+ planned T/As for 2018
- Average T/A investment is $2.3 Million
- Capital projects influencing maintenance schedules

2018 & 2019 T/A activity

Source: IIR PECWeb
## Planned Turnarounds

<table>
<thead>
<tr>
<th>Year</th>
<th>1st Qtr</th>
<th>2nd Qtr</th>
<th>3rd Qtr</th>
<th>4th Qtr</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Days</td>
<td>Units</td>
<td>Days</td>
<td>Units</td>
<td>Days</td>
</tr>
<tr>
<td>2017</td>
<td>514</td>
<td>18</td>
<td>265</td>
<td>15</td>
<td>735</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>211</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,725</td>
</tr>
<tr>
<td>2018</td>
<td>396</td>
<td>15</td>
<td>705</td>
<td>32</td>
<td>278</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>201</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,580</td>
</tr>
<tr>
<td>2019</td>
<td>520</td>
<td>15</td>
<td>255</td>
<td>13</td>
<td>589</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>247</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1,611</td>
</tr>
</tbody>
</table>

2017 unplanned T/As totaled 1,725 days and 58 events
2018 unplanned T/As total 70 days so far from just 10 events
U.S. & Canada Chemical Industry

Conclusion...

- Elevated Oil to Gas ratio continues to drive spending
- Global dependency for demand
- In-Plant Capital spend trends higher in 2018
- Mega projects continue to set the pace for the industry
- Focus on derivatives and specialty chemicals a positive
- Maintenance activity and spend reaches historic high
Global Market Intelligence
Constantly Updated

Global Presence
Over
Speaking
18
34
59

Offices Around The World
Years of doing Business
languages Globally

Thank You!

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