Global Petrochemical Overview: Changing Olefins Markets

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By Nexant and ChemVision

APLA, 10th November 2014
What are the global olefin demand trends?

How are feedstock developments affecting monomer supply?

How do changing global dynamics influence Brazil?
Global ethylene demand recovered in 2013, after stalling in 2012 due to concerns surrounding the Chinese economy.

Asian development is supported by both domestic demand and exports to Western markets. Key growth markets include China, Indonesia and India.
Polyethylene accounts for 60% of total ethylene demand. Almost all new steam crackers have polyethylene units as the main on-site ethylene consumer.

**Global Ethylene Demand by Derivative, 2014-e**

*Volume = 134 million tons*

[Chart showing distribution of ethylene demand by derivative]

**Global Ethylene Demand Growth by Derivative**

*Volume Growth, %*

[Bar chart showing growth in volume by derivative]

While polyethylene dictates ethylene market dynamics, propylene is influenced by polypropylene. Polypropylene accounts for around 65% of global propylene production and drives propylene growth of 4.3%.
Propylene prices are tied with ethylene, although expected to trade marginally higher; butadiene pricing is influenced by demand dynamics and natural rubber trends.

- Ethylene production is continuing to trend towards lighter feedstocks
- Reduced propylene and C4 availability from steam crackers thus promoting on-purpose production
- Propylene prices expected to trade marginally higher than ethylene, which is highly sensitive to polymer markets and inter material competition
- Price spikes in butadiene also due to record high natural rubber prices in 2011 supporting robust growth for alternative synthetic rubbers

U.S. Olefins Historic Pricing
Current US Dollars per Ton

- Ethylene
- Propylene
- Butadiene
- Mixed C4
How are feedstock developments affecting monomer supply?
Each region has its own unique feedstock and market position shaping investment trends.

**NORTH AMERICA**
- **IA**: High
- **FS**: Ethane/NGLs
  - New activity driven by shale gas

**EUROPE**
- **IA**: Low/decline
- **FS**: Naphtha/Ethane
  - Selective investments in FSU/EE
  - Further rationalisation in the EU

**SOUTH AMERICA**
- **IA**: Low/moderate
- **FS**: Mixed
  - Potential for ethane, naphtha and bio based projects

**MIDDLE EAST & AFRICA**
- **IA**: Moderate
- **FS**: Ethane/NGLs
  - Further utilisation of ethane & NGLs
  - Selective Refinery integrated projects

**CHINA**
- **IA**: High
- **FS**: Naphtha/Coal
  - Refinery integrated projects with further expansions in CTO/MTO

**SEA/INDIA**
- **IA**: Moderate
- **FS**: Naphtha
  - Refinery integrated projects in selected markets by NOCs

**Legend**
- **IA** = INVESTMENT ACTIVITY
- **FS** = FEEDSTOCK SLATE
Global olefin capacity growth is underpinned by Asia, particularly China, with a combination of steam cracker development and coal-based olefins production.

Olefins Capacity by Region/Country, 2014-e

- **Ethylene**: Rest of Asia, Europe, China, Brazil
- **Propylene**: Middle East & Africa, China, Rest of North America
- **Butadiene**: Middle East & Africa, China, Rest of South America

Global Olefins Capacity Outlook, 2010-2025

- **Ethylene**: 4.6% growth
- **Propylene**: 5.1% growth
- **Butadiene**: 4.1% growth
United States ethane supply continues to boom. Security concern in China continues to support investment in coal based olefins.

Shortage of conventional supply is driving major investment in unconventional propylene and butadiene capacity

Ethane exports from the U.S. will be available for ethylene producers in Europe, South America and Asia from 2016

Lower LPG prices relative to naphtha are impacting propylene and butadiene supply in most regions

Poor liquids cracking economics has created interest in MTO/MTP and PDH

Chinese supply security agenda is encouraging a surge in coal/methanol based olefins
Move to lighter feedstocks has reduced propylene co-product production and global CC4 availability resulting in increased investment in on-purpose production.

- **Global Propylene Production by Process Million tons**
  - 30% of global propylene supply will be from unconventional sources by 2025
  - PDH has been through a phase of major expansion in the Middle East, but the focus is now moving to China and the U.S.
  - Methanol-based projects have focused on China.

- **Global Butadiene Production by Process Million tons**
  - Nearly 10% of butadiene will be produced from dehydrogenation by 2025
  - Chinese companies are implementing numerous butylene dehydrogenation projects using new (and proven) Chinese technology

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An estimated 12 million tons of new ethane-based ethylene capacity will become available in the U.S. in the next 10 years. New capacity is focused in the gulf.

### U.S. Ethylene Production by Process

#### Million tons

- Steam cracker - naphtha
- Steam cracker - mixed feed
- Steam cracker - heavy liquid
- Steam cracker - ethane
- Steam cracker - E/P
- FCC offgas recovery

### U.S. Firm Projects

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Capacity, 000 tons</th>
<th>Start-Up</th>
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<tbody>
<tr>
<td>ExxonMobil</td>
<td>Baytown, TX</td>
<td>1,500</td>
<td>2017</td>
</tr>
<tr>
<td>Formosa</td>
<td>Point Comfort, TX</td>
<td>1,000</td>
<td>2017</td>
</tr>
<tr>
<td>Dow</td>
<td>Freeport, TX</td>
<td>1,500</td>
<td>2017</td>
</tr>
<tr>
<td>Sasol</td>
<td>Lake Charles, LA</td>
<td>1,500</td>
<td>2018</td>
</tr>
<tr>
<td>CP Chemical</td>
<td>Cedar Bayou, TX</td>
<td>1,500</td>
<td>2017</td>
</tr>
<tr>
<td>Ingleside Ethylene</td>
<td>Ingleside, TX</td>
<td>554</td>
<td>2017</td>
</tr>
</tbody>
</table>

### Recent & Announced U.S. Expansions/Conversions

- INEOS
- Westlake
- Williams

### Proposed Projects

- Shell
- Axiall/Lotte
- BASF TOTAL
- LyondellBasell
- SABIC
- Aither Chemical
- Odebrecht

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The U.S. will reinforce and improve its position as a net exporter as cost competitive capacity additions based on shale gas developments are commercialised.

The new capacity developments in the US will require producers to establish major derivative export positions in South America, Europe and Asia.
New pipelines and export terminals will permit up to 6m tons per year of ethane exports. As yet there are no proposals for a new ethylene export terminal in the U.S.

Recent developments in U.S. ethane/NGL transmission infrastructure

- The ATEX (Appalachia-to-Texas Express) pipeline links four fractionators in the Marcellus region to the Mt Belvieu storage and distribution hub
- The planned Enterprise export terminal will allow around 4m tons/year of exports from Mt Belvieu
- The Mariner East and Vantage pipelines will each transport around 1m tons/year of ethane to Canada
- Several other pipelines are being developed to link into the ATEX and directly into Mt Belvieu from mid America gas fields

Source: Nexant Analysis, OICA

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How do changing global dynamics influence Brazil?
Brazil is the leading player in the South American olefin industry. Steam cracker projects include COMPERJ and projects in Bolivia, Colombia, Peru, Argentina and Venezuela.

South America Olefins Production and Consumption, 2013

**Million tons**

Note: Shaded area represents Brazil’ share of South America.
Brazil currently is a net exporter, but is expected to face growing shortfalls which will be met by exports from the U.S.

Brazil Olefins and Key Derivatives Import/Exports 2013

Thousand tons

Imports

Exports

Ethylene
Propylene
Butadiene
HDPE
LDPE & LLDPE
PP (HP)
PP (CP)
Competitive raw material supply is likely to change

Brazil in the Future

- Longer term, after 2020 (most likely around 2025), natural gas availability, mainly from Pre-Salt, may increase ethane availability and improve PE’s competitiveness.

- Similarly, LPG production from Pre-Salt can become in excess over demand, as fuel, converting Brazil into a net exporter. This scenario may offer opportunities for use of propane and butane as chemical feedstock.

- An interesting option is for Brazil to import competitive ethane from the U.S. to expand cracker capacity, similar to recent trends in Europe.

- Although just starting to develop, shale gas and liquids from Argentina could also become an important new feedstock source.

- Thus, in the next decade, Brazil will have a number of opportunities to become a more competitive player in monomers, aggregating value along the production chain.
Thank you!

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