Global Propylene Market

Motivated to Change

Chuck Carr, IHS Senior Director - Propylene
September, 2014
IHS Asia Chemical Conference
Singapore
Global Propylene Market

- The “Big Picture” and what is motivating the changes
- China continues to strive towards self sufficiency
- North America NGL’s impact supply
- Overbuild on the horizon.....prices forecast to weaken
Global Propylene Market

• The “Big Picture” and what is motivating the changes
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Propylene Demand Growth Averages 4 mmt/yr

Million Metric Tons

Operating Rate

08 09 10 11 12 13 14 15 16 17 18 23

Acrylic Acid
Acrylonitrile
Cumene
Butanols
Others
Operating Rate

Butanols
Polypropylene Oxide
Propylene Oxide
2-Ethyl Hexanol
Isopropanol
Operating Rate

Operating Rate

50%
60%
70%
80%
90%
Capacity Additions….PDH and CTO Lead the On-Purpose Wave

Doubling On-Purpose Capacity

2013 ➔ 2018
Global On Purpose Production/Demand

Million Metric Tons

Op. Rate, Percent


Production Capacity Operating Rate

Big Ramp in Capacity
Global Propylene Market

• The “Big Picture” and what is motivating the changes
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Asia Leads Demand Growth…..

Million Metric Tons

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China’s Propylene Self-Sufficiency is Rapidly Improving

- Production
- Net Equivalent Import (Export)
- Self-sufficiency

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Not Surprising with All the New On-Purpose Capacity

Asia Propylene Incremental Capacity, Million Metric Tons
Propylene Derivative Capacity Additions Shift Away from PP

Global Percentage

PP

Polypropylene
Cumene
Acrylonitrile
Oxo Alcohol
Acrylic Acid
Propylene Oxide
Other

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And Provides Abundance of Non-PP Derivative Capacity…Mostly China
Global Propylene Market

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- **North America NGL’s impact supply**
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NGL’s Supplies: Effects on Propylene

Ethane: Negative
Propane: Positive
Butanes: Negative
C5+: ?

Provides alternatives for refiners and steam crackers
North America Propane Abundance Supports Global PDH Additions

MBPD

Domestic | Exports

World Propylene – PG/CG Cost Curve 2018

$/Metric Ton

Cumulative Production - Million Metric Tons

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US Propylene Prices Stay Discounted Versus Alky Alternatives
Propylene Splitter Margin – More Motivation for Refiners

Price, Cents Per Pound

Margin Gain by Splitters

Margin

RG Wtd Avg Acq (Estimated)

PG Benchmark Contract

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Propylene Alkylation Economics Revived – Will Refiners Invest?

Return on Investment for an Alky Unit in US

ROI @ $75 Million
ROI @ $150 Million
ROI @ $225 Million

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Global Propylene Market

- The “Big Picture” and what is motivating the changes
- China continues to strive towards self sufficiency
- North America NGL’s revive supply
- Overbuild on the horizon…..price forecast weakens
Global Propylene Capacity Additions Versus Demand Growth

Capacity Overwhelms Anticipated Demand Growth

Million Metric Tons

<table>
<thead>
<tr>
<th>Year</th>
<th>North America</th>
<th>China</th>
<th>Middle East</th>
<th>West Europe</th>
<th>Others</th>
<th>Other Asia</th>
<th>Annual Demand Increase</th>
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Global Monthly Propylene Prices

Monthly Volatility Already Declining

- NAM Net Trans. Contract Price
- WEP Disc. Contract Price
- SEA CFR Spot Price

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Global Propylene Net Equivalent Trade Contracts With the Overbuild

Million Metric Tons

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<th>Year</th>
<th>Net Exports</th>
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</table>

Legend:
- North America
- West Europe
- Middle East
- Asia (Ex China)
- China
Propylene to Ethylene Price Ratios

A Return to the 1990’s?

More than 2X GDP Growth in 1990’s

Ratio

More than 2X GDP Growth in 1990’s

Ratio

Southeast Asia

North America

West Europe

0.5
0.7
0.9
1.1
1.3
1.5

90 93 96 99 02 05 08 11 14 17 20 23

0.5 0.7 0.9 1.1 1.3 1.5

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World PG/CG Propylene GDP Elasticity

Average GDP Elasticity from 1990-99' = 2.14
Average GDP Elasticity from 2000-07 = 1.58
Forecast GDP Elasticity from 2010-17 = 1.55
Forecast GDP Elasticity from 2018-23 = 1.15

Could Get a Boost from Weaker Prices
Global Annual Propylene Prices

Dollars Per Metric Ton

1,800


NAM Net Trans. Contract Price
WEP Disc. Contract Price
SEA CFR Spot Price

NAM back to lowest
Asia lowest price
Conclusions

• Propylene demand growth could get a boost if oversupply of propylene and propylene derivatives significantly weakens prices

• Abundance of North America NGL’s will provide a mixed impact on propylene supply

• On-purpose will continue to be the growth engine for propylene supply. Could methane based propylene via methanol could be the next wave
Thank You