

Surf's up: Riding the petrochemical revival wave in North America

Bernardo Fallas, Managing Editor, Americas Petrochemicals – Platts
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- The ethylene boom – US projects at a glance
- Cheap feedstock and its effect on olefins pricing
- Cashing in through exports of polymer resin
- The propylene dilemma – is propane the savior?
- Other products being squeezed – butadiene, benzene
- Short-term implications for Mexico

- The North American petrochemical industry is bullish about the future thanks to the shale gas boom
- Olefins, in particular, are undergoing a renaissance – and dreaming big – less than 7 years after being left for dead

Ethylene – In the US alone, more than 11.5 million mt/year in announced greenfield expansions

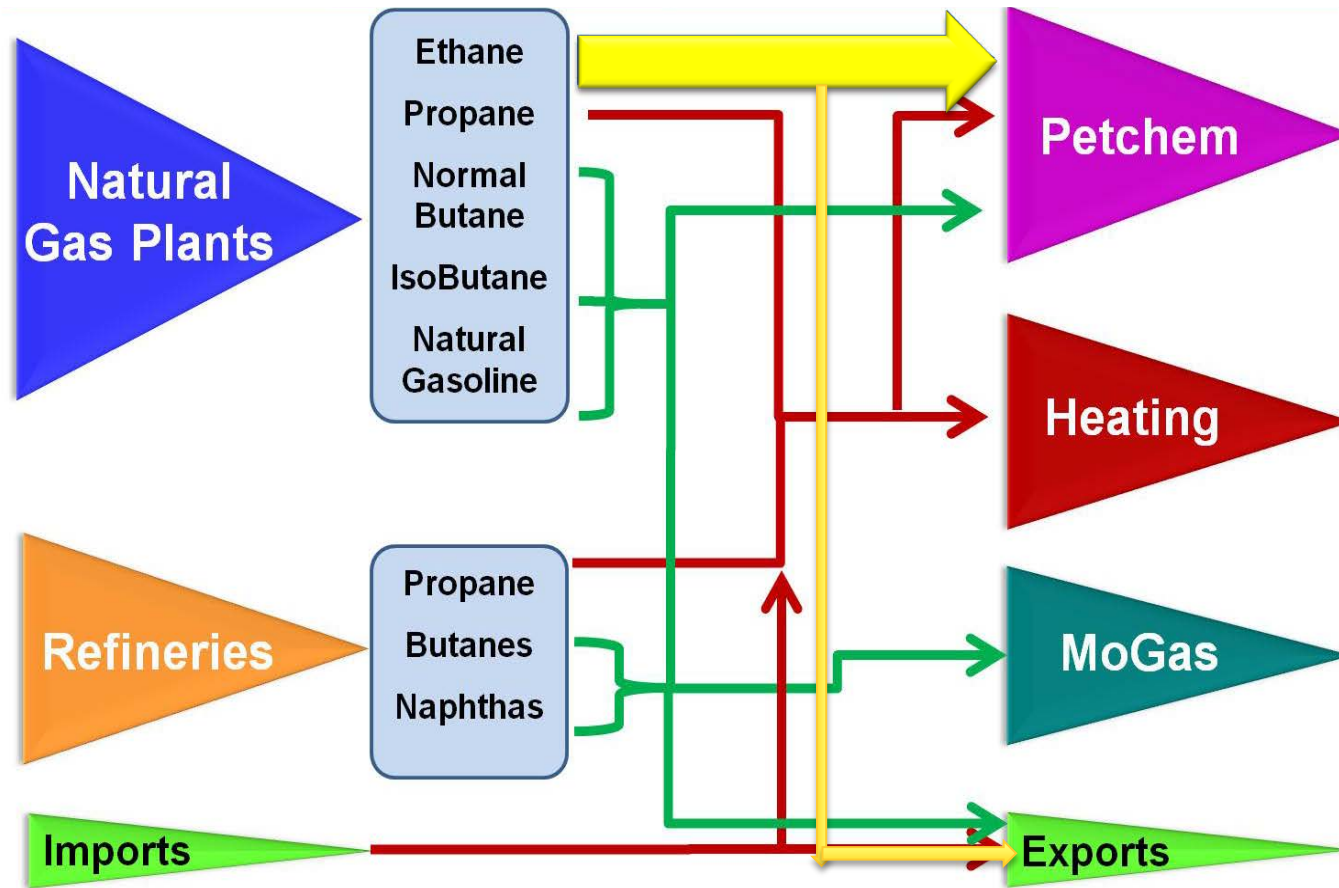
– Up to 2.45 million mt/year in brownfield

Propylene – Up to 4.1 million mt/year (greenfield)

Butadiene – TPC Group to expand on-purpose production

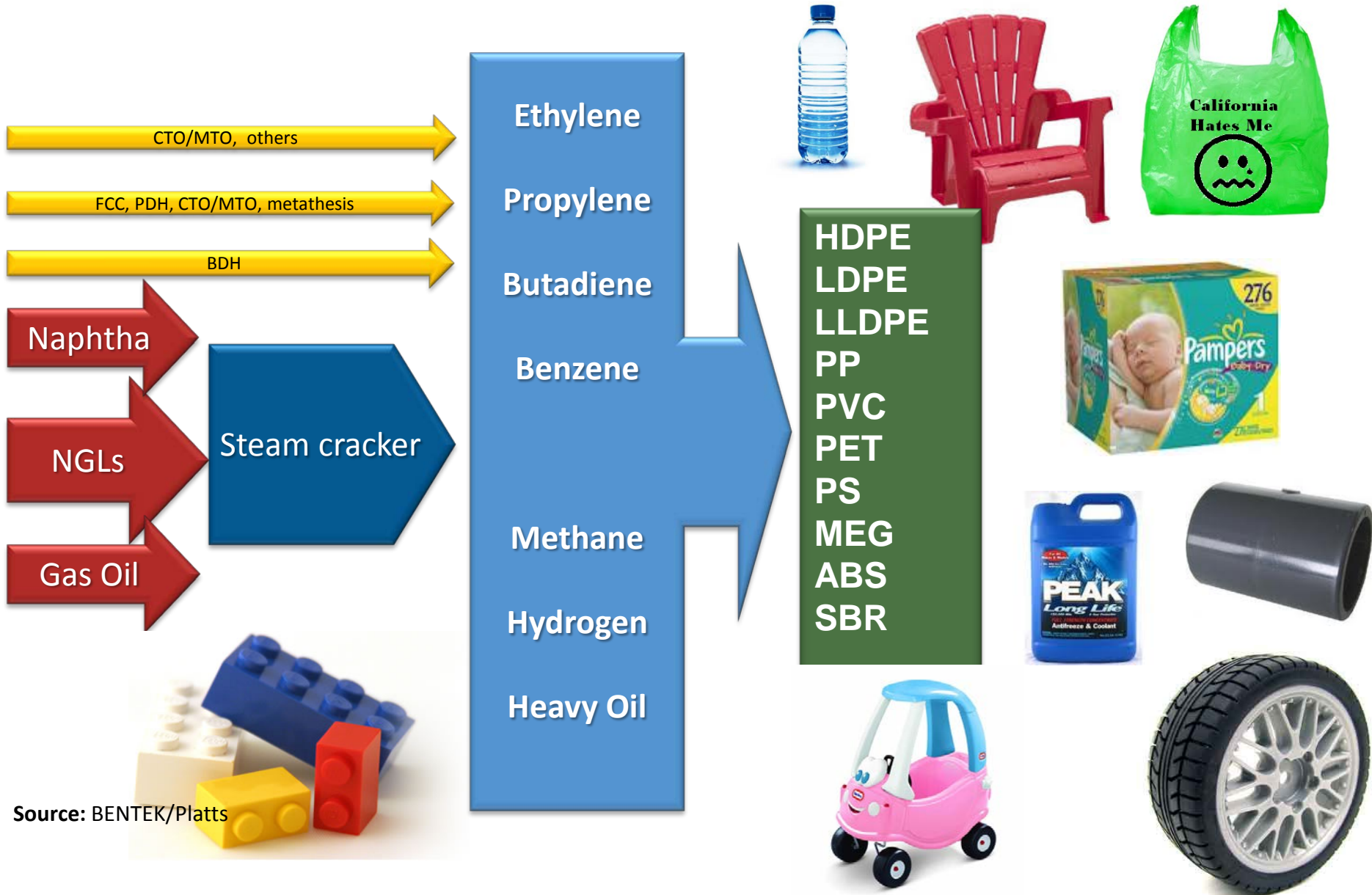
- Methanol production in North America is staging an impressive comeback after years of exile

Shale gas & petchems– the link



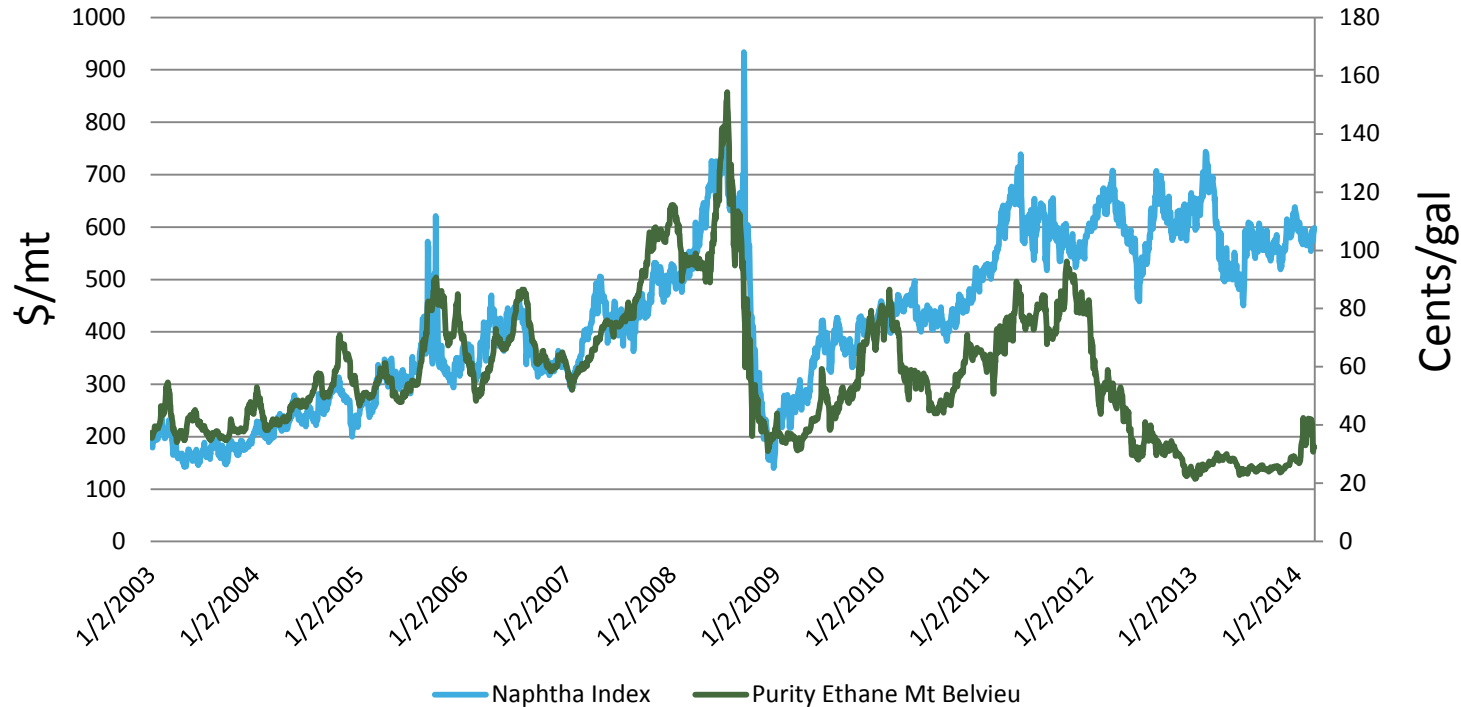
Source: BENTEK/Platts

Olefins are key building blocks



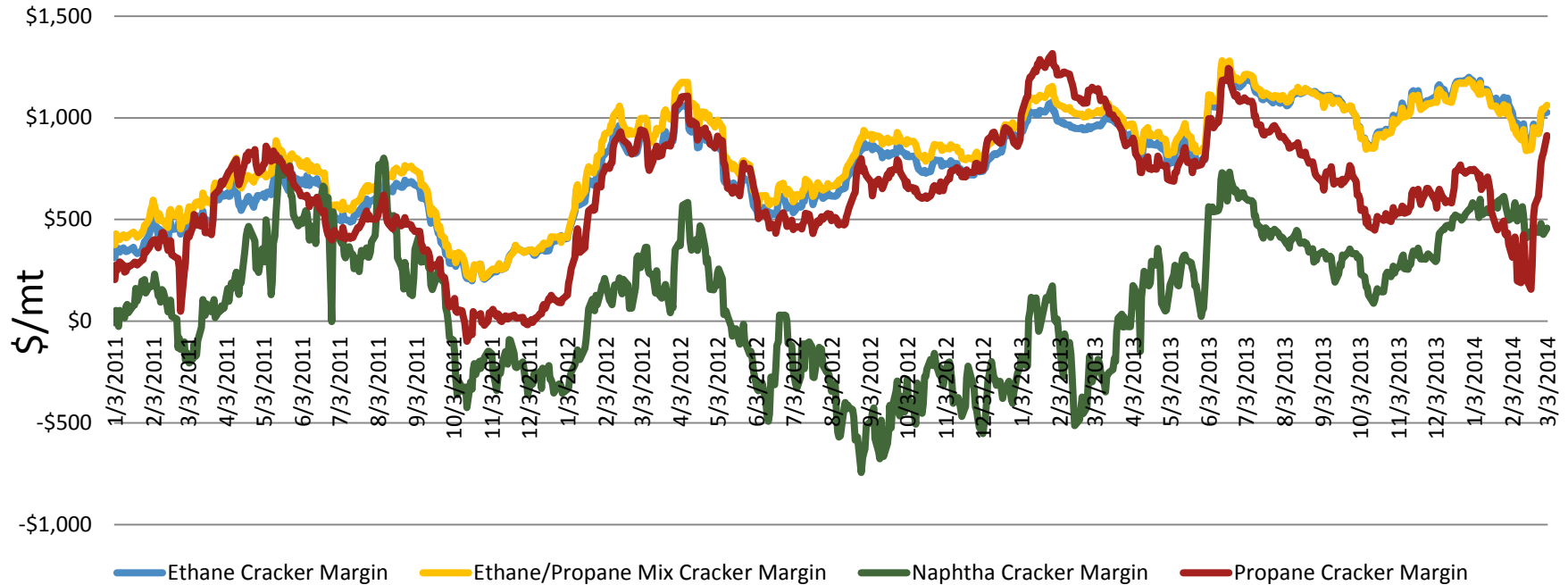
Source: BENTEK/Platts

Ethane vs. Naphtha price



- The delta between feedstocks is dictating ethane profitability
- Crude-to-gas ratio has more than doubled since 2008

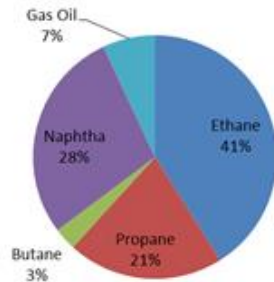
US cracker margins



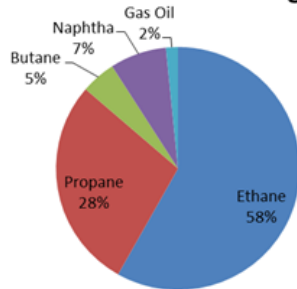
Source: Platts

Since early 2011, margins for US ethane and E/P Mix have climbed from \$500/mt to \$1,000/mt; naphtha margins fluctuate

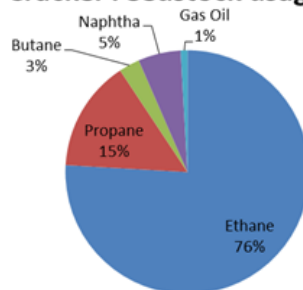
US Cracker Feedstock usage, 2005



US Cracker Feedstock usage, 2013



US Cracker Feedstock usage, 2024



- 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
 - Aromatics output at the cracker has diminished, contributing to a tighter benzene market

North American ethylene at a glance

Cheap feedstock, projected PE demand drive expansions



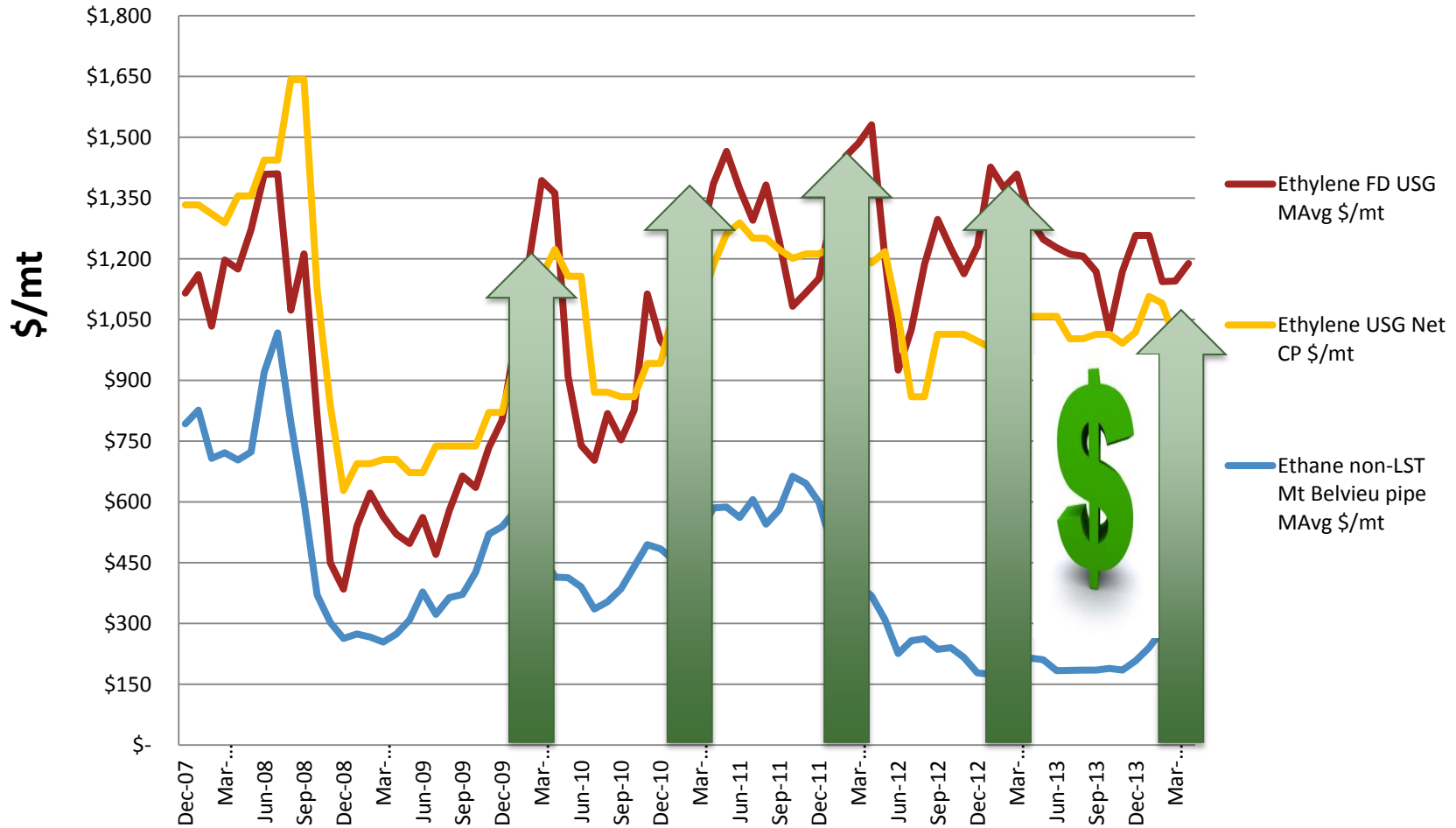
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Spot is becoming indifferent to ethane

Ethylene contract vs. spot price vs. ethane



Source: Platts

US olefins producers are “all in”

Company	Location	,000 mt/yr	ETA
Formosa Plastics CUSA	Texas	1,200-1,500	2017
ExxonMobil Chemical 	Texas	1,500	2017
Chevron Phillips Chemical	Texas	1,500	2017
Dow Chemical 	Texas	1,500	2017
Sasol	Louisiana	1,500	2017
Occidental/Mexichem 	Texas	550	2017
Appalachian Resin	W. Virginia	250	2017
Aither Chemical/RMG	W. Virginia	200-300	2017
Odebrecht (Braskem)	W. Virginia	1,000-1,500	2018
Axiall	Louisiana	1,000	2019
Shin-Etsu (Shintech)	Louisiana	1,000	2019
Shell Chemical	Pennsylvania	1,000-1,500	2019

Source: Company announcements, Platts

Brownfields: Good barometers

Company	Location	+,000 mt/yr	ETA
BASF-Total	Texas	60	2012
Dow Chemical (restart)	Louisiana	400	2012
Westlake Chemical	Louisiana	110	2013
Williams	Louisiana	230	2013
BASF-Total	Texas	100	2014
Westlake Chemical	Kentucky	80	2014
Ineos	Texas	120	2014
Westlake Chemical	Louisiana	110	2015
LyondellBasell	Texas (3)	830	2014-16
Dow Chemical	TX/LA (2)	400	2014-16

Source: Company announcements, Platts

North American PE expansions

Company	Location	,000 mt/yr	Grade(s)	ETA
Braskem/Grupo Idesa	Coatza., MEX	1,000	HD, LD	2015
Nova Chemicals	Joffre, CAN	450	LLD	2015
LyondellBasell	Texas	450	LD, LLD	2016
Ineos/Sasol	Texas	470	HD	2017
Sasol	Louisiana	420	LD	2017
Dow Chemical	Texas	TBD	LD, EPDM	2017
ChevronPhillips	Texas	1,000	HD, LLD	2017
ExxonMobil Chemical	Texas	1,300	HD, LLD	2017
Formosa Plastics CUSA	Texas	300	LD	2018
Sasol	Louisiana	450	HD, LLD	2018
Nova Chemicals	Sarnia, CAN	500	TBD	2018+
Shell Chemical	Pennsylvania	1,000	TBD	2018+
Odebrecht (Braskem)	W. Virginia	TBD	TBD	2019

CENTRAL & SOUTH AMERICA *for* POLYETHYLENE

Capacity, Production and Demand Outlook

To what extent would the new U.S. PE capacity affect Asia's exports to Central and South America?

For more information visit: www.platts.com/ppa

U.S. Demand & Production 2014/2023



Central and South America Demand & Production 2014/2023



PE Expansion Projects Through 2022

Project	Startup
1 Etileno XXI	2015
2 Olefinas III	2019
3 PIS	2019
4 Comperi	2020+
5 Bolivia	2022

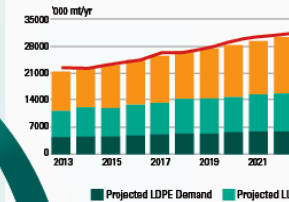
★ 600,000 mt/yr ★ 1,000,000 mt/yr

Asia Imports

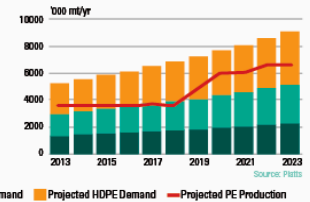
Peru has the highest import share from Asia at 22.6%, for 60,000 mt.

Thailand and Korea are the two largest Asian PE exporters to Central and South America.

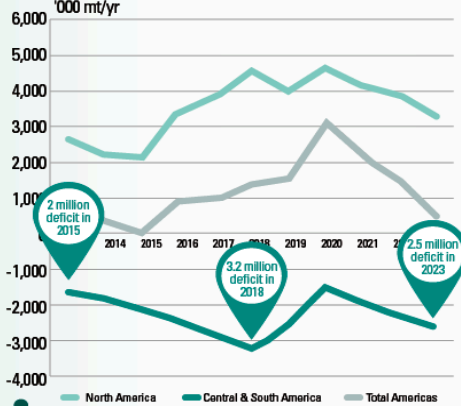
Americas to be Balanced by 2023



Central & South America PE Deficit to Attract Imports

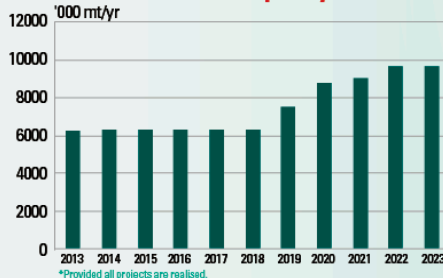


Polyethylene Surplus/Deficit Through 2023



Central and South America can absorb some, but not all, of that surplus

South America PE Capacity 2013/2023



*Provided all projects are realised.

Did You Know?

Brazil

The country is the biggest importer by volume, but less than 9% of that PE comes from Asia.

Chile

It is expected to have the largest LLDPE deficit in the region at 755,000 mt/yr by 2023.

North America

PE surplus to peak at 3.5 million mt/yr in 2017

Mexico

Despite Etileno XXI, it will remain a net importer, with deficits climbing to 1.6 million mt/yr by 2023.

- Demand '000 mt/yr
- Production '000 mt/yr
- Platts Key Assessment Hubs
- Imports
- Exports

Argentina's LDPE deficit to grow to 237,000 by 2023.

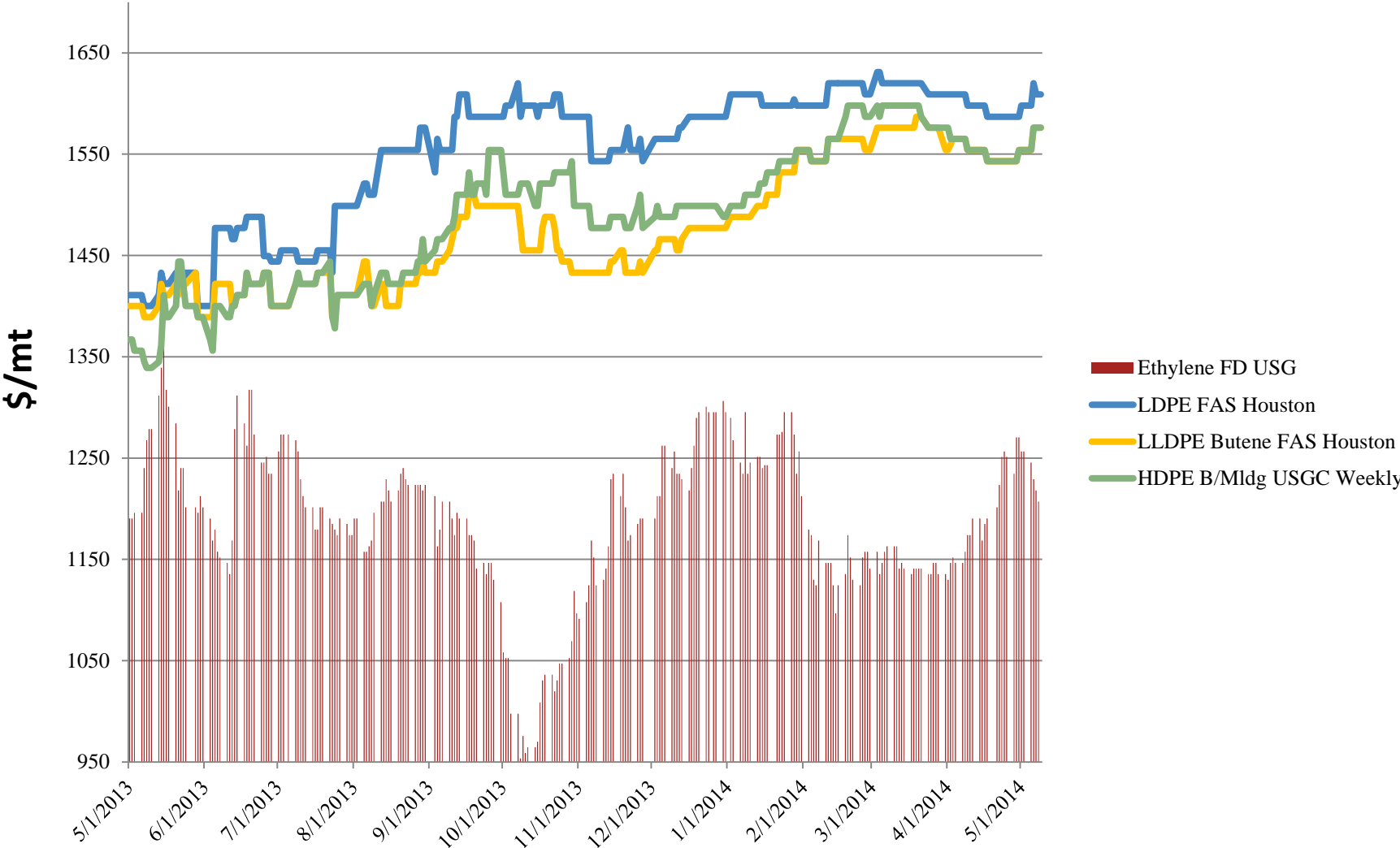
Top US PE Export Destinations

Country	2012 (MT)	2000-2012 (MT)
Mexico	980,949	10,751,045
Canada	593,670	7,228,356
China	173,140	2,962,309
Colombia	138,962	1,067,259
Brazil	165,176	980,295
Belgium	85,228	930,664
Hong Kong	62,036	847,535
Peru	99,407	785,584
Guatemala	67,362	763,976
Ecuador	55,040	723,765

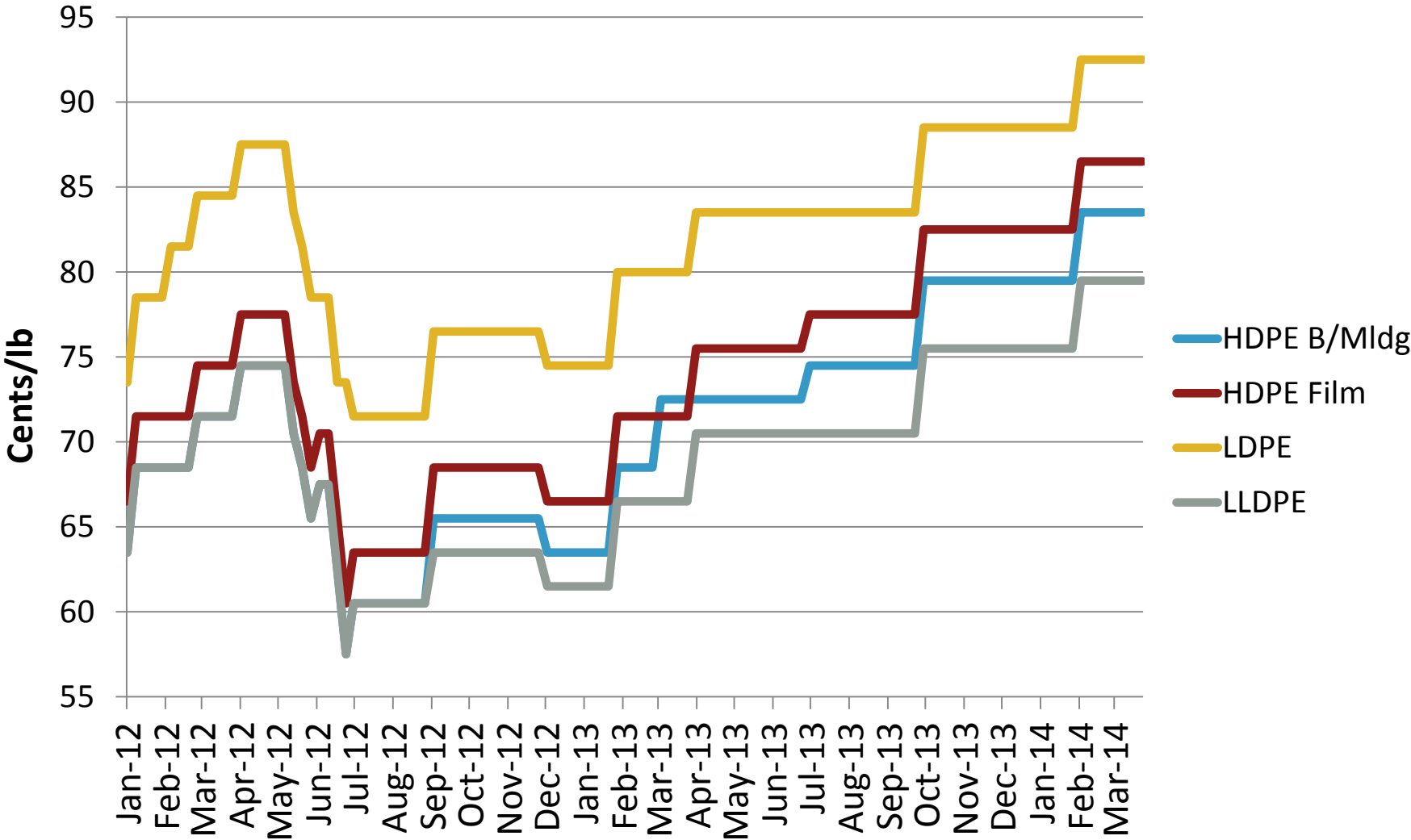
Source: U.S. Dept. of Commerce/US International Trade Commission



Export shows disconnect with C2



US domestic contract PE prices



Source: Platts

Company	Location	+,000 mt/yr	ETA
Westlake Chemical	Kentucky	80	2014
Shintech	Louisiana	300	2016

Source: Company announcements, Platts

- Caustic, ethylene expansions have translated in additional PVC capacity projects, although scope is currently limited
- However, cracker project announcements by Shintech, Axiall and Oxychem/Mexichem could signal expansions
- Dow Chemical's proposed divestment of its \$5 billion chlor-alkali, chlor vinyls business adds new wrinkle to North American market

North American propylene at a glance

Shift to light feeds has diminished production, injecting volatility in pricing

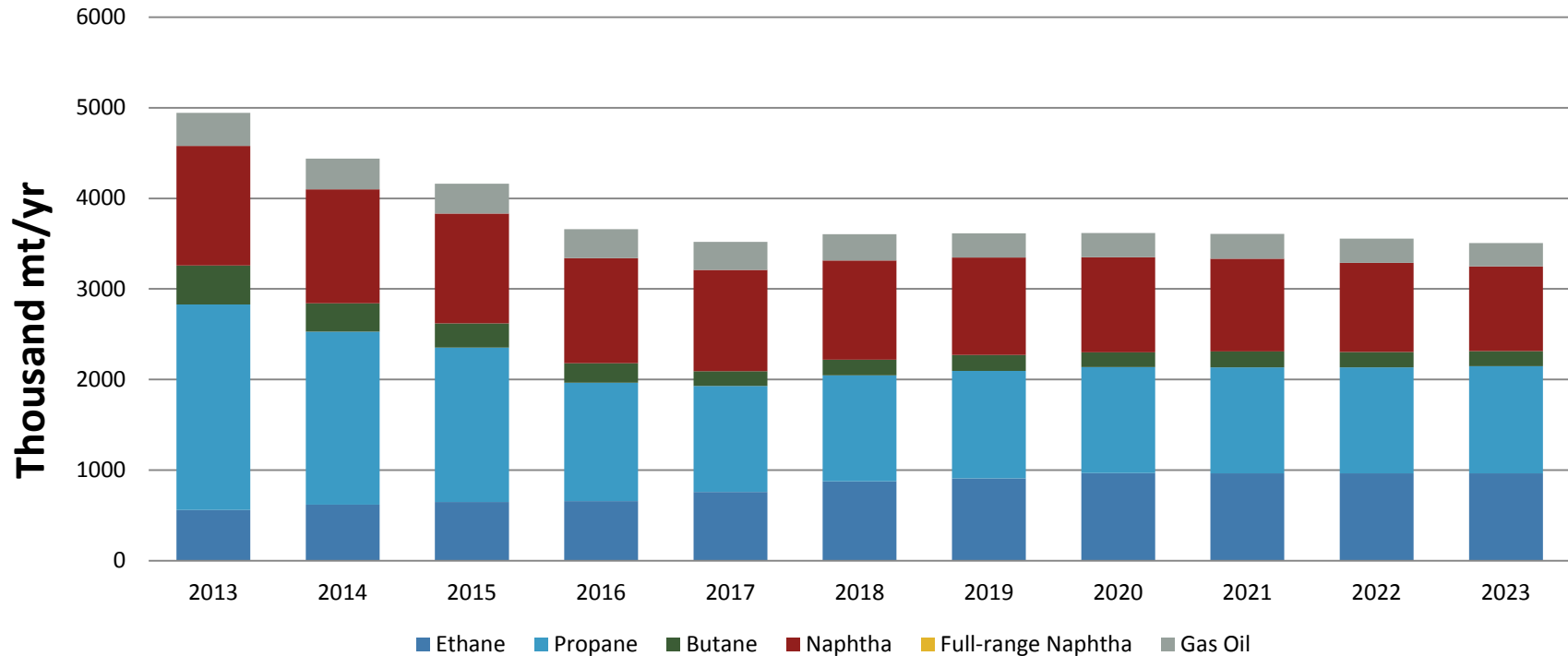


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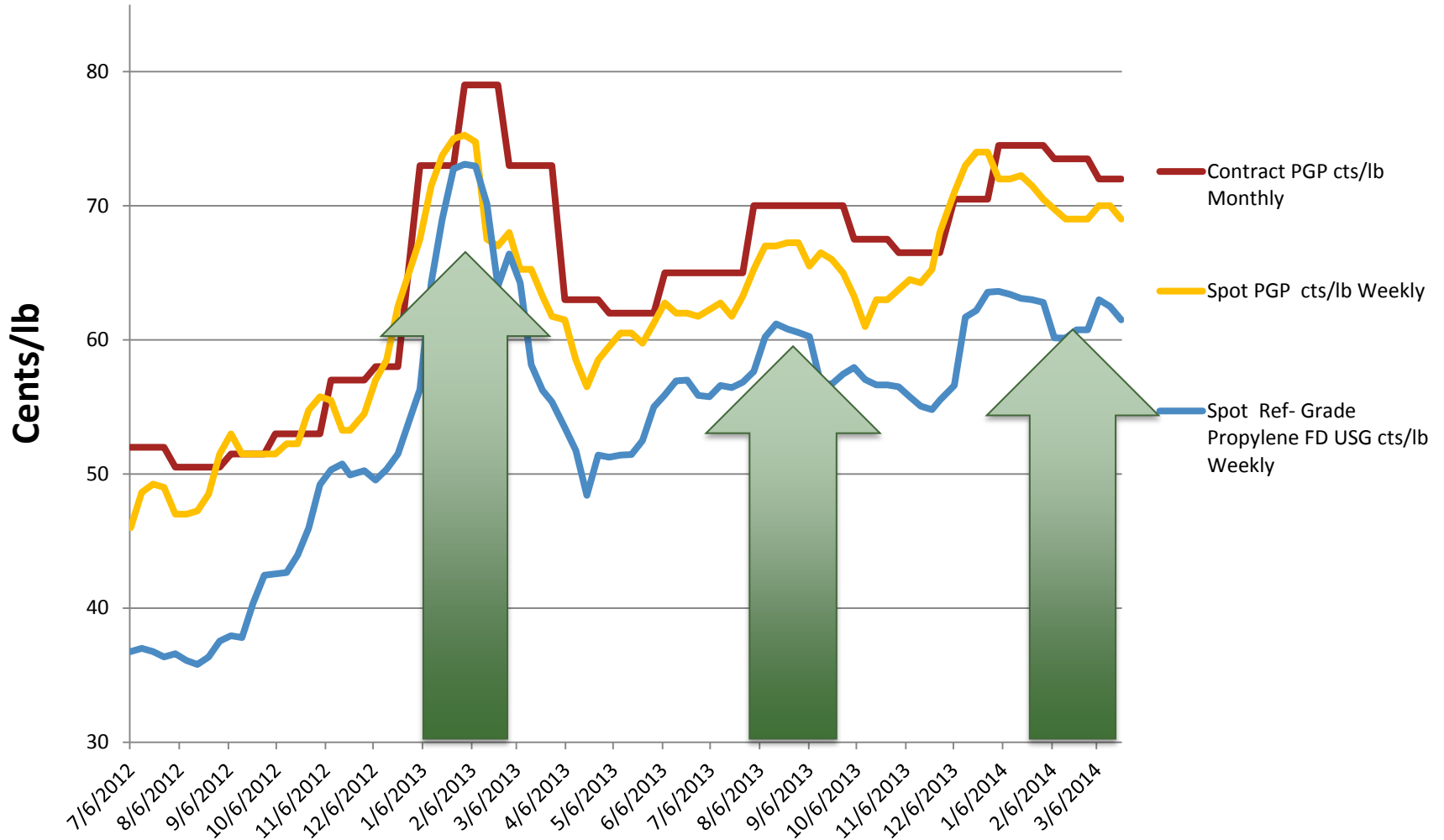
Propylene produced in US crackers, by feedstock



Source: Platts

During the next decade, propylene produced by US crackers will fall 30% to 3.5 million metric tons

Tightening supply yields volatility



Source: Platts

Propane: The propylene lifeline?

Company	Location	,000 mt/yr	ETA
Dow Chemical (PDH)	Freeport, TX	750	2015
Enterprise Products (PDH)	Mt. Belvieu, TX	750	2015
C3 Petrochemicals (PDH)	Alvin, TX	1,200	2015
Formosa Plastics CUSA (PDH)	Point Comfort, TX	600-750	2016
Williams (PDH)	Alberta, Canada	500	2016
REXTac (PDH)	Odessa, TX	300	2016
Dow Chemical (PDH II) *	TBD/USG	TBD	2018
Enterprise Products (PDH II) *	TBD/USG	TBD	TBD
Williams (PDH II) *	news Alberta, Canada	TBD	TBD
BASF (MTO) *	news TBD/USG	TBD	TBD
PetroLogistics (PDH)	news Houston, TX	Expansion	---
LyondellBasell (metathesis)	Texas	Expansion	---

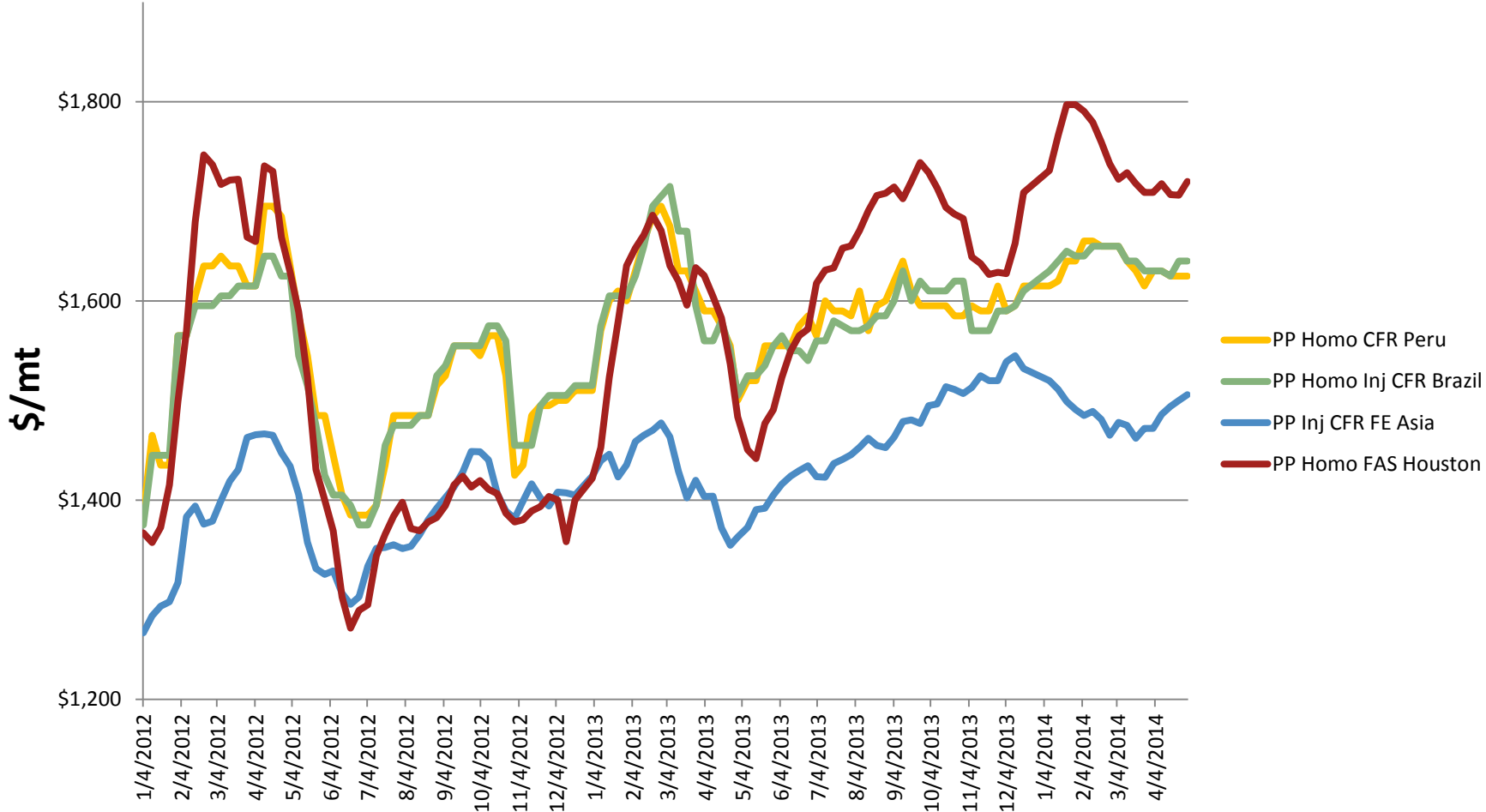
Source: Company announcements, Platts

Company	Location	,000 mt/yr	ETA
RexTac	Odessa, TX	270	H2 2016

Source: Company announcements, Platts

- Despite several on-purpose propylene projects, only one PP expansion has been announced
- For the past few years, the business has looked unattractive, with the likes of Dow and Sunoco exiting it all together
- In 2012, Chevron Phillips and Sumika ended a JV in Pasadena, Texas, taking 320,000 mt/year out of the market

US PP uncompetitive globally



Source: Platts

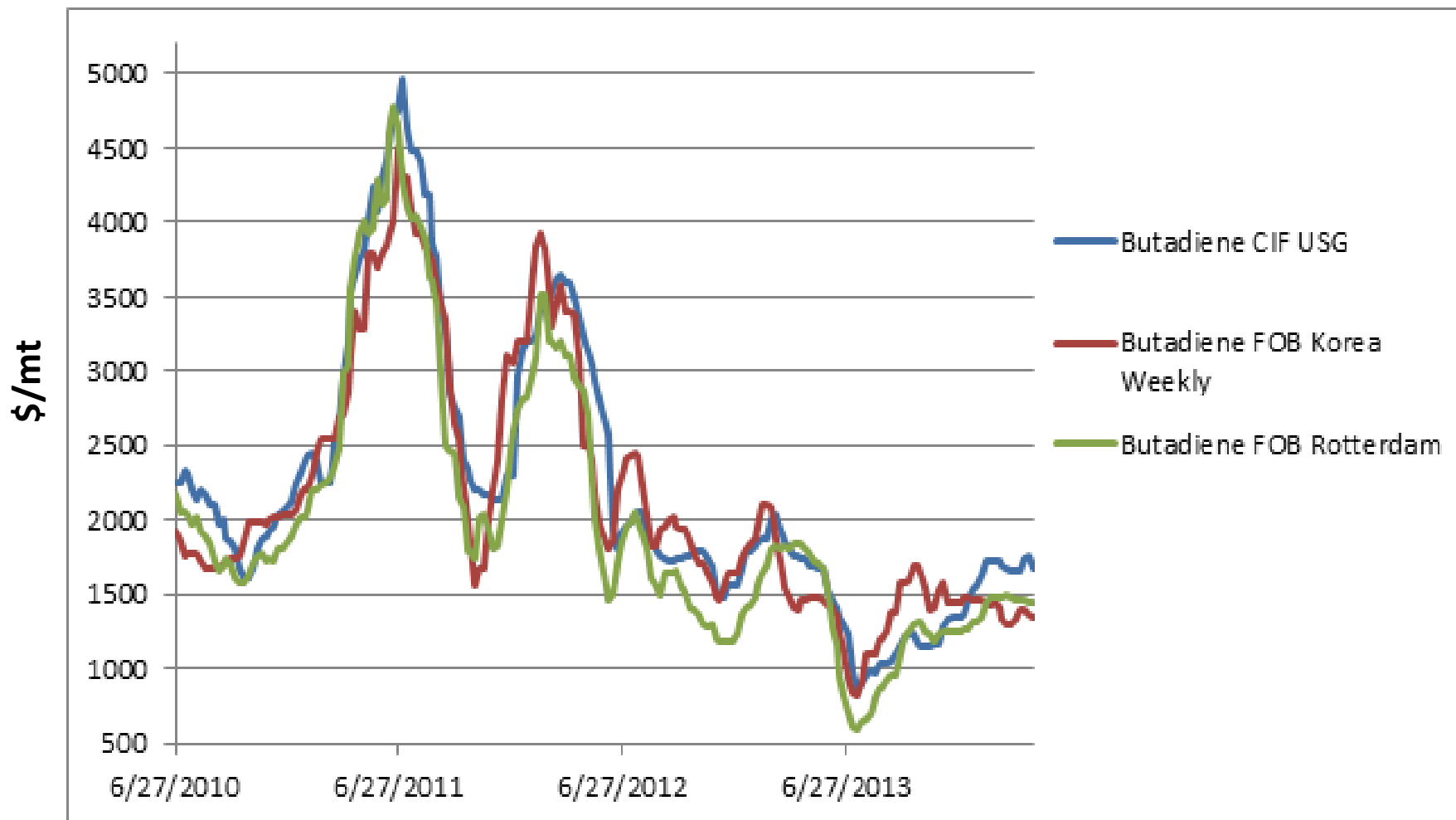
North American butadiene at a glance

Demand expected to outstrip supply globally, with the automotive sector the key driver; US expansions limited despite feedstock availability

Company	Location	,000 mt/yr	ETA
TPC Group (BDH)	Houston, TX	295 (isobutylene)	2014
TPC Group (OXO-D)	Houston, TX	272 (butadiene)	2016

- Restart of dehydrogenation assets to provide isobutylene feedstock for MTBE, PIB, HP isobutylene and diisobutylene
- Engineering design optimization for TPC OXO-D unit due late 2013
- Engineering also underway for PIB expansion

Global butadiene comparison

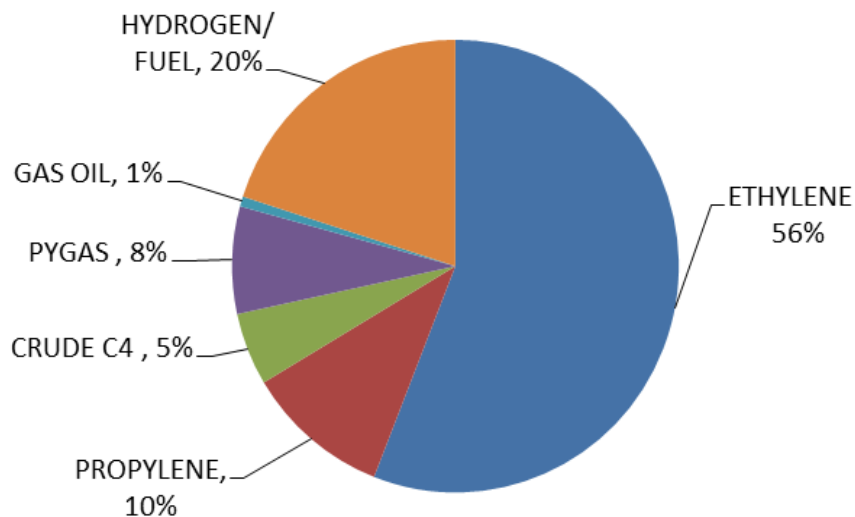


Source: Platts

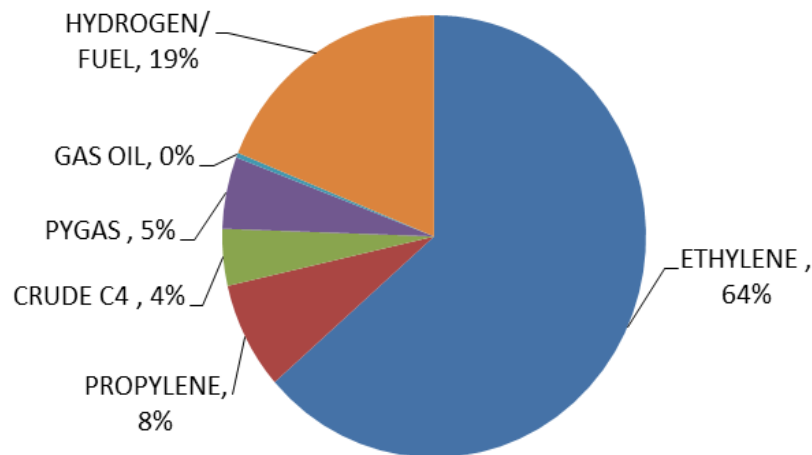
North American benzene at a glance

The region, but especially the US, is net-short; dropping production at the cracker will only tighten supply and apply price pressure to downstream markets

US Cracker Co-Products 2012



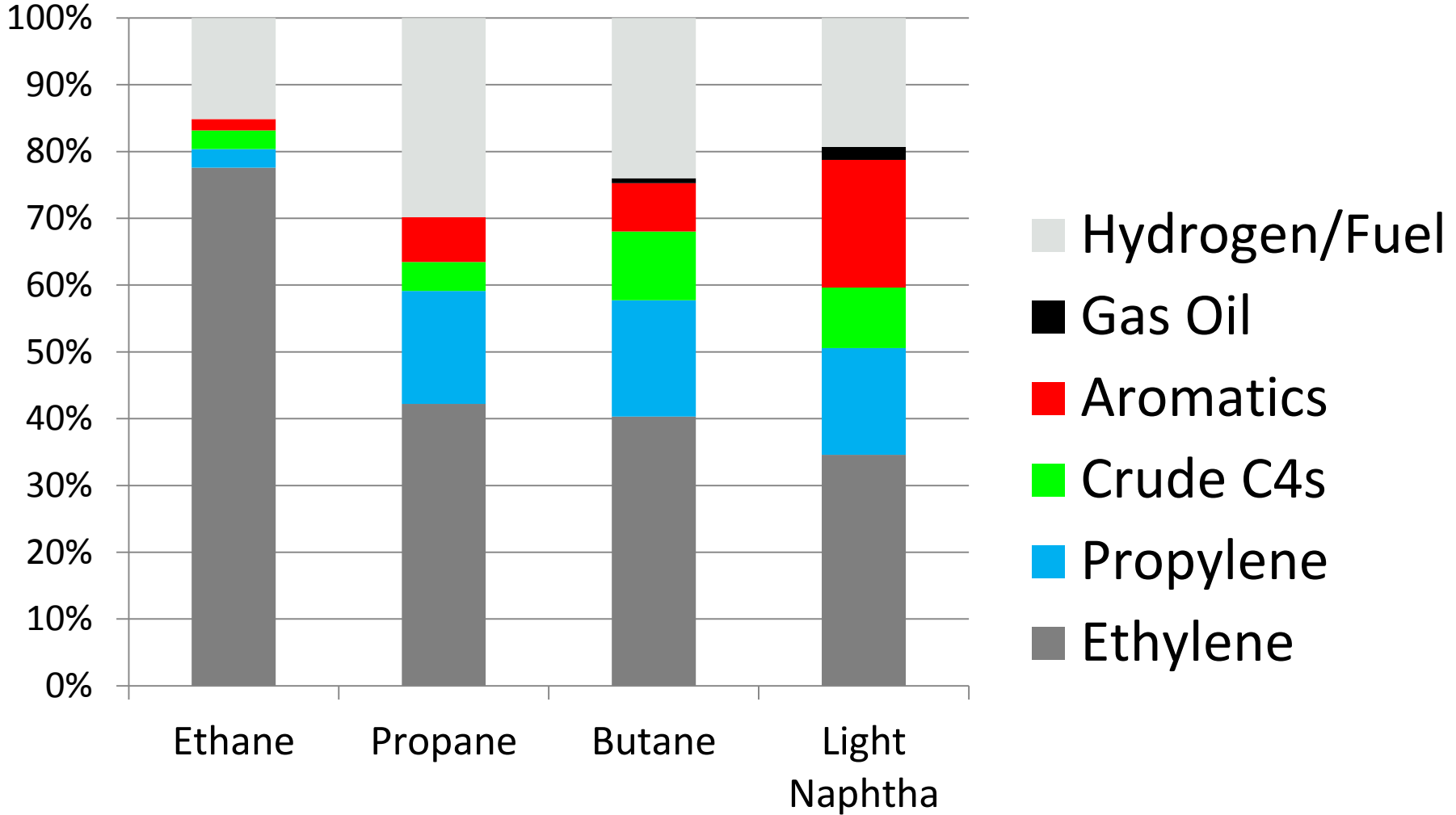
US Cracker Co-Products 2023



- **69%** growth in ethane based output
- **32%** decrease in naphtha based output
- Pygas to decrease **40%**
- Crude C4 to decrease **20%**
- Propylene to decrease **20%**

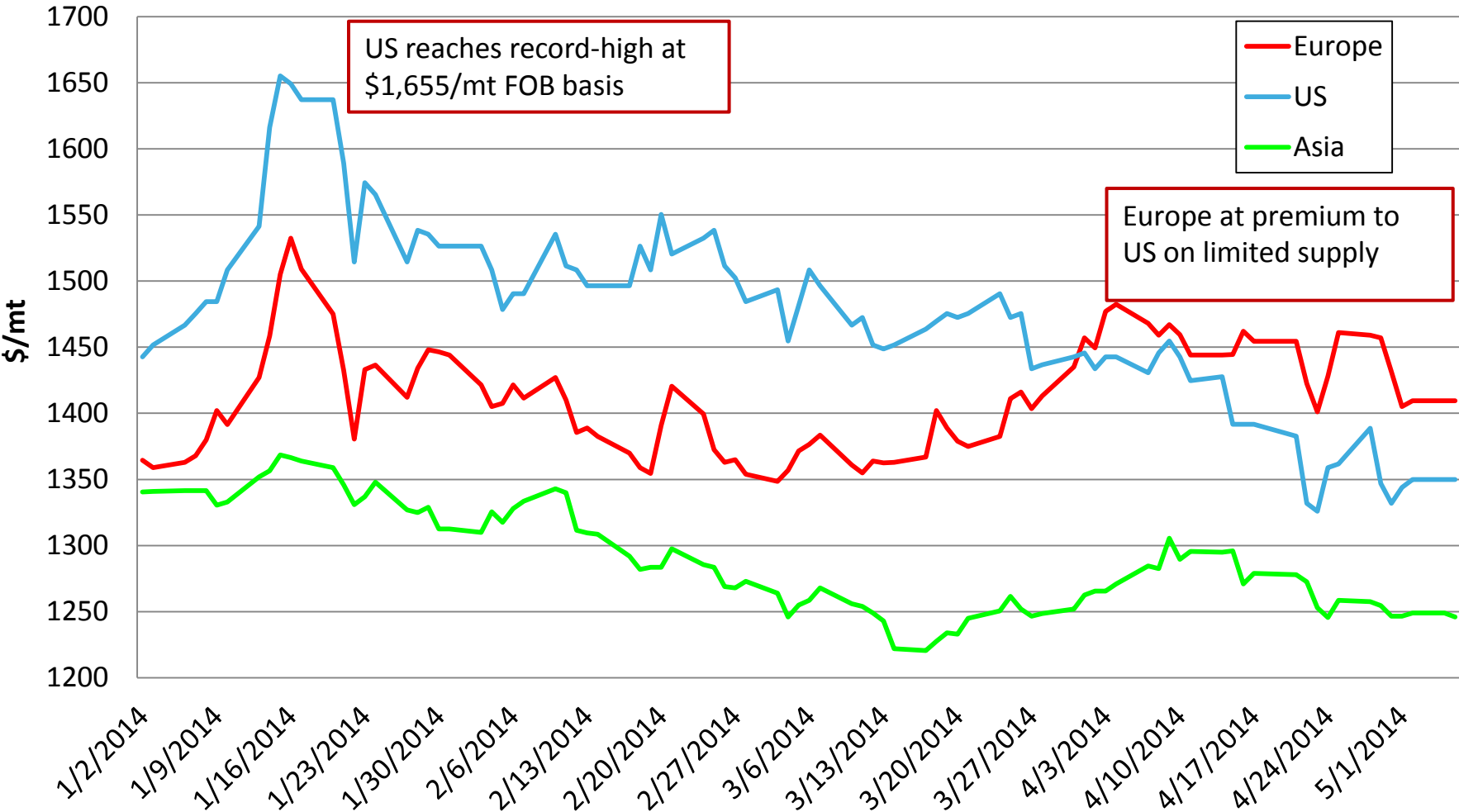
Ethane yields lowest amount of aromatics

Yields by feedstock



US benzene depends on Asia

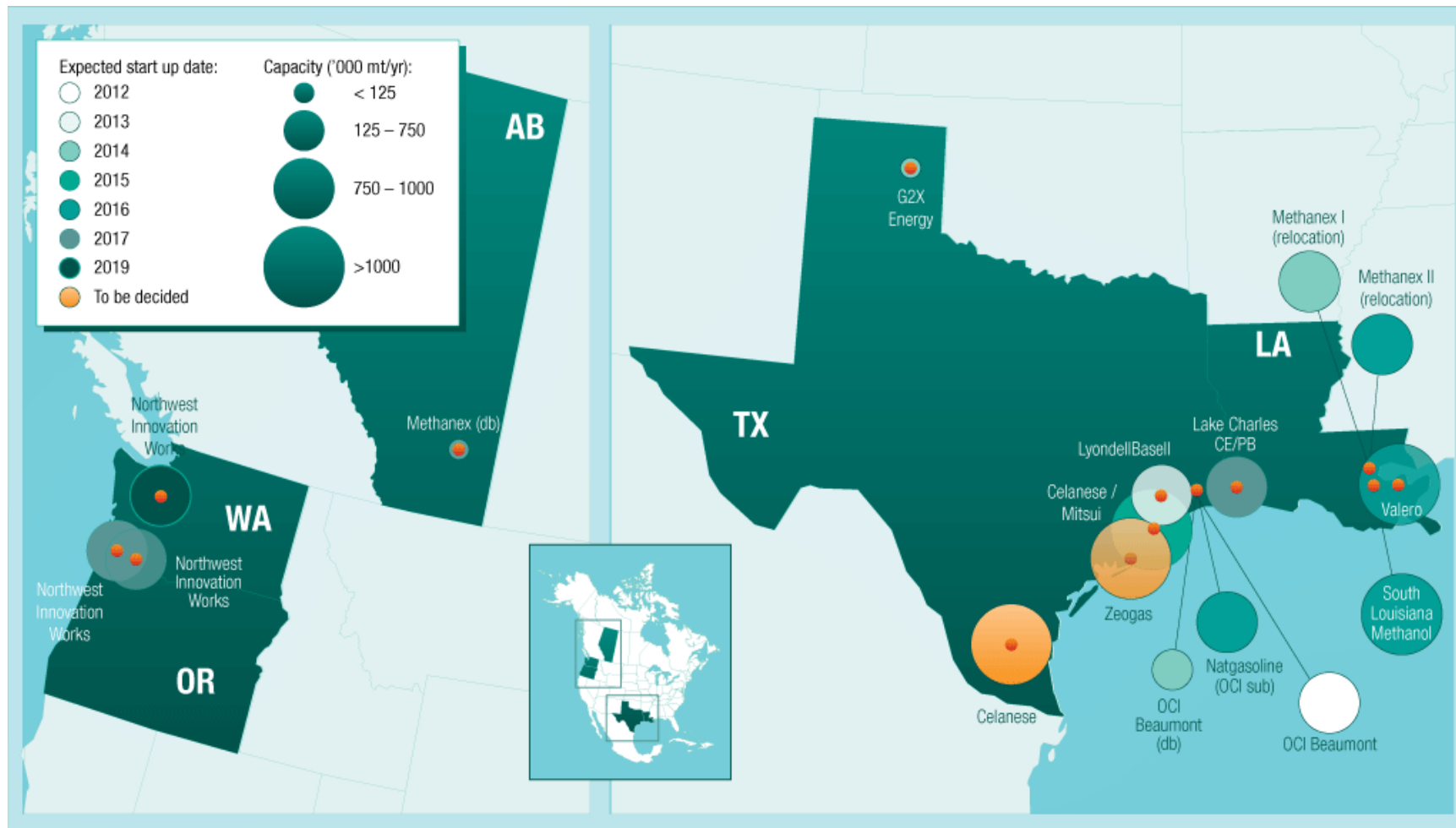
Global benzene prices



North American methanol at a glance

Cheap natural gas could bring unprecedented capacity growth to the US Gulf Coast region and elsewhere, with Asia a likely importer

US methanol – announced projects



Chinese CTO/MTO projects



Source: USGS, Platts

- 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

Implications for Mexico

Major imports of polymers to continue despite new PE capacity coming online;
production of basic petrochemicals to remain insufficient

- Etileno XXI will be the first new steam cracker and polyethylene project in North America in over a decade, but...
- Mexico is expected to remain an importer of PE, with the US as its main supplier
- Polypropylene imports account for at least half of consumption, and a portion of the raw material is outsourced
- Will remain net short butadiene, styrene, among others, which are key to a booming automotive industry
- Energy reform will likely invite petrochemical investment, but realization of major petchem projects is easily 5-10 years away

Muchas gracias!

Preguntas?

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