



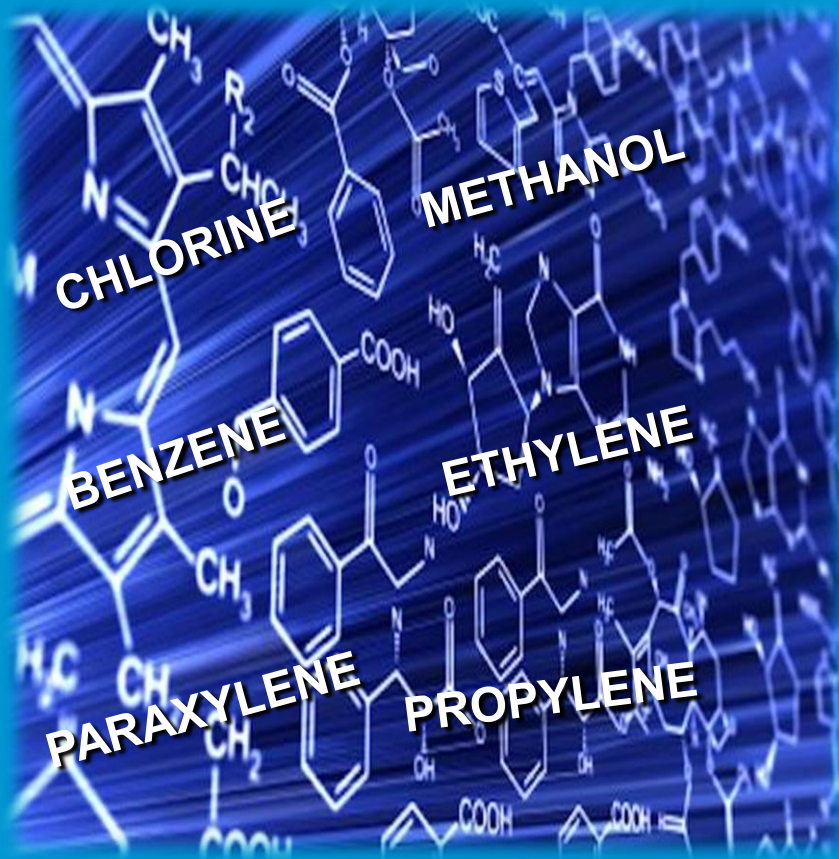
Global Petrochemical Market Outlook: *Impact of Energy at the Extremes*

Presented to: Valve Manufacturers Association of America
MARKET OUTLOOK WORKSHOP
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Mark Eramo
Vice President - Global Chemical Insights
IHS Chemical, Houston, TX
mark.eram@ihs.com



Agenda



- Energy, Economy & the role of Chemicals
- Impact of Energy At The Extremes
- Investment Trends
- Chemical Demand & Trade
- Impact On Profit Cycle
- Closing Thoughts

The Chemical Industry Enables Modern Living

...Connecting Energy Products With Consumer Markets

ENERGY



Energy markets provide essential BTU's to power operations and feedstock sources including natural gas liquids, naphtha and coal that are consumed in the production of basic chemicals

CHEMICALS

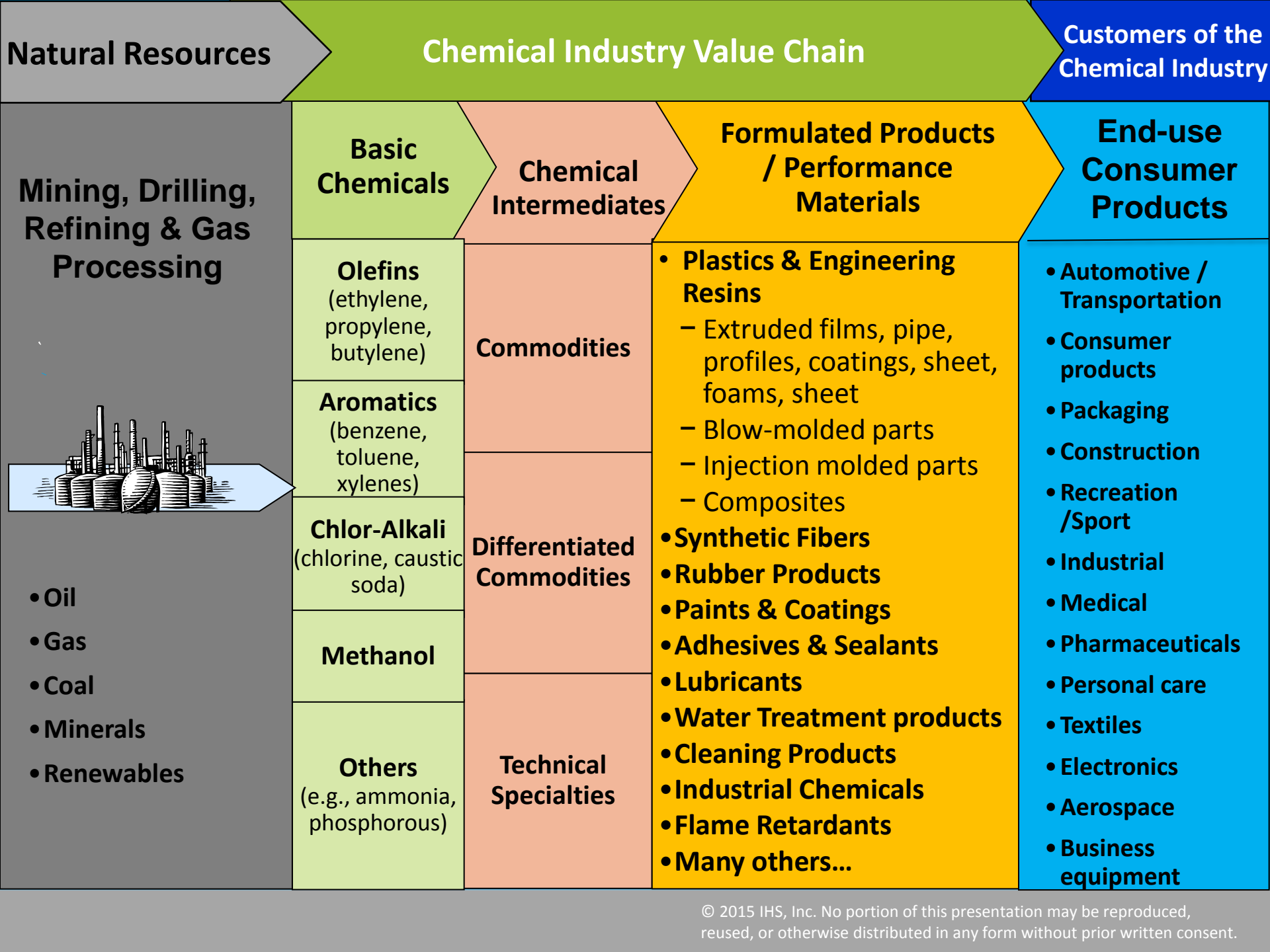


Chemical industry converts energy and feedstock's into basic chemicals, intermediates, plastics and fibers that are used to produce durable and non-durable consumer goods

ECONOMY



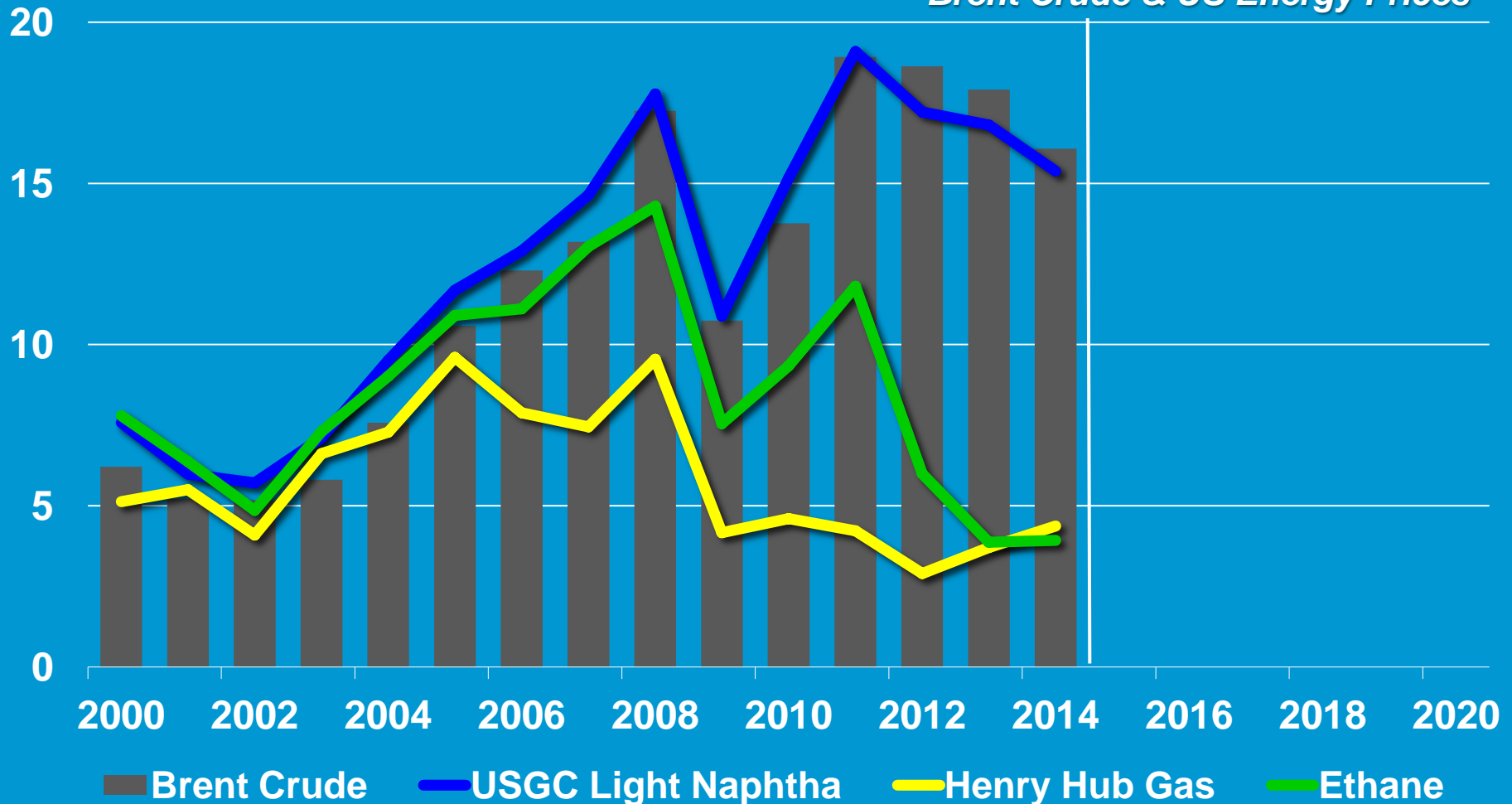
Economic growth in developed and developing economies around the world drive consumer buying trends for durable and non-durable goods; hence creating demand for the chemical industry



Extreme Energy Differentials Create Opportunities and Risks – July 2015

Constant 2012 Dollars Per MMBtu

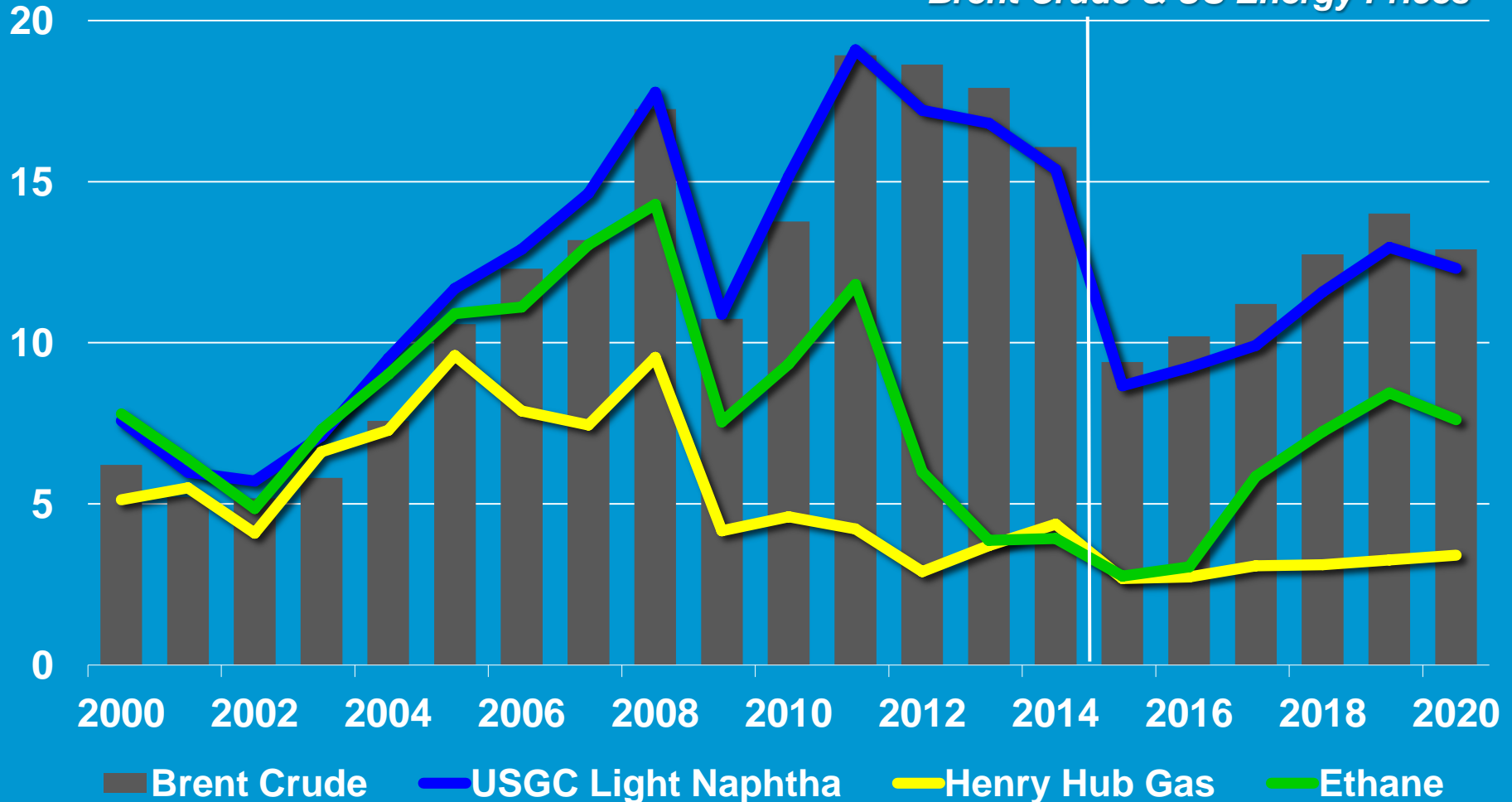
Brent Crude & US Energy Prices



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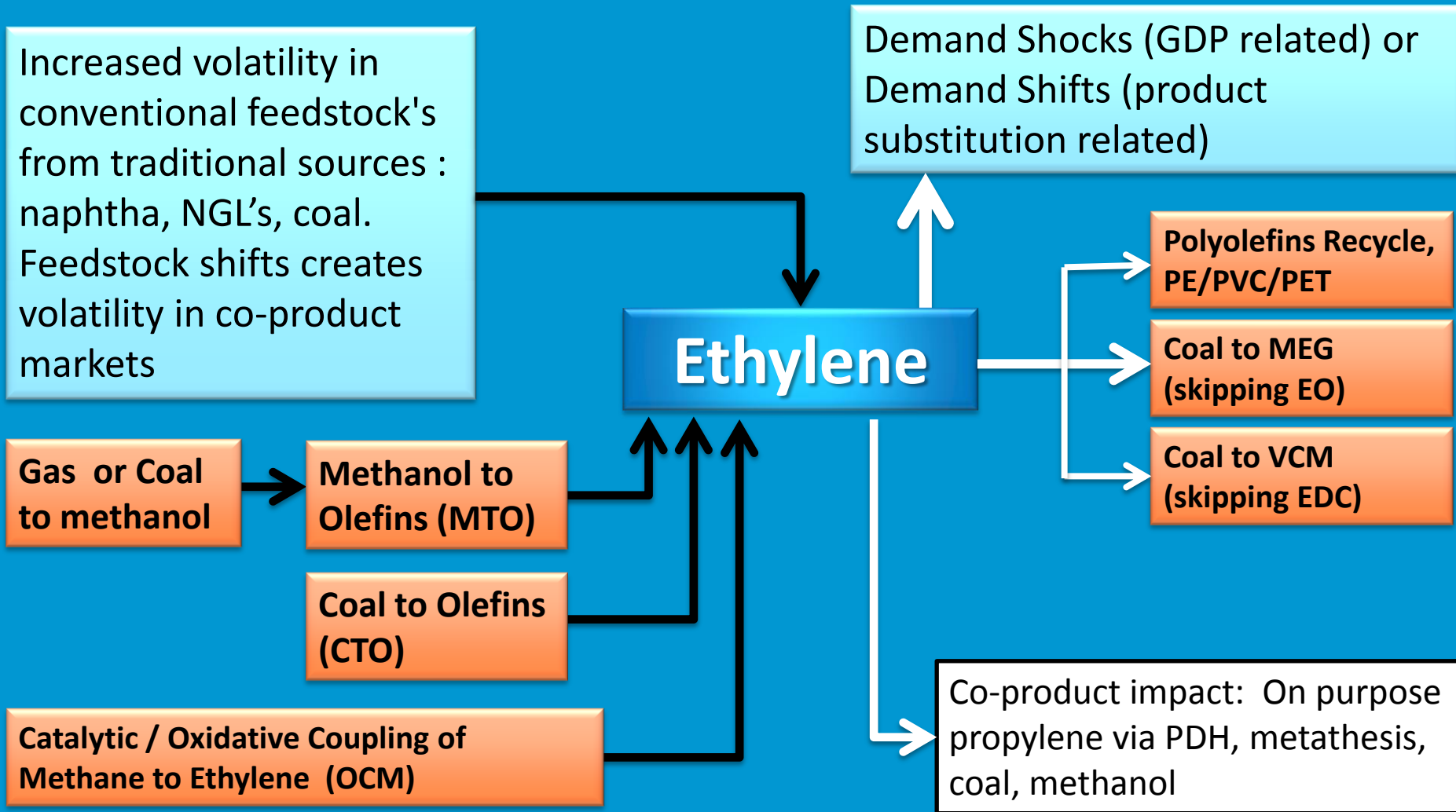
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Brent Crude & US Energy Prices

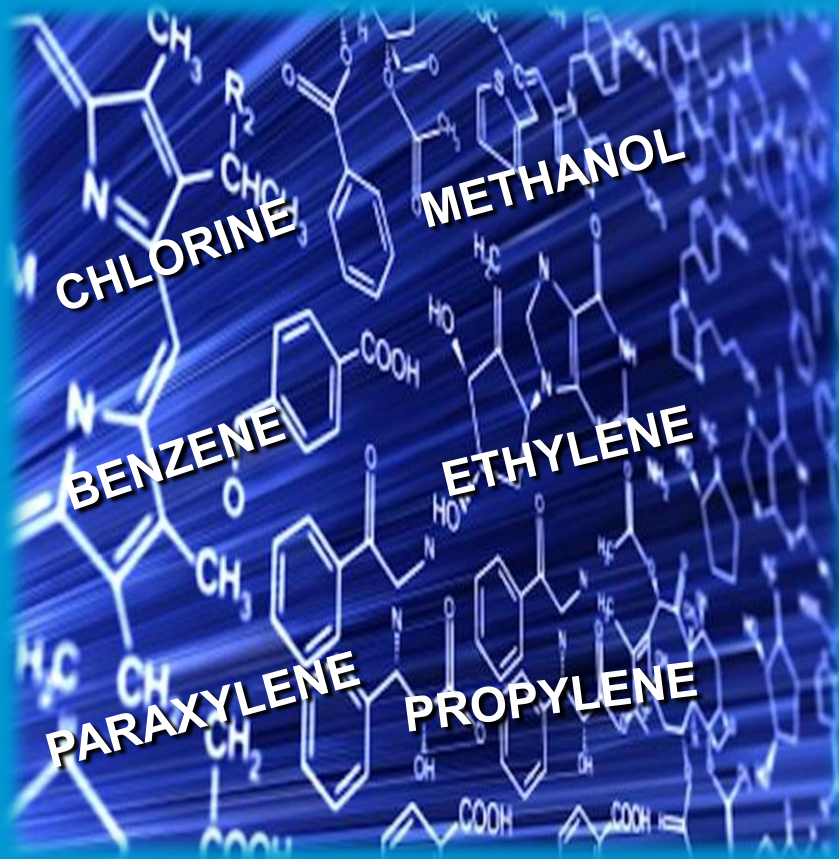


Increasing Complexity In The Ethylene Value Chain

Emerging changes in ethylene supply drivers and demand drivers make modeling the ethylene supply/demand balance more complex than ever before



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Investment Drivers Vary By Region By Value Chain



Chemical Industry Investments Seek A Sustainable Advantage

- **North America (USA)**
 - ❖ Leverage low cost natural gas based chemicals into investments in ethylene, propylene and methanol based derivatives.
 - ❖ Invest to establish export channels to market that exceed historical norms
- **Middle East (Saudi Arabia)**
 - ❖ Moderated investment pace, diversified feedslate to support downstream market development and continued industrial expansion well beyond ethylene chemistry
- **North East Asia (China)**
 - ❖ Strong domestic investment focused on reducing import dependencies.
 - ❖ Leverage coal to chemicals technology near term

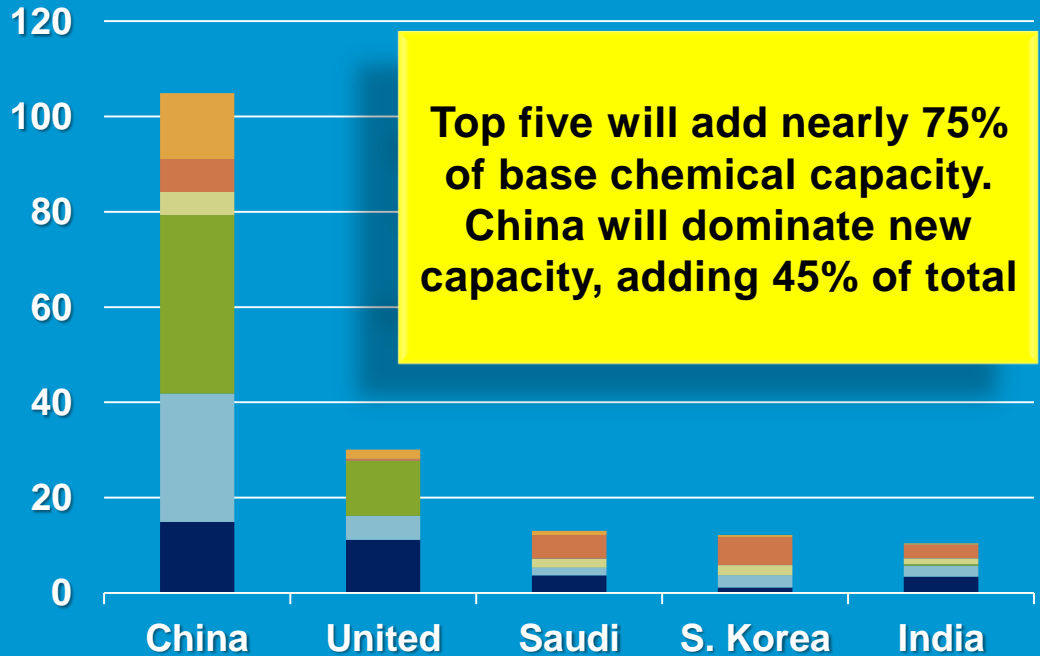
Top 5 Countries Adding Base Chemical Capacity

231 Million Tons from 2010 to 2020



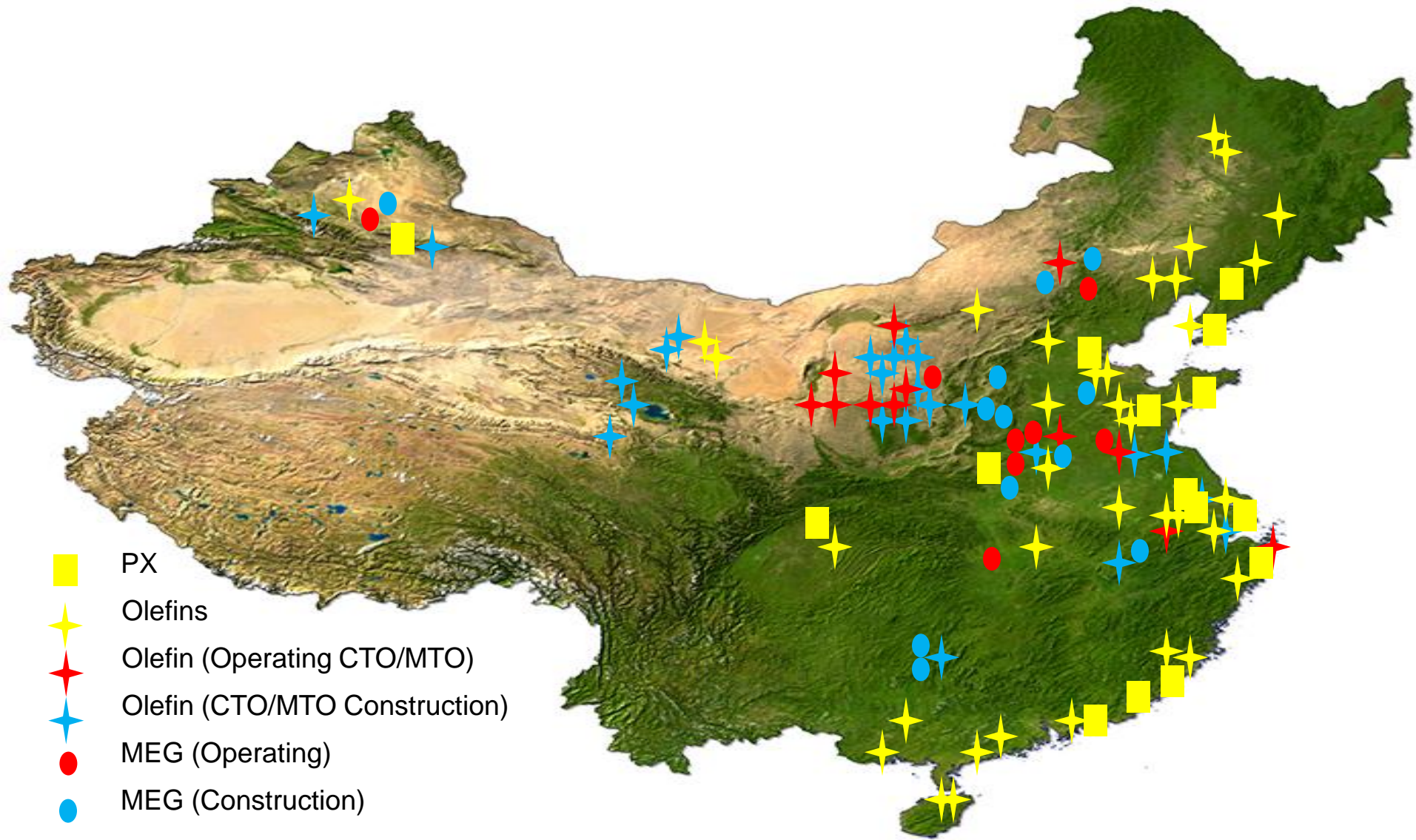
Investment capital has shifted to North America, however, the vast majority of new investment continues to accelerate in Asia/Pacific, dominated by China

Million Metric Tons



- Chlorine
- Paraxylene
- Benzene
- Methanol
- Propylene
- Ethylene

Petrochemical Investment In China Moves West



North America Ethylene Capacity Growth: 2014 – 2020

Completed or Firm Projects (Thousand Metric Tons)



North American ethylene capacity will increase to 45+ million metric tons by 2020, driven by low-cost ethane feedstock

<u>Company</u>	<u>Location</u>	<u>Total Growth</u>
BASF/Total	Port Arthur, TX	128
ChevronPhillips	Cedar Bayou, TX	1,500
Dow	Freeport, TX	1,500
Dow	Plaquemine, LA	220
Eastman	Longview, TX	17
Equistar	Various sites	1,112
ExxonMobil	Baytown, TX	1,500
Flint Hills	Port Arthur, TX	100
Formosa	Point Comfort, TX	1,150
Oxy/Mexichem	Ingleside, TX	550
Shin-Etsu	Plaquemine, LA	500
Sasol	Lake Charles, LA	1,550
Westlake	KY and LA sites	216
Williams	Geismar, LA	258
Braskem Idesa	Mexico	1,000
Nova	Sarnia	168
Total Additions		11,469

North America Ethylene Projects “In The Press” 2020+

Projects Noted Below Are Not Firm, But Announced And Under Study

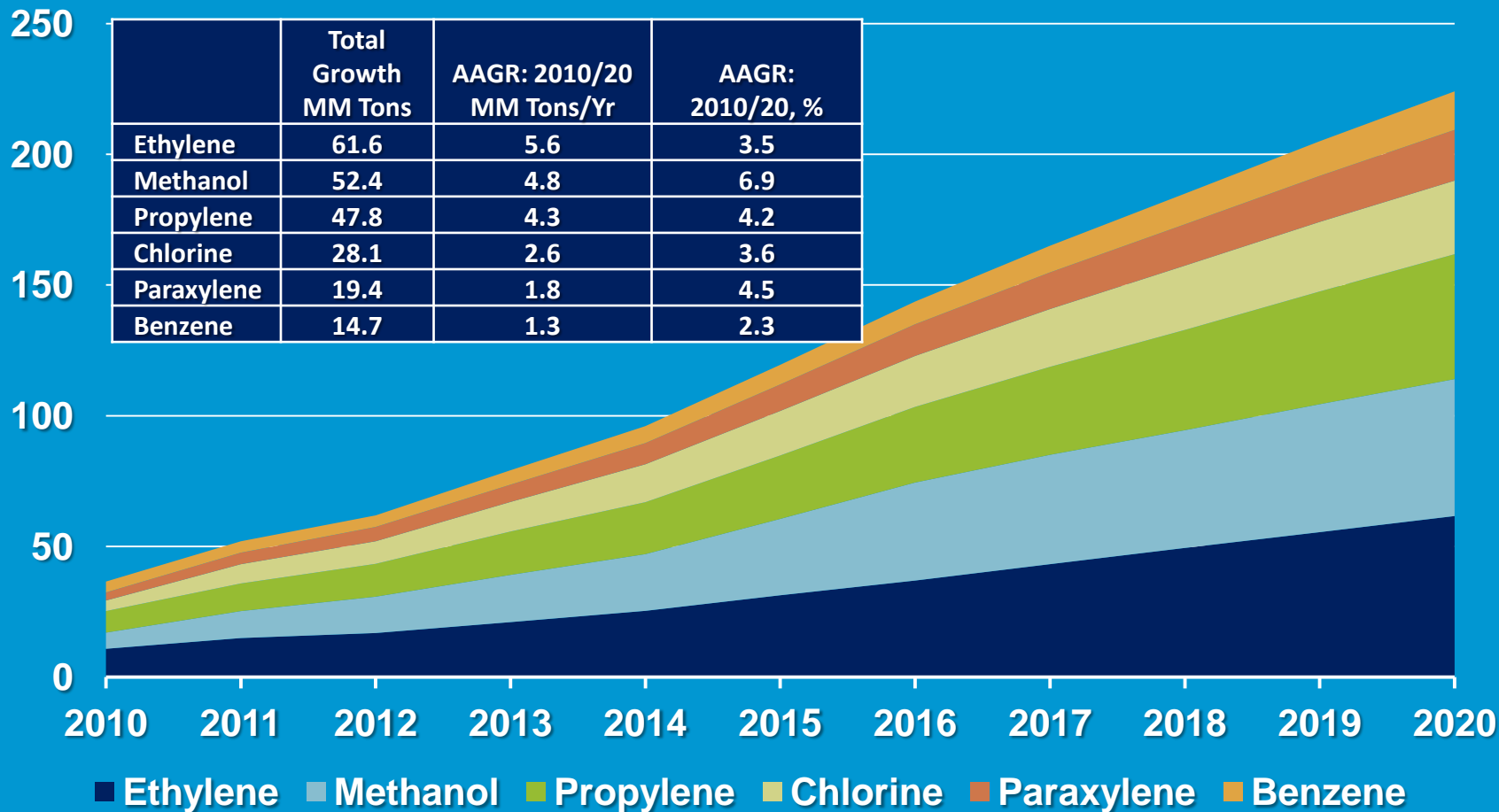


IHS Chemical & IHS Energy long term forecast assumes an additional 15 million metric tons ethane based ethylene in NAM from 2020 to 2030

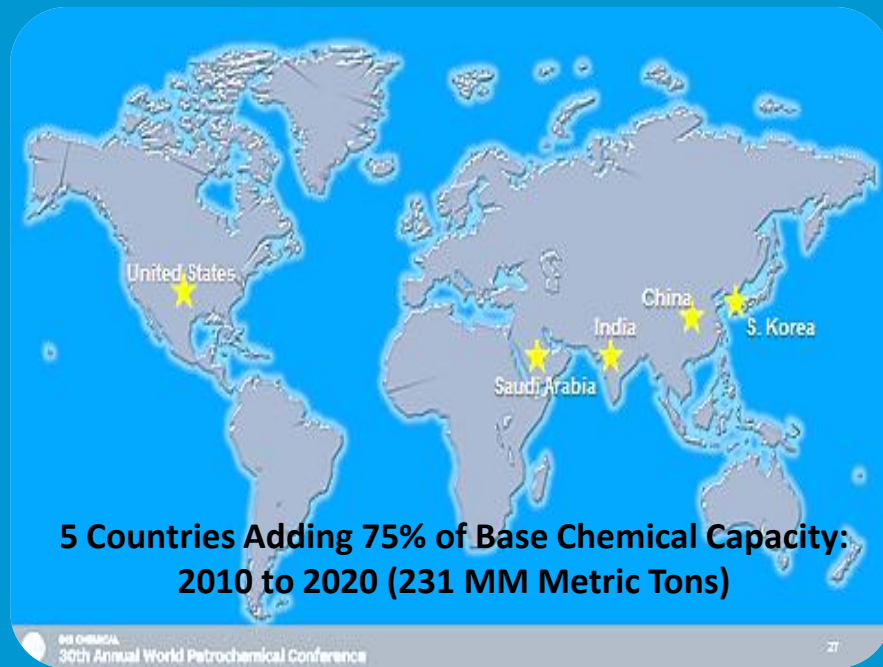
<u>Company</u>	<u>Location</u>	<u>Total Growth</u>
Aither Chemicals	West Virginia	200
Appalachian Resins	Salem Township, OH	275
Ascent	West Virginia	1,000
Axiall/Lotte	Lake Charles, LA	1,000
Badlands NGL 1	North Dakota	1,500
ChevronPhillips 2	Cedar Bayou, TX	1,500
Hanwha	TBA	1,000
Indorama	LA or TX	1,500
PTTCG/Marubeni	Shadyside, OH	1,000
Shell	Monaca, PA	1,500
Total	Port Arthur, TX	1,000
Williams	Geismar, LA	1,500
Total Additions		12,975

Global Base Chemicals Cumulative Demand Growth 2010 - 2020 = 224 Million Metric Tons

Million Metric Tons



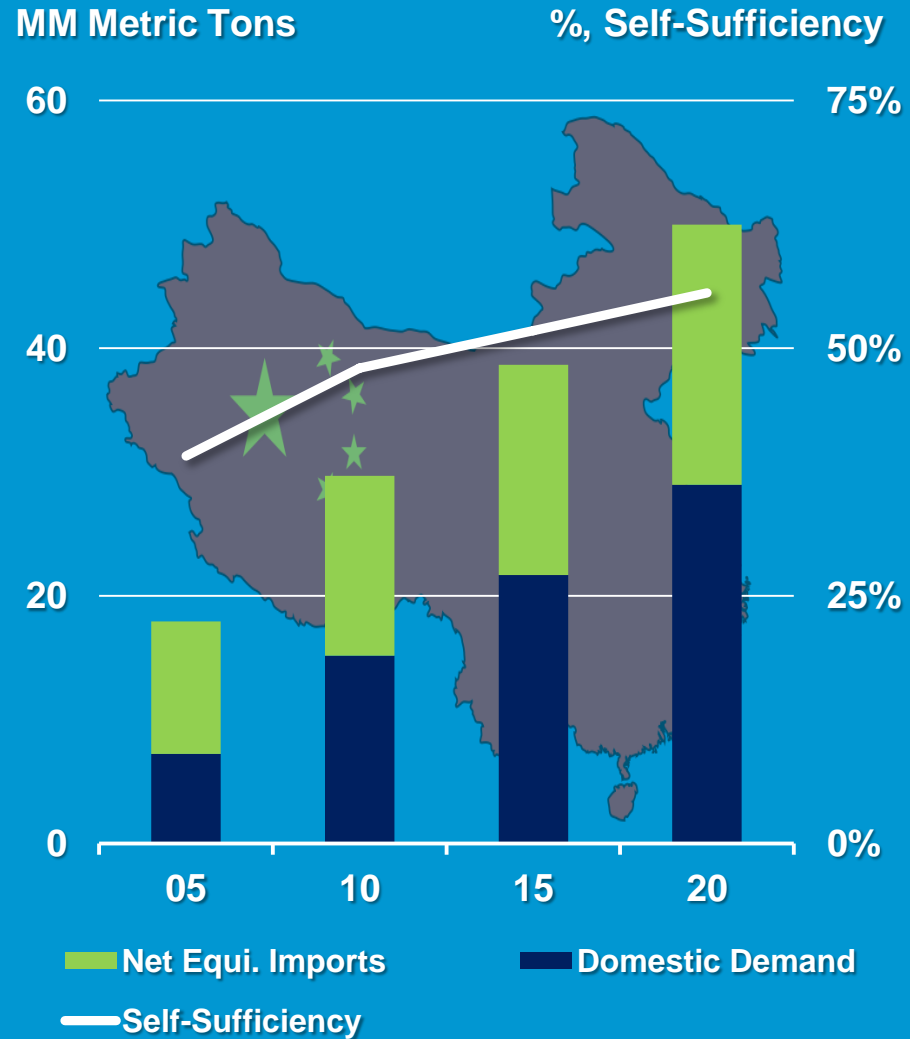
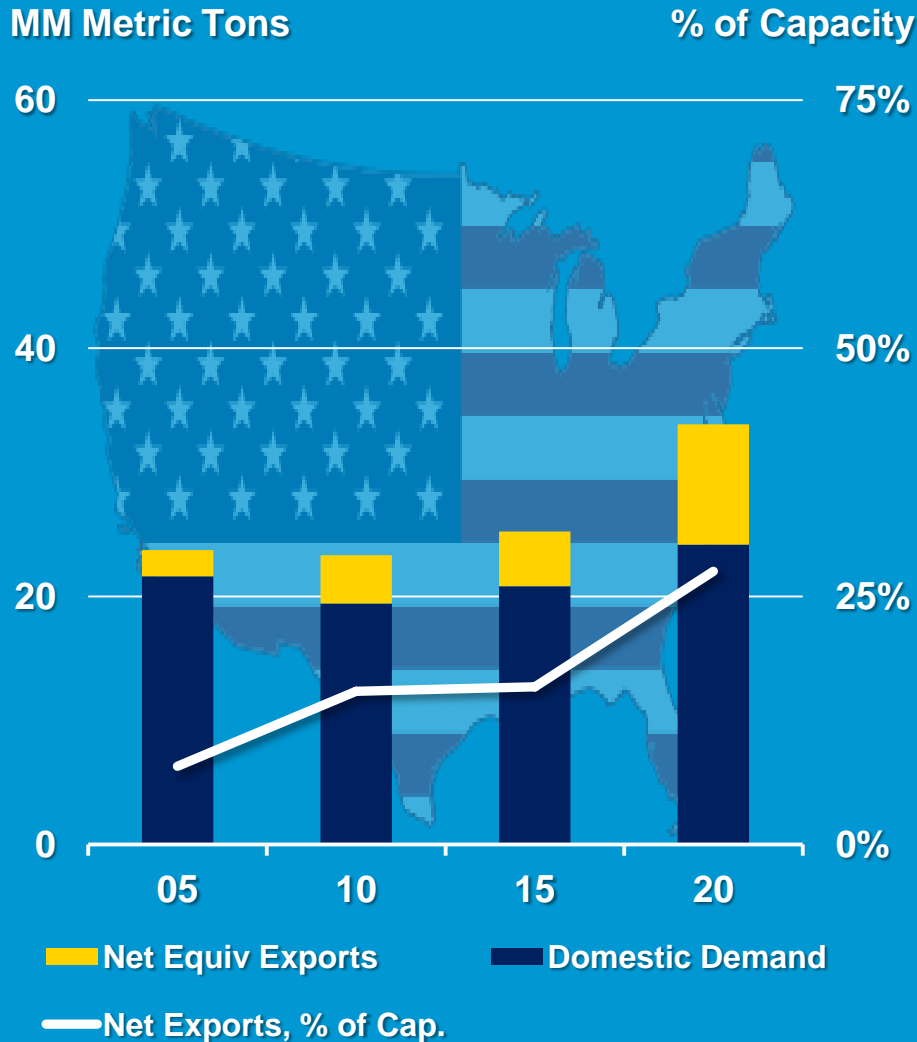
Regional Trade Is Critical To Success



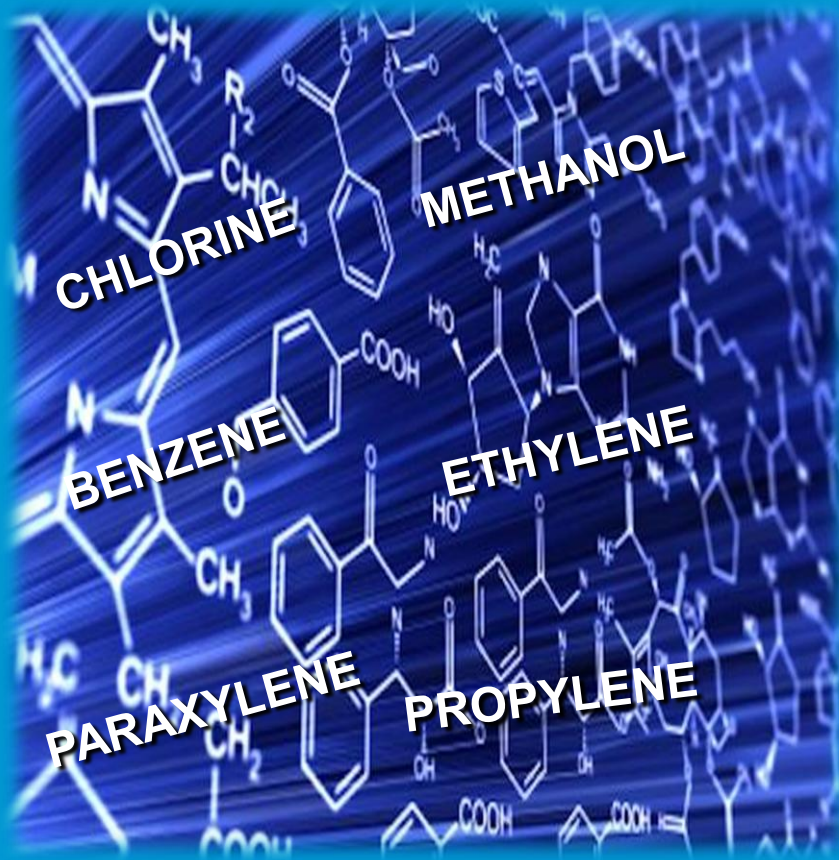
- Trade is an essential element of basic chemical supply chains
- Low cost regions such as North America and the Middle East will export increasing volumes
- On-purpose technology will change trade patterns
- Significant investment in ships, ports, and infrastructure is needed to support increasing trade volumes

China Remains Central To Basic Chemical Trade

US Ethylene Demand & Equivalent Trade

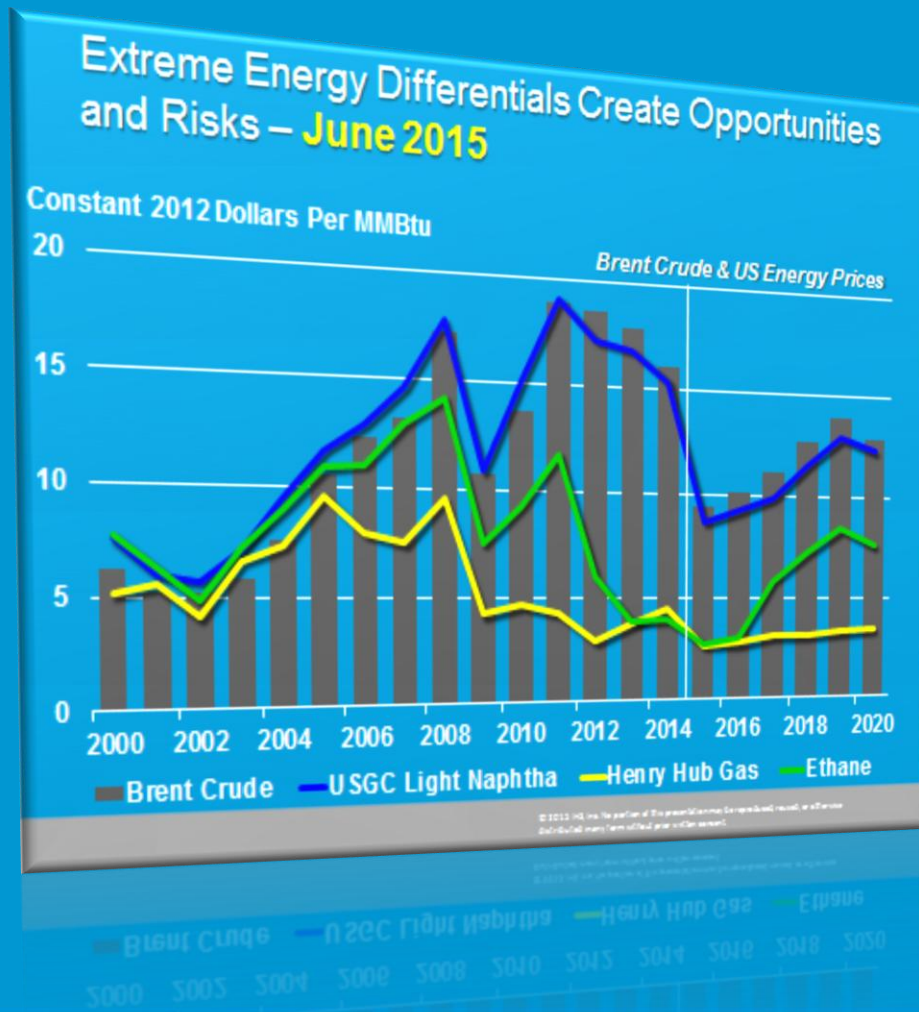


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When Energy Markets Move Chemical Will Markets Respond



- The rapid decline in crude oil pricing causes supply-chains to “pause” as buyers anticipate lower prices “tomorrow”.
- Combination of a pause in demand and the decline in costs for high-cost producers results in price decreases.
- As market prices “chase” falling costs, cash margins for high-cost producers can expand while cash margins for low cost producers will decline.

Chemical Markets Respond To Lower Crude Oil

Dollars Per Metric Ton

2,000

“Price Setters” Driven By Crude Oil

1,500

“Price Setters” Driven By Coal or Gas

1,000

500

0

Jan-2009 Jul-2009 Jan-2010 Jul-2010 Jan-2011 Jul-2011 Jan-2012 Jul-2012 Jan-2013 Jul-2013 Jan-2014 Jul-2014 Jan-2015 Jul-2015 Jan-2016 Jul-2016

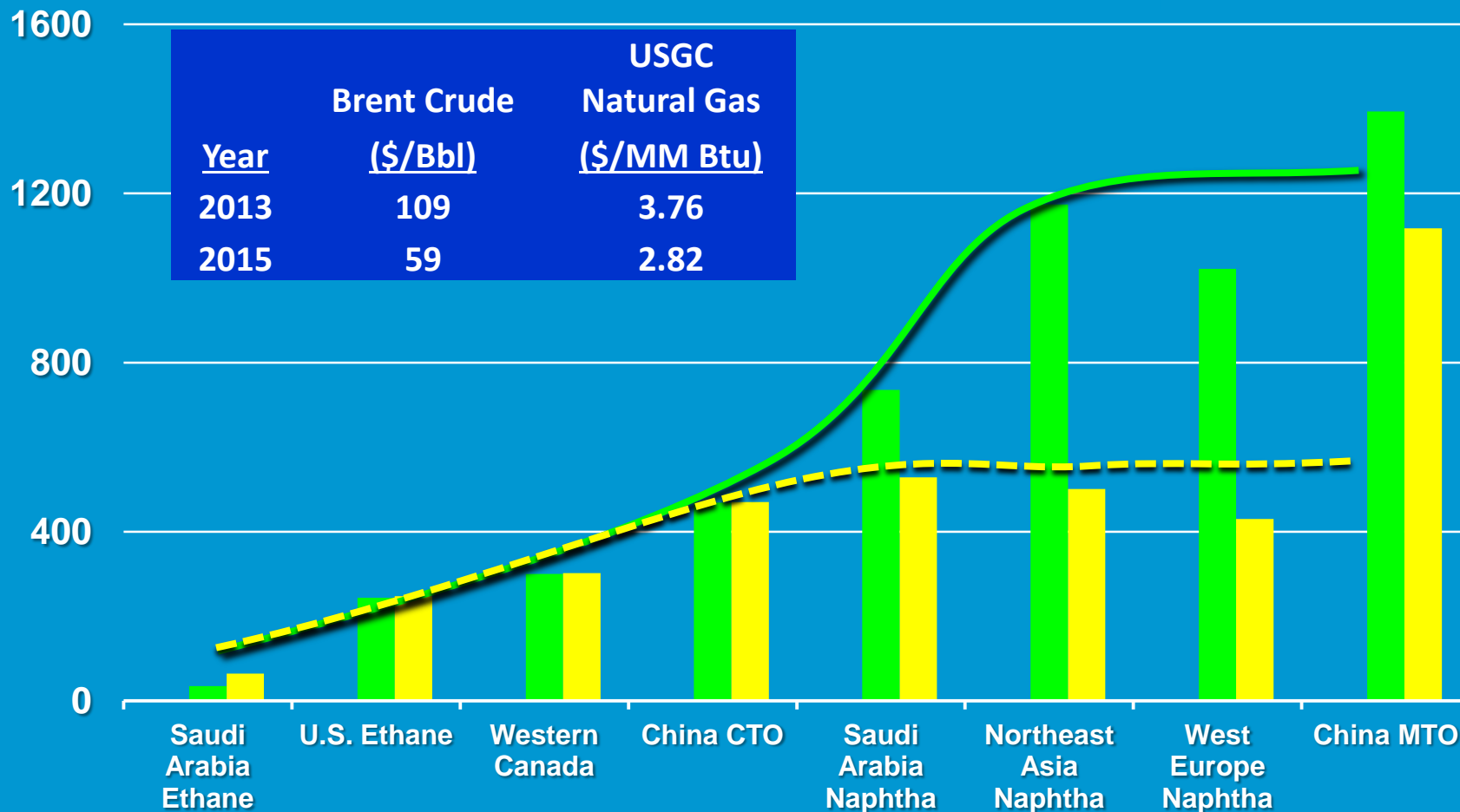
- Benzene Northeast Asia Spot, Avg.
- Benzene Southeast Asia Spot, Avg.
- Ethylene Northeast Asia Spot, Avg.
- Ethylene Southeast Asia Spot, Avg.
- Methanol Northeast Asia Spot
- Methanol Northeast Asia Spot
- Methanol Southeast Asia Spot
- Methanol West Europe Spot T1
- Paraxylene Northeast Asia Spot
- Paraxylene West Europe Spot
- Propylene Polymer Grade Northeast Asia Spot
- Propylene Polymer Grade Southeast Asia Spot, Avg.

Ethylene Cash Cost Comparison

With Energy At The Extremes

US\$ / Metric Ton

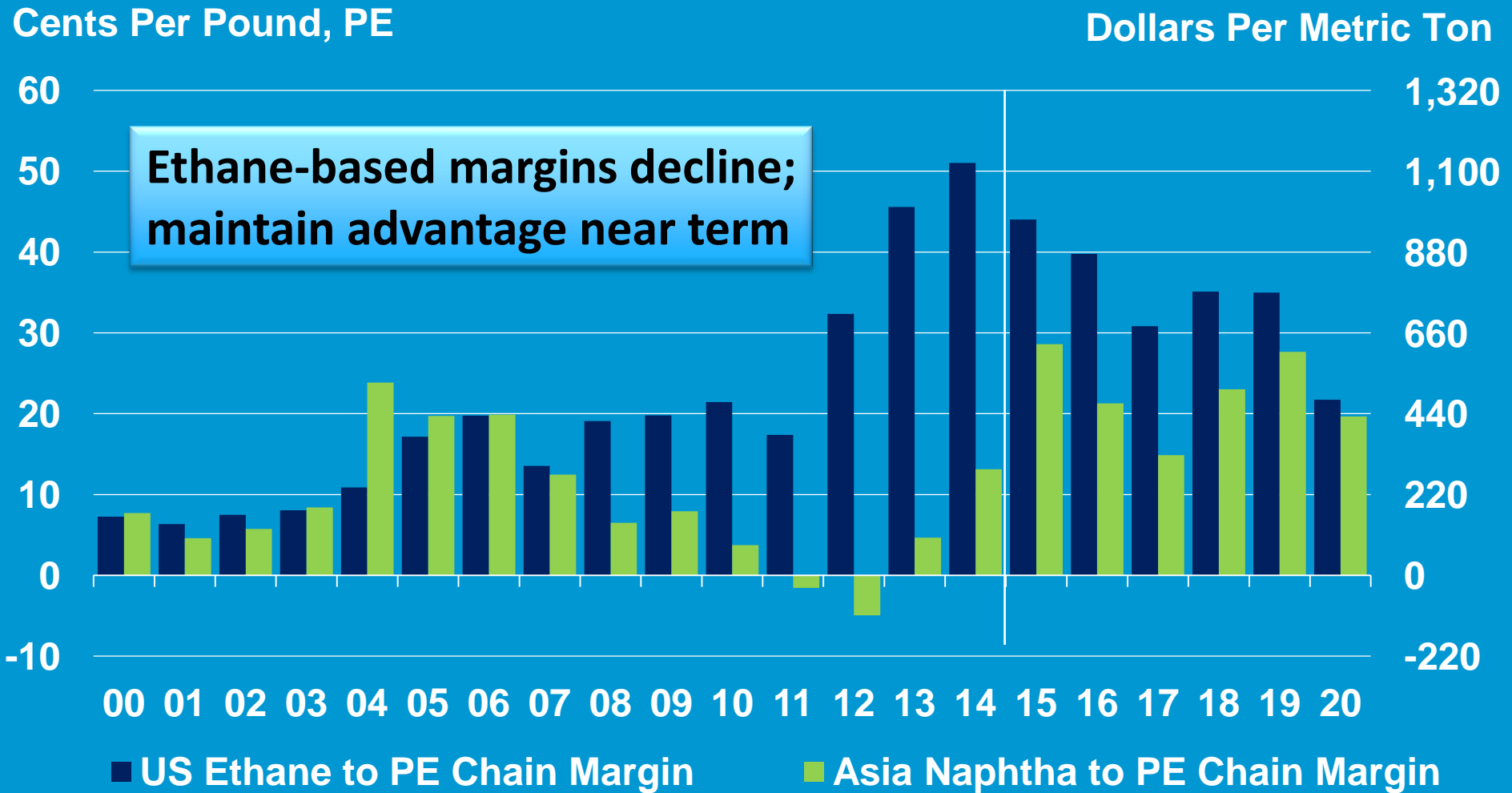
■ 2013 ■ 2015



CTO = Coal-to-Olefins; MTO = Methanol-to-Olefins

High Density Polyethylene Integrated Cash Margins

US Ethane Vs. Asia Naphtha

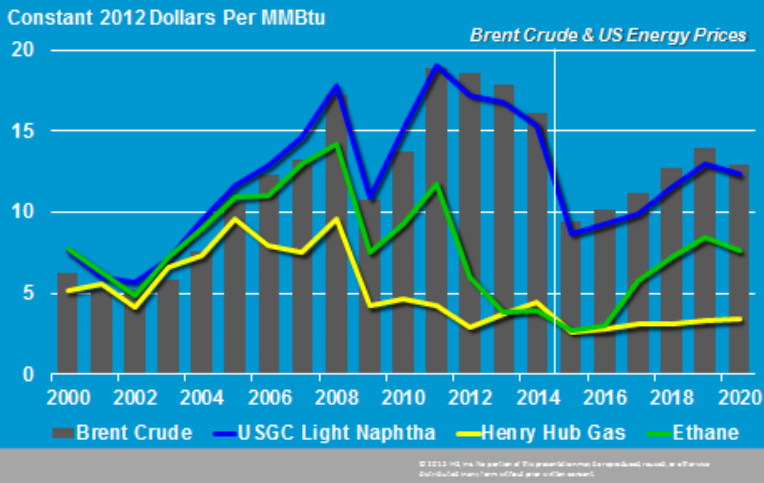


The Impact of Energy At The Extremes...

Conclusions

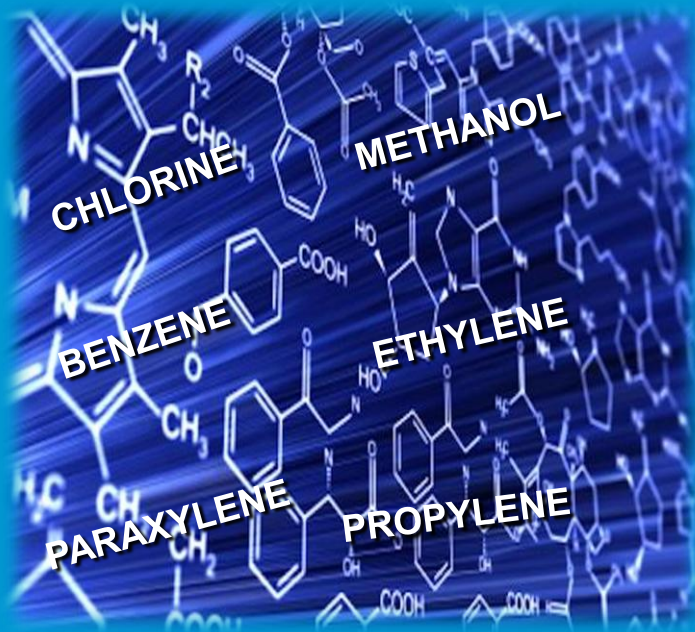
- Basic chemicals and derivatives markets adjust to “new energy”
- Price setters have lower cost...prices decline seeking new steady state; impact on trade
- Integrated margins for low-cost producers decline, some high-cost producer margins improve
- Approved “advantaged” projects advance; new projects may pause
- Demand declines followed by demand surge; trade patterns shift; potential upcycle in ethylene; propylene oversupply

Extreme Energy Differentials Create Opportunities and Risks – **June 2015**



The Impact of Energy At The Extremes...

Beyond 2020...



- **Availability of low-cost ethane and propane in North America** to support continued investments; both domestic and international
- **Developments in on-purpose technology for olefins** versus traditional routes, including the use of methanol as a route to olefins.
- **Impact of coal-to-chemicals and on-purpose propylene in China:** private/provincial investment versus state-owned; self-sufficiency and surplus capacity impacting trade; economic slowdown and impact on need for imports for China.
- **Need for ethylene supplied from naphtha cracking:** both higher operating rates for existing assets and investments in new naphtha cracking

THANK YOU !!



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