



# Light Olefins Outlook

Presentation to APIC General Matters & Raw Materials  
Committee

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# Agenda



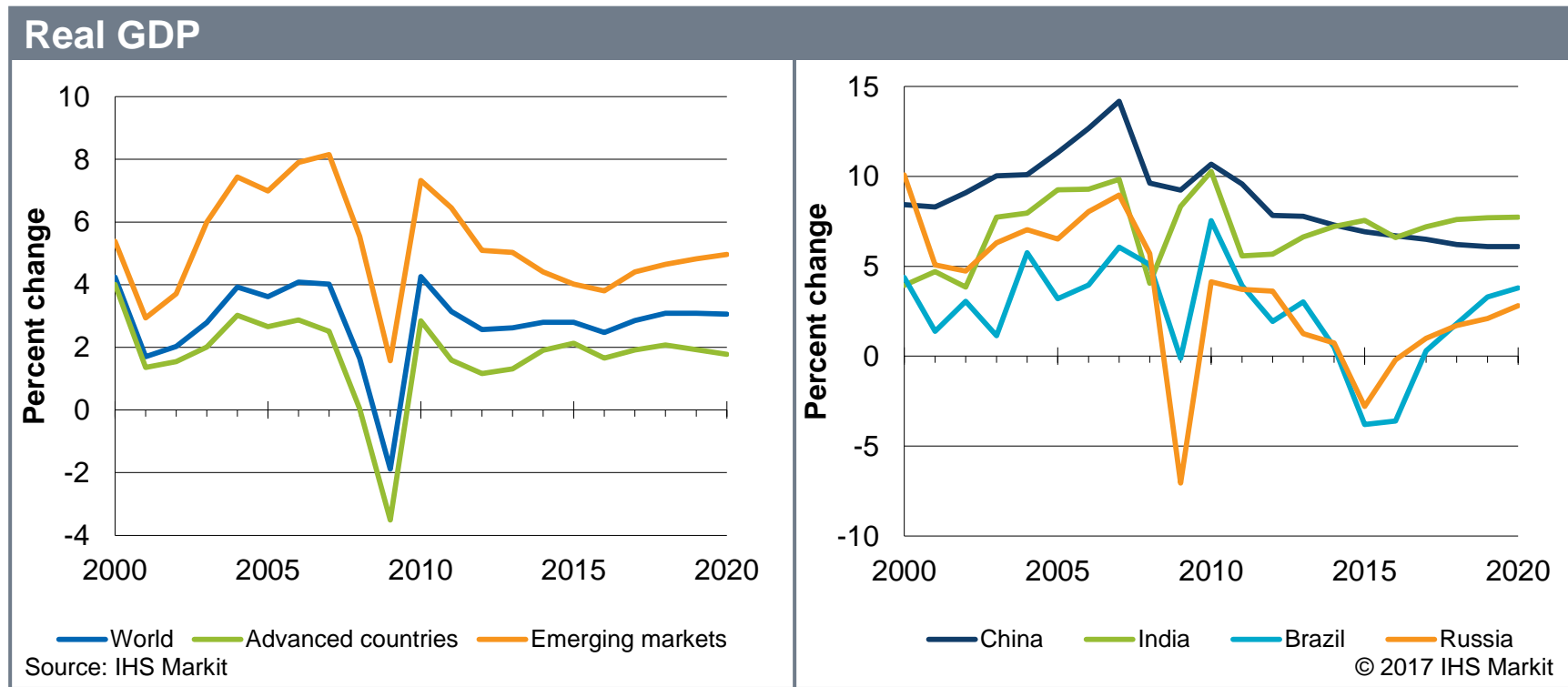
## Economy & Energy Drivers

Ethylene

Propylene

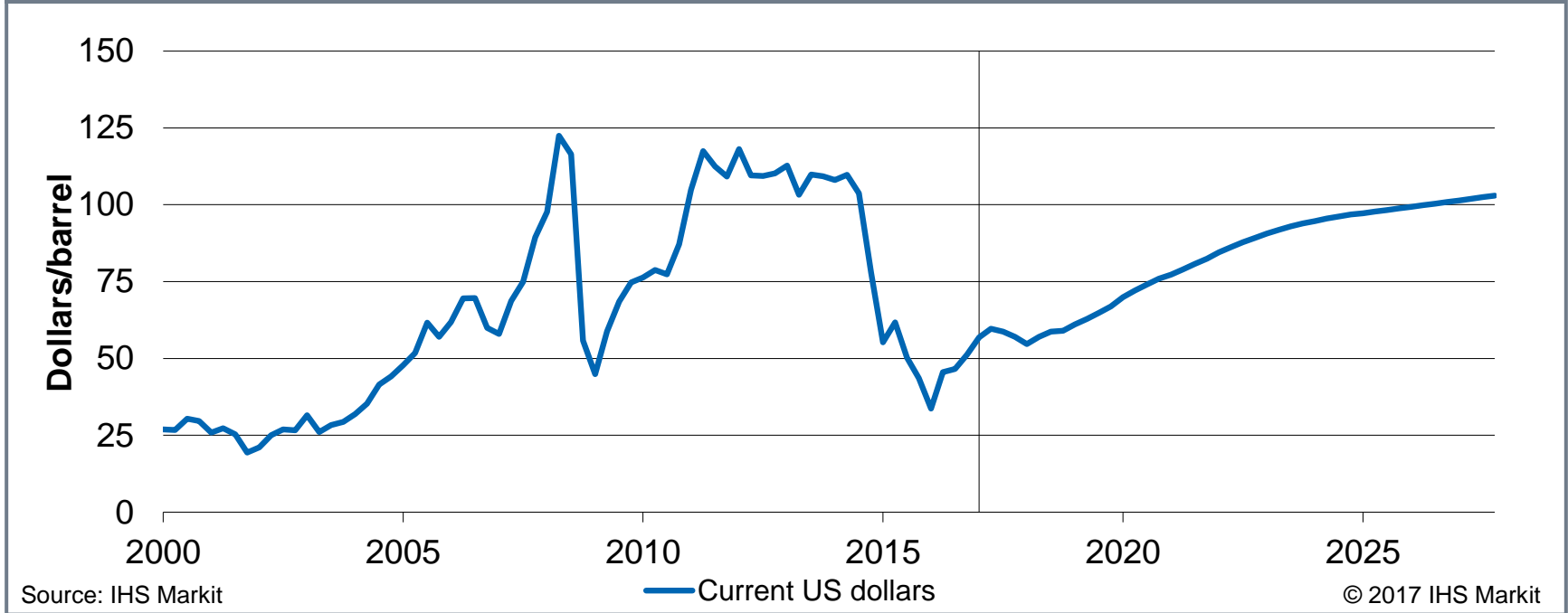
What does this mean for Asia?

# Global real GDP growth will strengthen in 2017–18 led by the United States and commodity exporting regions



# Crude oil prices will gradually recover beyond 2018 as the world needs oil “yet to be found”

Price of Dated Brent crude oil



# Agenda



Economy & Energy Drivers

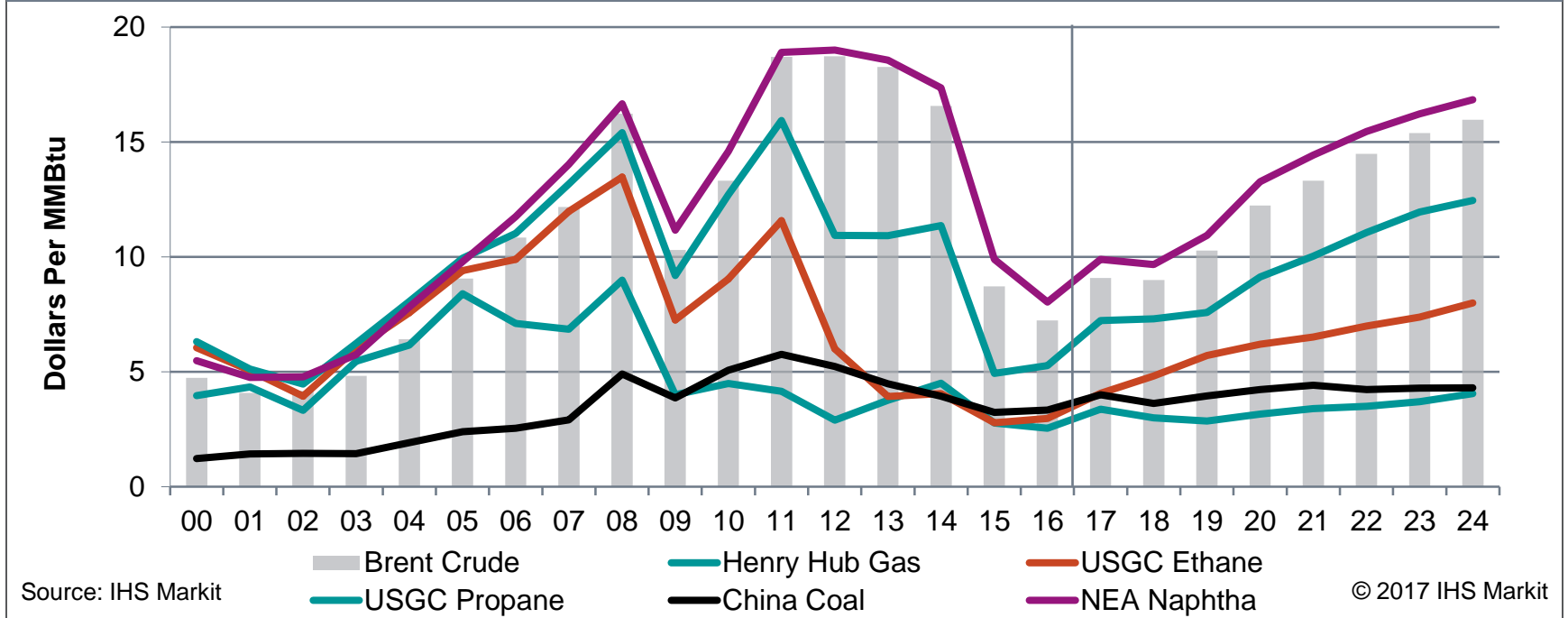
**Ethylene**

Propylene

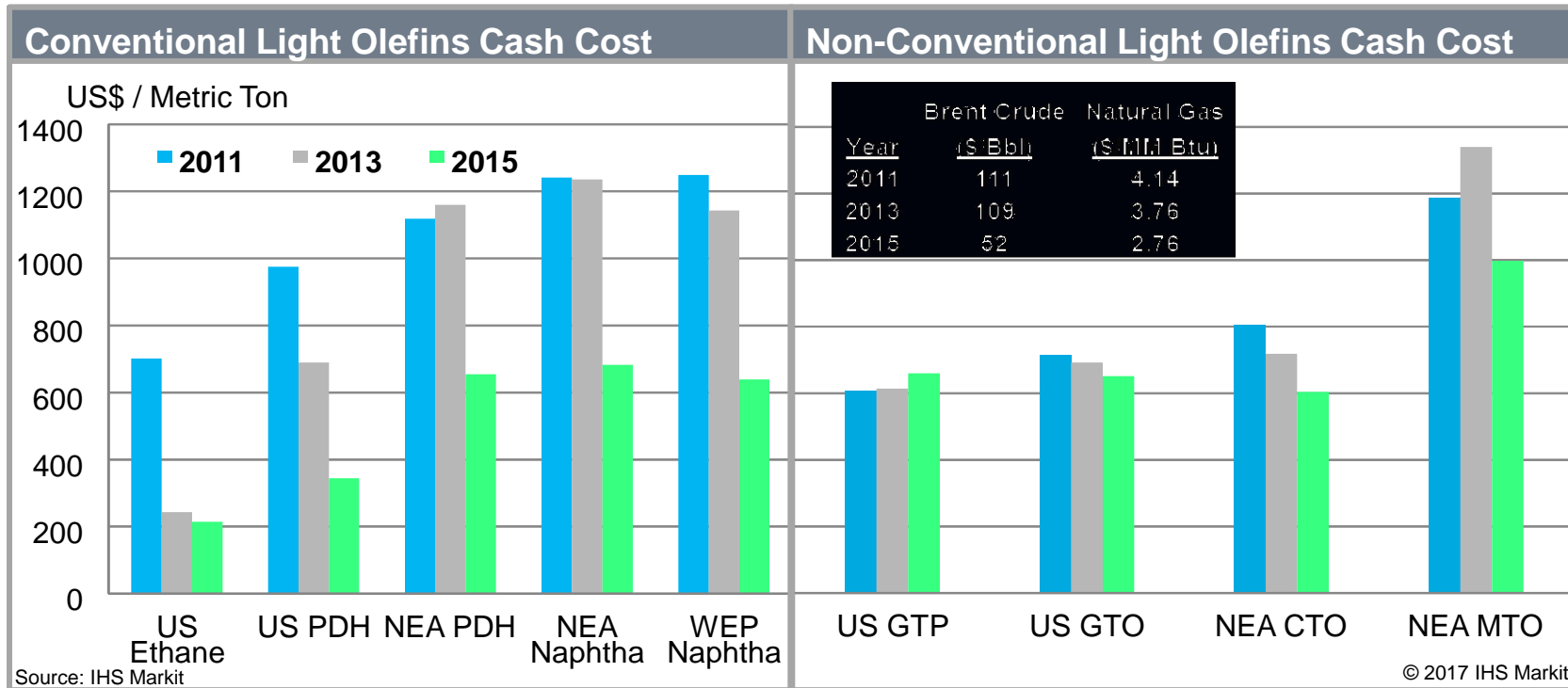
What does this mean for Asia?

# Regional Competitiveness Induced By NGL Oversupply To Remain In the Longer Term

## Crude Oil vs. Natural Gas Based Energy & Feedstocks



# Non-conventional Technology Providing Options For Future Investments In Olefins Production



PDH = Propane Dehydro; GTP = Gas to Propylene; GTO = Gas to Olefins; CTO = Coal to Olefins; MTO = Methanol to Olefins

## North America ethylene capacity growth\*

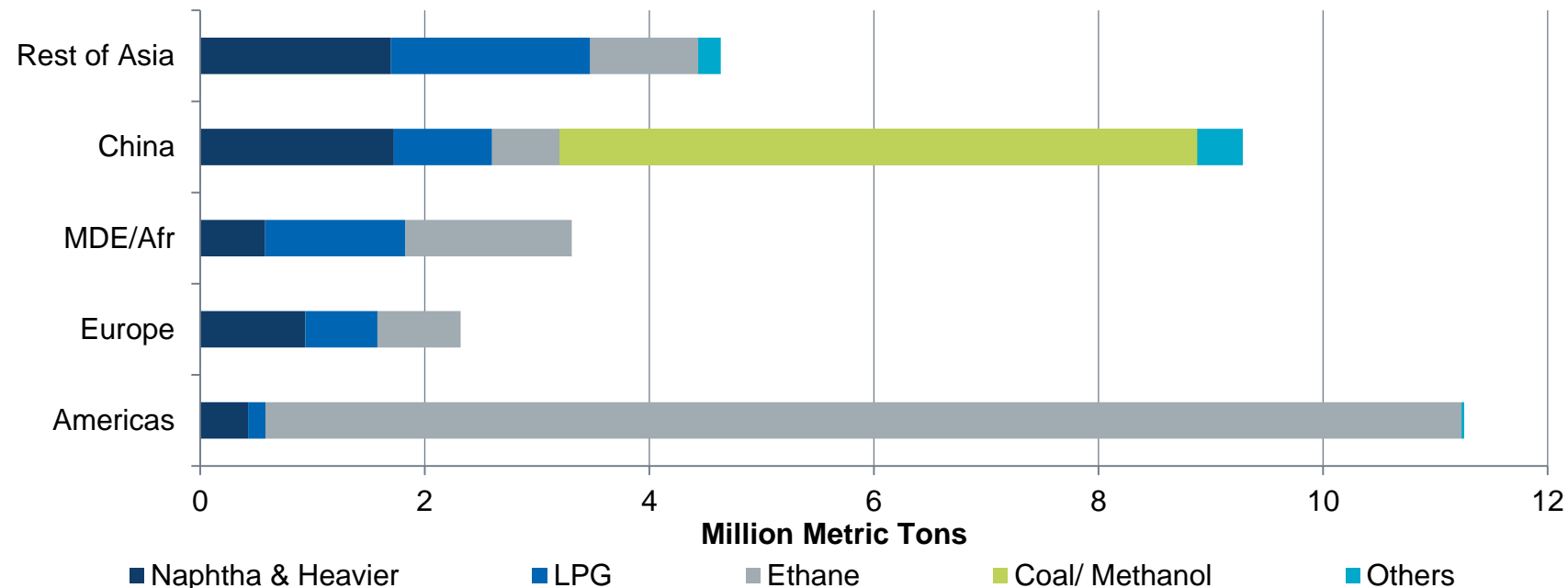
Starting	Company	Location	Total Growth**
Q1-17	Dow	Plaquemine, LA	250
Q1/2-17	Equistar	Corpus Christi, TX	401
	Oxy/Mexichem	Ingleside, TX	550
Q3/4-17	ChevronPhillips	Cedar Bayou, TX	1,500
	Dow	Freeport, TX	1,500
Q1-18	ExxonMobil	Baytown, TX	1,500
Q2/3-18	Indorama	Lake Charles, LA	420
Q4-18	Formosa	Point Comfort, TX	1,150
Q1-19	Shin-Etsu	Plaquemine, LA	500
	Sasol	Lake Charles, LA	1,550
Q1-20	LACC	Lake Charles, LA	1,000
Q2-22	Shell***	Monaca, PA	1,500
Total additions			11,821

\*Firm 2017 through 2021/22 \*\*000 metric tons \*\*\* Shell Monaca, PA was last to FID



# Low Cost Coal and Ethane Driving Investments

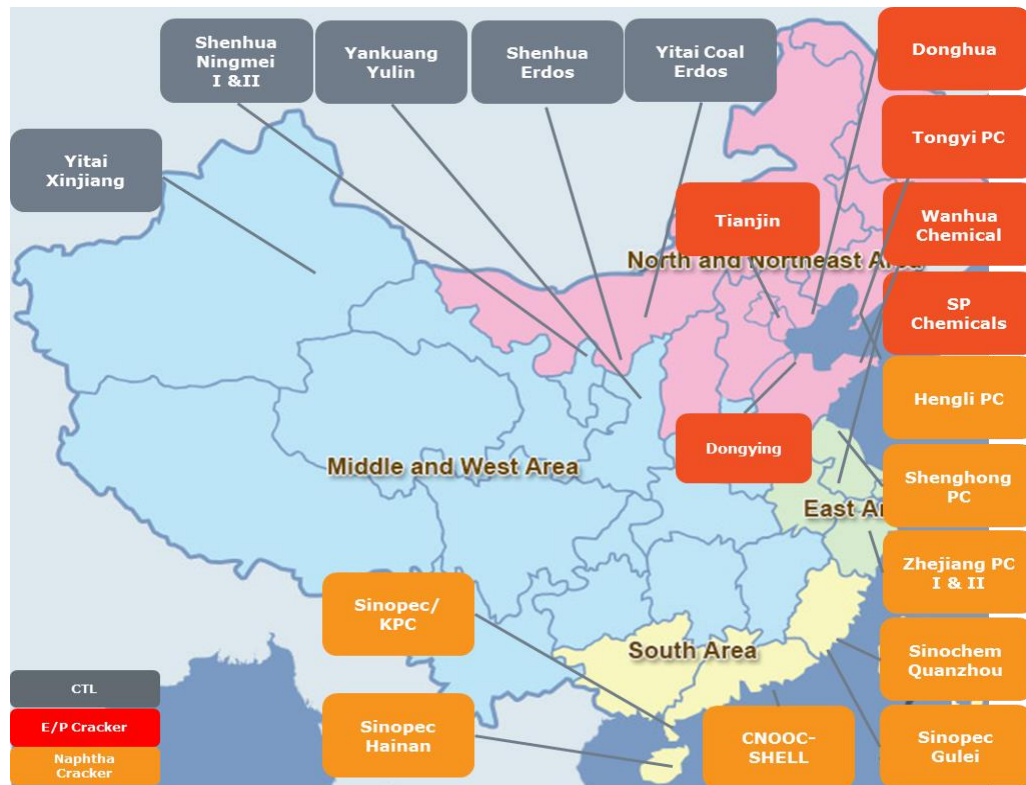
## Incremental Ethylene Capacity 2016-2021



Source: IHS Markit

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# Unconventional Feedstocks for China Crackers?



Name	Startup	Status	Feedslates
CNOOC-SHELL II	2017	Constructing	Naphtha/LPG
Shenhua Ningmei	2017	Constructing	Naphtha/LPG
SP Chemicals	2019	Constructing	Ethane/Propane
Zhejiang PC I & II	2020/2022+	Constructing	Naphtha
Sinopec/KPC	2021	Constructing	Naphtha

## Reasonable Unconventional Feedstocks?



### Coal-to-Liquids-Cracker

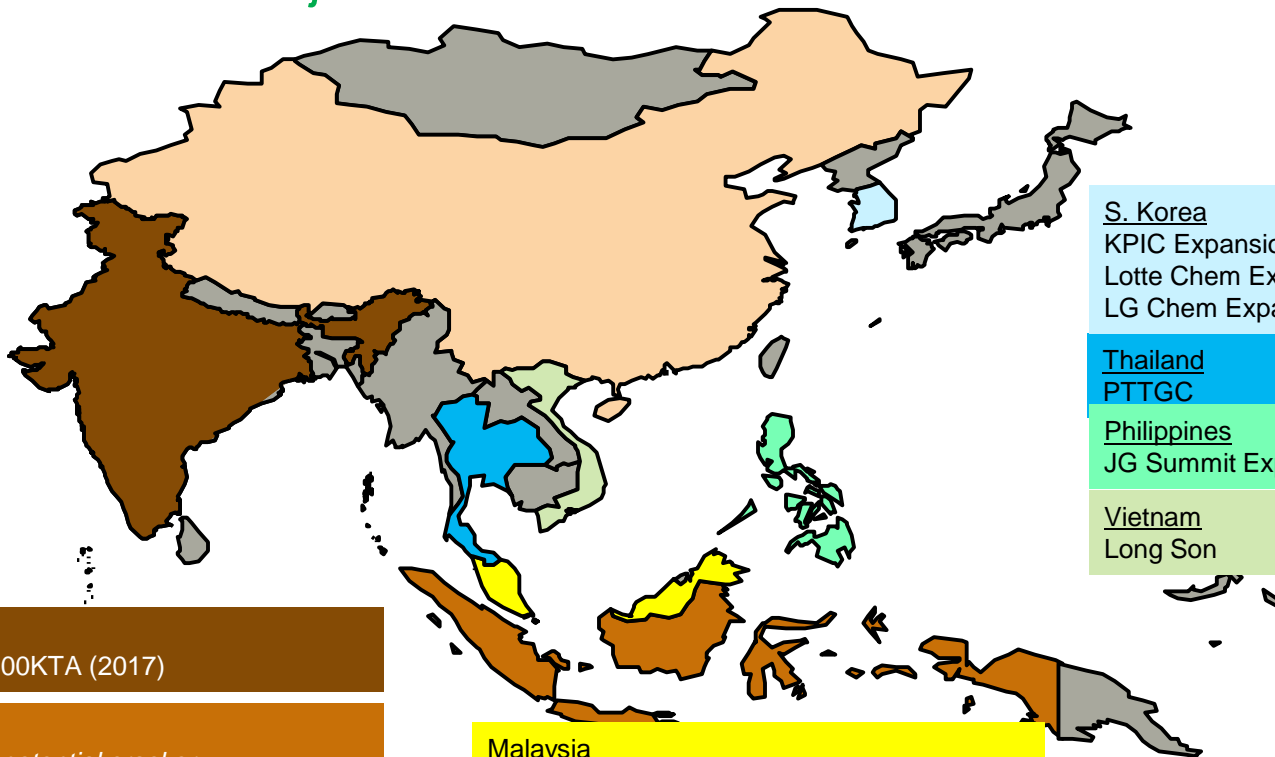
- X Huge capital cost. Over 60 Billion RMB for 4 Million CTL and 600 KTA cracker.
- X Environmental challenges—water consumption and carbon tax.
- X Low crude oil price impact.
- ✓ National energy security strategy support. Consumption tax (30%-50%) could be exempted.



### Ethane/Propane Cracker

- X Highly rely on imported feedstocks from NAM. Ethane/Propane prices will rise with demand increase and crude oil price rise.
- X E/P supply is fine in the US. But infrastructure and logistics are key restrictions.
- ✓ Lower capital cost per ton and highly environmentally friendly.
- ✓ Highest C2 yields meet C2 and C3 fundamental difference.

## New Cracker Projects in the rest of Asia



India  
Reliance 1,500KTA (2017)

Indonesia  
At least one potential cracker  
1,000KTA(2023+ ?)

Malaysia  
LC Titan Expansion +92KTA (2017/2018)  
Petronas 1,200KTA (2020)

S. Korea  
KPIC Expansion +330KTA (2017)  
Lotte Chem Expansion +200KTA (2018/2019)  
LG Chem Expansion +230KTA (2019)

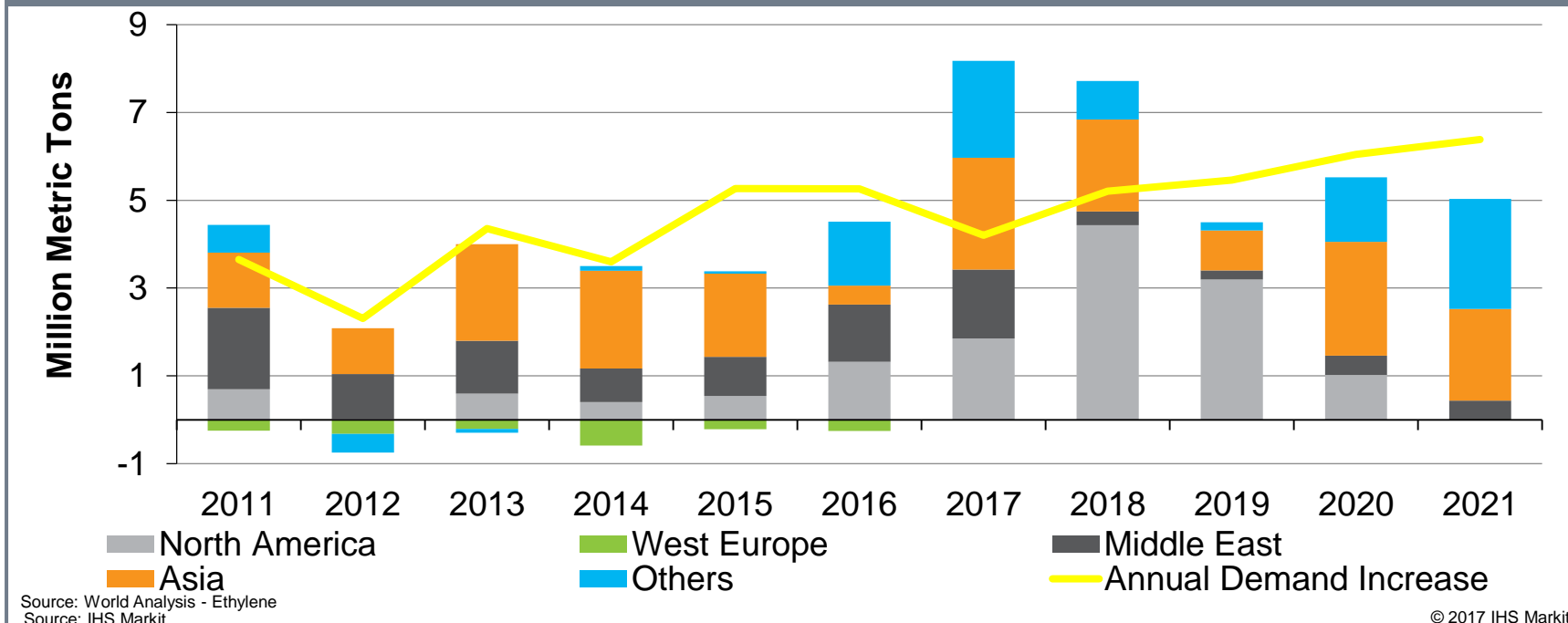
Thailand  
PTTGC 500KTA (2021)

Philippines  
JG Summit Expansion +160KTA (2021)

Vietnam  
Long Son 1000KTA (2022+)

# Capacity addition outpaces demand in 2017/18 but does not guarantee supply

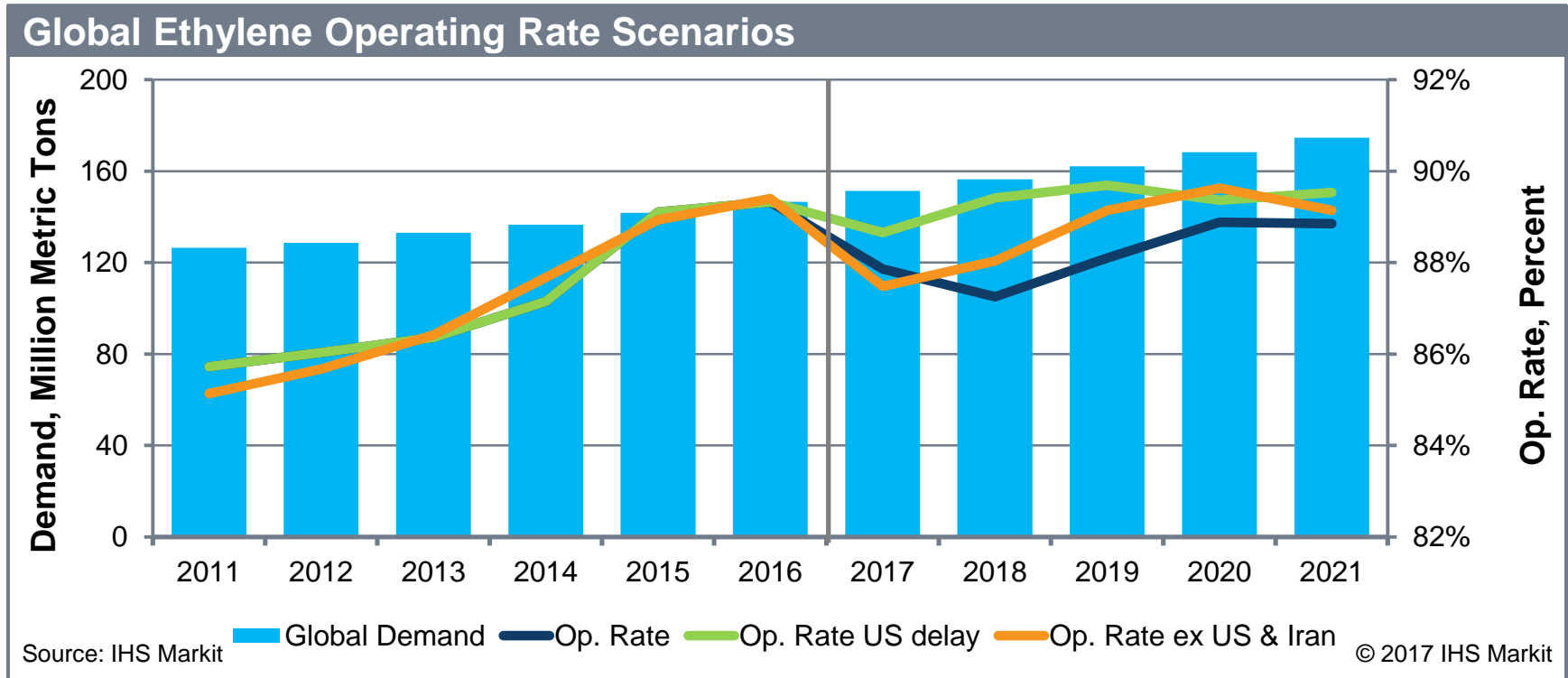
## Global Ethylene capacity additions vs. demand



Source: World Analysis - Ethylene  
Source: IHS Markit

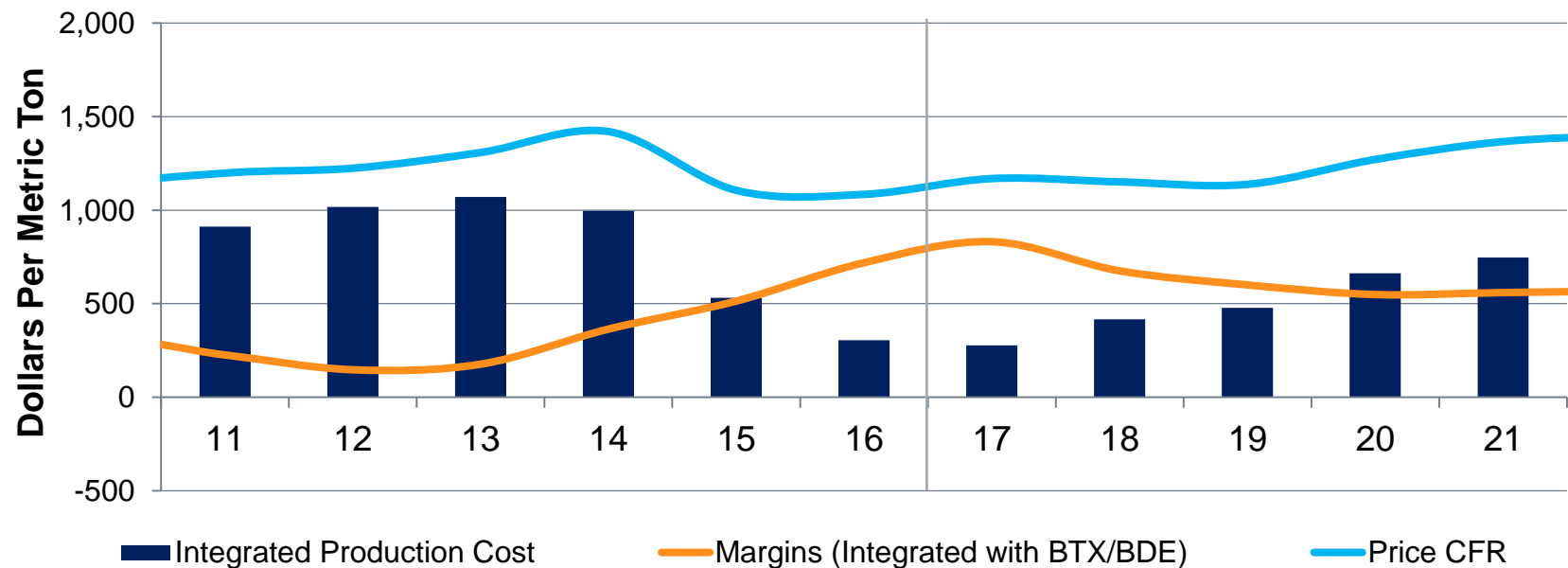
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Global ethylene 'Operating Rate ex US & Iran' is how the market will feel, but with a US delay...



# The slowdown in project approvals will sustain healthy margins for Asia naphtha crackers

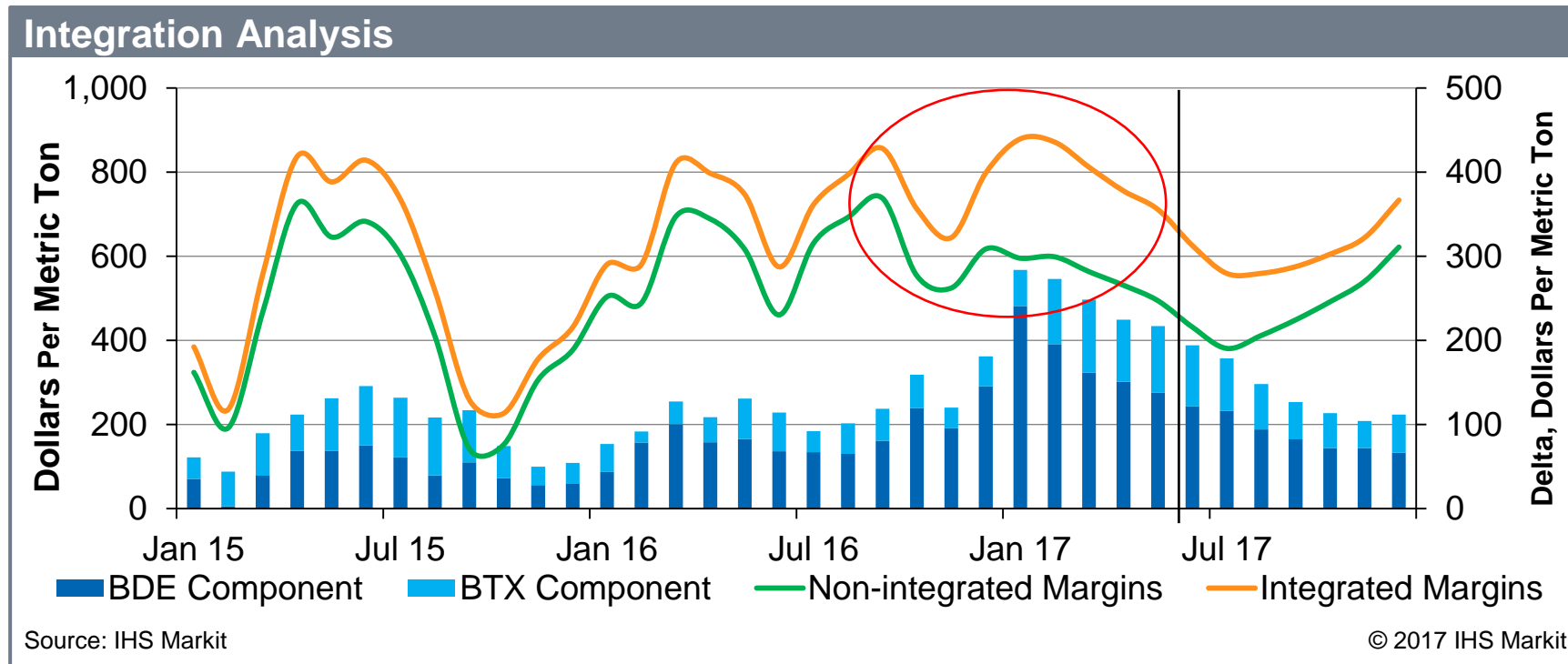
## NEA Cracker Production Cost and Margins



Source: IHS Markit

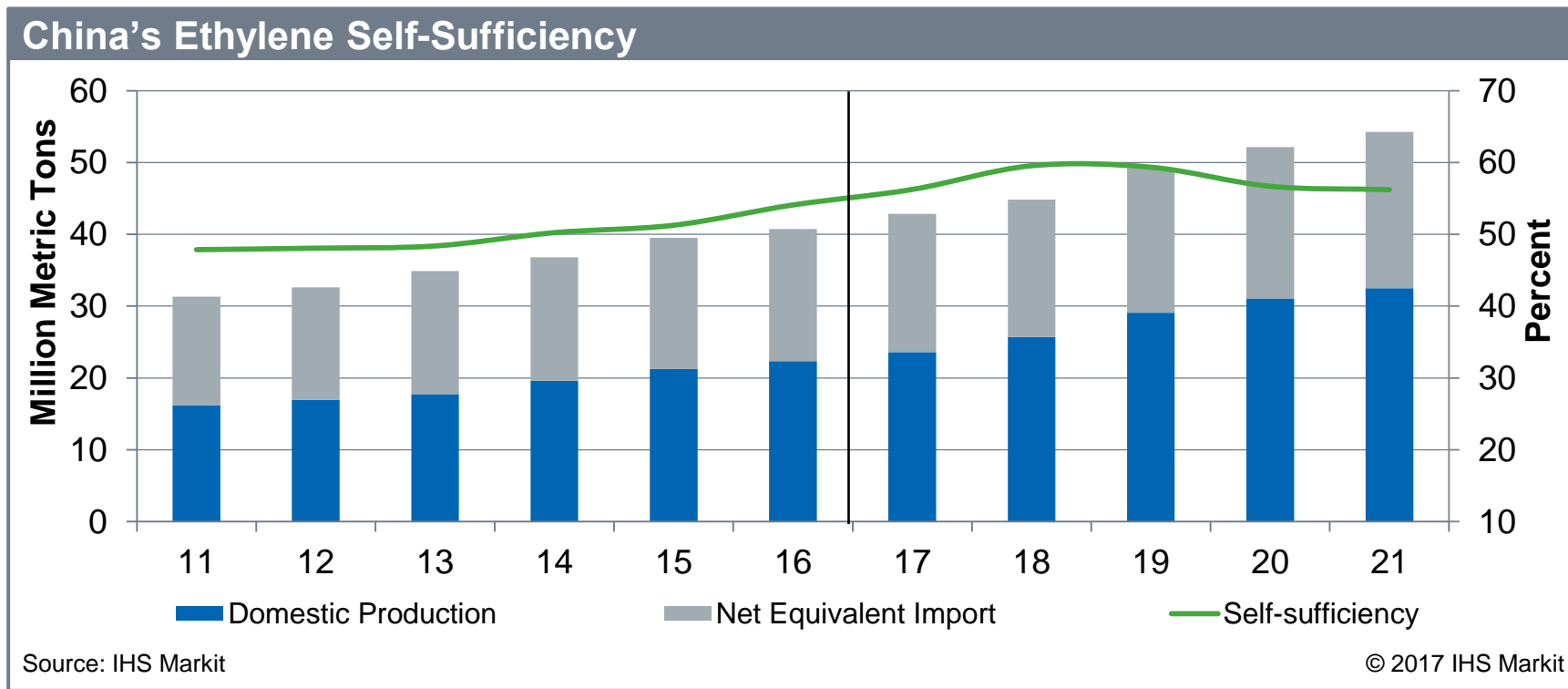
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# Asian cracker margins supported by recent surge in Butadiene prices

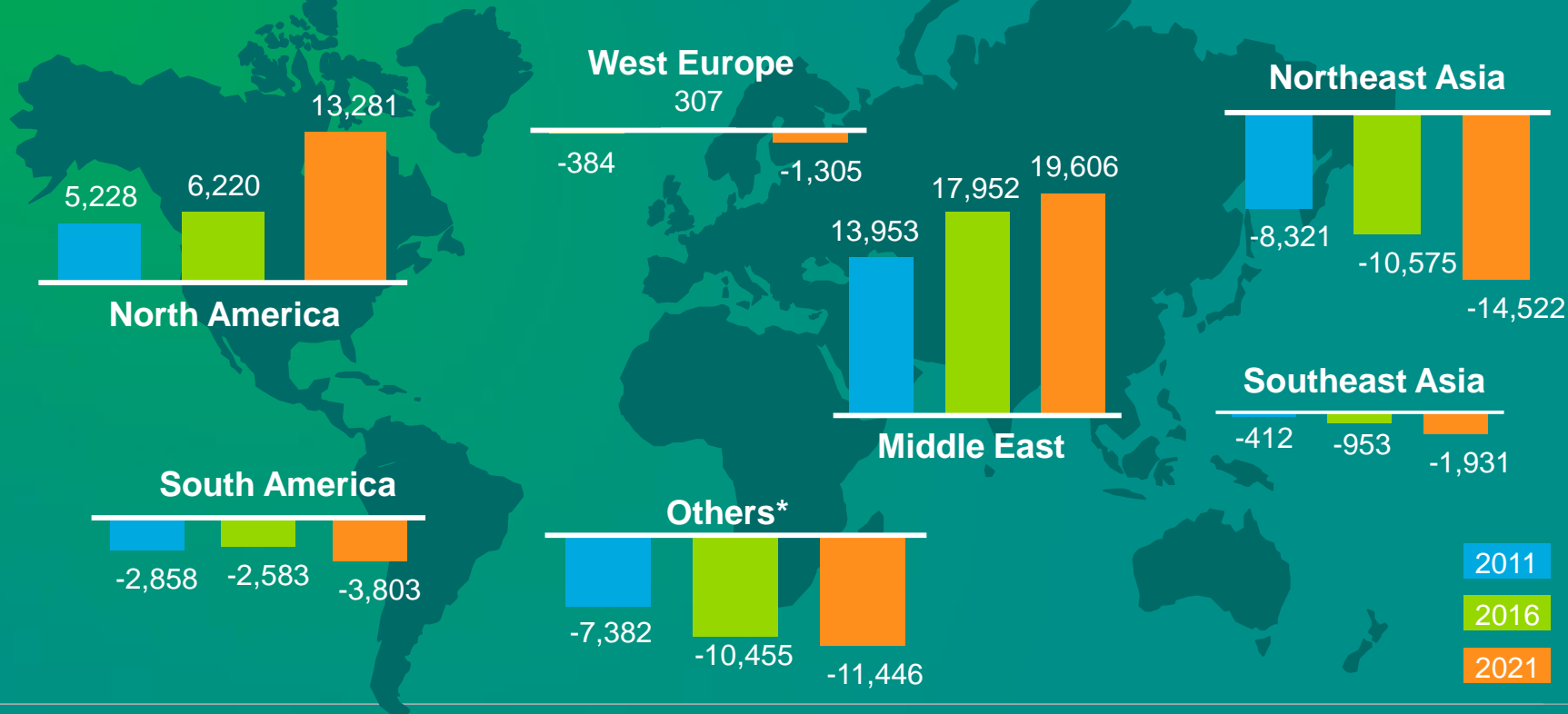




# China's Ethylene Self-Sufficiency Rises



# Asian equivalent ethylene shortfall continues to grow despite substantial China investments



# Agenda



Economy & Energy Drivers

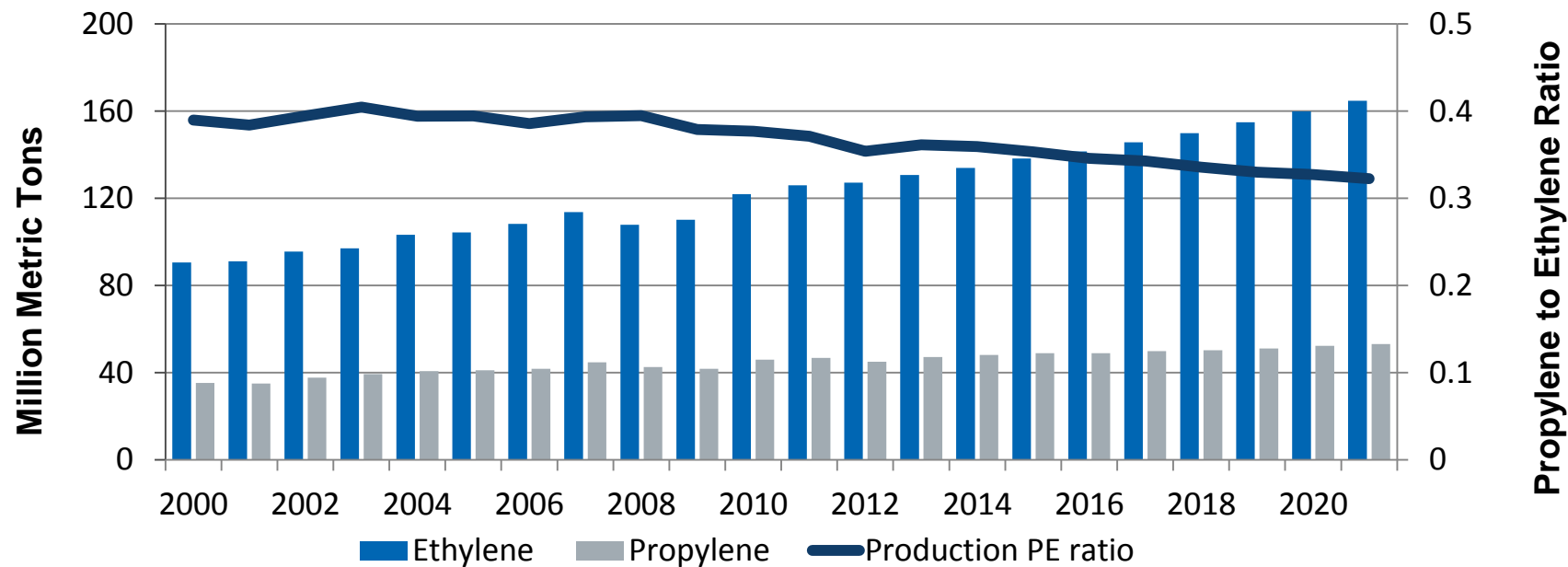
Ethylene

**Propylene**

What does this mean for Asia?

# Steam cracker shift to lighter feeds leaves propylene supply far behind ethylene

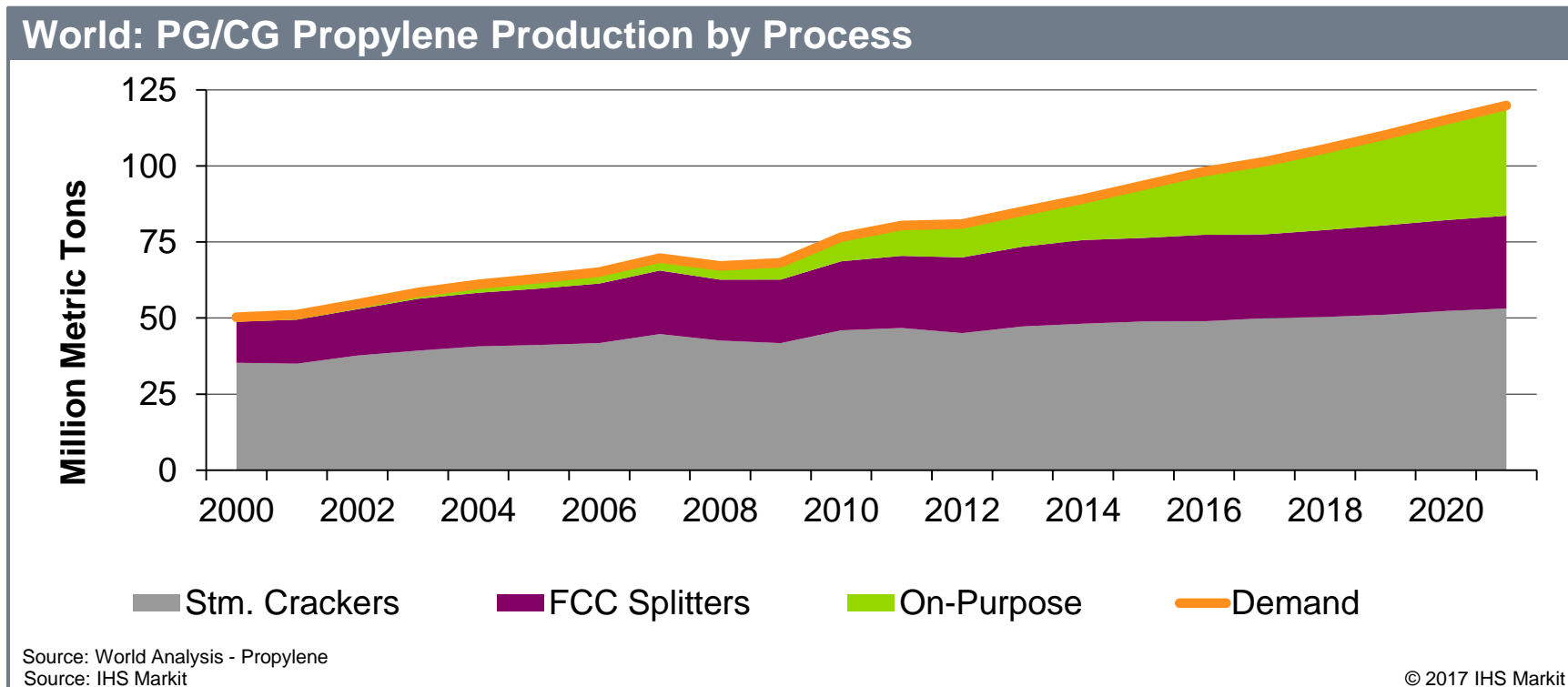
## Global Olefins Production from Steam Crackers



Source: IHS Markit

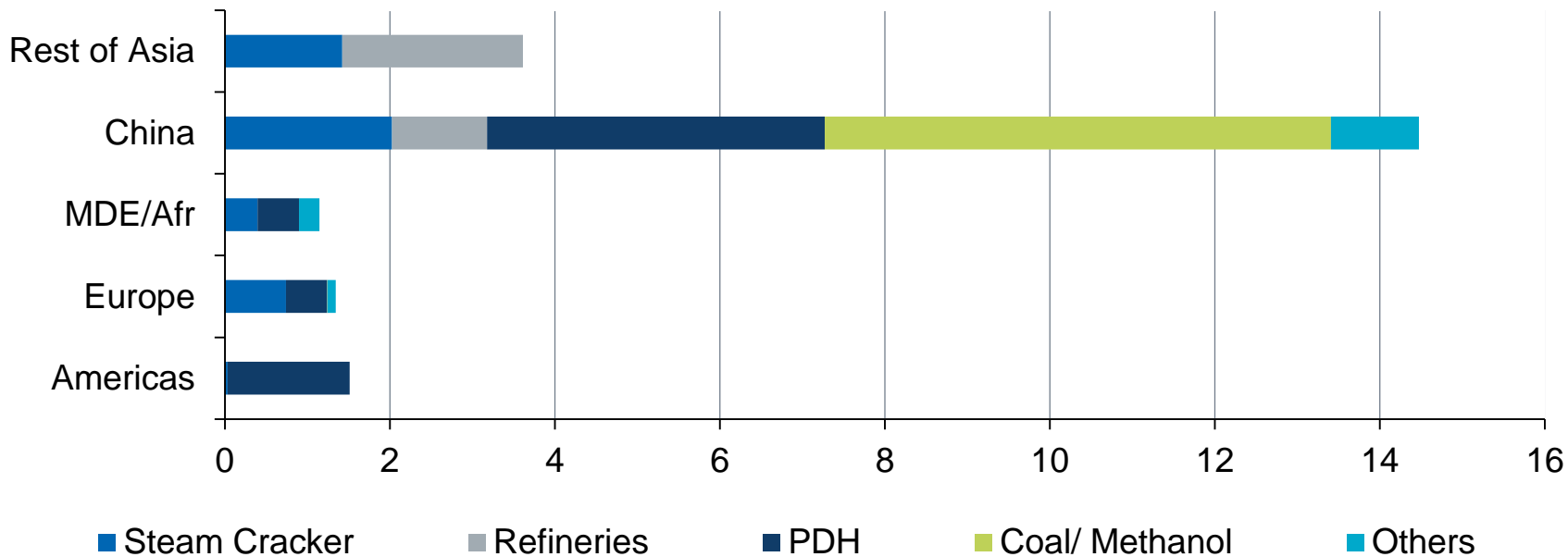
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## Non-traditional propylene supplies meet demand growth



# Global Propylene Capacity Additions

Global Propylene Capacity Additions 2016 - 2021

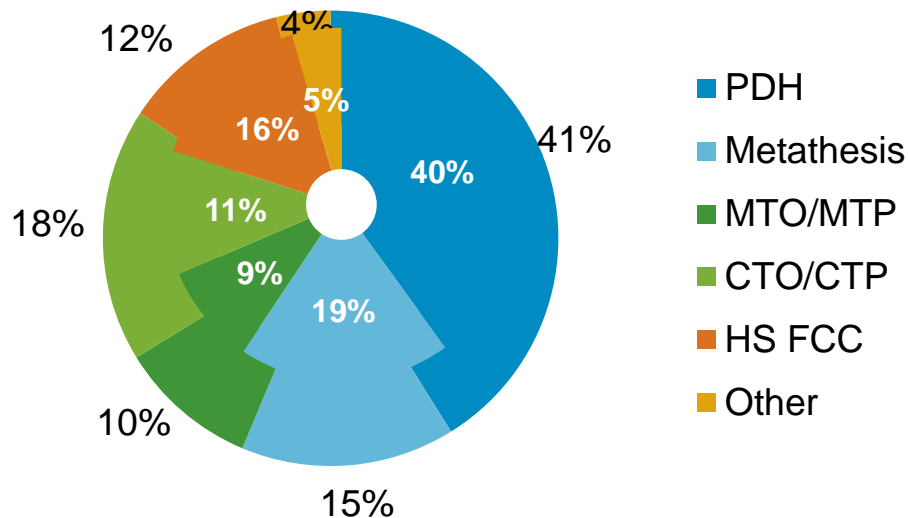


Source: IHS Markit

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## PDH remains flavor of the day due to ample propane supply

World: PG/CG Propylene Capacity by Alternate Routes



**2016 (inner)**

Capacity = 27.9 MM MT/y  
23% of global capacity

**2021 (outer)**

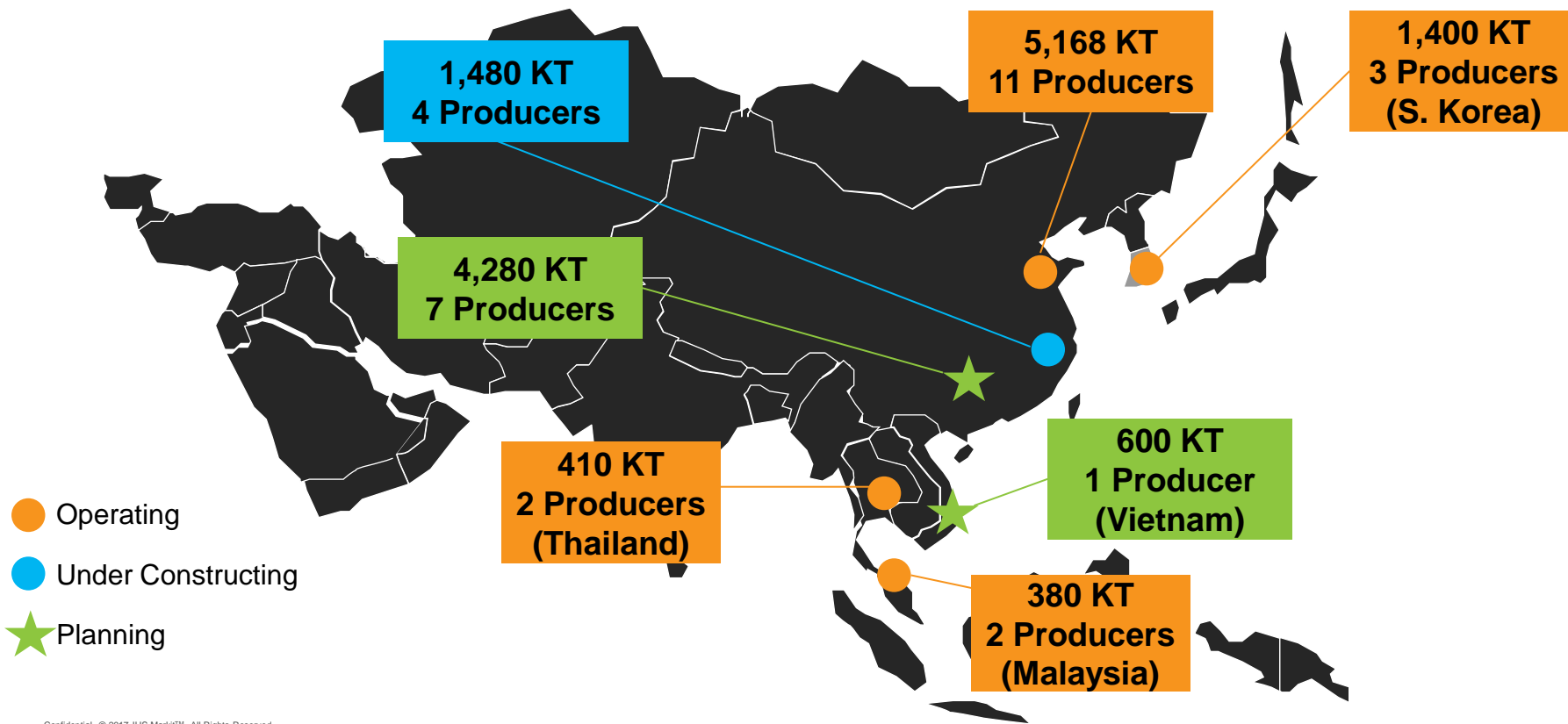
Capacity = 45.1 MM MT/y  
31% of global capacity

Source: World Analysis - Propylene

Source: IHS Markit

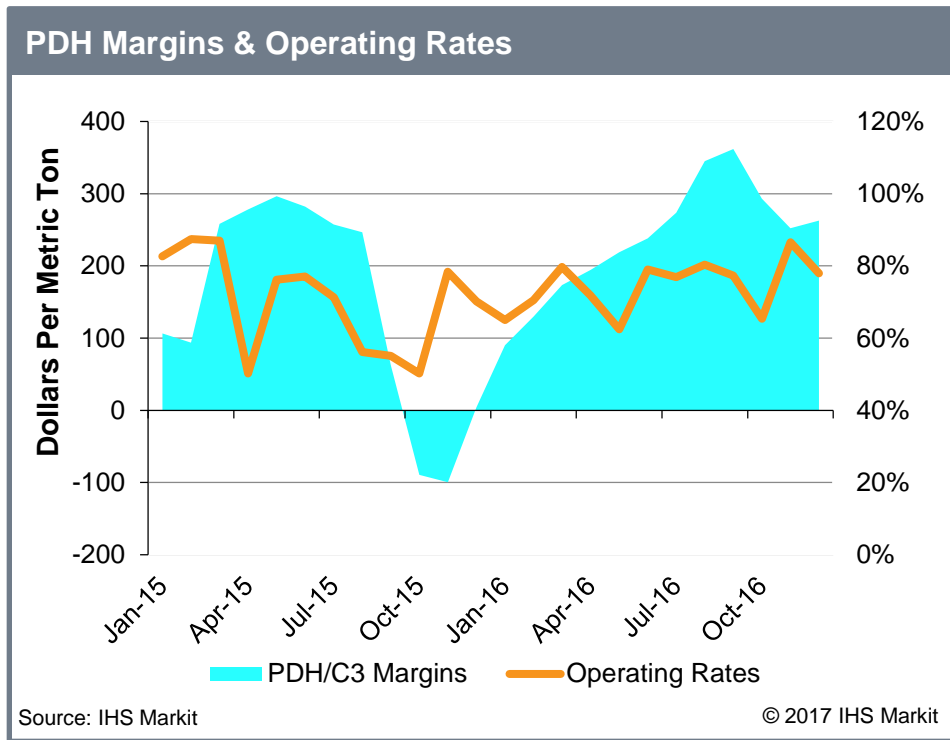
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## More than 13 million tons of propylene from PDH



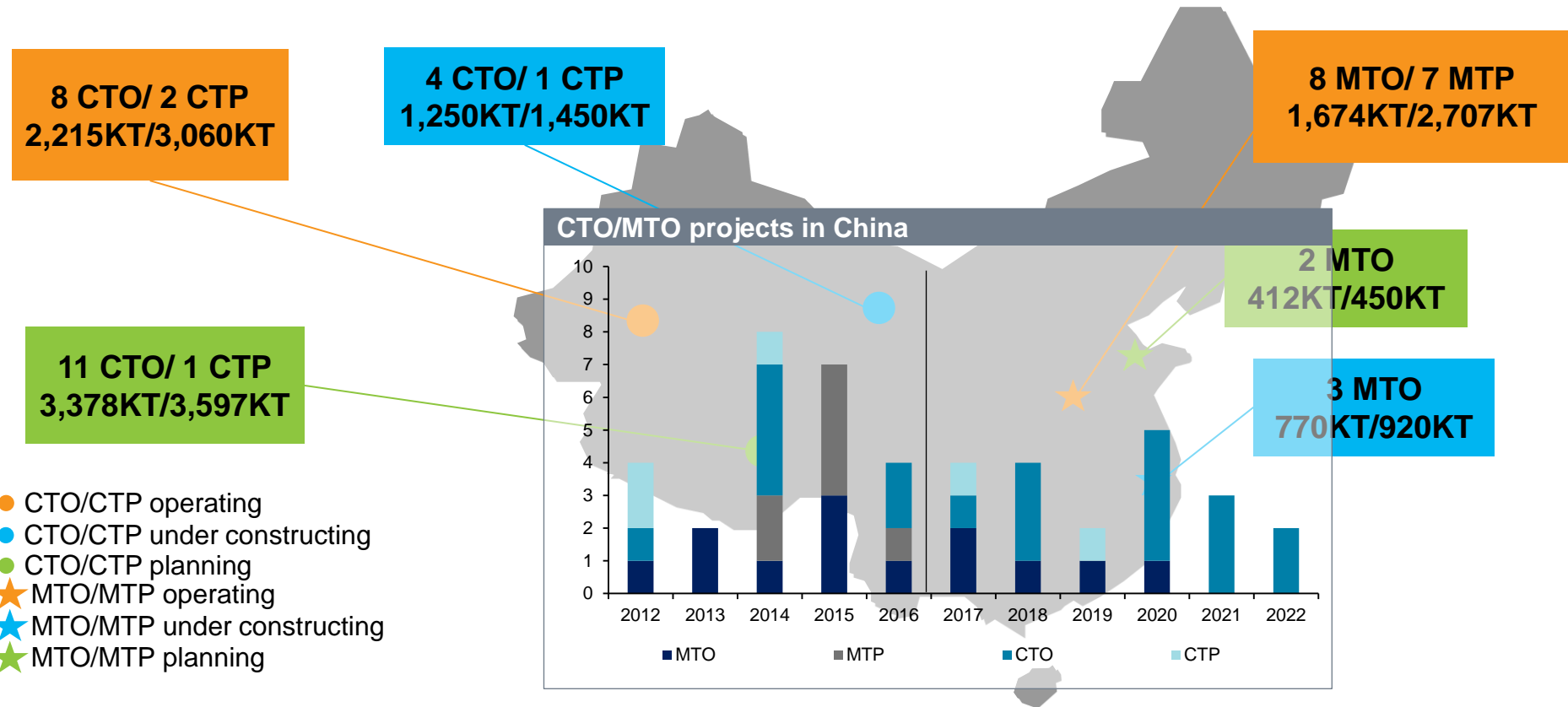


## PDH-A Seasonal Player and Struggling Technical Glitch



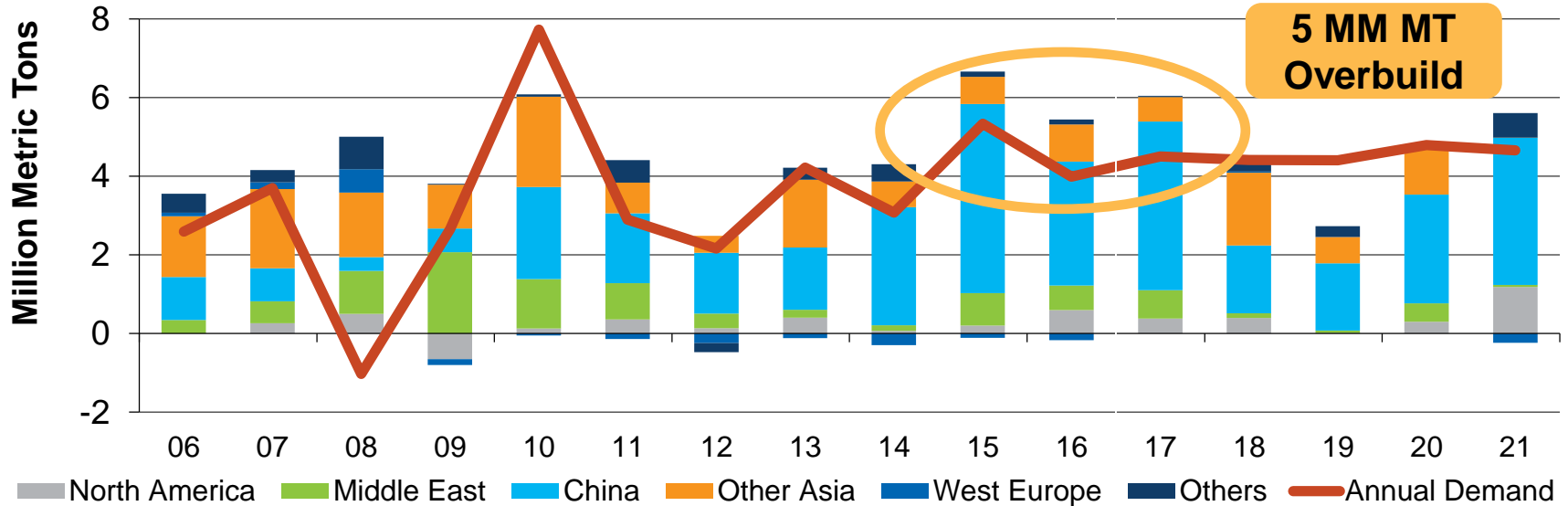
- Better margins in summer than in winter given the relative lower LPG prices.
- Operating rates remain relatively low as producers experience numerous unplanned outages

# Methanol based investments slowing down



# Did capacity additions overwhelm demand growth?

## Annual Propylene Capacity Additions

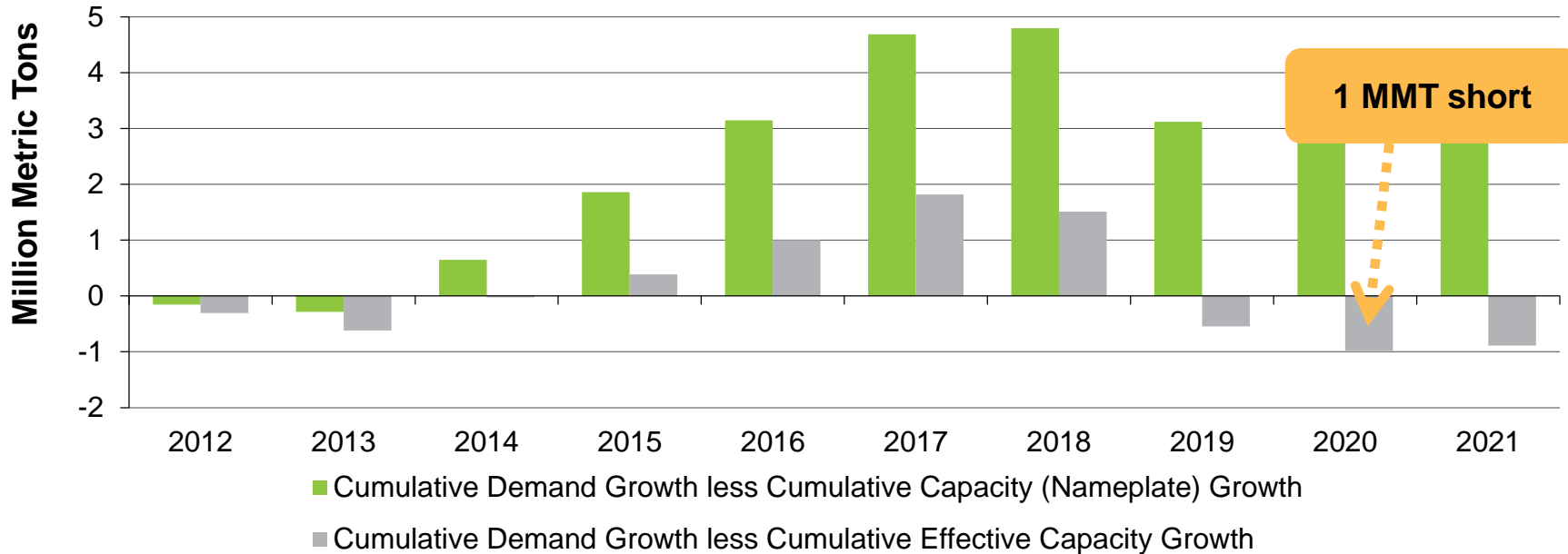


Source: World Analysis- Propylene  
Source: IHS Markit

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# Using effective operating rates – market is hungry for more capacity by 2019

## Cumulative Effective Capacity Growth less Cumulative Demand Growth

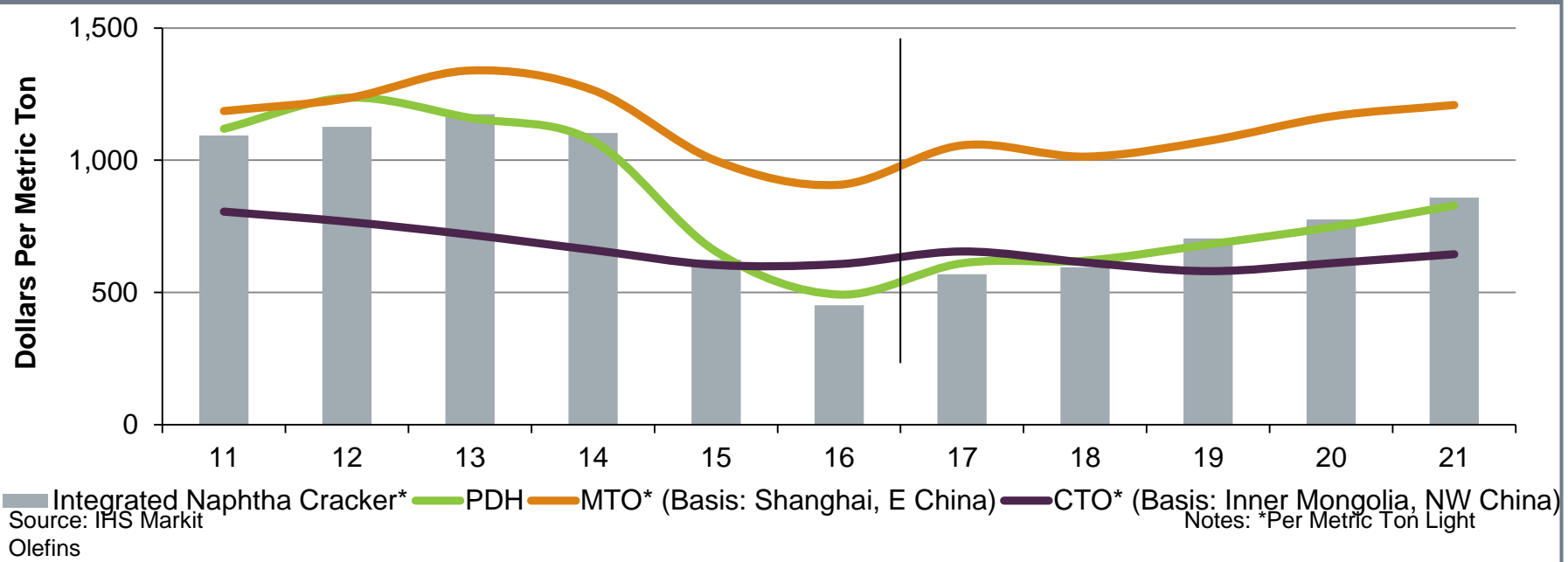


Source: IHS Markit Assumed 85% operating rates on-purpose units.

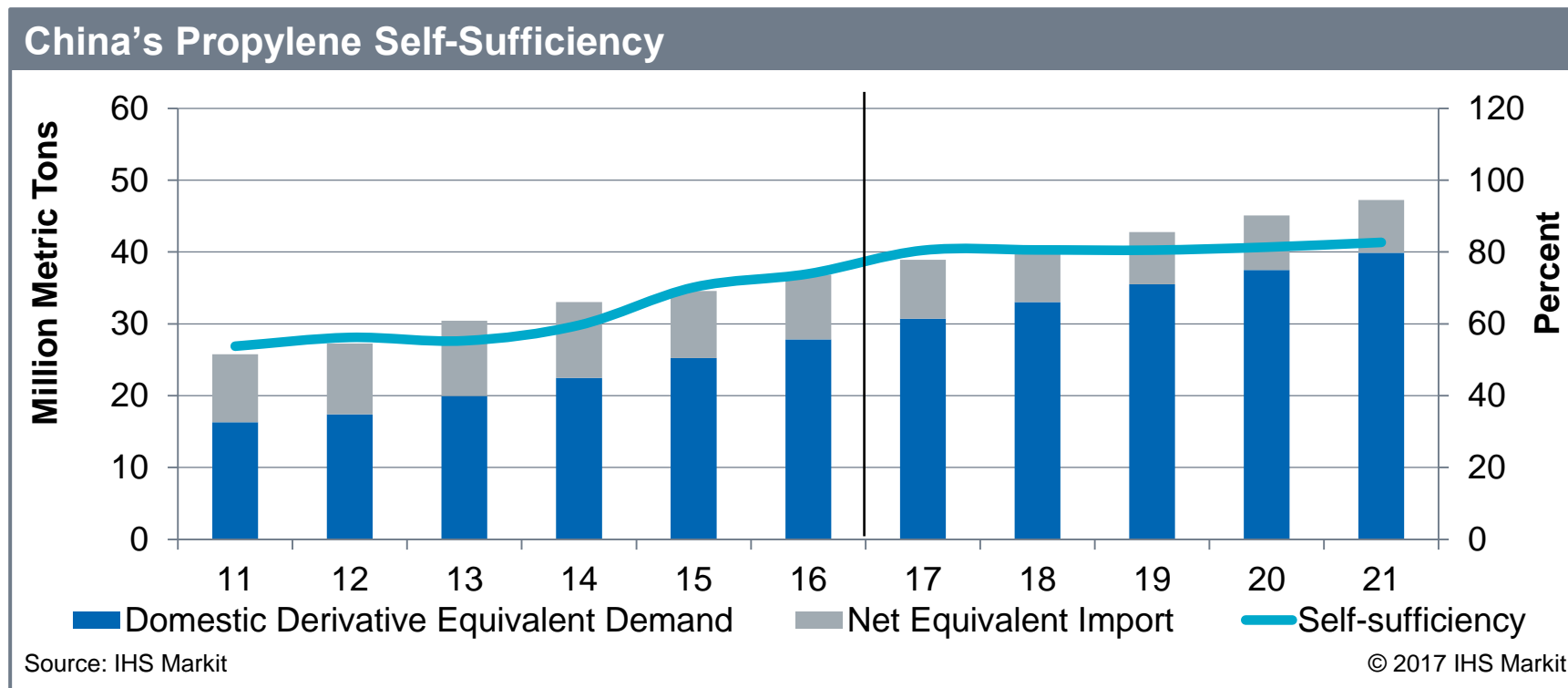
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# PDH setting prices. Coal-based economics still attractive long-term

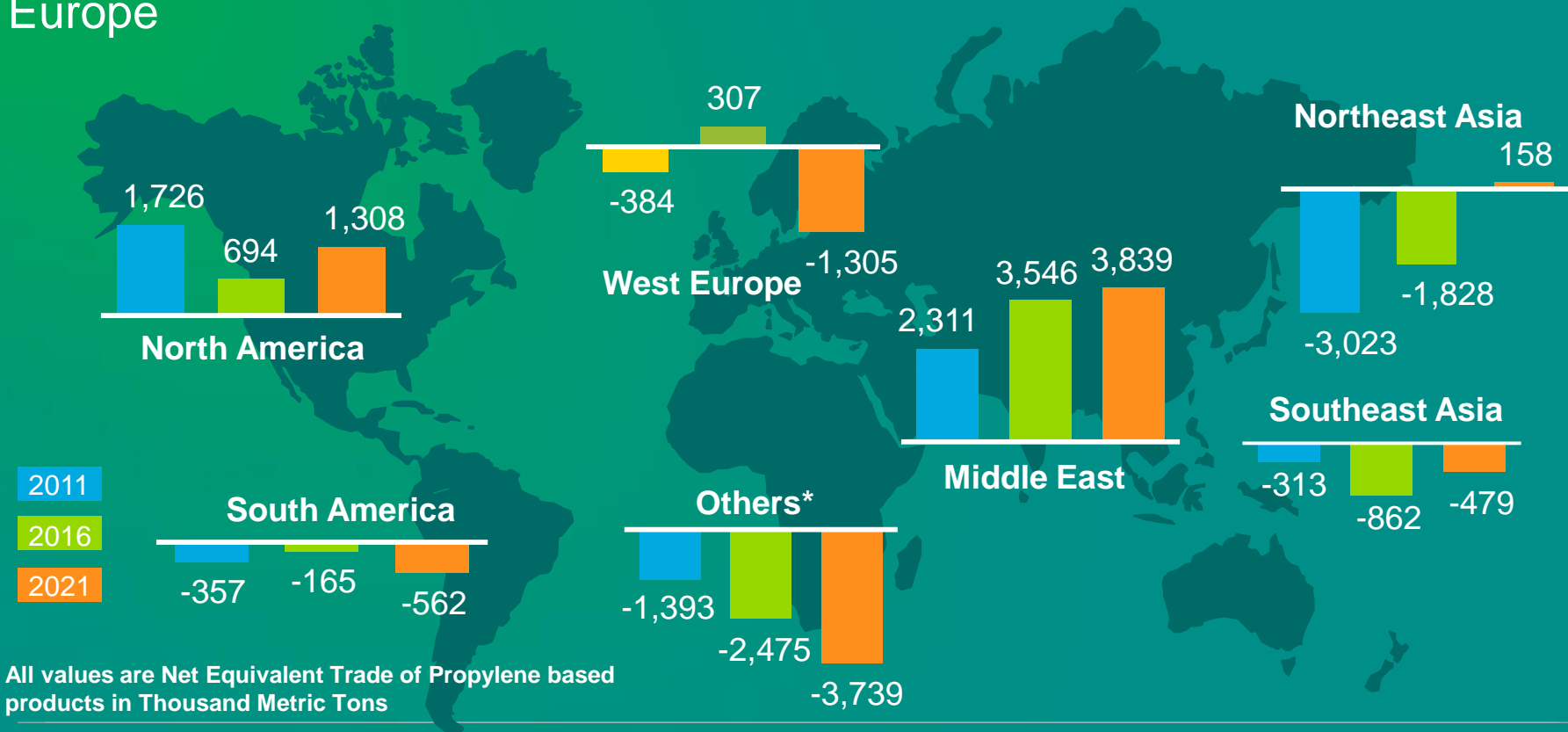
Northeast Asia on-purpose propylene production cost



# China's Move Towards Self-Sufficiency in Propylene



# Propylene net equivalent imports shift away from Asia to India, Africa, W. Europe



All values are Net Equivalent Trade of Propylene based products in Thousand Metric Tons

# Agenda



Economy & Energy Drivers

Ethylene

Propylene

**What does this mean for Asia?**

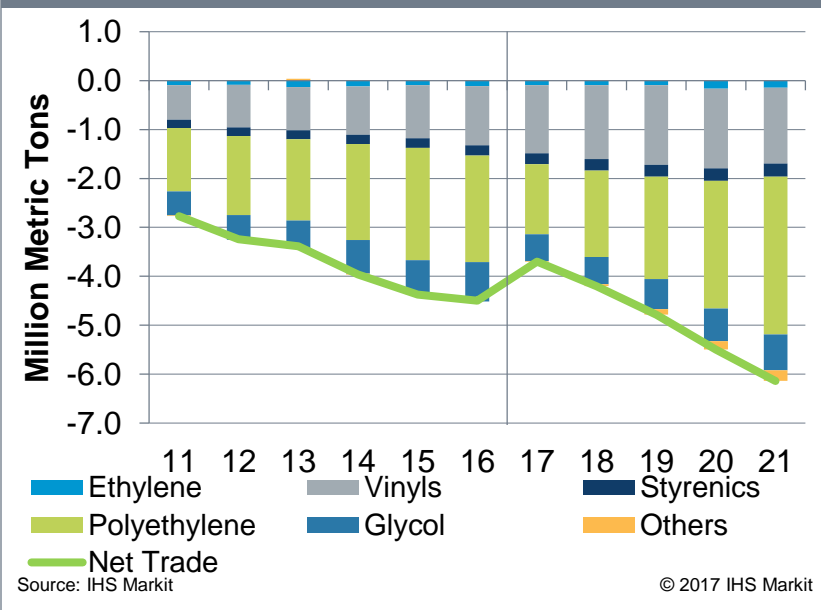


# China industry is going through a transformation

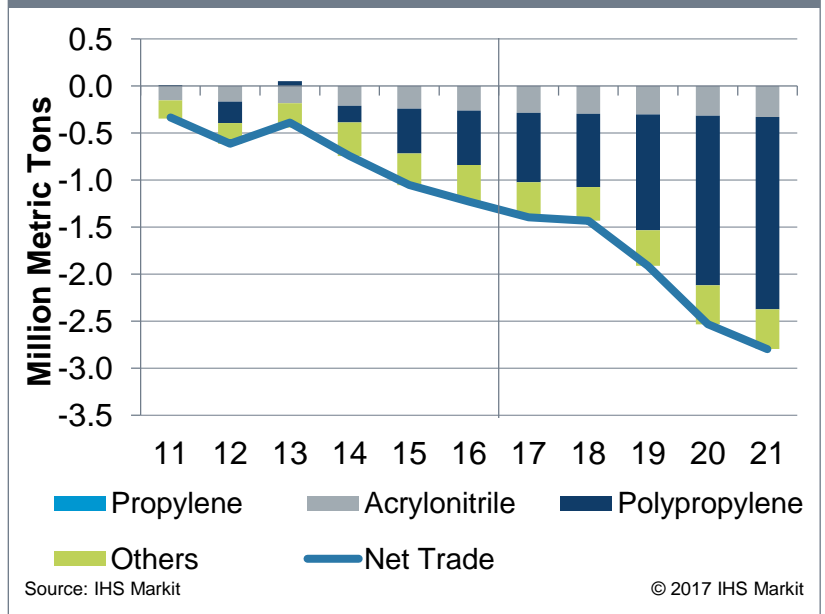
- China demand growth will slow but remain substantial driven by the growth of the middle classes
- Consolidate and rationalize. Centralizing production bases into chemical industry parks
- Financing is becoming more transparent
- Environmental legislation is becoming more stringent. Introduction of carbon tax dents competitive position of coal
- China is approaching self-sufficiency for some products forcing exporters to find new markets. In other value chains, import dependency is growing
- SOEs vs private companies. Private companies now allowed to import crude. Mega-aromatics complexes back integrating into refining and planning to add olefins capacity

# India's petchem and polymer investment is not keeping up with domestic demand growth

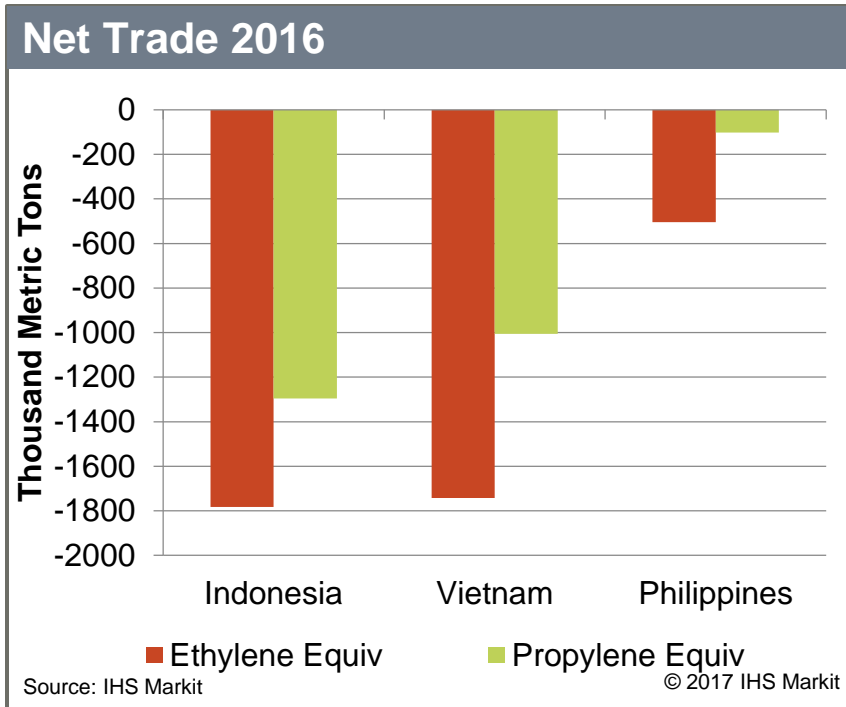
### Indian Subcontinent Ethylene Net Equivalent Trade



### Indian Subcontinent Propylene Net Equivalent Trade



## Growing deficits of base chemicals and polymers are investment opportunities in Indonesia, Vietnam and The Philippines



- Indonesia and Vietnam studying joint venture cracker opportunities.
- NOC involvement: decision making process is slow
- Transportation fuel deficits driving refinery investments
- Logistics: some parts of eg Indonesia are easier to supply from other SE Asia countries

## Asia Pacific Summary

- Asia Pacific is not a homogenous market. China will remain a huge opportunity but India, Indonesia, Vietnam and others have large populations and substantial and growing petchem deficits
- Not a feedstock cost advantaged region. “Cheap” feedstocks elsewhere have oil parity once they reach APAC
- Growing fuel needs are driving refinery investments across SE Asia and India, on the back of which there will be opportunities for petchem investments
- As coal based investments slow down, there will be greater dependence on naphtha cracking to close the ethylene balance
- On purpose propylene units are essential to the supply-demand balance and set the pricing in the market. Slowdown in investment and technical glitches could leave the market short by 2020