US Role in Global NGL Market

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May 18, 2017
Motive for export projects was “supply-push”
   Ethane pipelines to Canada; LPG, ethane overseas

US steam crackers will have ample NGL supply following market readjustment in 2019/2020
   Ethane exports will remain steady on long-term commitments

US LPG testing Middle East on price and volume
   Propane stocks at end of 2017 build indicator for future
   Inexpensive LPG fosters global feedstock flexibility

Supply-push role realigns to demand
   Opportunity for counter-seasonal butane export

Mont Belvieu sets price for ethane, LPG globally
Oil

Supply-push view (Benposium 2014)

Exports will balance the US NGL market.

NGL exports by purity product

Transportation mode
2013

Pipe/Rail
34%

Waterborne
66%

Source: Bentek Market Call: North American NGLs, 2Q2014
Supply-push Stronger Than Expected

Exports ahead of expectations from 2014:
- C3: 464 Mb/d (2014)
  800 Mb/d (2016 act.)

Lower than expected for other products:
- C2: 149 Mb/d vs. 95 Mb/d
- C4: 145 Mb/d vs. 106 Mb/d
- C5: 272 Mb/d vs. 197 Mb/d

Source: Platts Analytics
So what changed?

Ethane
Inclusion of Canadian Demand Reduced Exports

Canada ethane balance

Ethane exports to Canada

Source: Platts Analytics’ Market Call: North American NGLs 2Q 2017
Exports Timed With Ship Loadings

Ethane ship capacity at first loading

<table>
<thead>
<tr>
<th>Month</th>
<th>INEOS</th>
<th>Borealis</th>
<th>SABIC</th>
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Source: Platts Analytics
Ethane Rejection Minimum in 2019, Supplies Sufficient 2020+ for Petchem and Export

Source: Platts Analytics
### Ethane Price Set by Rockies Supply

<table>
<thead>
<tr>
<th>Region</th>
<th>Price (¢/gal)</th>
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<tbody>
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<td>Rockies</td>
<td>7</td>
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<tr>
<td>Bakken</td>
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<tr>
<td>Williston</td>
<td>15</td>
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<tr>
<td>SW Marcellus/Utica</td>
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#### Ethane Rejection by Region

<table>
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<tr>
<th>Year</th>
<th>PADD 1</th>
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<th>PADD 4</th>
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Source: Platts Analytics’ Market Call: North American NGLs 2Q 2017

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**Note:** The map shows the geographical distribution of ethane rejection by region, with specific points indicating the rejection rates for each year from 2014 to 2022. The bar chart inside the map illustrates the concentration of ethane rejection across different regions over the years.
Lower Ethane Price → Minimal Feedstock Switching

Ethane, Henry Hub heat equivalent price forecast

- Henry Hub
- MB Ethane (2Q 2017)
- MB Ethane (1Q 2016)

$/MMBtu

Year:
- 2012
- 2013
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020
- 2021
- 2022

Prices:
- 57 cents/gal
- 34 cents/gal
US Ethane Exports Grow to ~275 Mb/d in 2019

Source: Platts Analytics’ Bentek Energy Market Call: North American NGLs, 2Q2017
Exports Move Despite Low Margins
So what changed?

LPG
US LPG Volumes Largely Bound to Europe, Asia

US LPG Exports by Region

Exports by destination 2016 YTD

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<td>14%</td>
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</tbody>
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Source: EIA
What Changed?

Weekly, monthly propane stocks

Source: EIA, Platts Analytics

S&P Global
Platts
Winter Flows Tightened Spread Between Edmonton, Mont Belvieu

Source: National Energy Board

S&P Global Platts
2017 Flows Target Northeast Asia
US Spot Price nearly 20 Cents Below Saudi

Saudi Price Chasing Houston

Global propane prices

Spot propane prices

Source: Platts
US Gulf Coast Volumes to Asia Grow From 14 Mb/d to 470 Mb/d

USGC to North Asia LPG

Late summer cargoes canceled

Source: cFlow, Platts Analytics

S&P Global
Platts
Middle East LPG Declines on Spot Availability

Middle East to North Asia LPG

LPG Supply restricted due to OPEC cuts

Saudi Aramco expects OPEC crude oil output cut to be absorbed in spot LPG supplies

Tokyo (Platts)—7 Mar 2017 8:03 am EST/13:03 GMT

* Supply difficulties overcome by March
* Term LPG supplies set to rise to 8.4 mil mt in 2017
* All time high butane exports in 2016
USGC Matched Middle East into Global Premium Market in Winter 2017

North Asia LPG

Source: cFlow, Platts Analytics

S&P Global
Platts
Can Stocks Rebuild?

Weekly, monthly propane stocks

Source: EIA, Platts Analytics
US Propane Potentially Volatile on Exports

Annual change propane S/D

US LPG exports

Source: Platts Analytics
US Propane Potentially Volatile on Exports
Temperature-sensitive demand offers little supply growth

Annual change propane S/D

US propane exports

S&P Global
Platts

Source: Platts Analytics
US NGLs in Global Market
Petrochemicals

Ethylene Cost Curve Flatter on Co-Products

Global ethylene cost curve—Feb 2017

Source: Platts Analytics
PE Value Chain Shows Continued Strength

PE-Ethane Margins

Source: PIRA LPG Cracking Margins
Opportunities for other NGL exports
Room for butane in the USGC LPG export mix

US-origin cargoes may need more C4 to displace Middle East volumes

Source: EIA
Feedslate, Yield Favor Heavy Liquids Overseas

Yields by feedstock

- Ethane
- Propane
- Butane
- Naphtha

- Ethylene
- Propylene
- Crude C4s
- Aromatics
- Gas Oil
- Hydrogen/Fuel

Source: Platts Analytics

Butadiene prices

- USGC
- NW Europe
- NE Asia

Source: PIRA LPG Cracking Margins

S&P Global
Platts
US as Global NGL Price Setter

Viable supply volume for ethane into Europe, Asia, LatAm

Marginal supply of propane into demand markets (Europe, Asia)
  Supply growth sufficient to meet price-elastic demand
  Supply volume to compete for inelastic demand growth

Opportunity for counter-seasonal butane exports?
  INEOS project to store and distribute C4 into Europe
  Expanded feedstock flexibility for heavy olefins
Mont Belvieu Price Forecast

Prices stabilize on balance of gas/crude

MB price forecast

Source: Platts Analytics
Thank You!

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