



argusmedia.com

Petrochemicals Outlook: *Markets in Transition*

Paige Marie Morse
December 2017

London
Houston
Singapore
Moscow
Dubai
New York
Portland
Calgary
Santiago
Bogota
Rio de Janeiro
Beijing
Shanghai
Tokyo
Sydney
Astana
Kiev
Cape Town
Riga
San Francisco
Washington

Market Reporting

Consulting

Events

illuminating the markets

Markets in Transition: 2018 Outlook

Feedstocks: Fundamental changes in cost and selection
New sources and improving logistics

Development: Regional dynamics are a major factor
Existing asset base must adapt

Transition: Dynamics in opposite directions
Major petrochemicals not moving together

About Argus



Crude Oil

Global and specialist local markets, offering exclusive prices and insight.



Natural Gas/LNG

Daily price info for international natural gas and LNG markets as well as analytical reports and fundamental data.



LPG/NGL

Assesses international LPG prices each day, including the key European indexes and benchmarks.



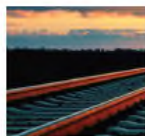
Petrochemicals

Assesses international LPG prices each day, including the key European indexes and benchmarks.



Emissions

Price assessments for green markets, including CO₂ permits, Renewable Energy Certificates (RECs), SO₂ and NO_x.



Coal

Price assessments for green markets, including CO₂ permits, Renewable Energy Certificates (RECs), SO₂ and NO_x.



Power

Price information for international electricity markets as well as analytical reports and fundamental data.



Fertilizer

Various reports covering international phosphates, nitrogen, ammonia, potash, sulphur and sulphuric acid markets.



Oil Products

Over 20 refined products reports, many of which include key industry index and benchmark prices.



Transportation

A range of reports covering spot freight rates, pipeline, rail and port throughputs for petroleum, coal, LPG and gas markets.



Bioenergy

Argus reports on international biofuel and biomass markets.



Metals

Over 1,100 global proprietary assessments, instant market news and commentary and live data feeds from key metal exchanges.

WHO OUR CLIENTS ARE:



Major Oil Companies



Governments



International Agencies



Trading Houses

We focus on not only providing the most accurate market data in the price reporting industry, but have passion for proving the best user experience for our customers as well.

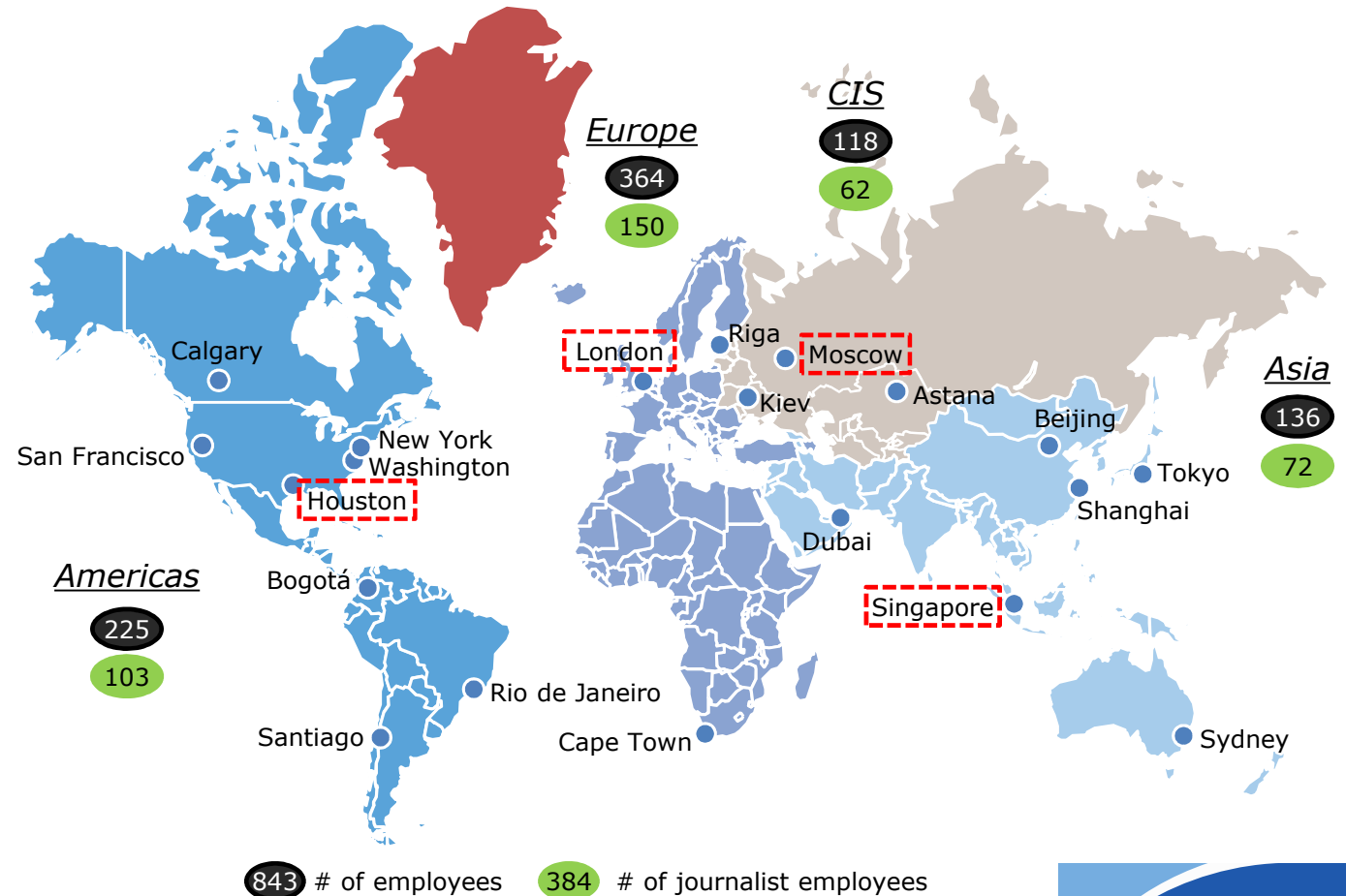
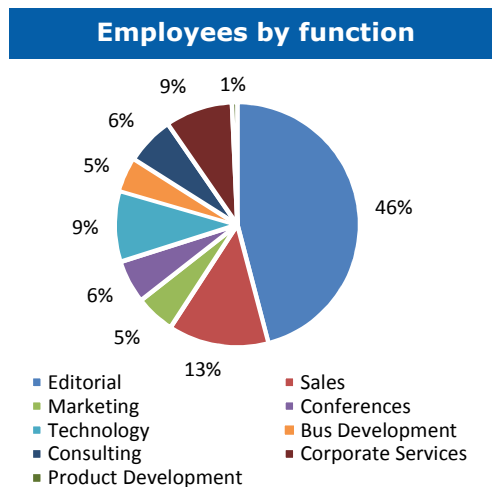
illuminating the markets

Copyright © 2017 Argus Media group. All rights reserved.

argus

Argus continues to invest and grow

Employees by region		
	2016	2017
Americas	193	225
Europe	305	364
CIS	113	118
Asia	119	136
Total	730	843



Argus Petrochemical Services

- **Full range of international petrochemical services, including key derivatives.**
- **A quality one stop shop for pricing, consulting and analysis thru the entire energy space.**
- **Mitigate risk with an in-depth understanding of current market and have confidence in the decisions made using our analysis.**

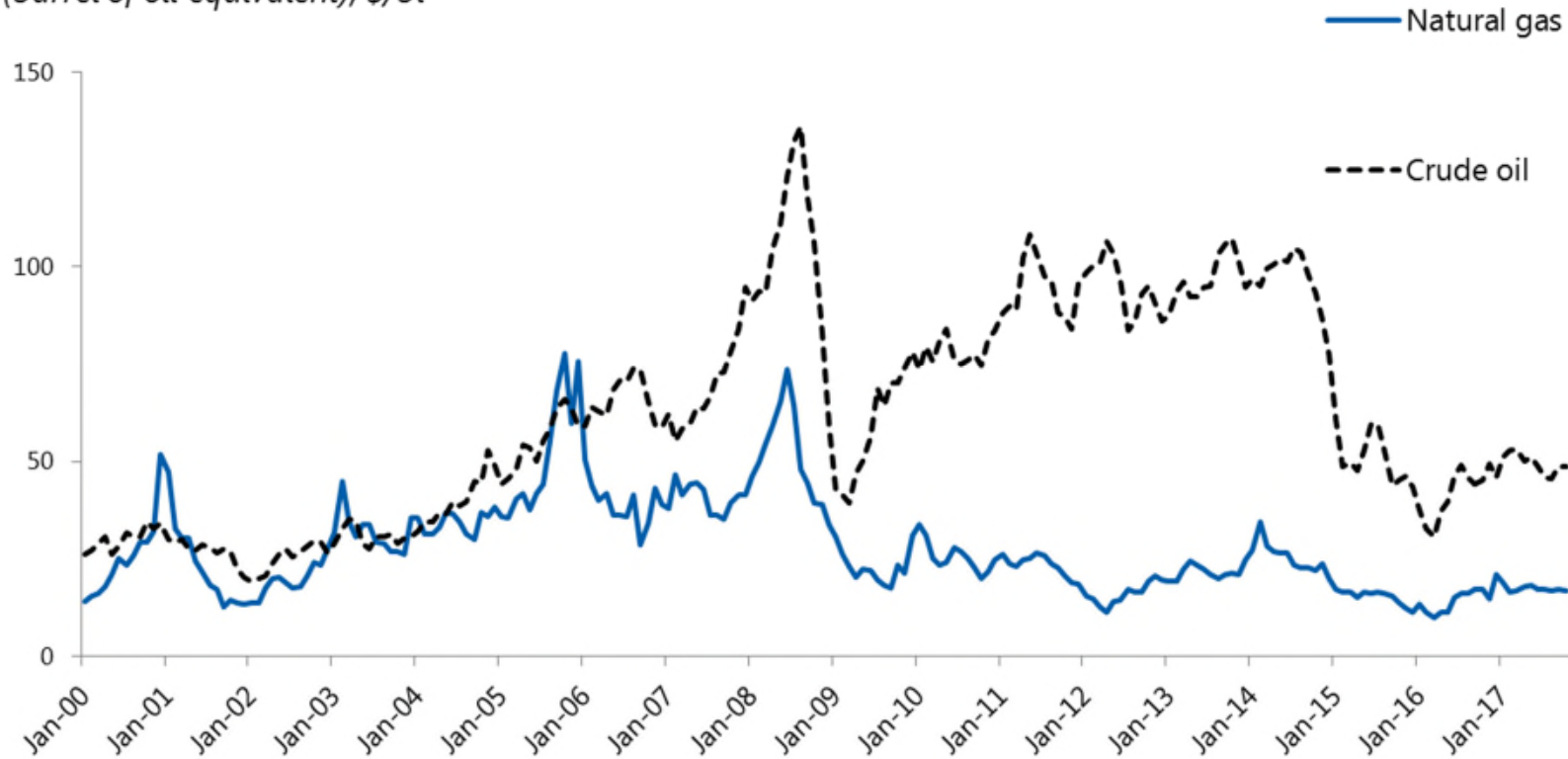
Benzene	Methanol	Ethylene
Toluene and Xylenes	Chlor-alkali	Propylene
Fuels and Octane	C5 and Hydrocarbon Resins	Butadiene
		Polymers



Energy price evolution

USGC- Monthly energy prices

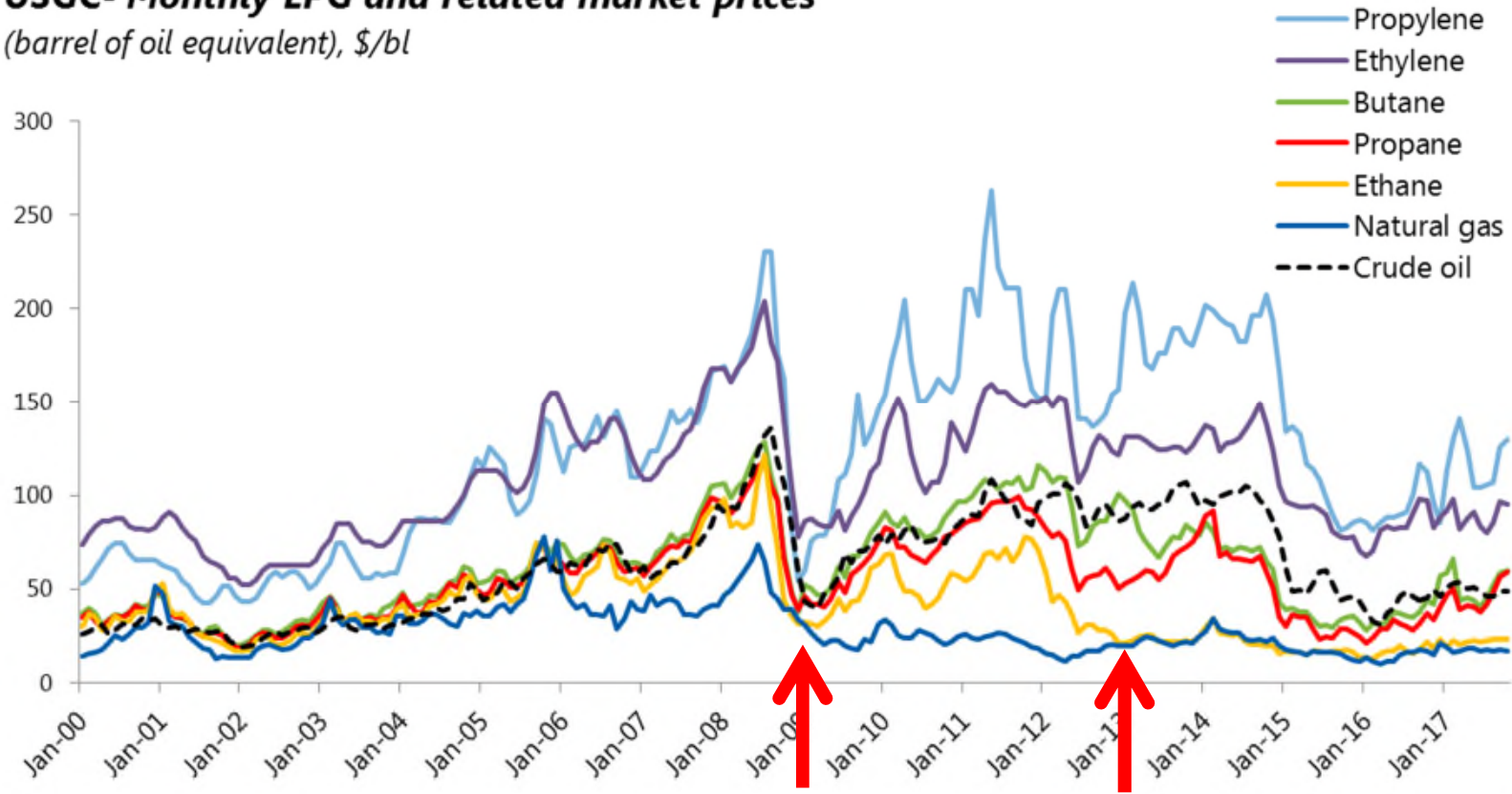
(barrel of oil equivalent), \$/bl



-Argus

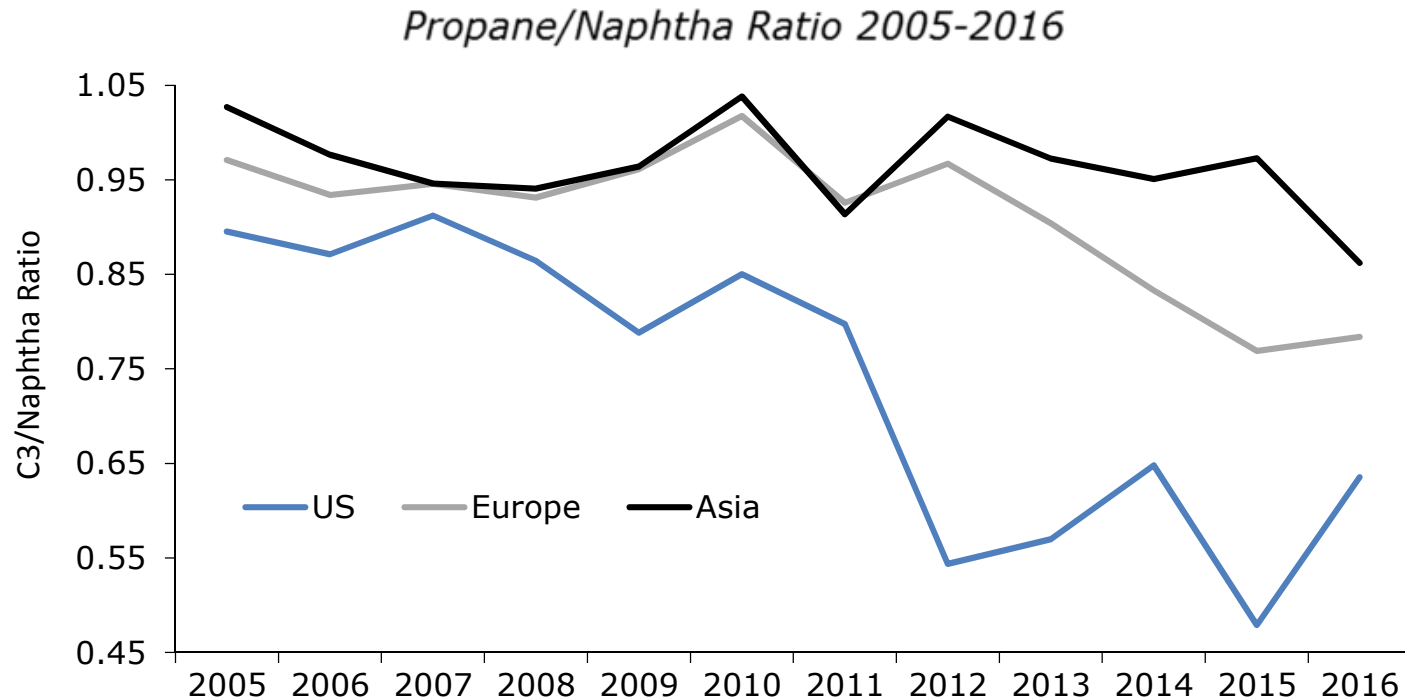
Shifting feedstock relationships

USGC- Monthly LPG and related market prices
(barrel of oil equivalent), \$/bl



-Argus

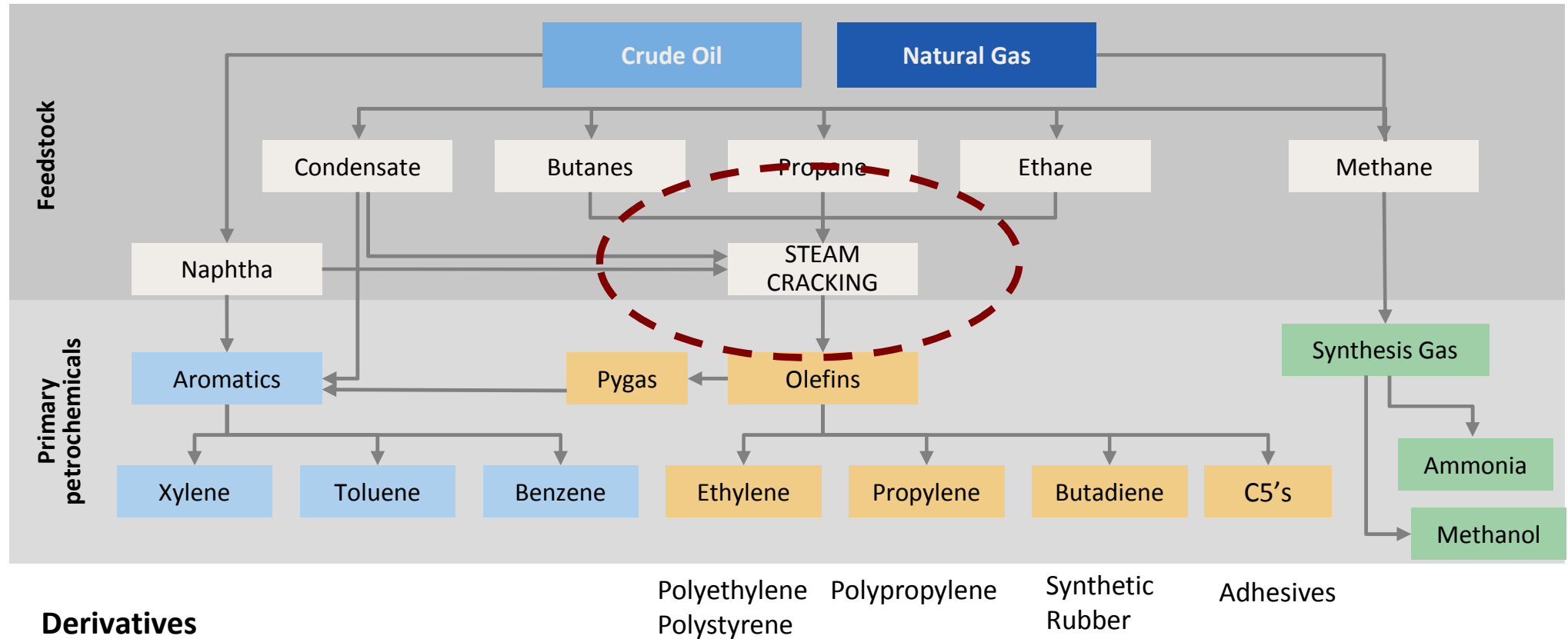
Propane has been getting cheaper vs Naphtha



- Propane/Naphtha ratio has dropped as NGL availability has grown in US
- LPG needed economic incentive to find outlet in petrochemicals

— Argus Consulting

The Petrochemical Value Chain



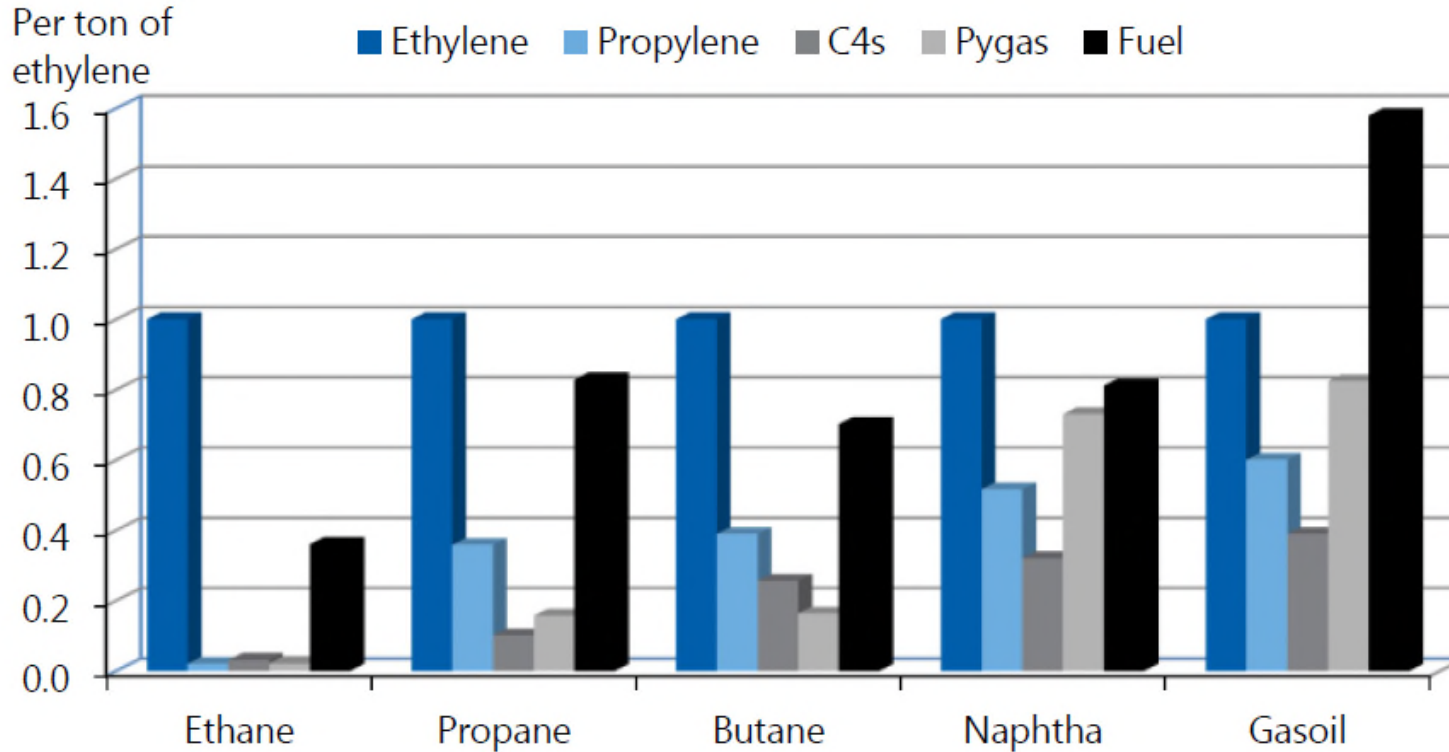
Derivatives

illuminating the markets

Copyright © 2017 Argus Media group. All rights reserved.



Product Mix varies with Cracker Feedstock



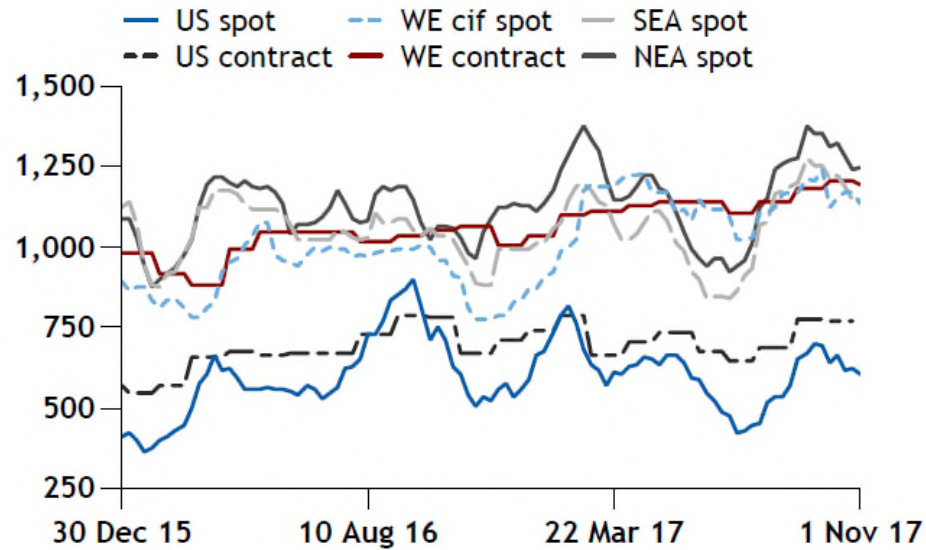
Shift towards Ethane has critical impact on supply of other petrochemicals

*Split of co-products per feedstock type for every ton of ethylene produced
— Argus Consulting*

Global olefins prices

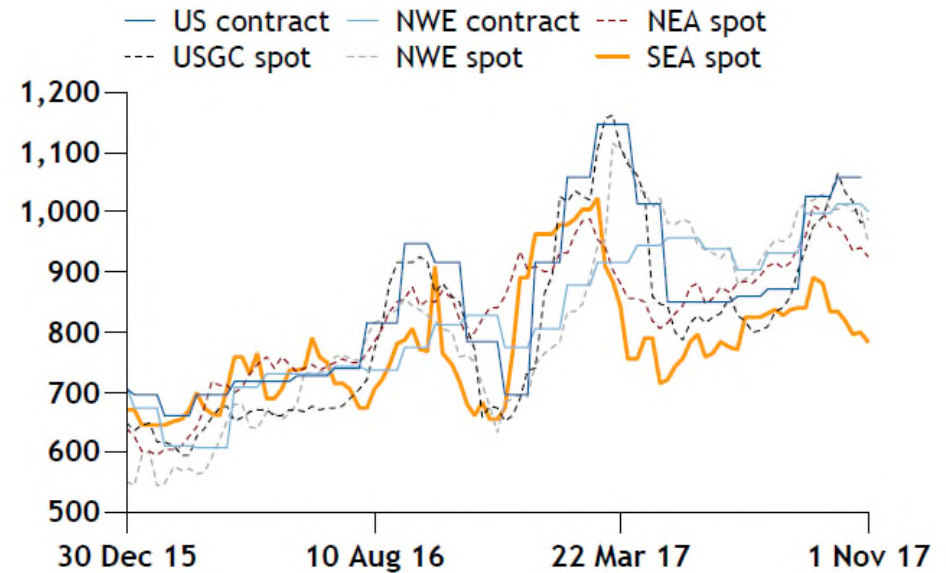
World ethylene prices

\$/t

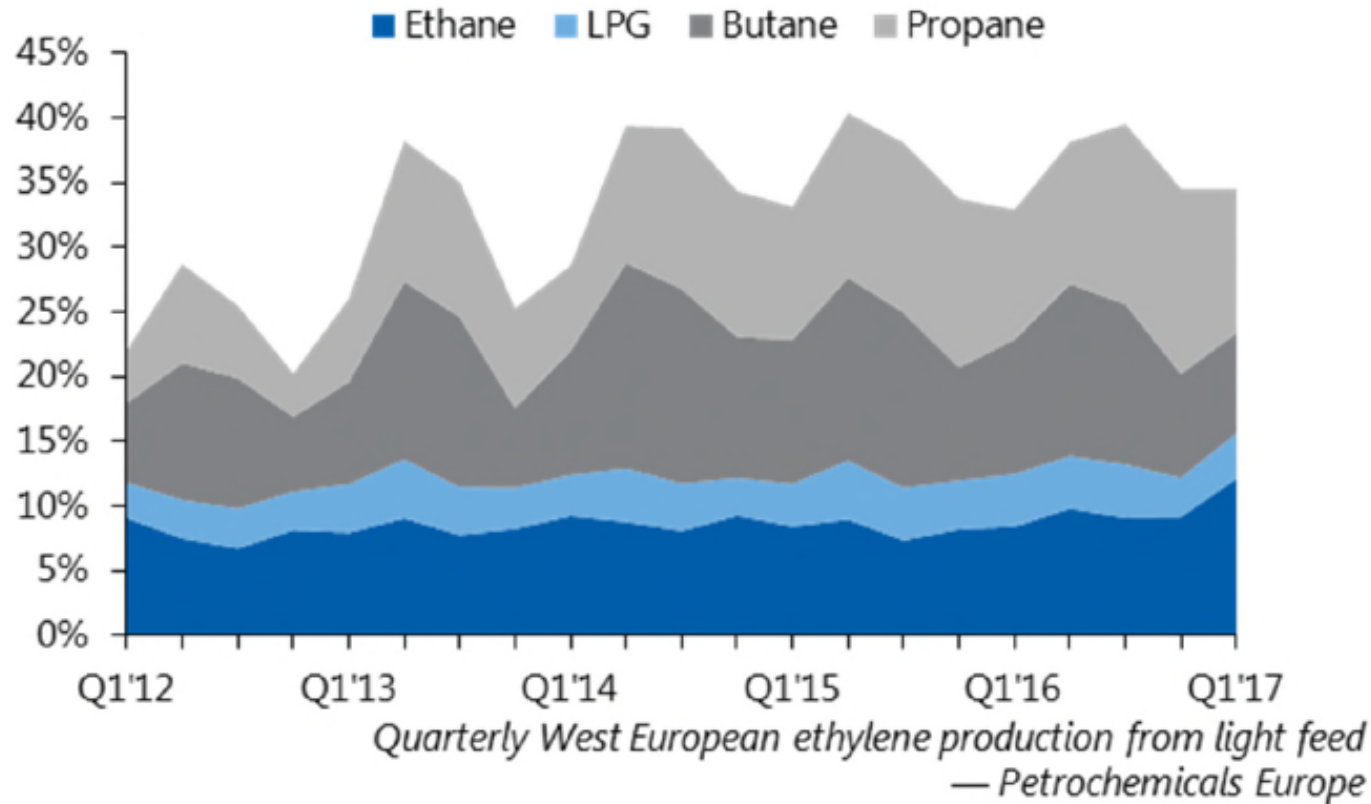


World PG propylene prices

\$/t



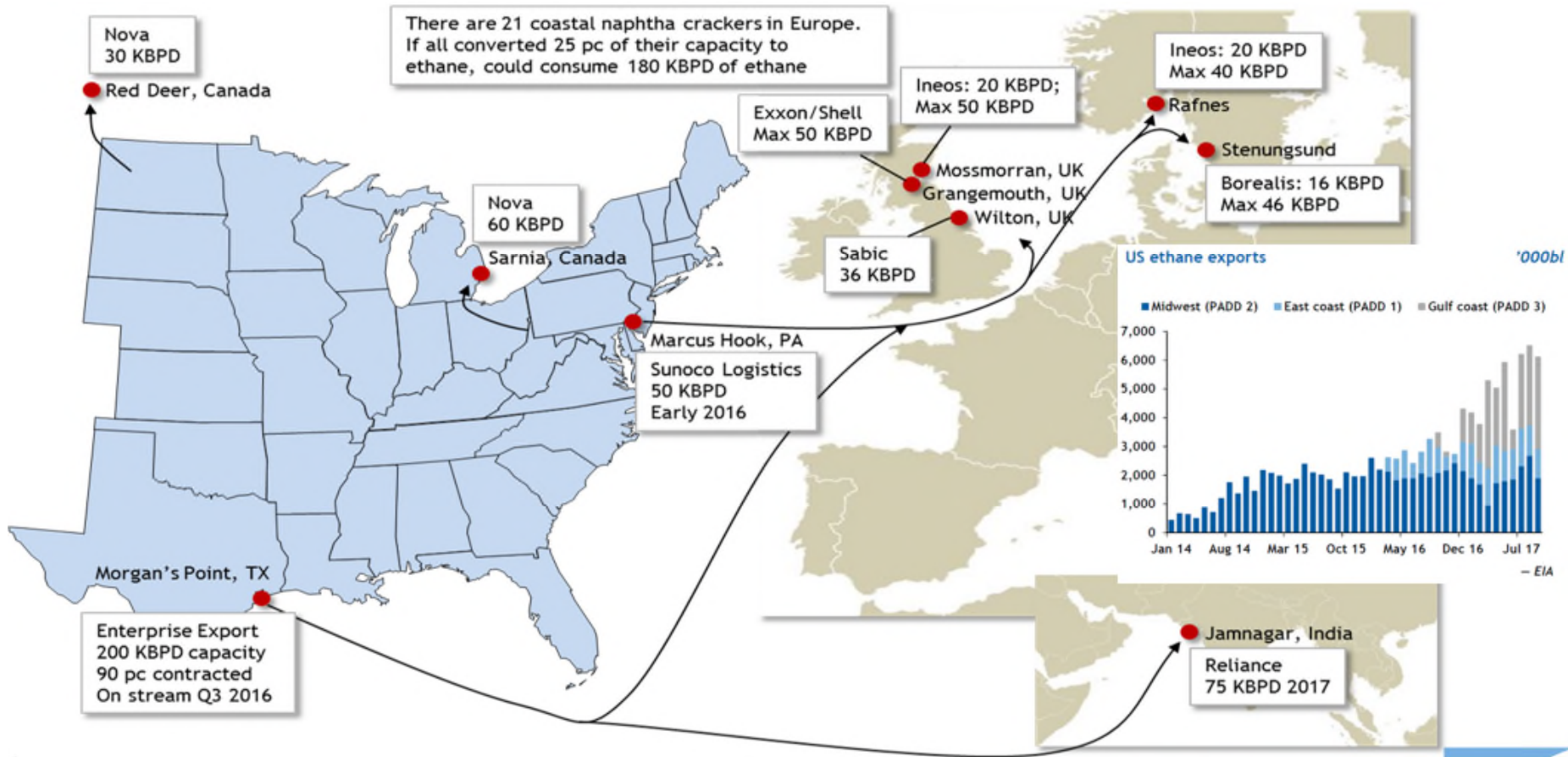
Europe moving to lighter feedslate



- Naptha remains dominant feedstock for steam crackers
- Ethane investments yet to be fully realized

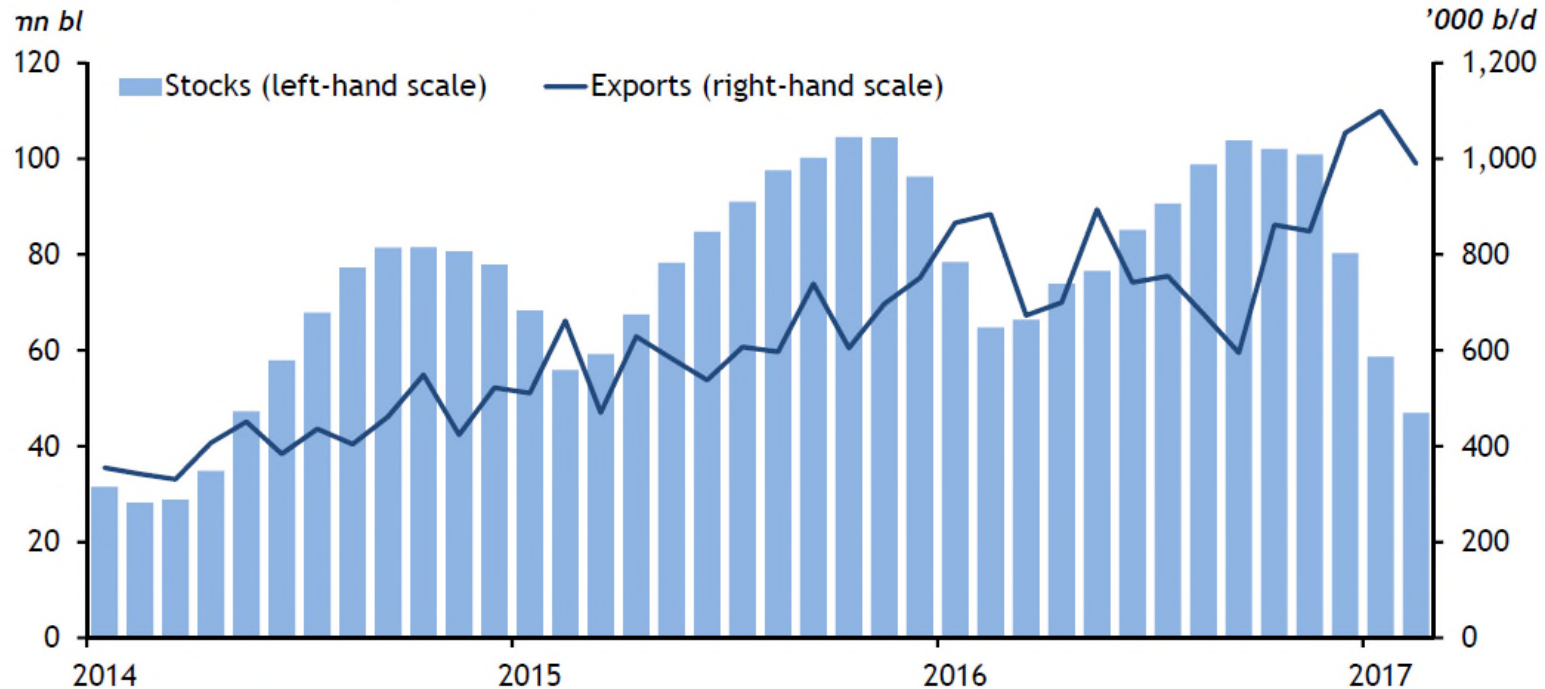
Source: Argus LPG Analytics

US Ethane exports: Wide-ranging destinations



US Propane exports: Changing market dynamic

US propane stocks and exports

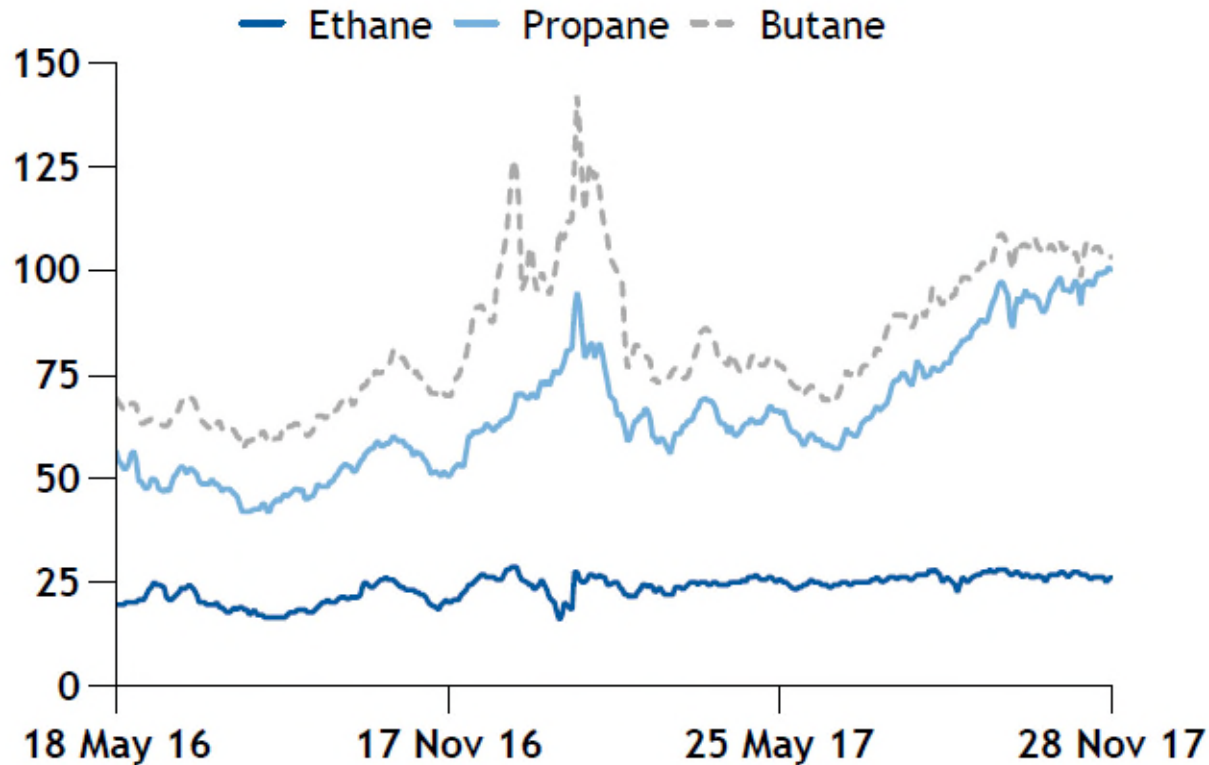


Source: Argus LPG World

LPG prices higher than expected in 2017

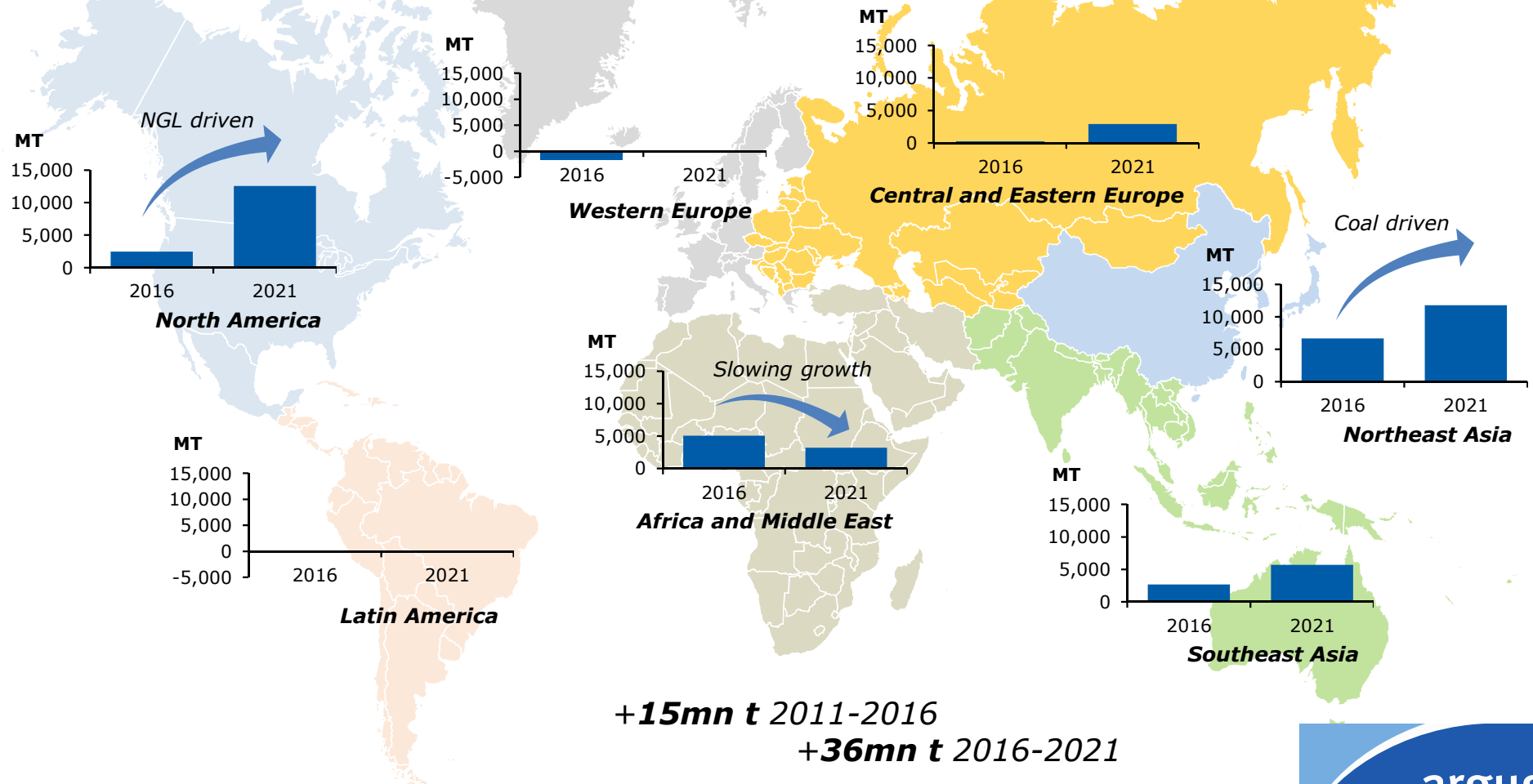
US Gulf coast NGL prices

¢/USG

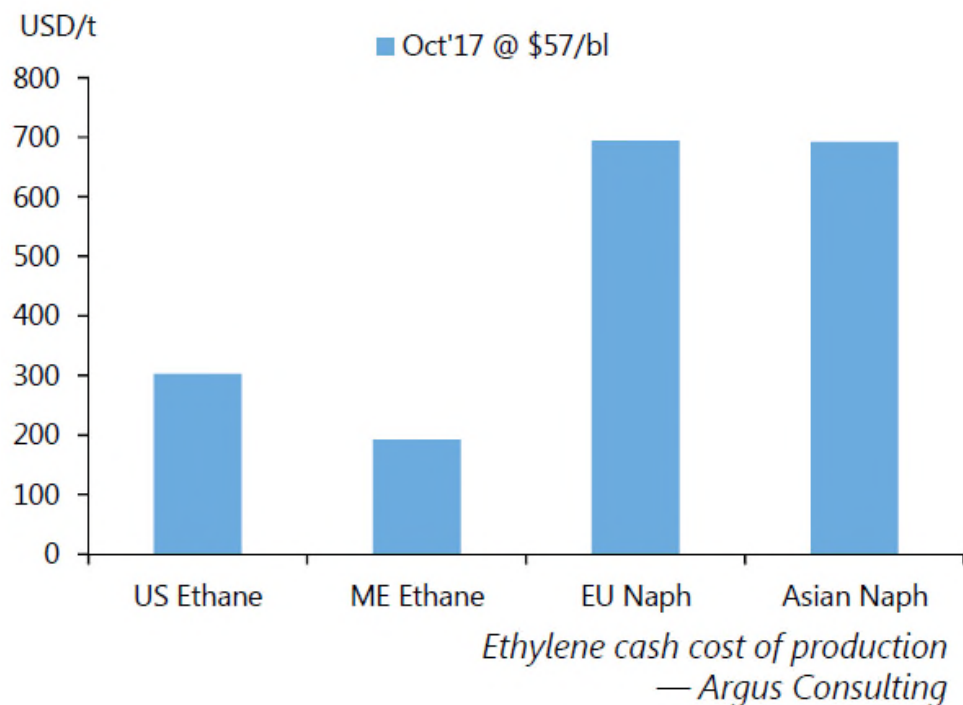


- Strong petrochemical demand from Asia
- Exports have created tighter local market
- Improved logistics may allow for lower inventory needs

Global ethylene capacity growth



US steam cracker capacity growth

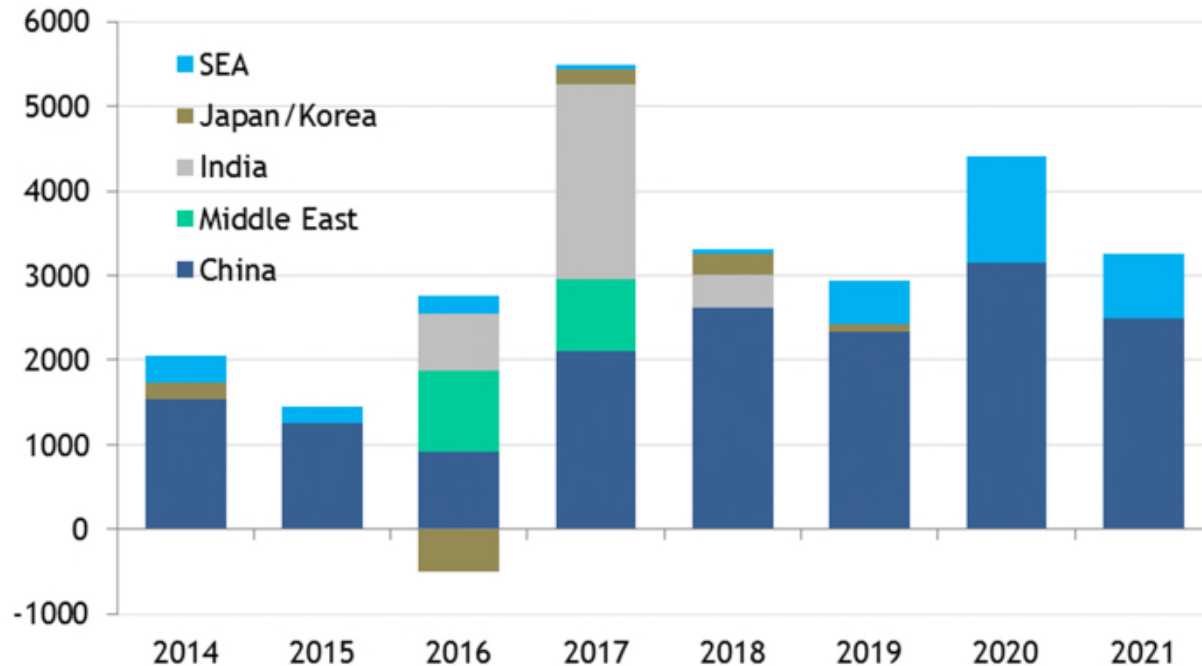


Company	Site	New or Expansion Capacity ('000t)	Timing
Oxychem/Mexichem	Ingleside, TX	500	Q1 2017
Westlake Chemical	Calvert City, KY	70	Q2 2017
LyondellBasell	Corpus Christi, TX	363	Q3 2017
Dow	Freeport, TX	1,500	Q3 2017
Chevron Phillips Chemical	Old Ocean, TX	1,500	Q1 2018
ExxonMobil	Baytown, TX	1,500	Q2 2018
Indorama	Lake Charles, LA	370	Q1 2018
Formosa Plastics	Point Comfort, TX	1,200	Q4 2018
Shintech	Plaquemine, LA	500	Q1 2019
Sasol	Lake Charles, LA	1,500	Q3 2019
Westlake/Lottel	Lake Charles, LA	1,000	Q3 2019
Total Petrochemicals	Port Arthur, TX	1,000	Q1 2021
Shell Chemical	Monaca, PA	1,600	Q3 2021
Total supply additions		12,603	2017-2021

- Cost advantage drives expansion in Ethylene, and Polyethylene

Most Expansion in China

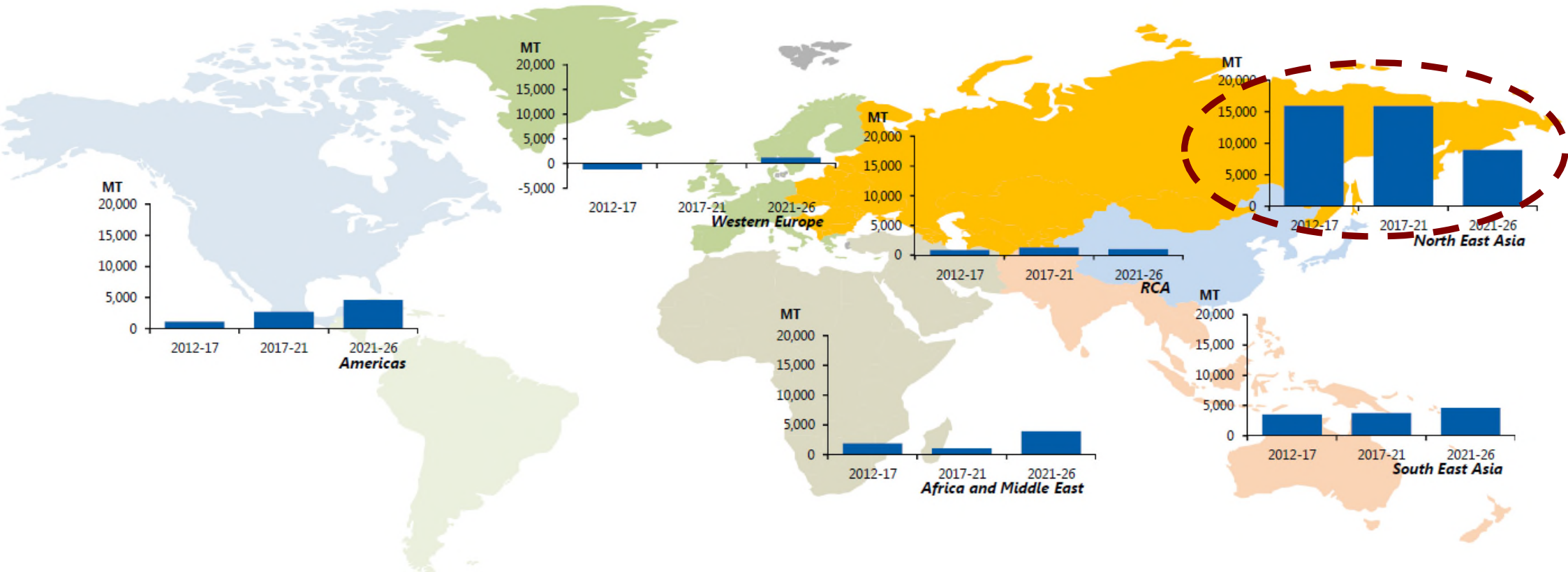
Asia ethylene capacity additions in 2014-2021



* Prorated annual capacities presented

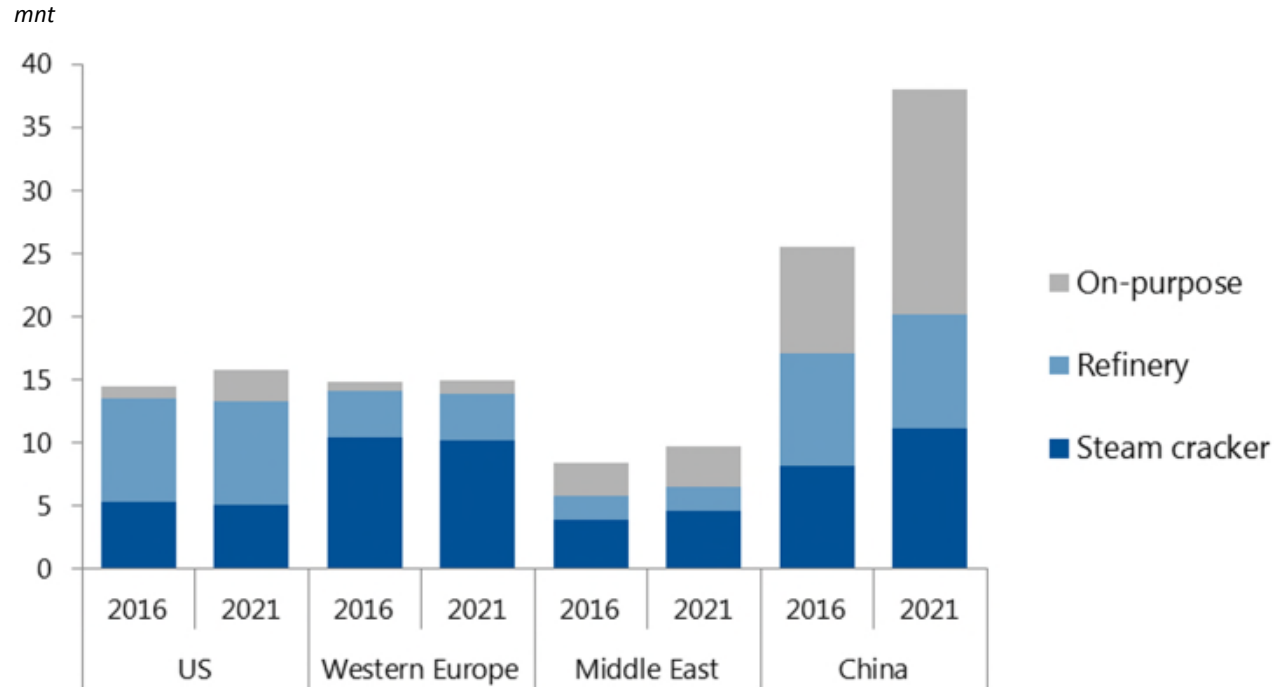
- Improved margins boost capacity expansions
- Asian expansions 5mn t/yr 2017 and 3mn t/yr 2018-20
- China leads adding new CTO/MTO and steam crackers

Propylene capacity growth



- Most additions in high demand region (Asia)
- Also driven by feedstock advantage: coal in Asia; propane in NA

Propylene production by region – 2016 and 2021

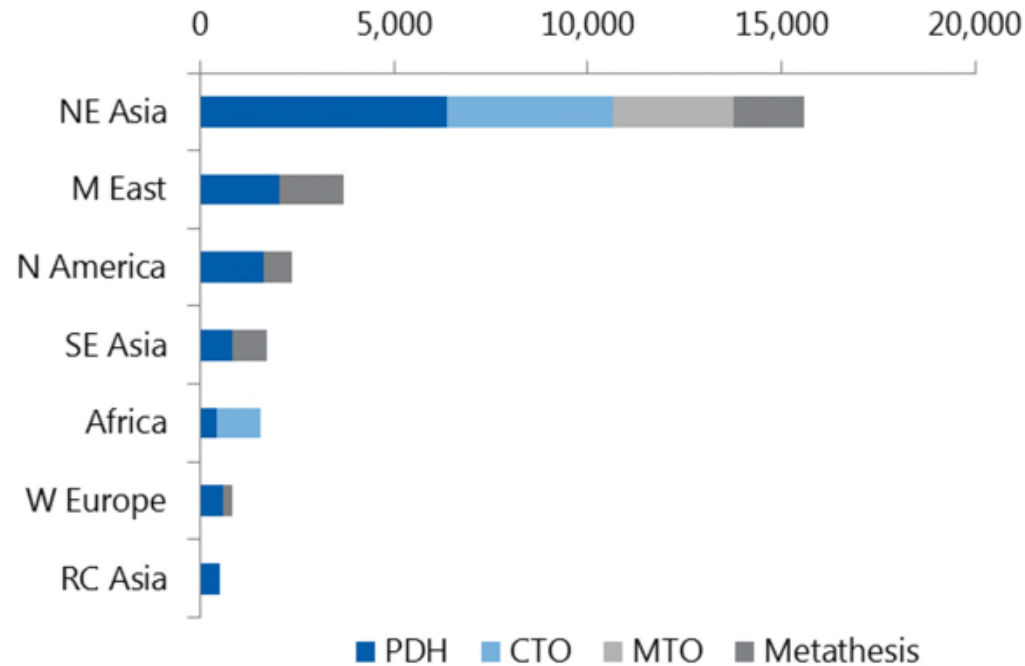


- China favors on-purpose production as demand grows faster than co-product routes
- US continues to rely on refineries, with growing PDH

On-purpose includes: Propane dehydrogenation (PDH), Coal-to-Olefins (CTO), Methanol-to-Olefins (MTO), and metathesis

Source: Argus 2017 Propylene Annual

On-purpose capacity by region in 2017

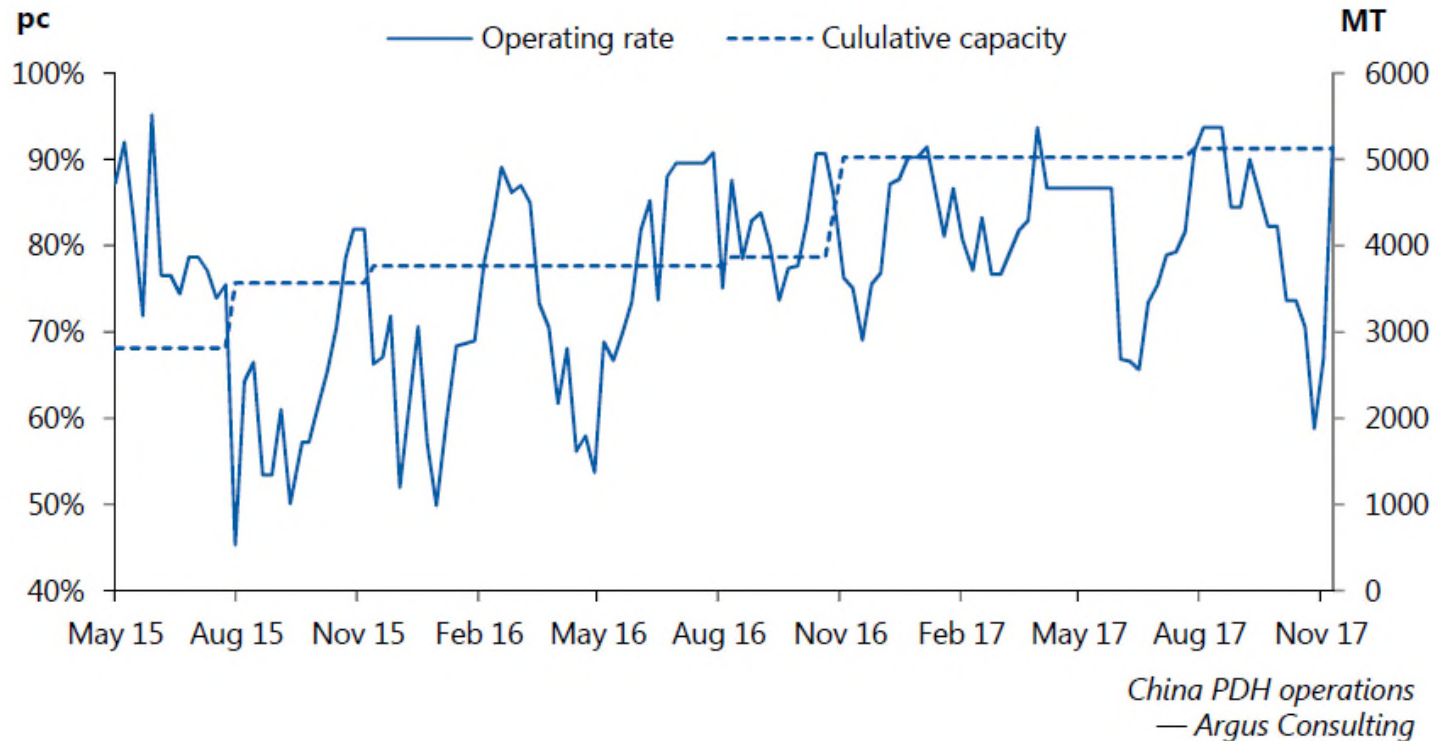


Total Capacity: 26.3 mn t

— Argus Consulting

- On-purpose capacity grew fastest in past five years
- PDH capacity grew 24pc in past five years . . . Slowing to 11pc
- PDH now accounts for 15pc of Chinese capacity

Chinese PDH operations



- 12 units operating since first in 2013
- Operations stabilizing before recent inspections
- Outages can create significant price volatility

Source: Argus Propylene and Derivatives

PDH units: North American projects

Company	Location	Capacity ('000 t/y)	Technology	Notes
Flint Hills Resources	Houston, TX	650	Lummus	Operating since 2010
Dow	Freeport, TX	750	UOP Oleflex	Operating Dec15
Enterprise	Mont Belvieu, TX	750	Lummus	<i>start-up Fall 2017</i>
Inter Pipeline	Alberta, Canada	2 x 500	UOP Oleflex	<i>2021; + 500 PP</i>
Pembina/PIC	Alberta, Canada	550	UOP Oleflex	<i>2021; + 550 PP</i>
Formosa Plastics	Point Comfort, TX	550	Uhde STAR	Unlikely before 2022
<i>Rextac</i>	<i>Odessa, TX</i>	<i>NA</i>	<i>TBA</i>	<i>cancelled</i>
<i>C3 Petrochemicals</i>	<i>Chocolate Bayou, TX</i>	<i>2 x 500</i>	<i>UOP Oleflex</i>	<i>suspended</i>
<i>Sunoco Logistics</i>	<i>Pennsylvania</i>	<i>NA</i>	<i>TBA</i>	<i>Under evaluation</i>
<i>Dow</i>	<i>TBA</i>	<i>NA</i>	<i>TBA</i>	<i>Under evaluation</i>
<i>Lyondell</i>	<i>USGC</i>	<i>Up to 1mn t</i>	<i>TBA</i>	<i>PO planned; Possible PP</i>

CTO units: Complex process

Major CTO plants and projects '000 t/yr		
Project	Olefin output	Start-up
Shenhua Baotou†	610	2011
Coal China Energy Yulin	600	2014
Yanchang-Coal China Yulin†	1,200	2014
Shenhua Ningxia CTO†	550	2015
Shenhua Xinjiang	720	2016
Coal China Mengda New Energy Chemical	600	2016
Shenhua Ningxia CTO†	1,010	Jul 17
Zhongtian Hechuang	1,370	Aug 17
Yan'an coal-oil-gas integrated project	670	2018
Yanchang-Coal China Yulin†	600	2019
Zhong An United Coal Chemical	700	2019
Sinopec Great Wall Energy and Chemical	600	2020
Shenhua Yulin*	400	2020
Shenhua Baotou†	1,350	2021
Shenhua Ningxia-Sabir	768	2022

*first phase †second phase

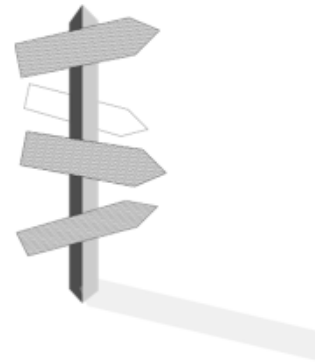
- Utilize domestic feedstock, but demanding multi-step process
 - Proceeds through syn gas, methanol intermediate, mixed products
- Most integrated to polymer for ease of shipment to market
- New environmental requirements may delay planned units

Source: Argus China Petroleum



Signposts: Emerging disruptions

- Growing feedstock trade helps to share competitiveness . . .
enabling petrochemicals growth in many regions
- CTO developments important in China . . .
but environmental concerns may impact growth
- Europe has been more resilient than expected . . .
but Ethylene/PE deluge will be significant test
- Cost metrics are shifting with supply sources . . .
challenging previous metrics for regional pricing



Paige Marie Morse, PhD

Vice President, Propylene and derivatives


Email: Paige.Morse@argusmedia.com

Phone: +1 713 360 7577

Office: Houston

Web: www.argusmedia.com

Stay Connected

 @ArgusMedia

 +Argusmediaplus

 Argus-media

 argusmediavideo

Copyright notice

Copyright © 2016 Argus Media group. All rights reserved. All intellectual property rights in this presentation and the information herein are the exclusive property of Argus and and/or its licensors and may only be used under licence from Argus. Without limiting the foregoing, by reading this presentation you agree that you will not copy or reproduce any part of its contents (including, but not limited to, single prices or any other individual items of data) in any form or for any purpose whatsoever without the prior written consent of Argus.

Trademark notice

ARGUS, the ARGUS logo, ARGUS MEDIA, ARGUS DIRECT, ARGUS OPEN MARKETS, AOM, FMB, DEWITT, JIM JORDAN & ASSOCIATES, JJ&A, FUNDALYTICS, METAL-PAGES, METALPRICES.COM, Argus publication titles and Argus index names are trademarks of Argus Media group.

Disclaimer

All data and other information presented (the "Data") are provided on an "as is" basis. Argus makes no warranties, express or implied, as to the accuracy, adequacy, timeliness, or completeness of the Data or fitness for any particular purpose. Argus shall not be liable for any loss or damage arising from any party's reliance on the Data and disclaims any and all liability related to or arising out of use of the Data to the full extent permissible by law.

The Argus logo consists of a blue square with a white curved line on the left side, and the word "argus" in white lowercase letters on the right.