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Petrochemical Feedstocks: Shale gas, coal to olefins, and the downstream impacts

Jim Foster, Editorial Director – Global Petrochemical Analytics

It depends on your perspective…

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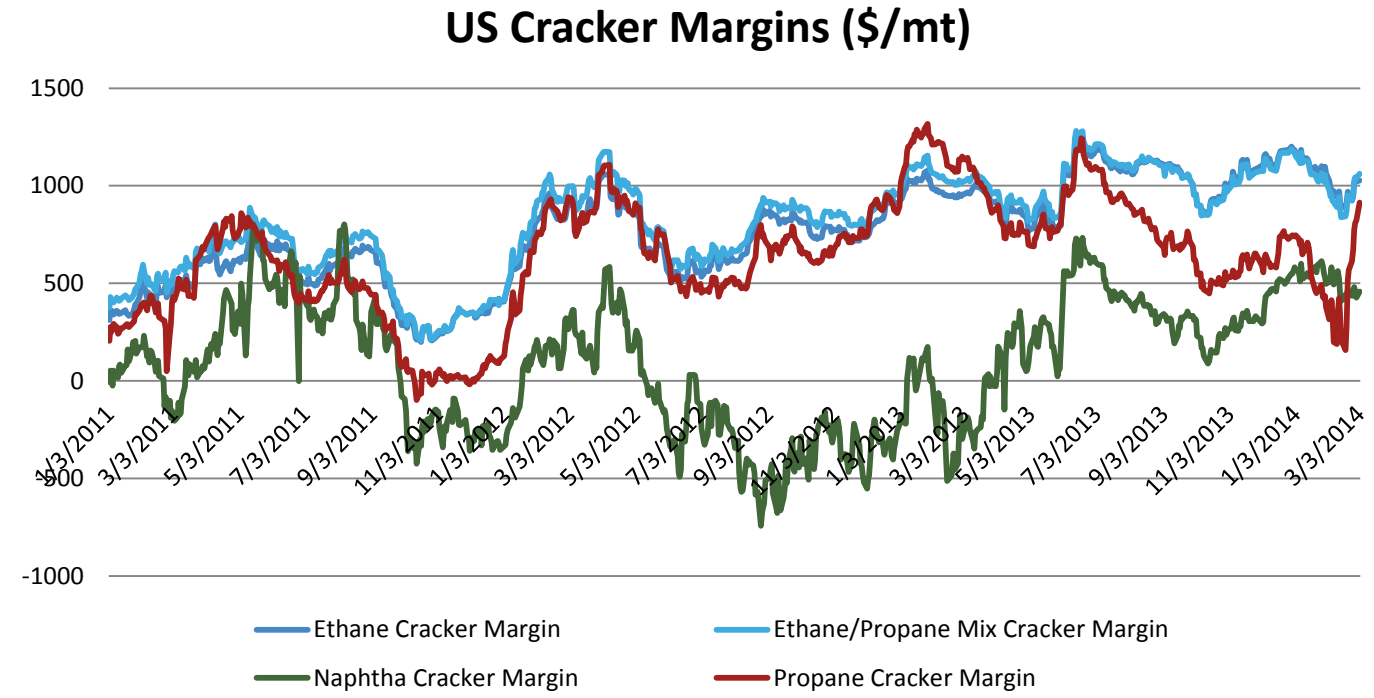
Motivation to build – and overbuild

- Cash costs and margins
- New cracker projects
- Downstream impacts
- The real game changer – CTO/MTO in China

Changing feed slates and co-product impacts

- Could co-product shortages be an issue?
- Propylene and PDH options
- The hidden curse – or blessing: Tight oil and naphtha oversupply

$1,000/mt margins for ethane to ethylene



Source: Platts

- Since early 2011, margins for US ethane and E/P Mix have climbed from $500/mt to $1,000/mt.
- Naphtha margins, though, fluctuate from negative to $500/mt.

US projects take advantage of ethane surplus

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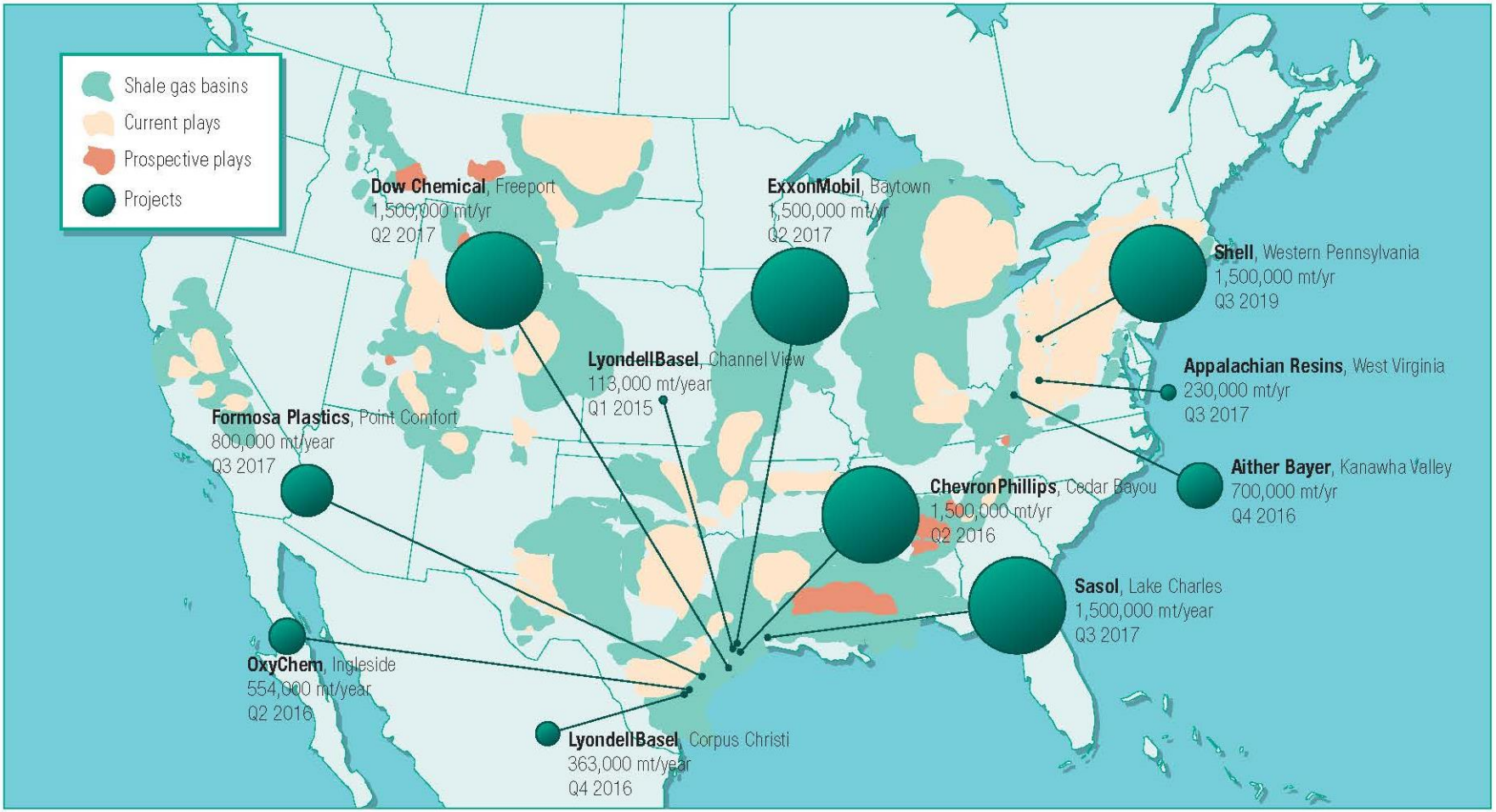
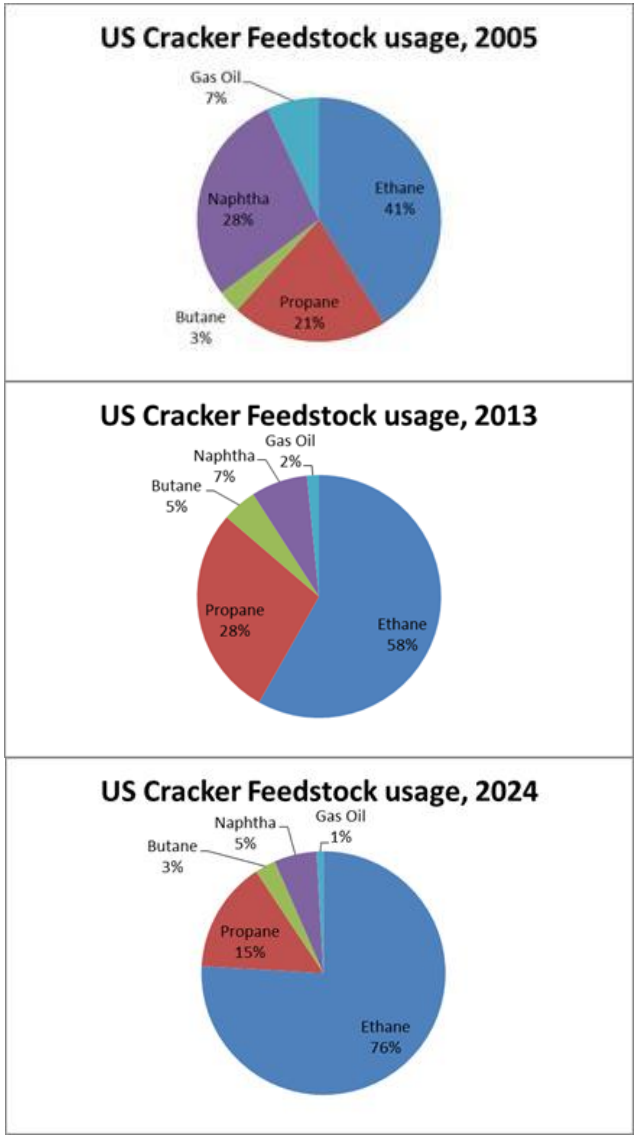


Source: EIA, Platts

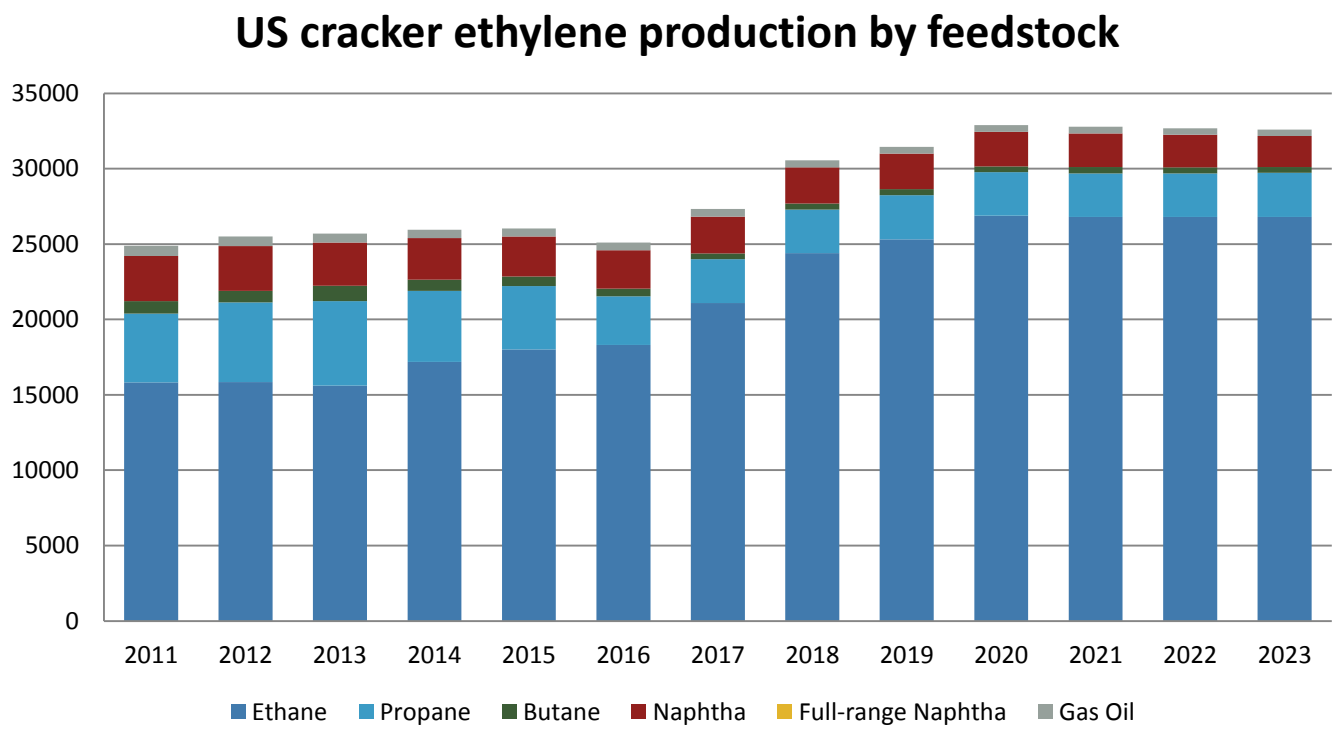
Ethane use to grow for next decade



Source: Platts

- Ethane consumption in US crackers has climbed from 41% of total feedstock in 2005 to 58% of total feedstock in 2013.
- Ethane is expected to account for 76% of US cracker feedstock by 2024.
  - Cut in propane use is necessitating PDH development.

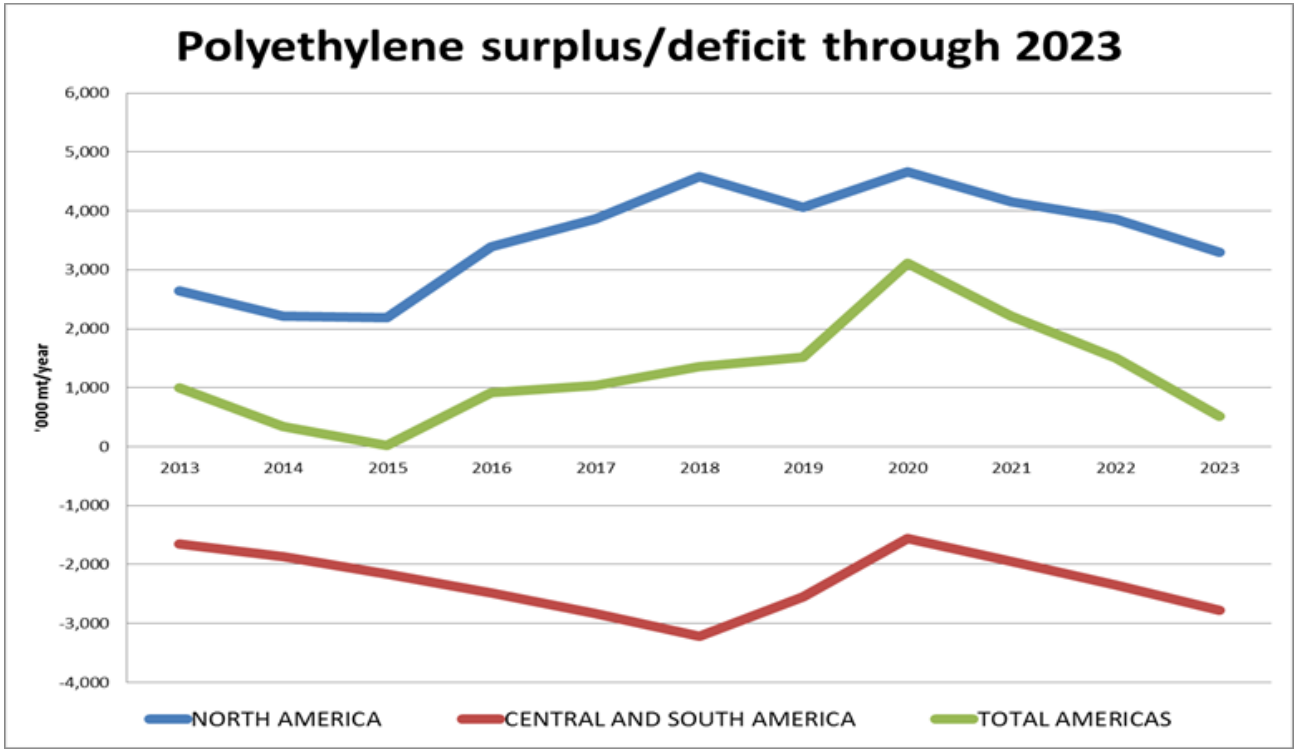
Ethylene product to grow by 27%



Source: Platts

- New cracker projects will add 7 million mt of new ethylene production annually.
- Most will be absorbed by polyethylene production.

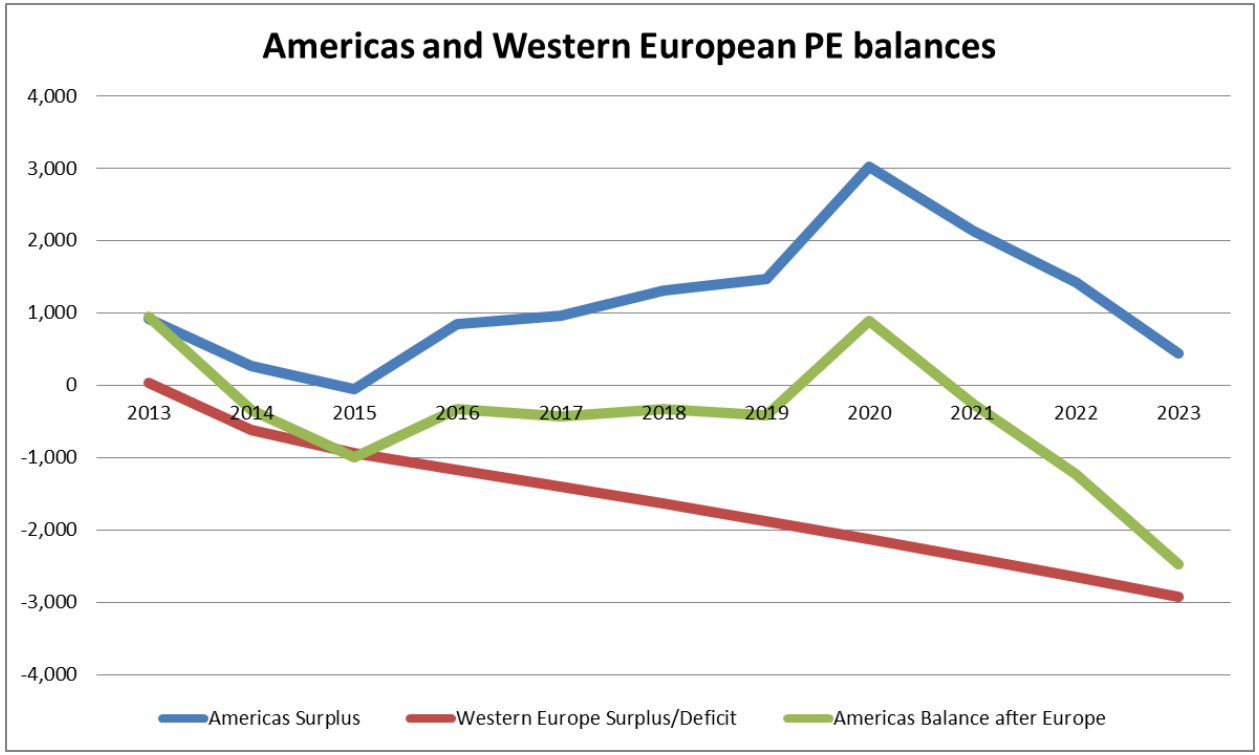
Latin America will not absorb all material



Source: Platts

- Regionally, PE is expected to be overbuilt from 2016 to 2023.
- Central and South America can absorb some, but not all, of that surplus.

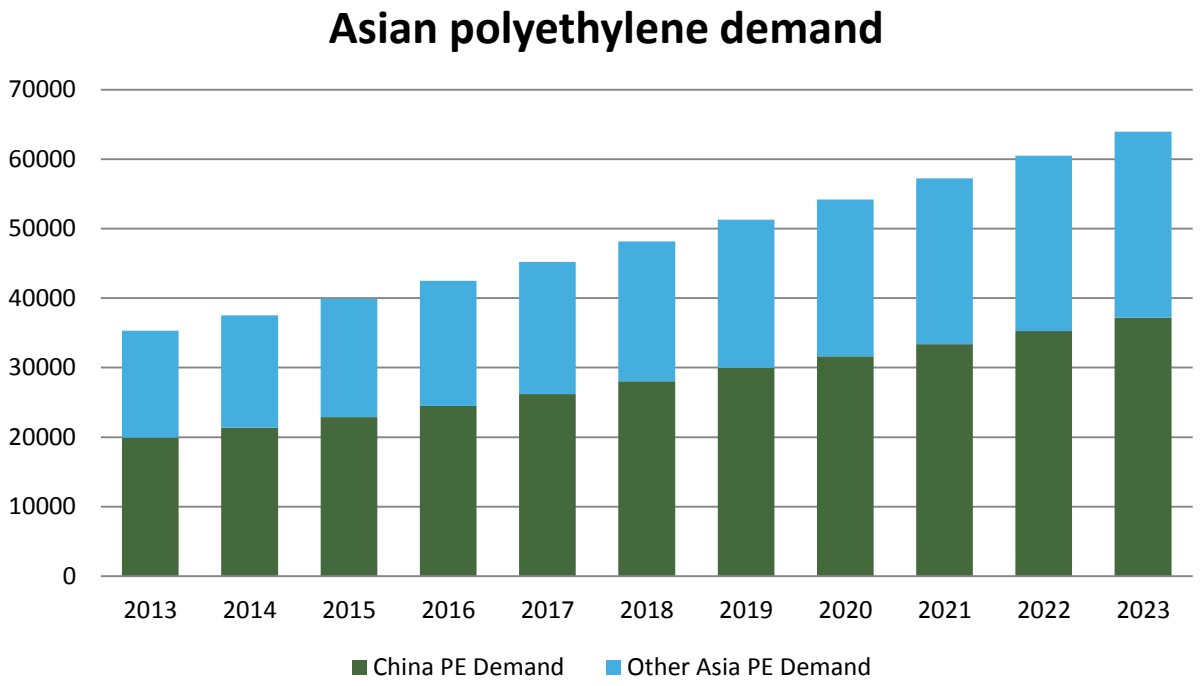
US will need to compete in Europe



Source: Platts

- Excess material from the Americas will need to compete in Asia or Europe.
- Europe could help balance the market through 2019, but supplies will be long in 2020-2022.

Asia is critical demand center



Source: Platts

- If China demand grows at just 75% of its forecasted GDP, PE demand is expected to climb by 67% during the next decade. The rest of Asia is expected to see demand grow 73%

New CTO/MTO projects

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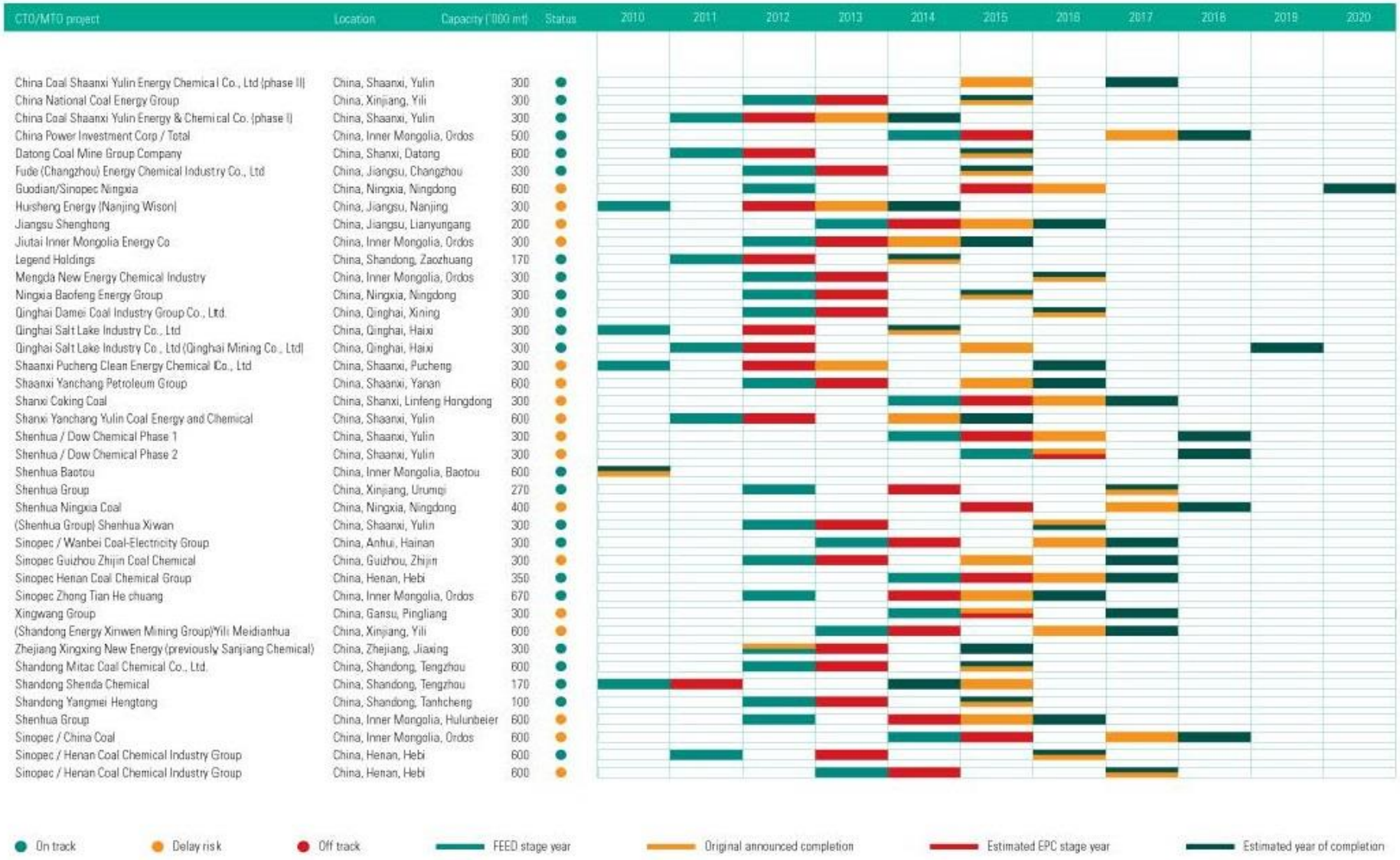

CTO/MTO project	Location	Capacity ('000 mt)	Status
China Coal Shaanxi Yulin Energy Chemical Co., Ltd (phase III)	China, Shaanxi, Yulin	300	On track
China National Coal Energy Group	China, Xinjiang, Yili	300	On track
China Coal Shaanxi Yulin Energy & Chemical Co. (phase I)	China, Shaanxi, Yulin	300	On track
China Power Investment Corp / Total	China, Inner Mongolia, Ordos	500	On track
Datong Coal Mine Group Company	China, Shanxi, Datong	600	On track
Fude (Changzhou) Energy Chemical Industry Co., Ltd	China, Jiangsu, Changzhou	330	On track
Guodian/Sinopec Ningxia	China, Ningxia, Ningdong	600	Delay risk
Hursheng Energy (Nanjing Wison)	China, Jiangsu, Nanjing	300	Delay risk
Jiangsu Shenghong	China, Jiangsu, Lianyungang	200	Delay risk
Jiutai Inner Mongolia Energy Co	China, Inner Mongolia, Ordos	300	Delay risk
Legend Holdings	China, Shandong, Zaozhuang	170	On track
Mengda New Energy Chemical Industry	China, Inner Mongolia, Ordos	300	On track
Ningxia Baofeng Energy Group	China, Ningxia, Ningdong	300	On track
Qinghai Damei Coal Industry Group Co., Ltd.	China, Qinghai, Xining	300	On track
Qinghai Salt Lake Industry Co., Ltd	China, Qinghai, Haixi	300	On track
Qinghai Salt Lake Industry Co., Ltd (Qinghai Mining Co., Ltd)	China, Qinghai, Haixi	300	On track
Shaanxi Pucheng Clean Energy Chemical Co., Ltd	China, Shaanxi, Pucheng	300	Delay risk
Shaanxi Yanchang Petroleum Group	China, Shaanxi, Yanan	600	Delay risk
Shanxi Coking Coal	China, Shanxi, Linfeng Hongdong	300	Delay risk
Shanxi Yanchang Yulin Coal Energy and Chemical	China, Shaanxi, Yulin	600	Delay risk
Shenhua / Dow Chemical Phase 1	China, Shaanxi, Yulin	300	Delay risk
Shenhua / Dow Chemical Phase 2	China, Shaanxi, Yulin	300	Delay risk
Shenhua Baotou	China, Inner Mongolia, Baotou	600	On track
Shenhua Group	China, Xinjiang, Urumqi	270	On track
Shenhua Ningxia Coal	China, Ningxia, Ningdong	400	Delay risk
(Shenhua Group) Shenhua Xiwan	China, Shaanxi, Yulin	300	On track
Sinopec / Wanbei Coal-Electricity Group	China, Anhui, Hainan	300	On track
Sinopec Guizhou Zhijin Coal Chemical	China, Guizhou, Zhijin	300	Delay risk
Sinopec Henan Coal Chemical Group	China, Henan, Hebi	350	On track
Sinopec Zhong Tian He chuang	China, Inner Mongolia, Ordos	670	On track
Xingwang Group	China, Gansu, Pingliang	300	Delay risk
(Shandong Energy Xinwen Mining Group)Yili Meidianhua	China, Xinjiang, Yili	600	Delay risk
Zhejiang Xingxing New Energy (previously Sanjiang Chemical)	China, Zhejiang, Jiaxing	300	On track
Shandong Mitac Coal Chemical Co., Ltd.	China, Shandong, Tengzhou	600	On track
Shandong Shenda Chemical	China, Shandong, Tengzhou	170	On track
Shandong Yangmei Hengtong	China, Shandong, Tanhcheng	100	On track
Shenhua Group	China, Inner Mongolia, Hulunbeier	600	Delay risk
Sinopec / China Coal	China, Inner Mongolia, Ordos	600	Delay risk
Sinopec / Henan Coal Chemical Industry Group	China, Henan, Hebi	600	On track
Sinopec / Henan Coal Chemical Industry Group	China, Henan, Hebi	600	Delay risk

CTO/MTO could flood global PE market

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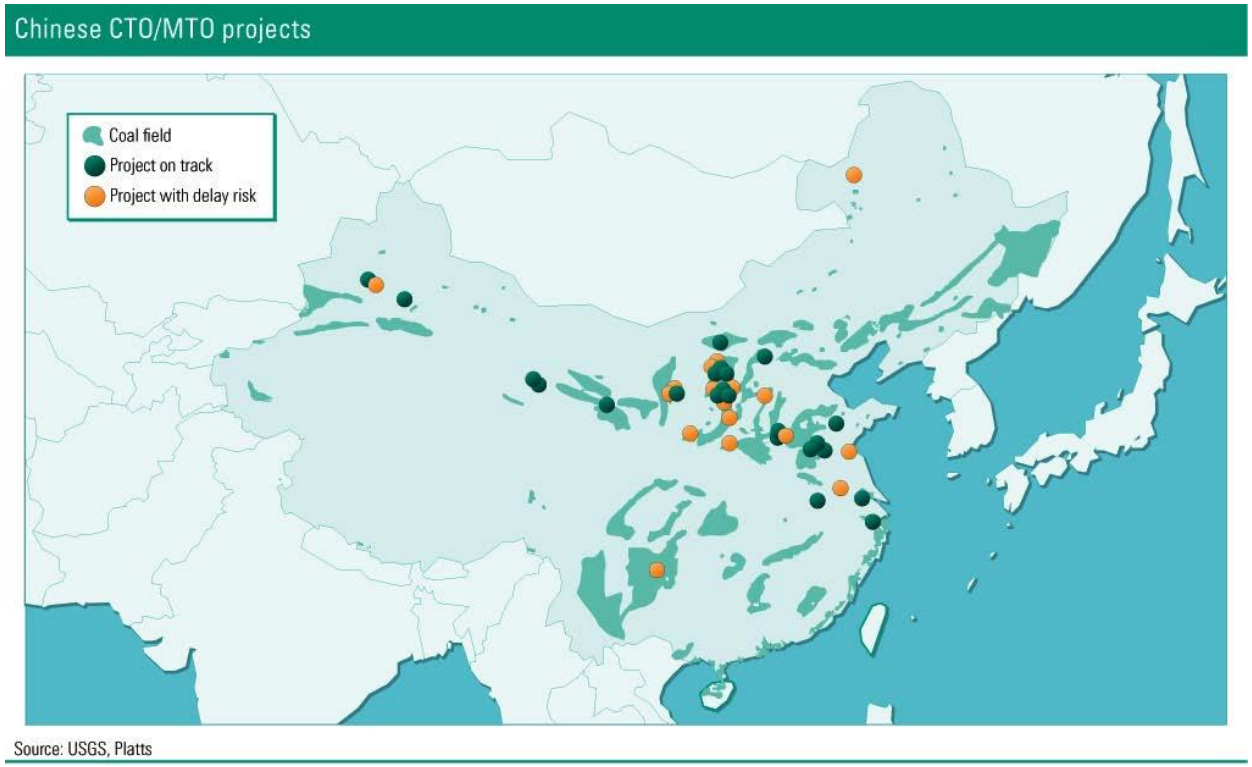
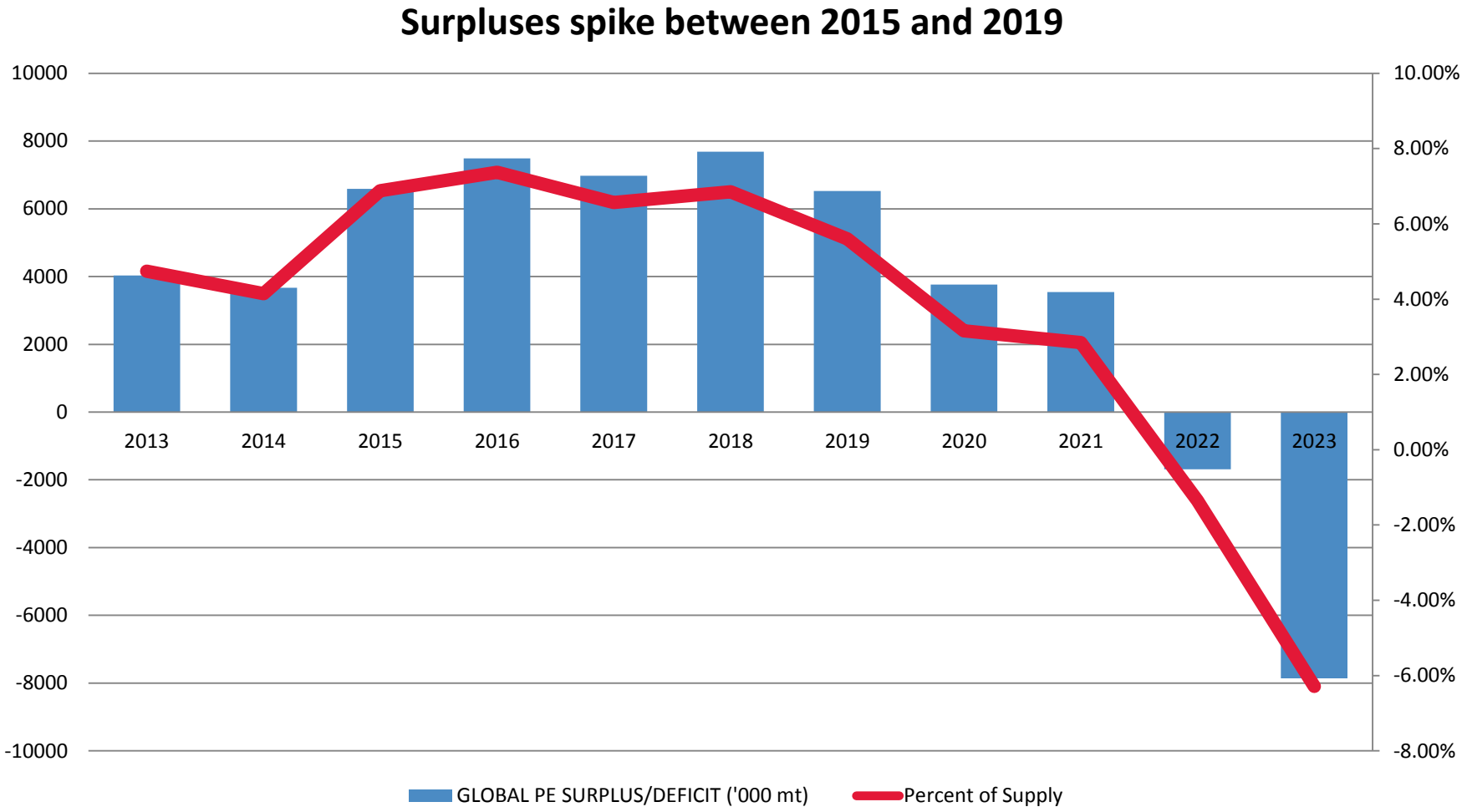


- CTO and MTO projects in China could add up to 10 million mt of new PE capacity in the country by 2020 – nearly equal to China's forecast demand growth.

Global surpluses expected



Other issues overbuilding can cause

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- Large global polyethylene surpluses are a real concern, specifically between 2016 and 2018.
- During those periods of global oversupply, US polyethylene run rates could be cut to 85%.
- These new projects face a real challenge getting enough skilled labor to build and run these units.
- In the United States, where feed stocks are secured, the future challenges are the cost of investment and delays in permitting.

Changing feed slates and co-product impacts

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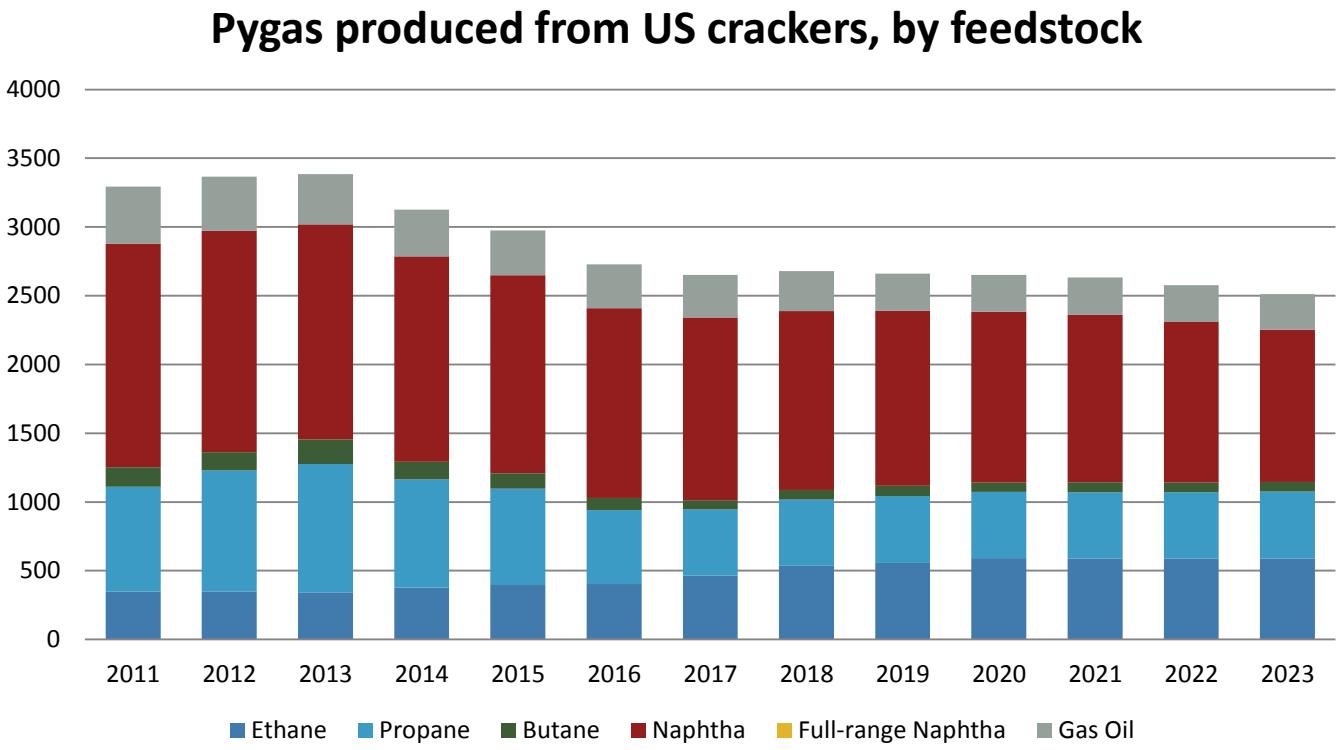
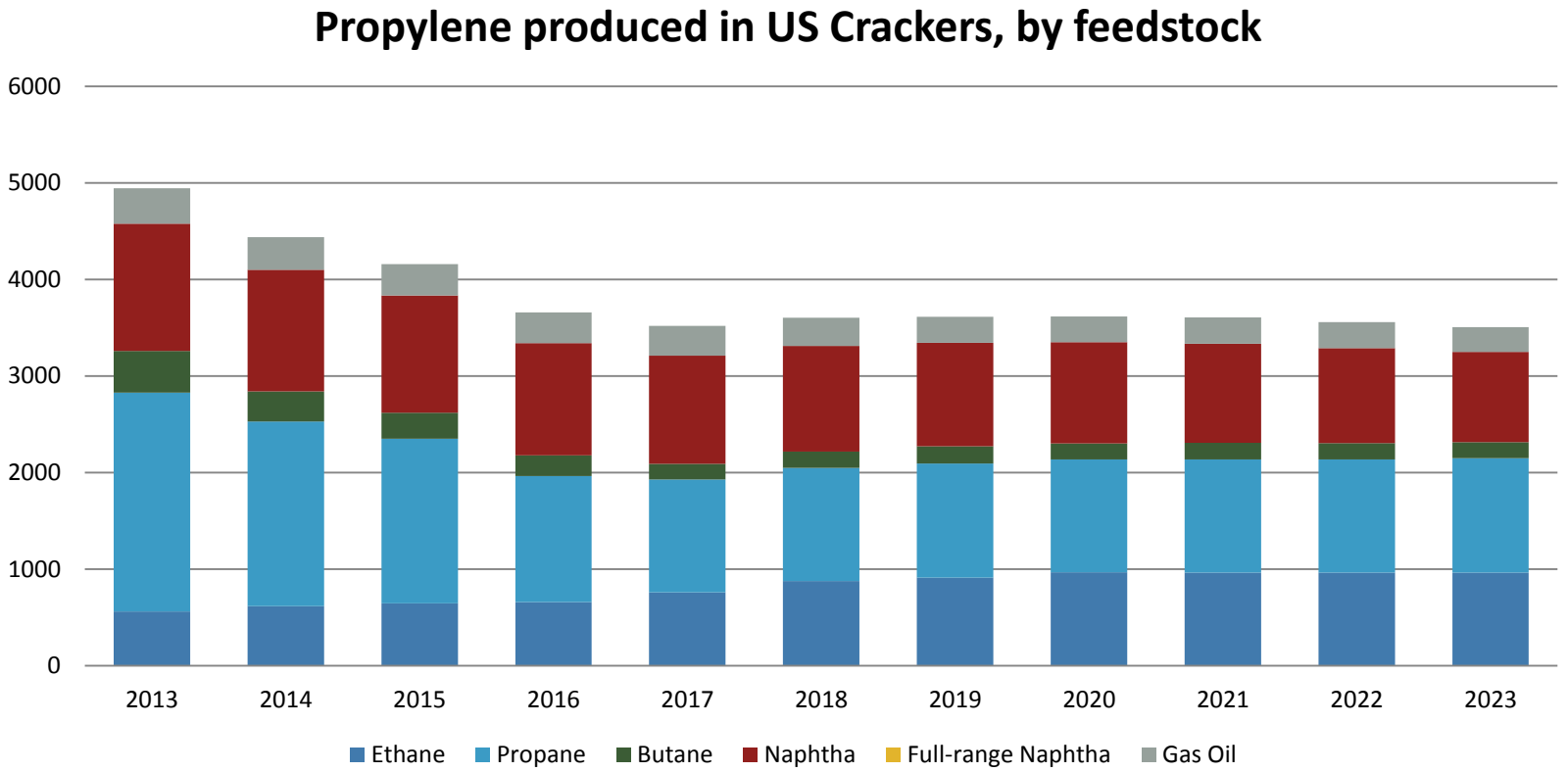
How hard will aromatics be hit?



- Benzene – 250,000 MT lost, 3% of capacity.
- Toluene – 75,000 MT lost, 1.5% of capacity.
- Xylenes – 65,000 MT lost, 1% of capacity.

Propylene is a much larger impact



- During the next decade, propylene produced by US crackers will fall 30% to 3.5 million metric tons in 2023 – down from just below 5 million metric tons in 2013. .

PDH announcements to make up for losses

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Dehydrogenation Units

Company	Feedstock	Location	Capacity (MMlbs/yr)	Demand (Mb/d)	In-Service Date
Dow Chemical	Propane	Freeport, TX	1650	29	2Q2015
Enterprise Products	Propane	Mont Belvieu, TX	1650	29	3Q2015
Formosa Plastics	Propane	Point Comfort, TX	1320	23	2Q2016
C3 Petrochemicals	Propane	Brazoria County, TX	2640	46	2Q2016
Williams (Canada)	Propane	Alberta, Canada	1100	19	4Q2015

- Total PDH capacity would approach 4.5 million metric tons.
- Profitability tied to inexpensive propane.
- Competition from commercial and residential fuel use could provide a price push for propane.

Watch the refinery

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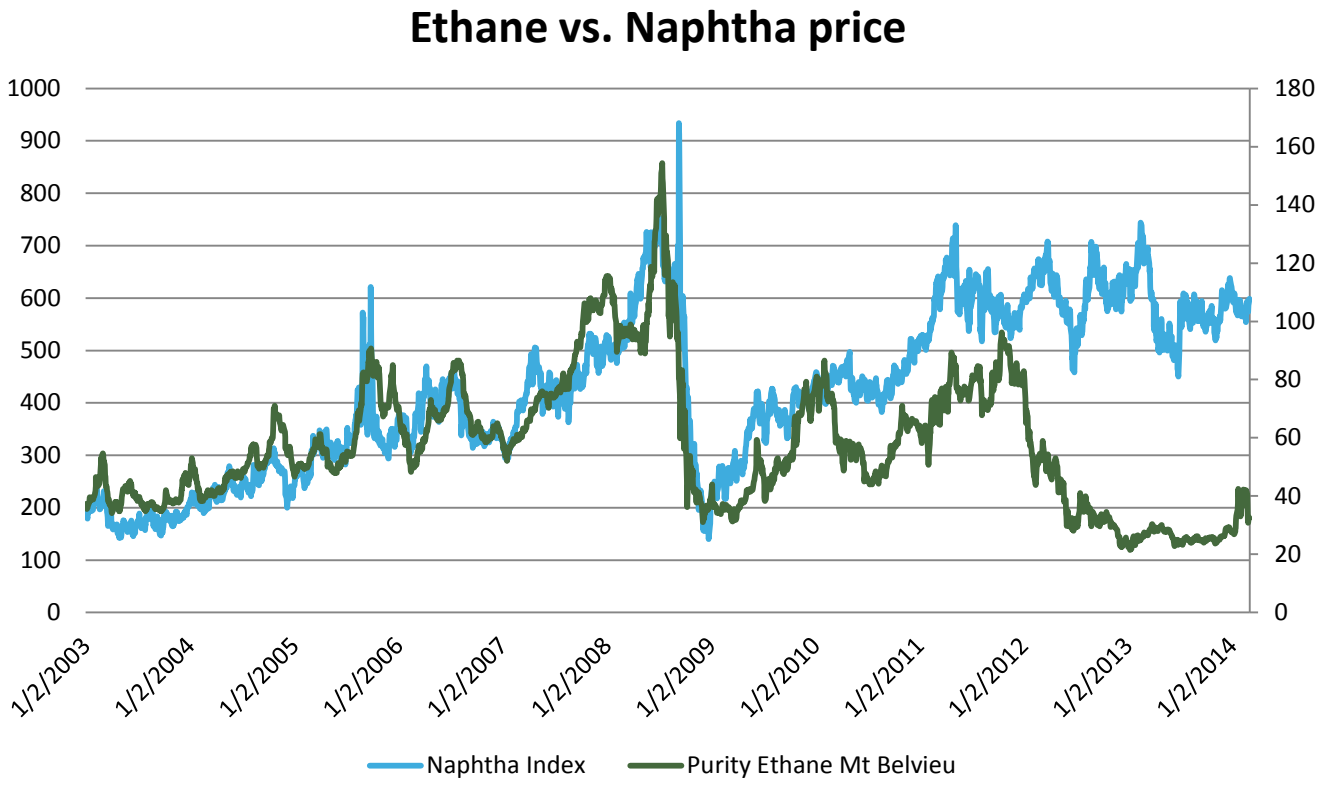
	Refinery Propylene in MMlbs from EIA	Cracker propylene production	Total propylene (Refineries + Crackers)	Percentage produced from crackers
2005	6,837	6,835	13,672	50%
2006	7,207	6,801	14,008	49%
2007	6,915	6,809	13,724	50%
2008	6,192	5,906	12,098	49%
2009	7,349	5,177	12,526	41%
2010	8,287	5,222	13,509	39%
2011	8,419	5,083	13,501	38%
2012	8,290	4,806	13,096	37%
2013	8,337	5,031	13,368	38%

Source: Bentek

- For propylene, as well as aromatics, refinery production will dominate the markets.
- There is a concern that outputs from refineries could fall – either from lower run rates or lower N+A content in tight oil.

Tight oil – the hidden curse (or blessing)



- The delta between naphtha and ethane is dictating ethane profitability.

Tight oil as influential as shale gas?

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- Increased ethane demand – and potential exports – could influence prices higher.
- Growing naphtha supplies could influence prices lower.
- A shrinking delta between naphtha and ethane would pinch the wide margins.

Questions?

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Thank you!

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