Advancing decisions that advance the world

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- Traded on the NYSE
- We are 8,000+ people, in 30 countries, speaking 50 languages – all working each day to:
  - Serve businesses and all levels of governments in 165+ countries worldwide
    - 70% of the U.S. Fortune 1000
    - 85% of the Global Fortune 500 companies
    - To small businesses and enterprises
  - With comprehensive content, software, expert analysis and forecasts
  - Helping customers drive critical processes and make high-impact decisions with speed and confidence
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Aligned to deliver a broad array of services

Combined strengths of CMAI, SRI Consulting, Chemical Week and Harriman Consult to create the most comprehensive set of chemical information and insights in the world

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Efficient delivery of high-velocity, quality-assured content

Technology & Analytics
New delivery systems and analytics & tools (internal & external)

Chemical Insight
Deep insights & knowledge that leverage data, analysis and platforms

Consulting Advisory
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Leading integrated information supplier and consultancy providing global and regional solutions leveraging the full breadth of IHS capabilities

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Polyethylene Update
Polyethylene: Global Demand Growing

2013 Global Demand

- HDPE
- LDPE
- LLDPE

Total Global Demand = 81.5 Million Metric Tons

2018 Global Demand

- HDPE
- LDPE
- LLDPE

AAGR 13-18 = 4.8%

Growth Forecast = 1.3 x GDP of 3.6%

Total Global Demand = 102.9 Million Metric Tons
Polyethylene Capacity Changes

Million Metric Tons

2008-2012 = +19.4 MMT

2013 – 2018 = +24.6

Asia Pacific
Africa/ Middle East
South America
Central Europe/ CIS
West Europe
Global Demand Change
Global Operating Rates – Regional Advantages

Polyethylene, Operating Rate, %

- **North America**
- **West Europe**
- **Northeast Asia**
- **South America**
- **Middle East**
- **World**

World Average 13-18 = 83.9%
South America: Imports Increasingly Important

Million Metric Tons

Operating Rate

2008 2010 2012 2014 2016 2018

Domestic Demand Exports Total Capacity Imports Operating Rate

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North America Capacity Expanding

Million Metric Tons

Operating Rate

Domestic Demand  Exports  Total Capacity  Imports  Operating Rate

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## Shale Drives North America PE Projects

### North America - New Polyethylene Projects

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Country</th>
<th>LDPE</th>
<th>LLDPE</th>
<th>HDPE</th>
<th>Resin Type TBA</th>
<th>Startup</th>
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<tbody>
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<td>Q2 2014</td>
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<tr>
<td>Ineos Sasol</td>
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<td>300 (2)</td>
<td>450 (4)</td>
<td>475 (7)</td>
<td>750 (6,7)</td>
<td>Q2-Q3 2015</td>
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<tr>
<td>Braskem Idesa</td>
<td>Nachital</td>
<td>Mexico</td>
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<td>Q3-Q4 2015</td>
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<tr>
<td>Nova</td>
<td>Joffre</td>
<td>Canada</td>
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<td>650 (5)</td>
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<td>500 (5)</td>
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<td><strong>2018-2019</strong></td>
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<td>Q3 2018</td>
</tr>
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<td>Shell*</td>
<td>Marcellus</td>
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<td>1500 (3)</td>
<td>Q3 2019</td>
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<td>Marcellus</td>
<td>United States</td>
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<td>2019</td>
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<td>1420</td>
<td>3698</td>
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<td>2000</td>
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*Reported projects not fully verified or approved and not included in IHS capacity database.

**Processes: (1) Autoclave, (2) Tubular, (3) TBA, (4) Gas Phase, (5) Other, (6) Ziegler, (7) PF Loop**
Economics by Region: Price Forecast

Cents Per Pound

NAM Cash Cost, Integrated
NAM LLDPE
WEP LLDPE
CHINA LLDPE (Spot)

Saudi ethane based
All PE - America’s Trade Balance

Net Trade, Million Metric Tons

2008 2010 2012 2014 2016 2018

-5.0 0.0 5.0 10.0

South America Net Trade
North America Net Trade
NAM Exports - SAM Imports
NAM Exports - SAM Imports as % of NAM Prod

Trade as a % of Production

2008 2010 2012 2014 2016 2018

0% 4% 8% 12% 16%

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HDPE America’s Trade Balance

Net Trade, Million Metric Tons

South America Net Trade
North America Net Trade
NAM Exports - SAM Imports
NAM Exports - SAM Imports as % of NAM Prod

Trade as a % of Production

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North America PE Contract Discounted Prices

Cents Per Pound

- LDPE GP
- LLDPE C4
- HDPE BM

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Polyethylene: Global Price Equilibrate

Price, Cents Per Pound

Price, Dollars Per Metric Ton

North America Discounted
CFR China Spot
West Europe Discounted

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Polyethylene Net Trade Flows

- 2013 Net Trade ( Thousand Metric Tons )
  - 6318
  - 2699
  - 2267
  - -1792

- 2018 Net Trade ( Thousand Metric Tons )
  - 13105
  - 9956
  - -1637
  - -3225
  - -2267
  - -2860
  - -1945

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• **Two low cost producing regions emerge** (N. Am, MDE) - compete for global market share.

• **China also adds** low cost capacity – domestic focus

• **N. American domestic demand accelerates**: driven by increased low cost production, competitive market dynamics, and increased exports of finished goods

• **Increased capacity / competition** drives PE prices toward global parity

• **N. American integrated margins** decline as: new capacity starts, feedstock prices rise, and competition increases.

• “**Commoditization**” of higher margin resins develops as producers add capacity
Global Polypropylene Demand Today

- **2013 Total Global Demand** = 56.0 Million Metric Tons
- **2018 Total Global Demand** = 71.6 Million Metric Tons

**2013-2018 AAGR**
- **Global** = 5.0%
- **West Europe** = 1.4%
- **North America** = 2.3%
- **South America** = 5.1%
- **Northeast Asia** = 6.0%
- **Southeast Asia** = 5.6%
- **China** = 6.9%
- **Africa/MDE** = 5.3%

**Demand Growth 2013-2018 = 28%**

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PP Capacity Builds in Middle East and China Leads to Over-Capacity

Million Metric Tons

North America
CEP/CIS
Northeast Asia
South America
Africa/Middle East
Indian Sub.
 Southeast Asia
 West Europe
 Global Demand Growth

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Global Polypropylene Operating Rates

Operating Rate, %

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Oversupply Explains Why Asia Lowest Price

Price, Cents Per Pound

Price, Dollars Per Metric Ton

North America Discounted
North America Spot Export

West Europe Discounted
China Spot

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Regional Polypropylene Prices

Price, Cents Per Pound

Price, Dollars Per Metric Ton

North America Discounted
SAM Domestic Delivered
West Europe Discounted
China spot (cfr China)

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North America Polypropylene Demand Today

- **US**: 77%
- **Canada**: 17%
- **Mexico**: 6%

**2013 Total Demand**: 8.9 Million Metric Tons
**2018 Total Demand**: 10.6 Million Metric Tons

**2013-2018 AAGR**
- North America = 2.3%
- United States = 2.1%
- Mexico = 3.1%
- Canada = 2.3%

**Demand Growth 2013-2018 = 19%**
North America Polypropylene Demand by End Use

2013 Total Demand = 8.6 Million Metric Tons
North American Integrated Producers To Benefit The Most

North America PP Margin, Discounted Contract, Dollars Per Metric Ton

- Non-integrated Producer
- PDH-Integrated Producer
- Refinery-Integrated Producer

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Polypropylene: Americas Trade Balance

Net Trade, Million Metric Tons

Trade as a % of Production

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Significant Shift for PP Global Trade

<table>
<thead>
<tr>
<th>Year</th>
<th>2008 Net Trade (Thousand Metric Tons)</th>
<th>2013 Net Trade (Thousand Metric Tons)</th>
<th>2018 Net Trade (Thousand Metric Tons)</th>
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<tr>
<td></td>
<td>203</td>
<td>248</td>
<td>759</td>
</tr>
</tbody>
</table>
How has Polypropylene compared versus other materials?
Global Polypropylene Competitiveness (PP/HDPE Ratio) vs. HDPE Improving

Price Ratio

Expensive

Cheap

2003 2005 2007 2009 2011 2013 2015 2017

PP/HDPE North America PP/HDPE West Europe PP/HDPE China

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North American Material PP Spreads (cents/cubic inch)
Polypropylene: Key Takeaways

• North American PP margins forecasted to expand and improve with likely peak in the 2016/2017 time period

• Cost to remain competitive with HDPE
  – While positioned favorably to PS and neutral to PET

• PDH based PP in North America to be advantaged
  – New PP capacity will continue to drive off propane based economics

• Next 5 Years brings significant shifts in trade
  – China becomes more self sufficient
  – Middle East Redirects Exports
  – New capacity in North America increases export position post 2017
  – Europe transitions to new import position
Polyethylene Terephthalate End Uses

PET Resin (Rigid Packaging) 31%
Oriented PET Film 4%
Fiber 62%
Other 3%

2012 Total Demand = 55.6 Million Metric Tons
World PET Capacity Versus Demand

- EMEA Capacity
- Asia Capacity
- Americas Capacity
- EMEA Demand
- Americas Demand
- Asia Demand
- Op. Rate w/o Hypo Capacity

<table>
<thead>
<tr>
<th>Million Metric Tons</th>
<th>Operating Rates, %</th>
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<td>2016</td>
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<td>2017</td>
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</tbody>
</table>
North America PET Demand

Million Metric Tons

Operating Rate, %


U.S. Mexico Canada Net Exports Capacity Operating Rate

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North American Capacity Growth

- **M&G 1 million metric ton expansion at Corpus Christi, Texas**
- **Indorama 540 thousand metric ton expansion.**

The graph shows North American capacity growth from 2007 to 2015, with specific expansions noted for M&G and Indorama. It also highlights operating rates and domestic demand growth.
Conclusions - PET

- Global PET markets will continue to be vastly oversupplied.
- North America is embarking on even further capacity expansion which will change the economic dynamic.
Polystyrene – Demand Decline in Developed Regions

Average Annual Demand Decline (0.6%)
• **Pricing Outlook – High**
  - No shale gas benefits - Benzene/Styrene prices to remain high
  - NAM PS prices at highest level seen to date driven by benzene.
  - Despite margin improvement, PS reinvestment economics still not there

• **Demand Outlook – Weak**
  - Below GDP growth globally for PS in the next five years
  - Future demand growth from Electronics and Consumer segment.
  - Packaging market remains weak – threat from substitution and environmental pressures (New York ban)
Resin Markets Summary

- Conditions very favorable today for PE producers
- Conditions improving for PP and PS producers
- PET producers look to continue to struggle
- Converters to benefit post 2015 time frame with more competitive pricing for PE and PP on a global basis
- Converter North American PE and PP demand expected to see bump as a result
- Tough sledding for converters with PS but PET prices should be competitive with ceiling set by Asian imports.
Thank you and upcoming in March

World Petrochemical Conference
March 25 – 28th

Houston, Texas Hilton Americas

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