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China's olefins and polymers demand – Can it absorb new US capacity

Tehran, Iran

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April 2017

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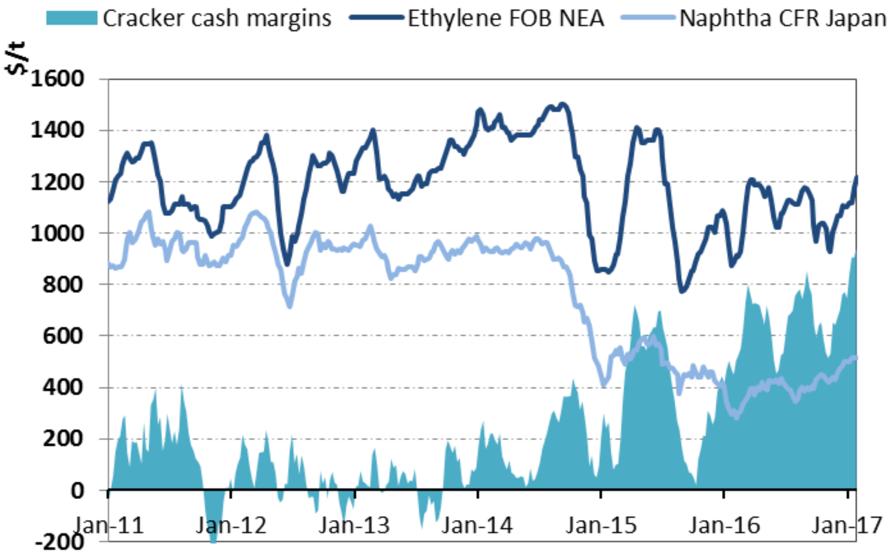
Asian/ Chinese Ethylene Industry

- Current operations and margins
- New capacity and investments
- Coal and methanol based capacity additions

Asian naphtha crackers run at high rates, record margins

- Naphtha crackers dominate Asian ethylene production, and also the second largest source of propylene
- High op rate 91-95pc on average
- Co-product prices surge in 2017 – propylene, butadiene, benzene
- Average cracker margins above $900/t now, $600/t in 2016, $365/t in 2015 and $190/t in 2014

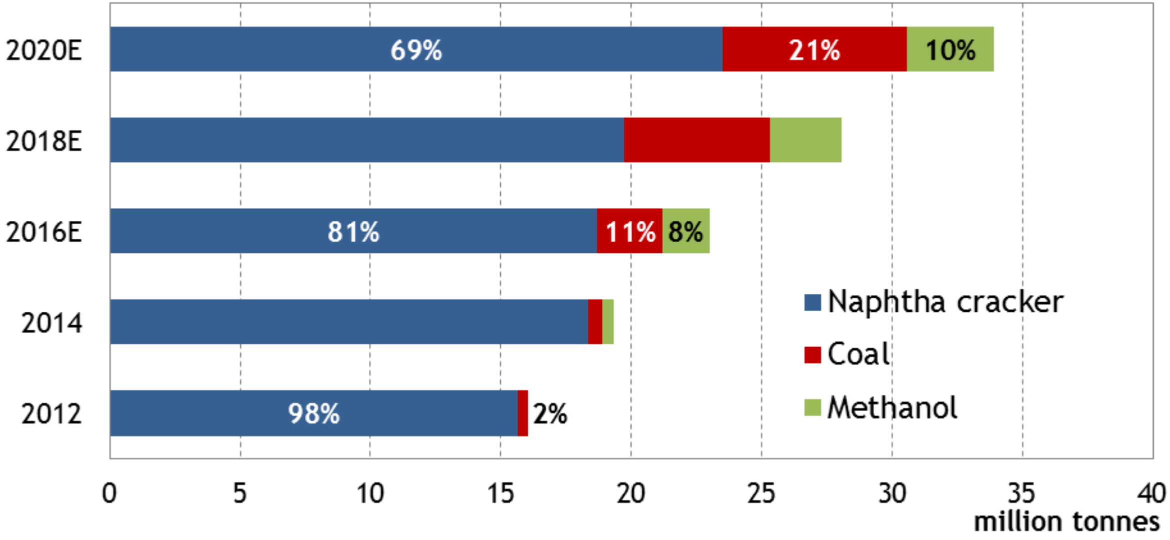
Asia cracker operations & margins



Data source: Argus

Unconventional ethylene >30pc of China capacity by 2020

China ethylene capacity by feedstock



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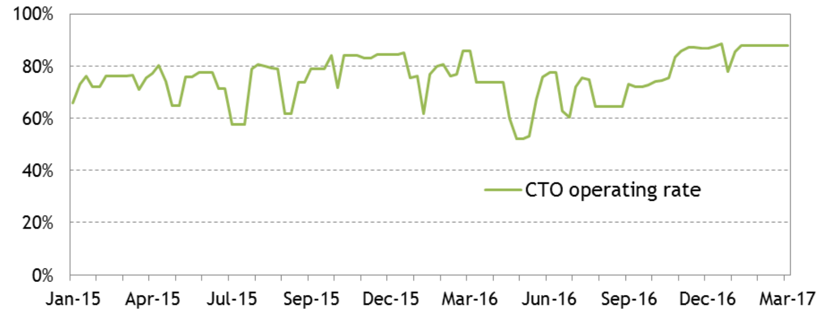
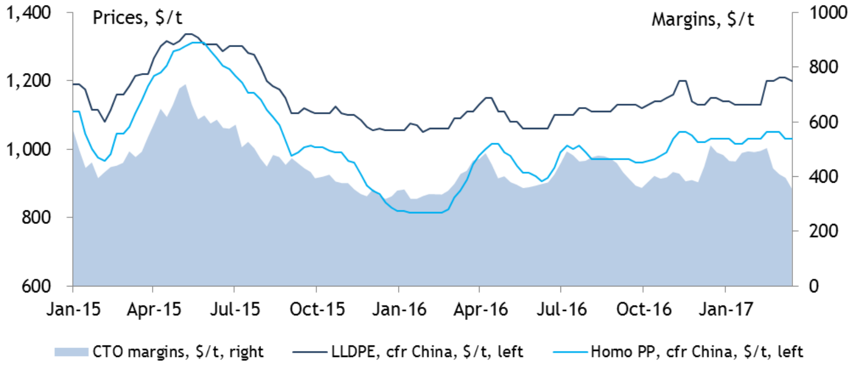
CTO competitiveness weak if crude is below $50/bl

- China has 9 CTO plants and 3 CTP plants
- Coal-based olefins capacity now 6.9mn t/yr
- The average O/R was 85pc in 2015 and 73pc in 2016 because of new capacities
- CTO margins averaged $480/t in 2015, and $400/t in 2016

China CTO operations & margins





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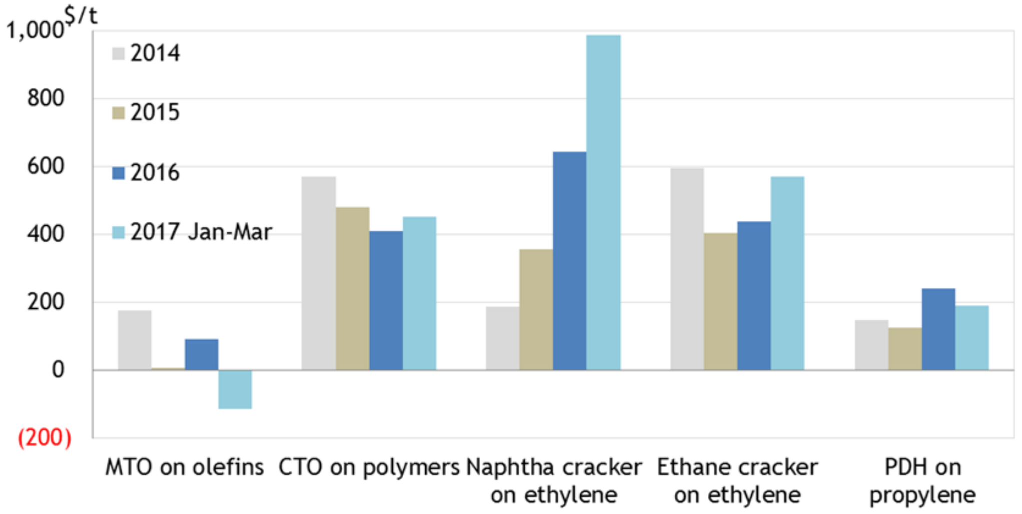
MTO margins are the lowest against other olefins tech

Olefins margins by feedstock



- MTO margins were negative so far in 2017, affected by a downturn in olefins market
- CTO margins attractive, but are losing their competitiveness to naphtha crackers on lower crude prices

Asia/Middle East expansions slow in 2015-16

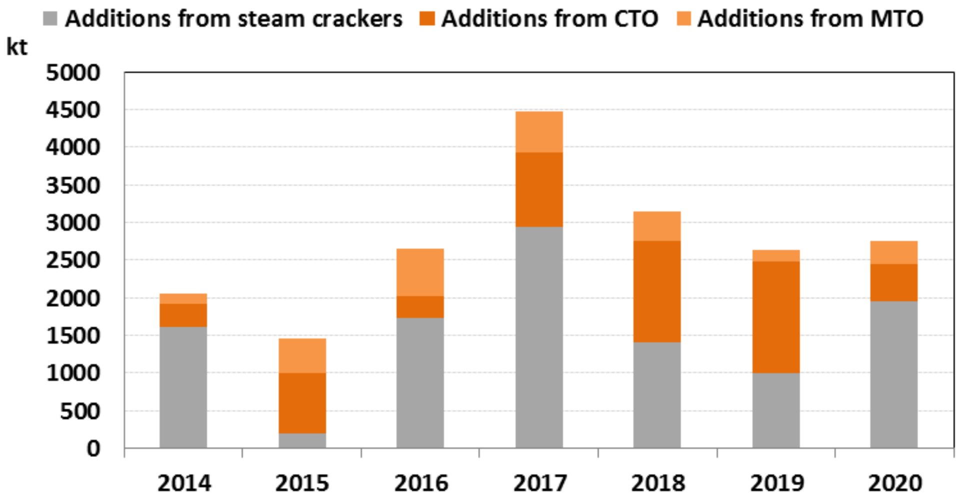
A rethink of naphtha cracker projects in China and new NGL crackers

Limited new cracker capacity in the last 3 years

2017 will see Reliance, Opal, and ramp up at Sadara, 2018 CNOOC Shell

Some naphtha crackers had been stalled in China, now talks of reviving from Sinopec.

China to build an ethane cracker – 650kt by SP Chemical (construction started Feb 2017) and 1mnt of LPG based cracker by Wanhua – to start construction 2017



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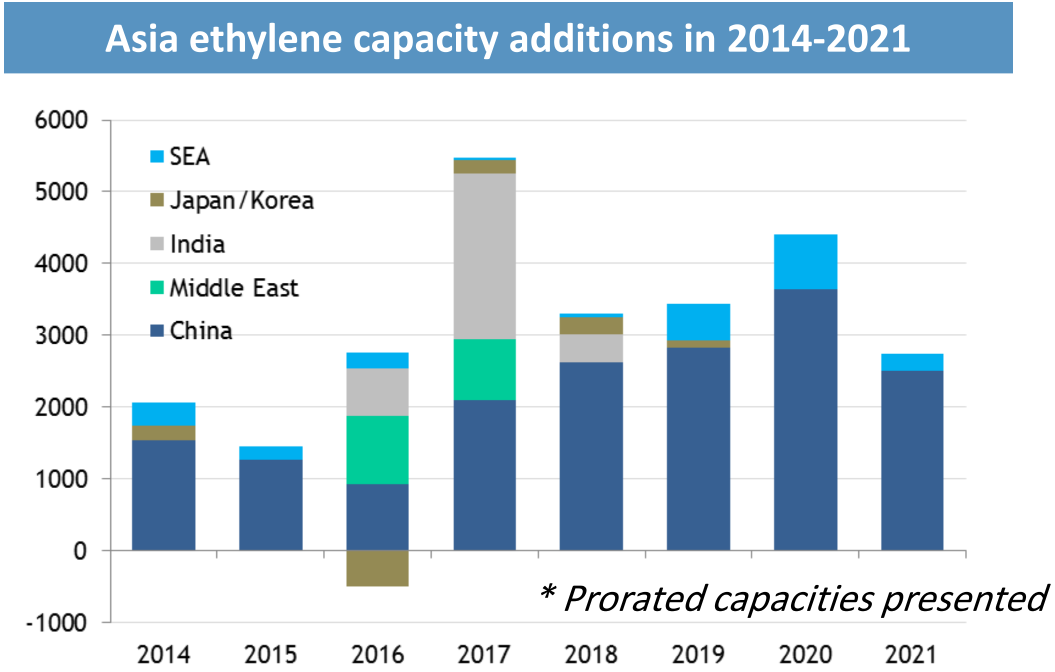
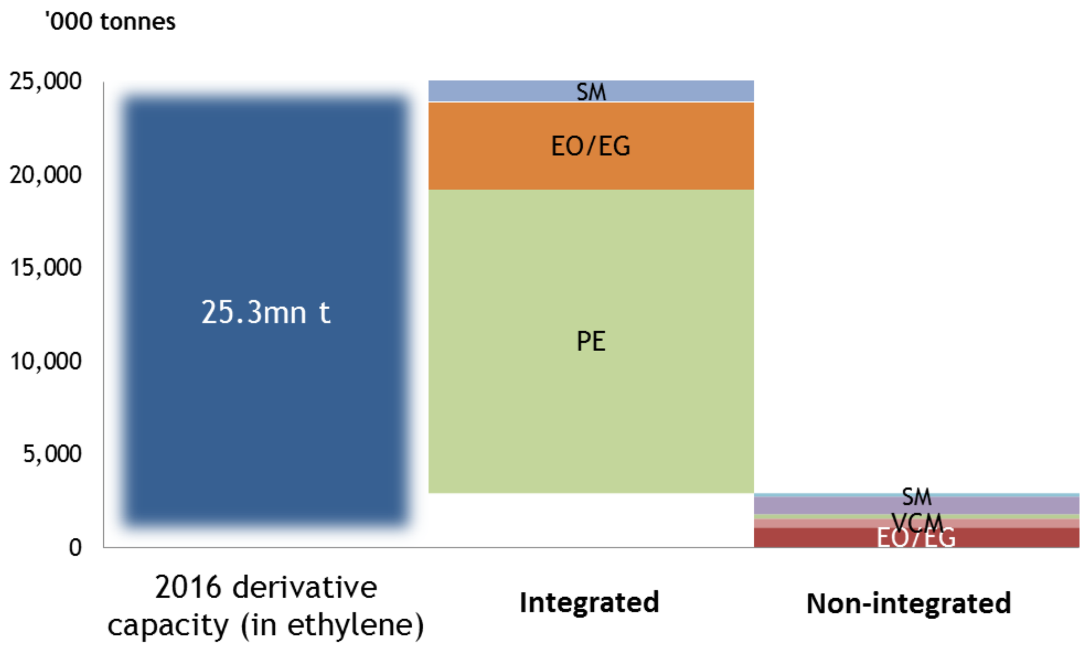
Asian Ethylene capacity expansions speed up on high margins



- Asian ethylene capacity to expand by more than 5mn t/yr in 2017 and by 3mn t/yr plus in the coming years
- China leads the expansions by adding on new CTO/MTO as well as naphtha /ethane/LPG crackers

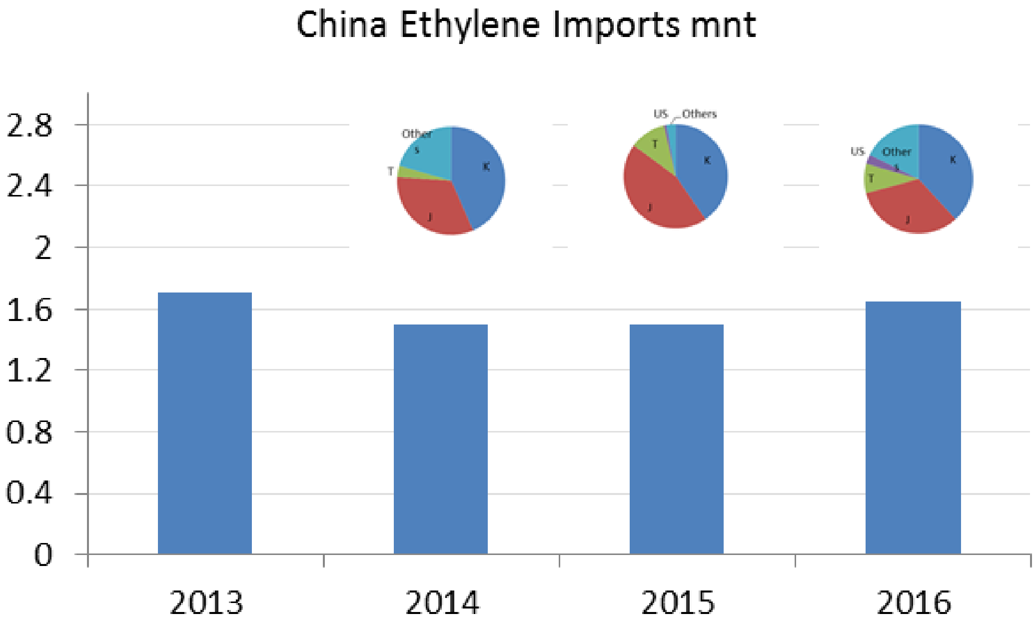
Chinese standalone derivatives drive imports

SM, EO, VCM , EPDM are key derivatives for C2 imports



China to remain a net ethylene importer

Main suppliers South Korea, Japan and Taiwan



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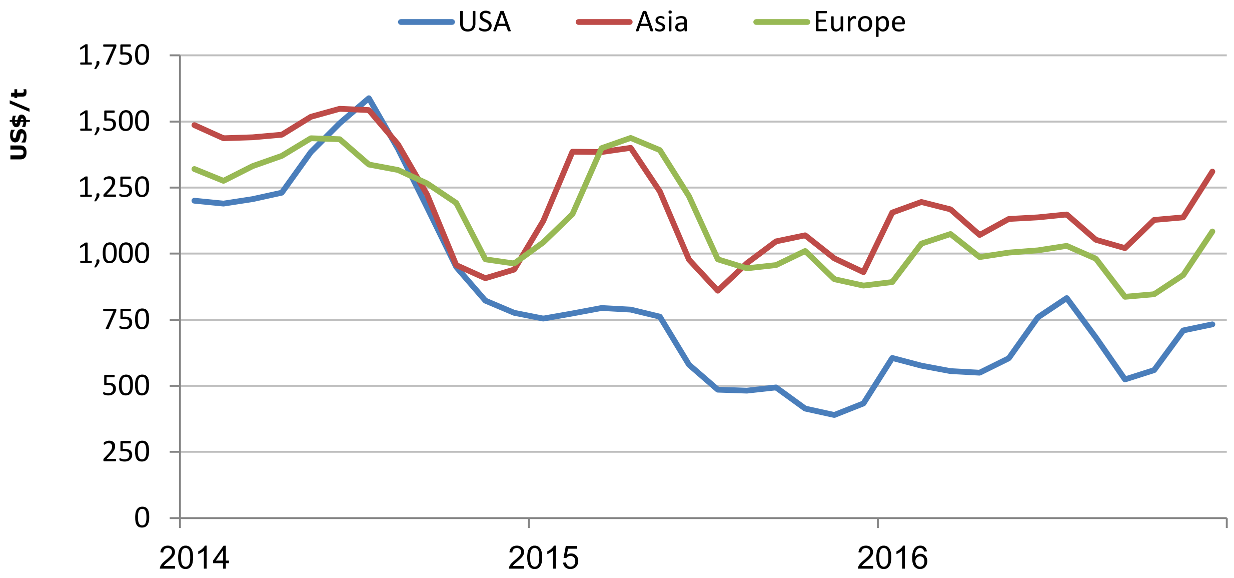
Despite arb, US ethylene export capacity limited



Asian/ Chinese Polyethylene Industry

- China PE capacity development
- China PE demand and import outlook

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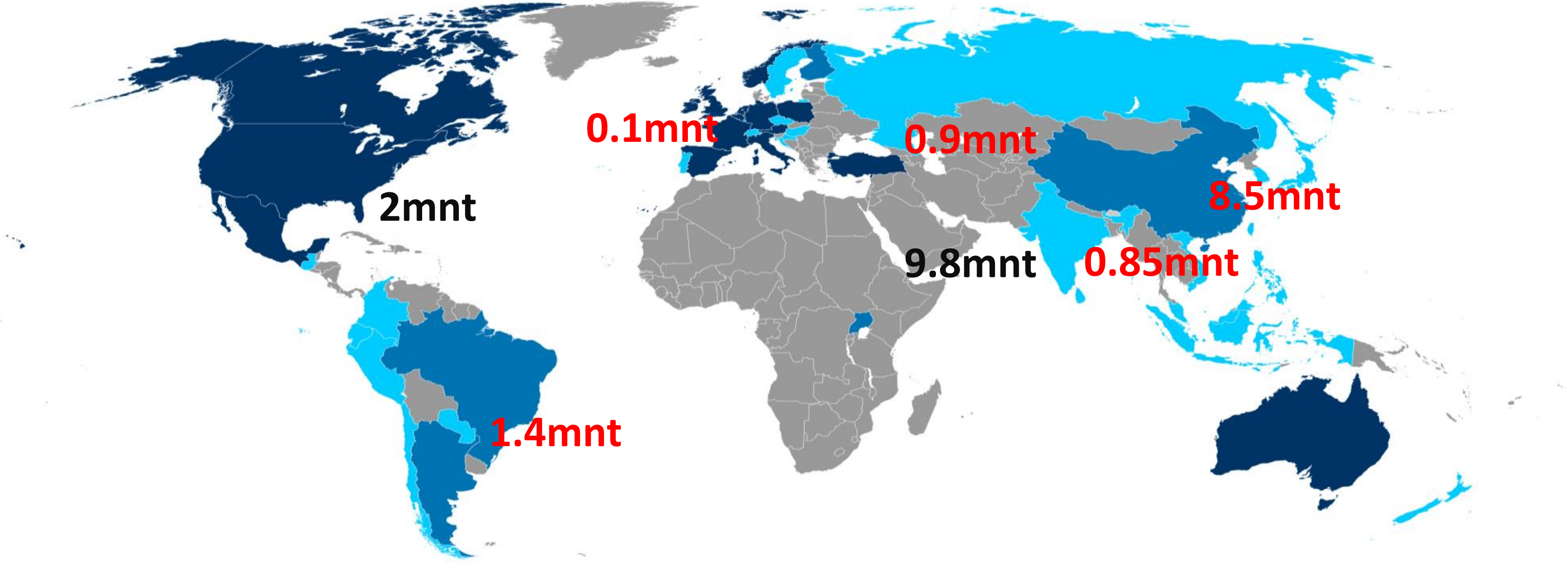
2015 World net PE trade



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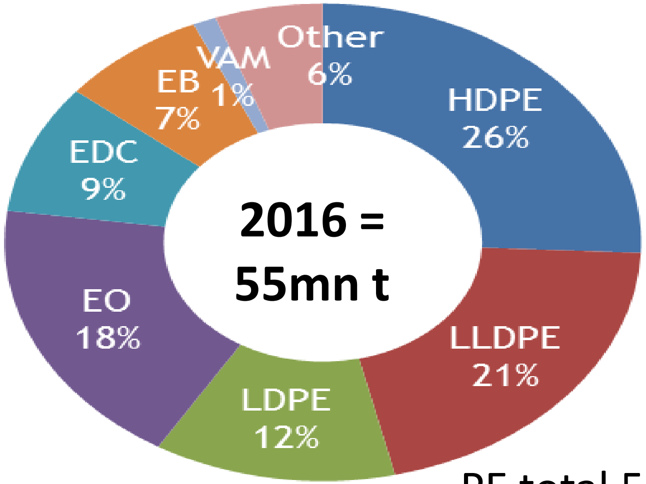
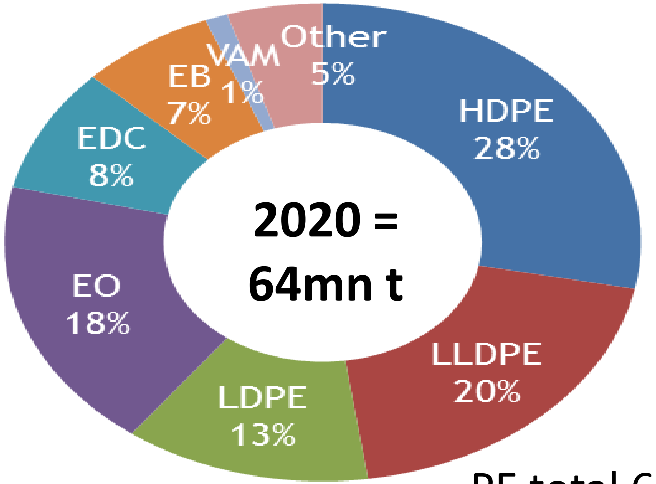
PE demand to grow by 20pc by 2020, another 9mnt

Asia ethylene demand by segmentation



PE total 59%

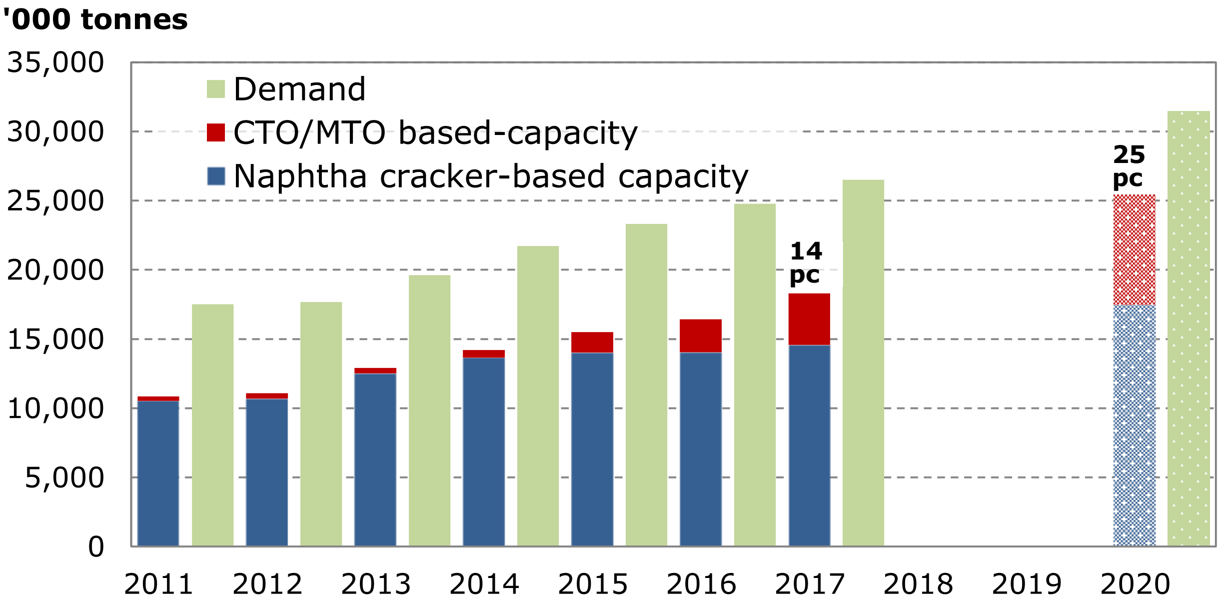


PE total 61%

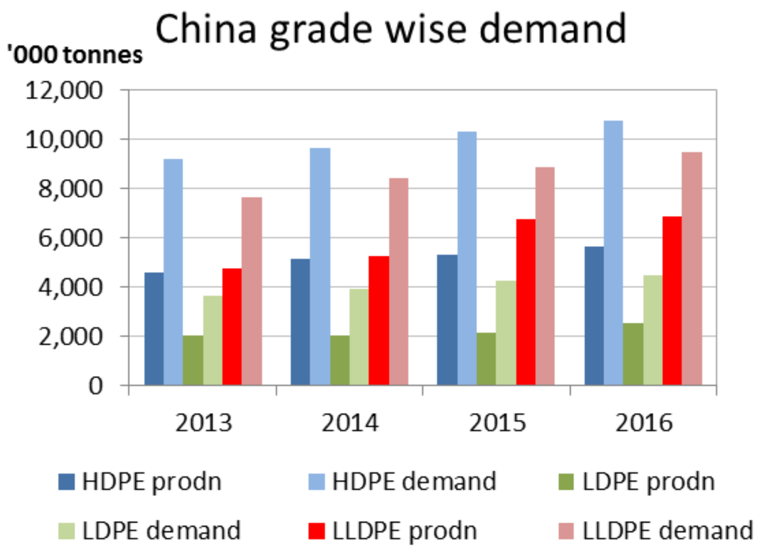
Data source: Argus Ethylene Annual 2016

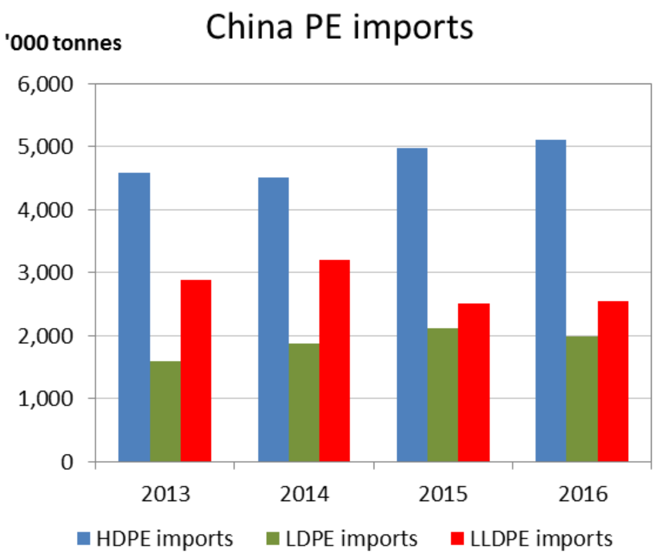
Chinese coal based PE capacity growing

Coal based capacity to be 25pc of total Chinese PE capacity by 2020

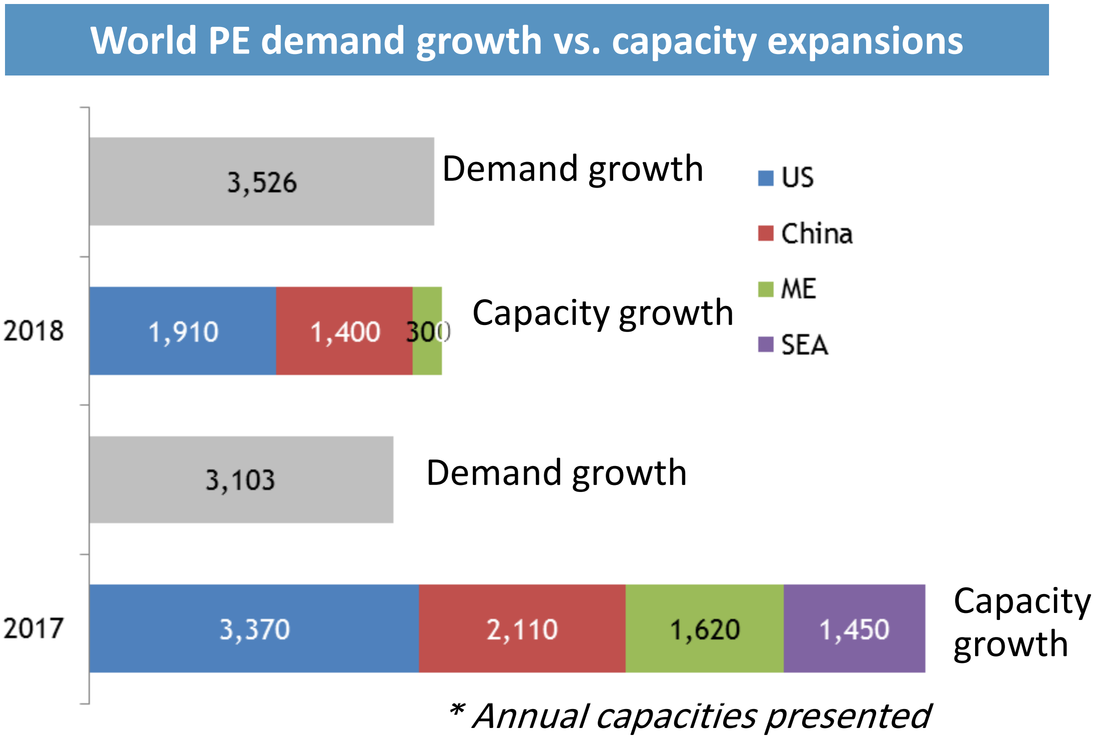


China grade wise PE demand





World PE industry is facing massive capacity expansions in 2017-2018



- Major ethylene downstream PE's capacity expansions outpaces demand growth during 2017-2018-2019
- The impact to ethylene could be negative as most PE projects are integrated

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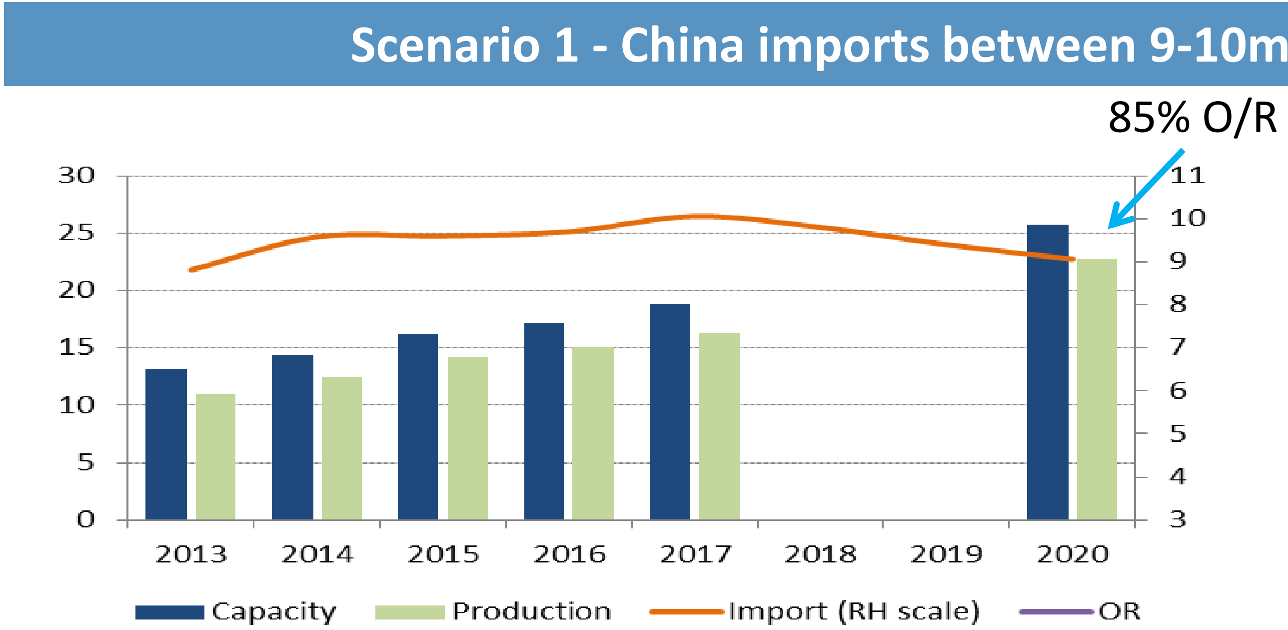
China PE capacity growing, remains net importer



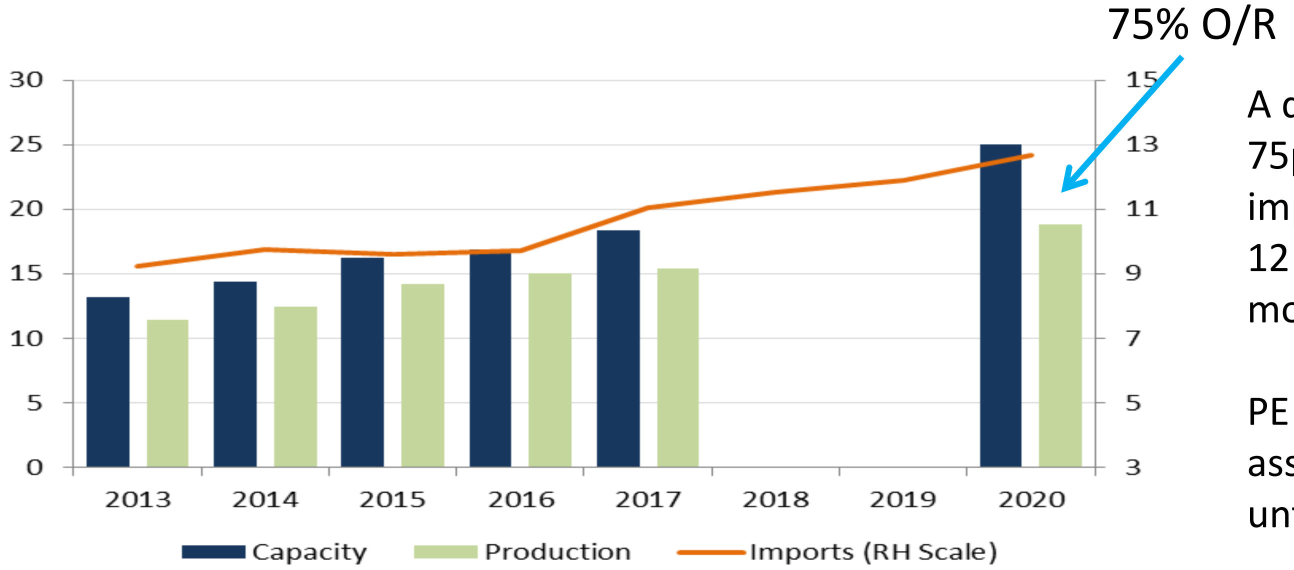
China has imported close to 10mnt of PE annually

PE O/R remain high around mid 80's

Coal and naphtha based capacity operates well

China PE capacity as well as imports grow

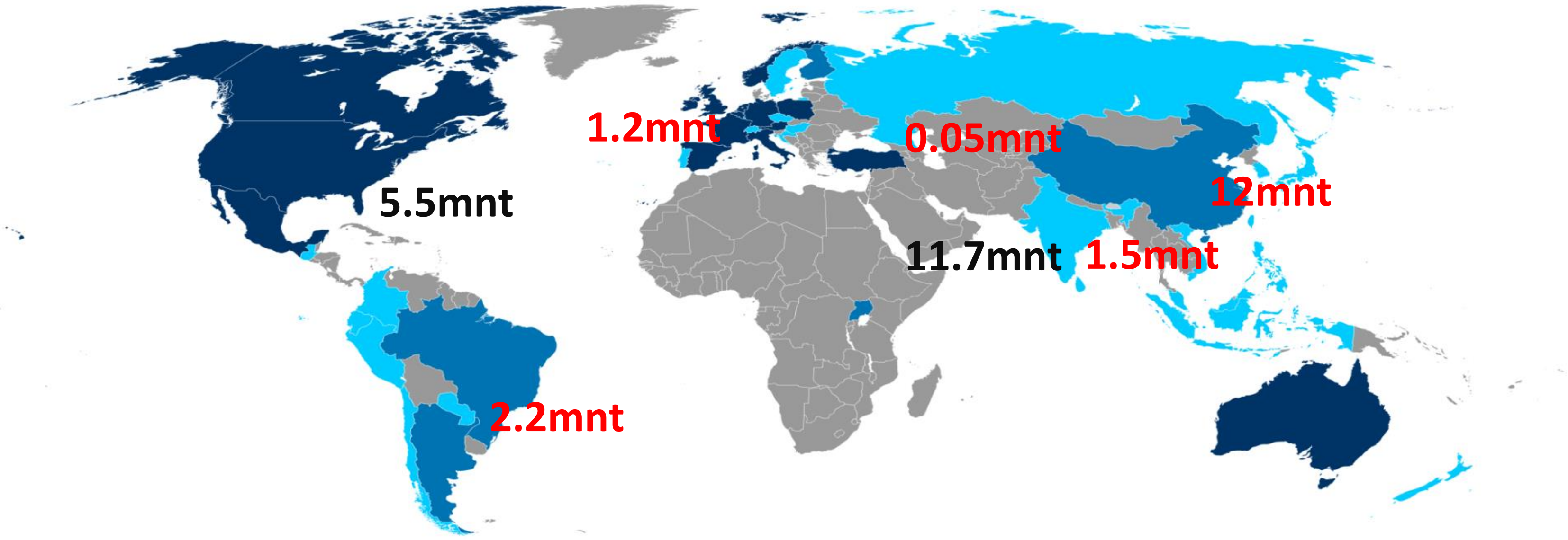
Scenario 2 - China imports grow to around 12mnt



A drop in O/R to 75pc needed for imports to grow to 12 mnt and absorb more US exports

PE growth rate assumption at 6pc until 2020

2020 World net PE trade



Developments in the Asian/ Chinese Polypropylene Industry

- China PP capacity development
- China PP demand and import outlook

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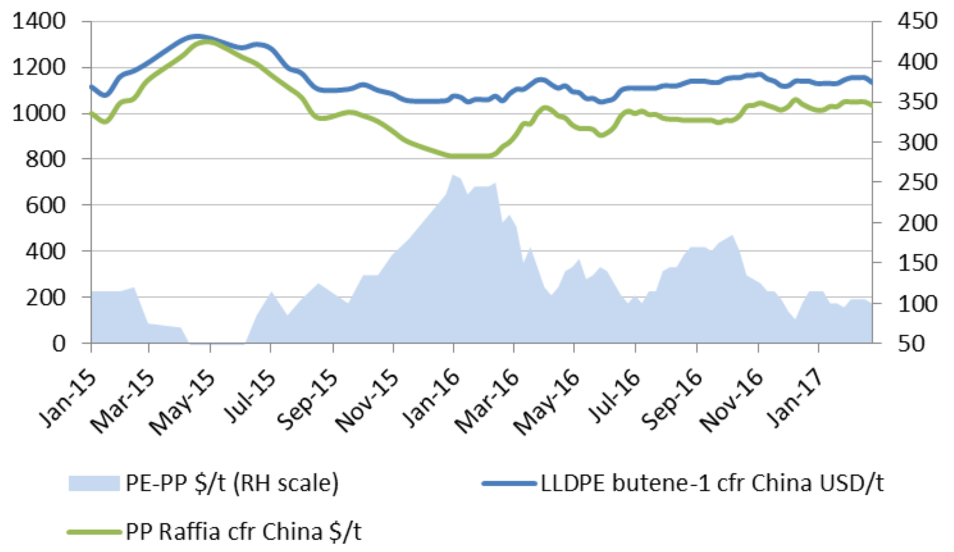
PP prices at discount to PE in Asia/China

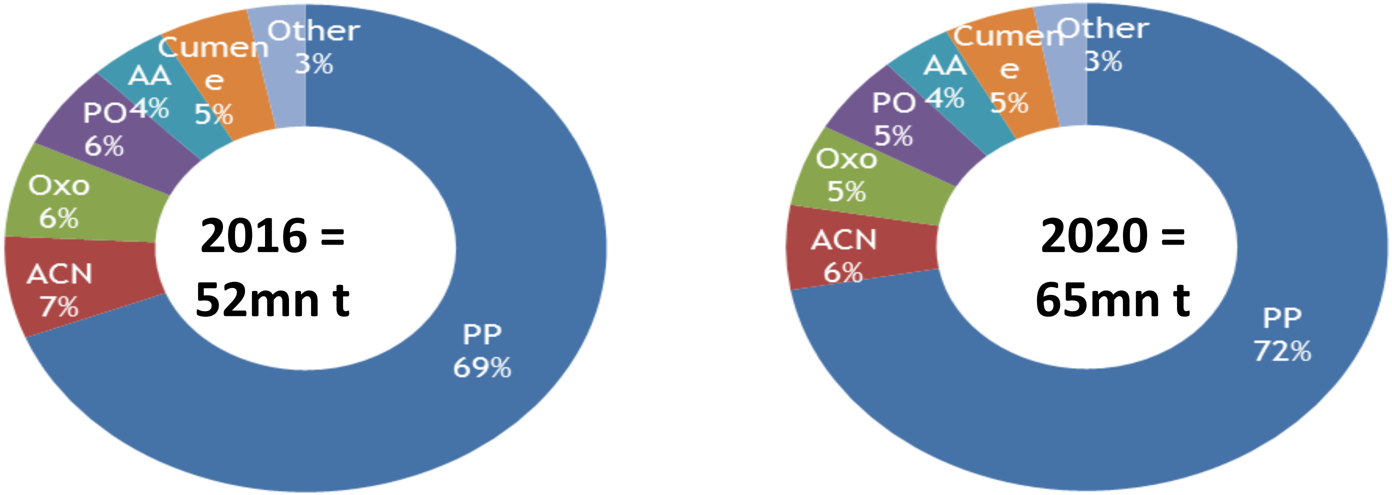
Helping PP grow faster than PE



Increasing PP supply and persistent price discount to PE resulting in faster growth rates for PP in Asia

PP demand to grow 32pc by 2020, leading derivatives

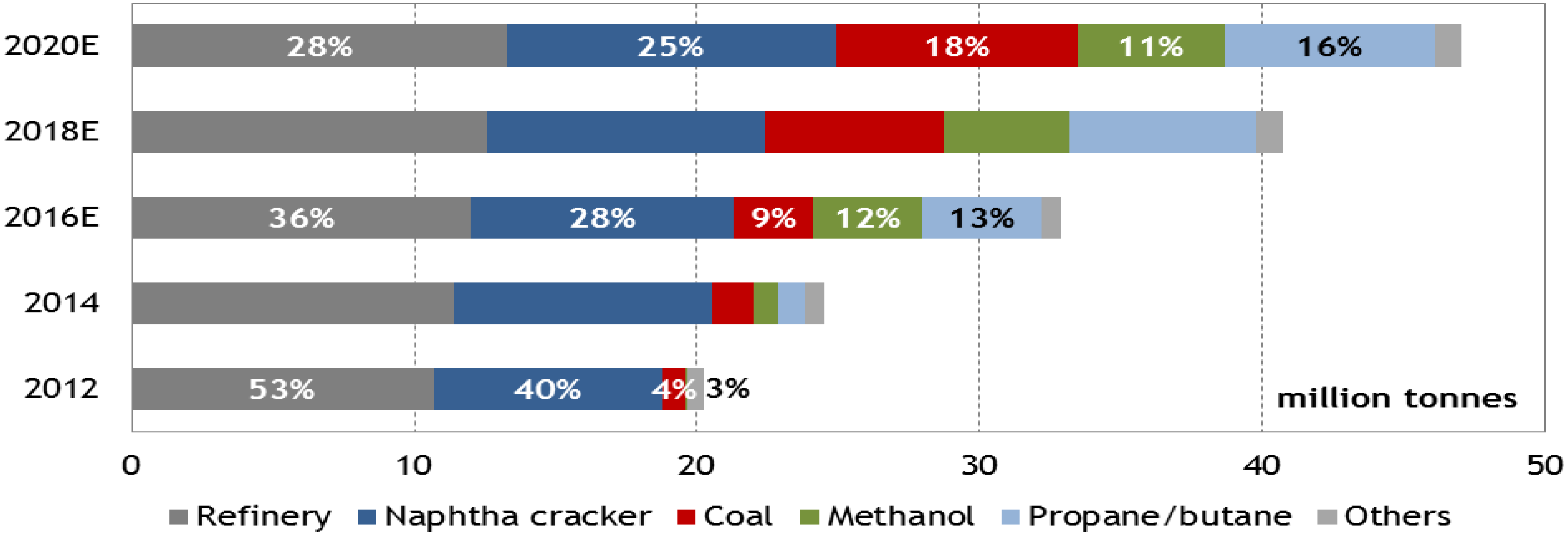
Asia propylene demand by segmentation



Data source: Argus Propylene Annual 2016

Surging propylene capacity drives PP supply, demand

Unconventional propylene will reach 45pc of China's production by 2020



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Summary

- Naphtha cracker margins in Asia still robust amid high ethylene and coproduct prices;
- High margins are prompting new cracker projects in China – including naphtha, ethane and LPG
- Market share of coal based olefins production technologies is expanding, but their economics and operations are vulnerable.
- Coal based PE capacity to reach 25pc of China’s total by 2020. Operations of this segment key to overall domestic PE production in China
- China building more propylene and PP capacity. PP demand growing more rapidly than PE on competitive prices, availability and properties. PP to take some share from PE and other polymers
- Massive US PE capacity expansions in end 2017 and 2018 and the need to sell them to China will weigh on global PE prices

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