

Key Trends in Global Petrochemicals Markets

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Agenda

- **IMO 2020 will impact refinery olefins & aromatics supply, potential for increased volatility**
- **International ethylene prices will be set by high cost naphtha crackers and outages while the US waits for the Enterprise export terminal to open**
- **Polyethylene capacity additions expected to pressure the market over the next 5 years**
- **Propylene prices will be set by Asian PDH units and gasoline values while the PP market will remain balanced to tight in the near term, especially in the US**
- **PX/PET upcoming expansions will take pressure off the markets and prices will be set by aromatics gasoline blending value floor and PET ceiling via substitution**
- **Plastics recycling – China ban on plastics waste imports, increasing social media attention and need to change consumer behavior**

IMO 2020 Impact

Global bunker spec change will affect other sectors / industries

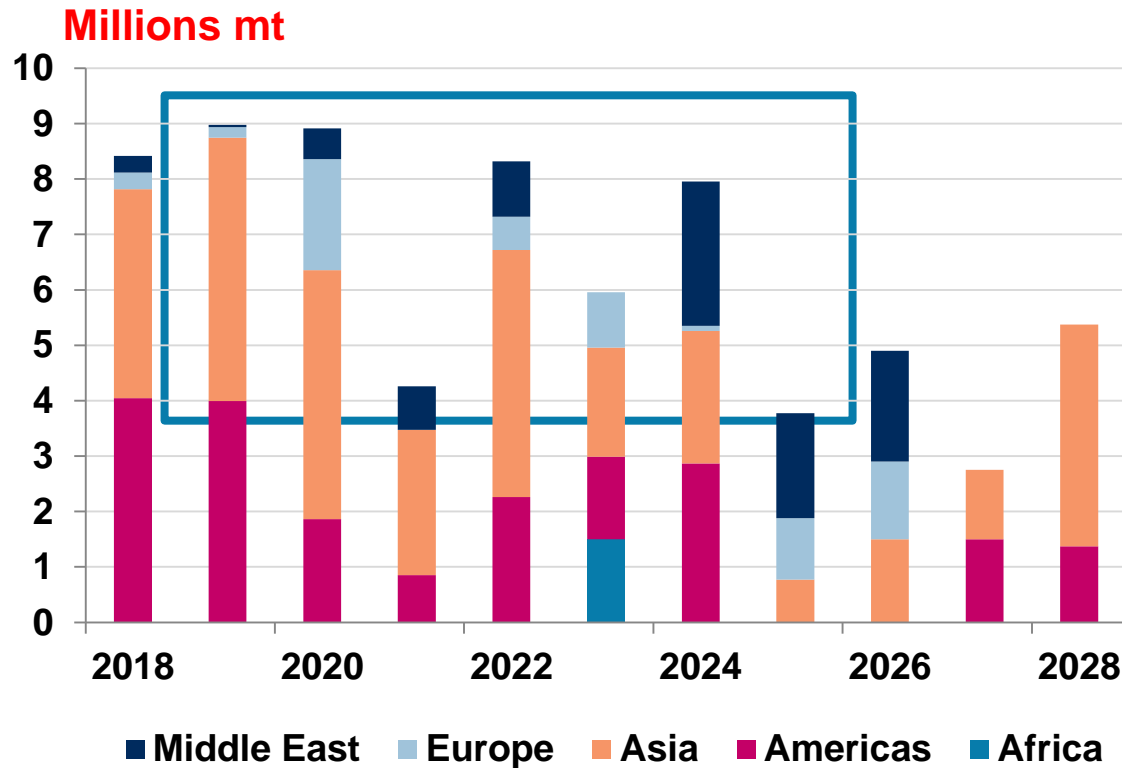
Petchem Impact

- Tighter gasoline due to yield shift implies more reforming, battle for aromatics (gasoline blending versus BTX petrochemicals)
- Higher naphtha prices implies steam cracker feed preference shift to LPG/ethane
- Lower severity FCC (max distillate mode) combined with lighter steam cracker feeds implies reduced refinery grade propylene and increased incentive for PDH supply

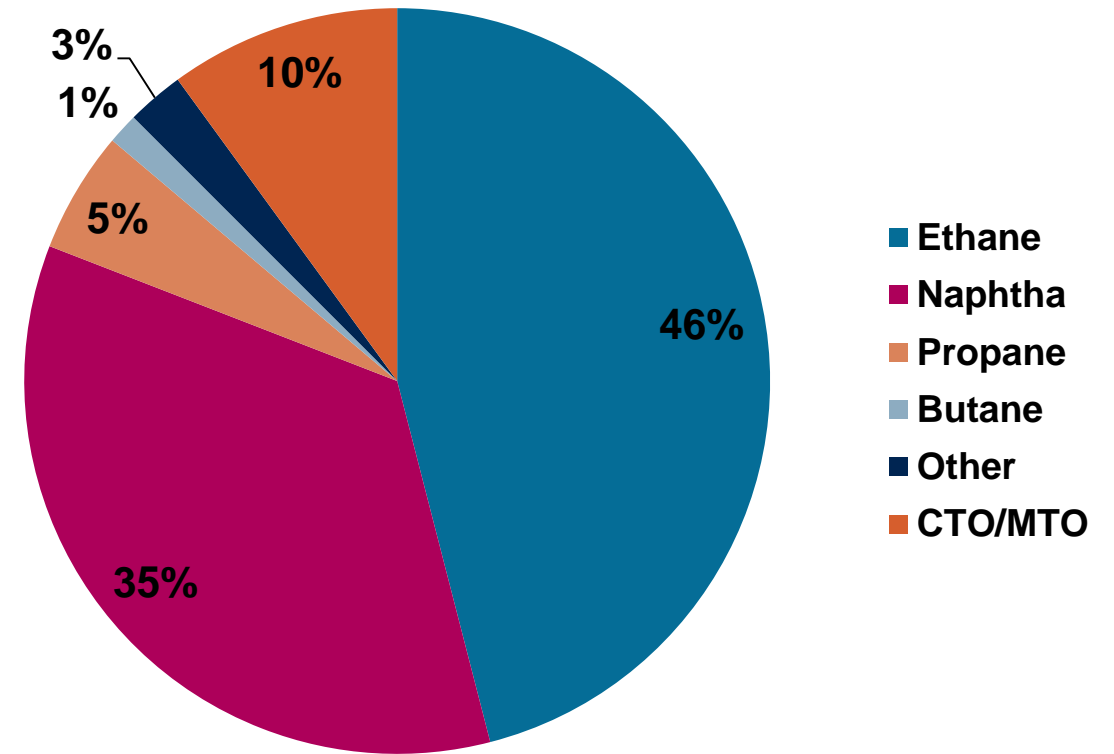
Ethylene

Global ethylene capacity additions focused in strong demand centers as well as low cost NGL feedstock hubs

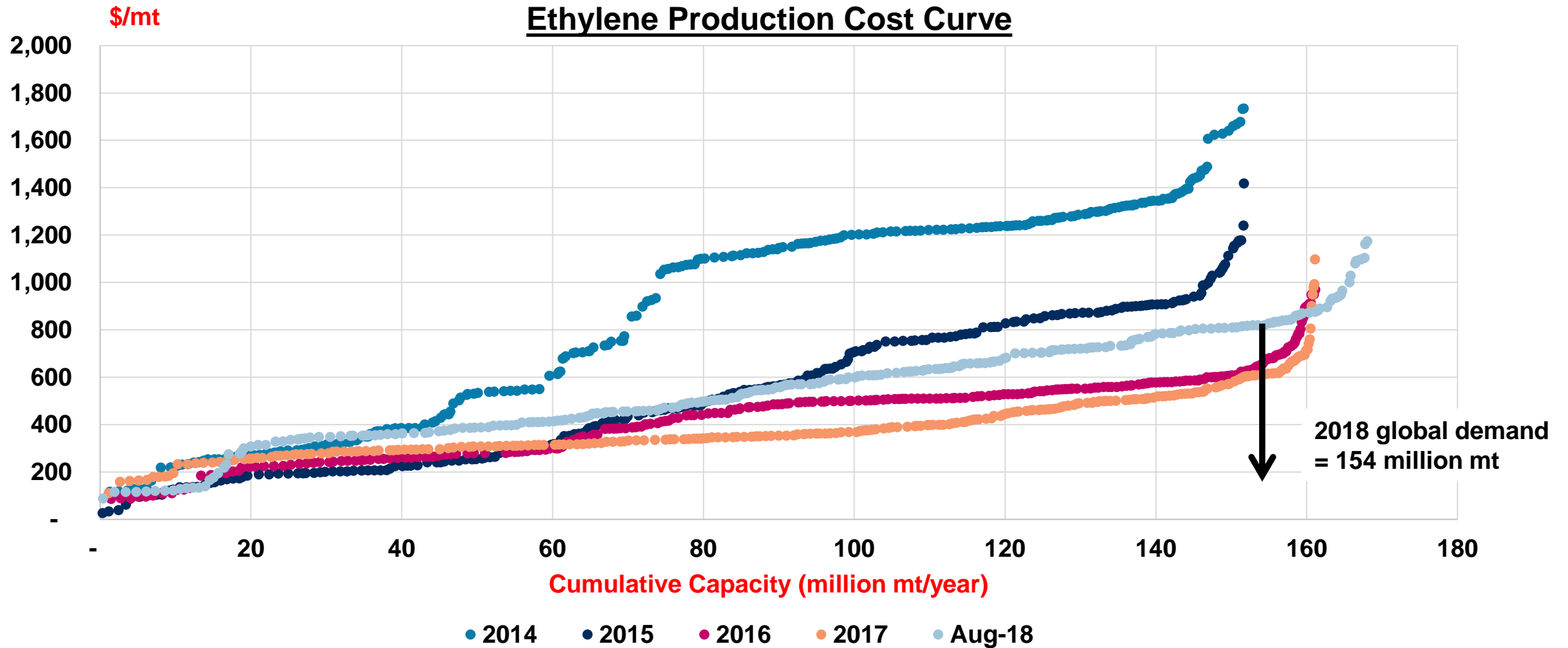
Global Incremental Ethylene Capacity Additions Including Speculative



Global Ethylene Capacity Additions by Feedstock

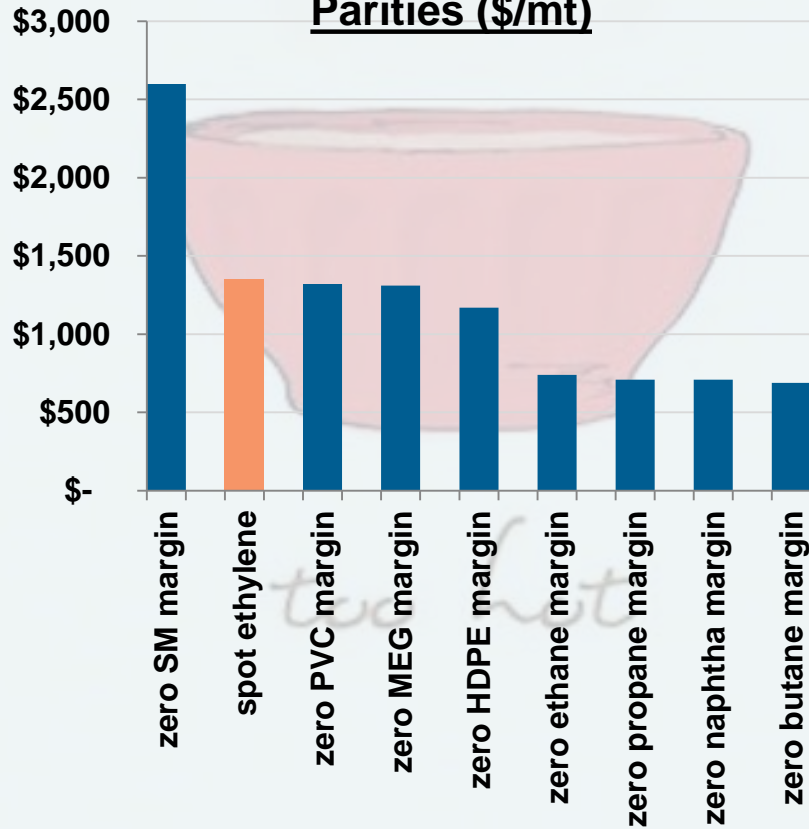


The ethylene cost curve has decreased since 2014 with the current marginal cost of production exceeding \$800/mt

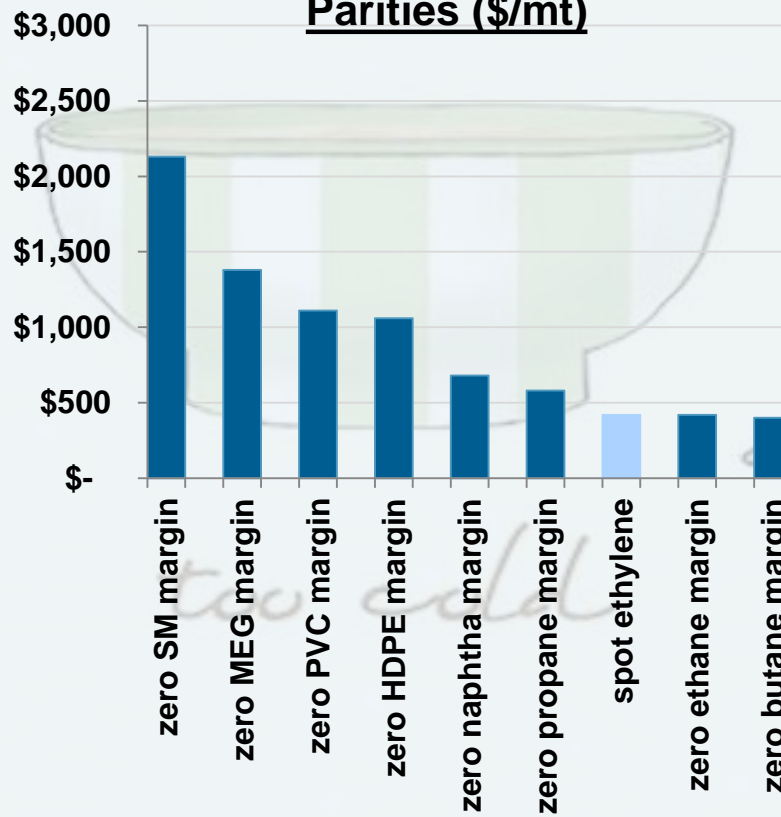


Recent ethylene market is a case of the Goldilocks Paradox: zero ethylene margins in US, too expensive for most derivatives in Asia and priced just right in Europe.

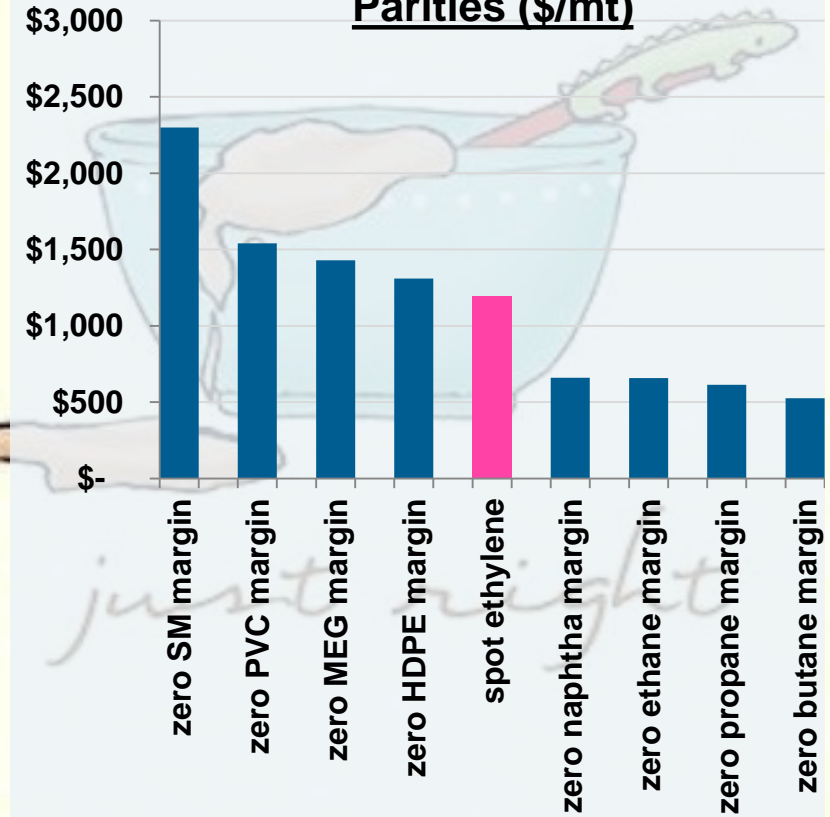
Asia Spot Ethylene Price Parities (\$/mt)



US Spot Ethylene Price Parities (\$/mt)



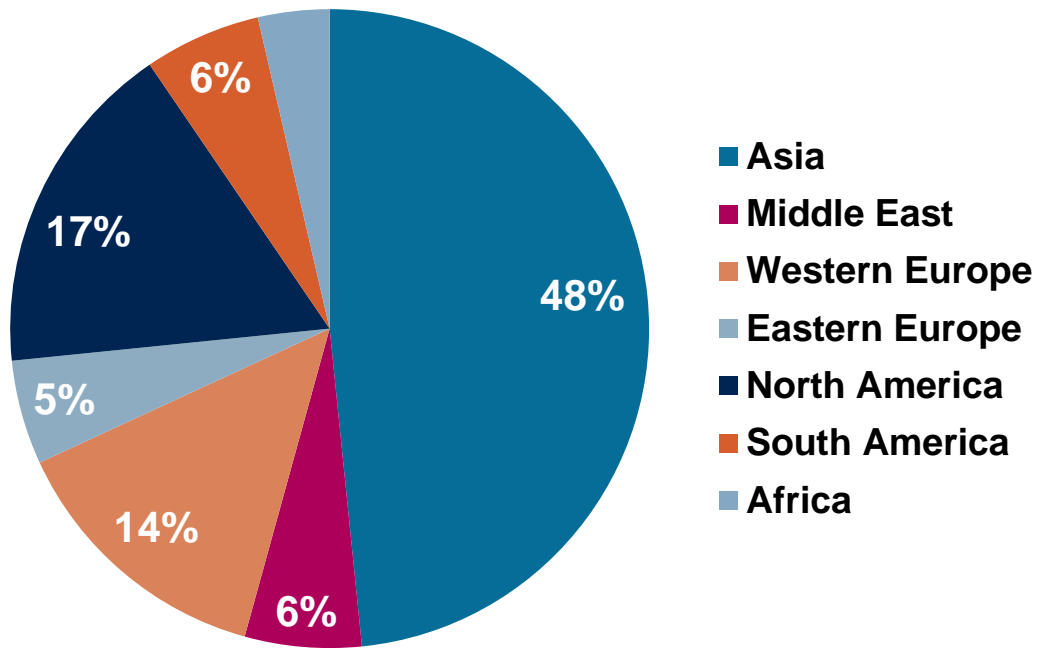
Euro Spot Ethylene Price Parities (\$/mt)



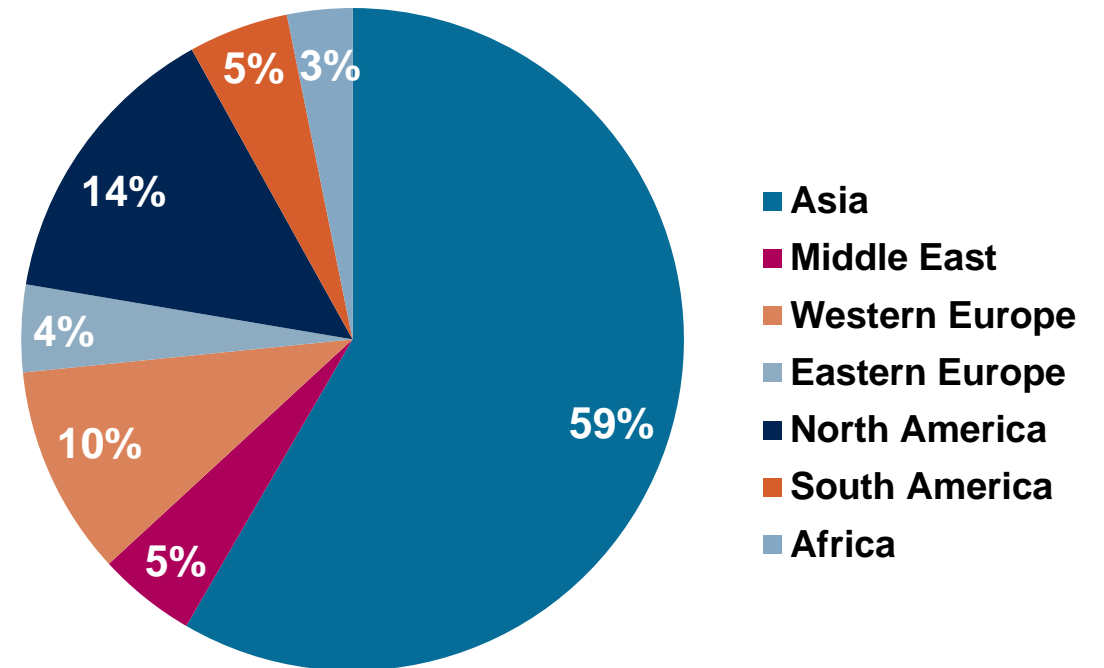
Polyethylene

Asia to dominate global PE demand with the region to account for close to 60% of total PE demand by 2028

Global PE Demand Breakdown-2018



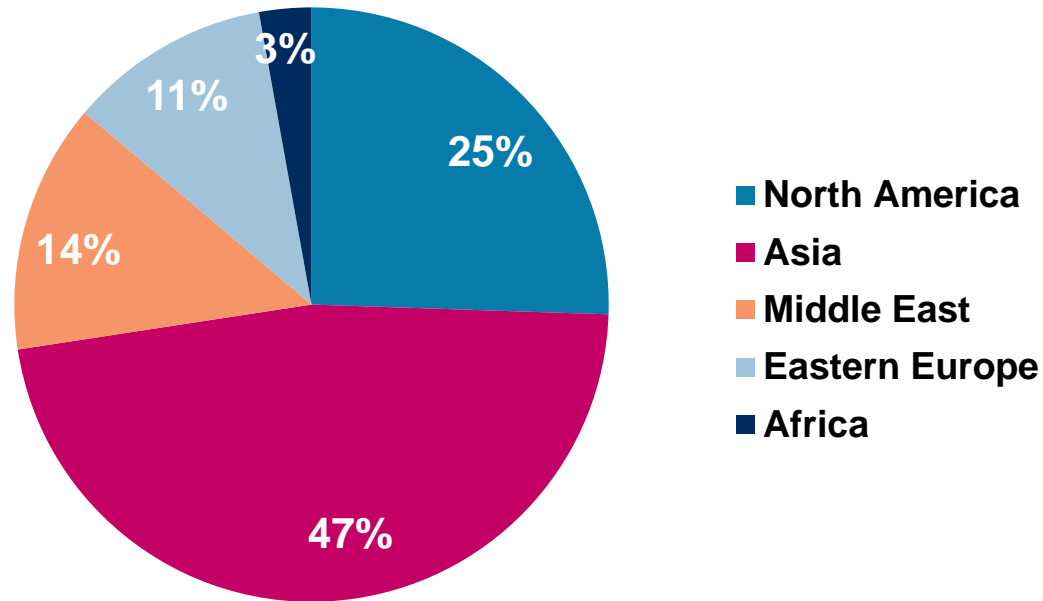
Global PE Demand Breakdown-2028



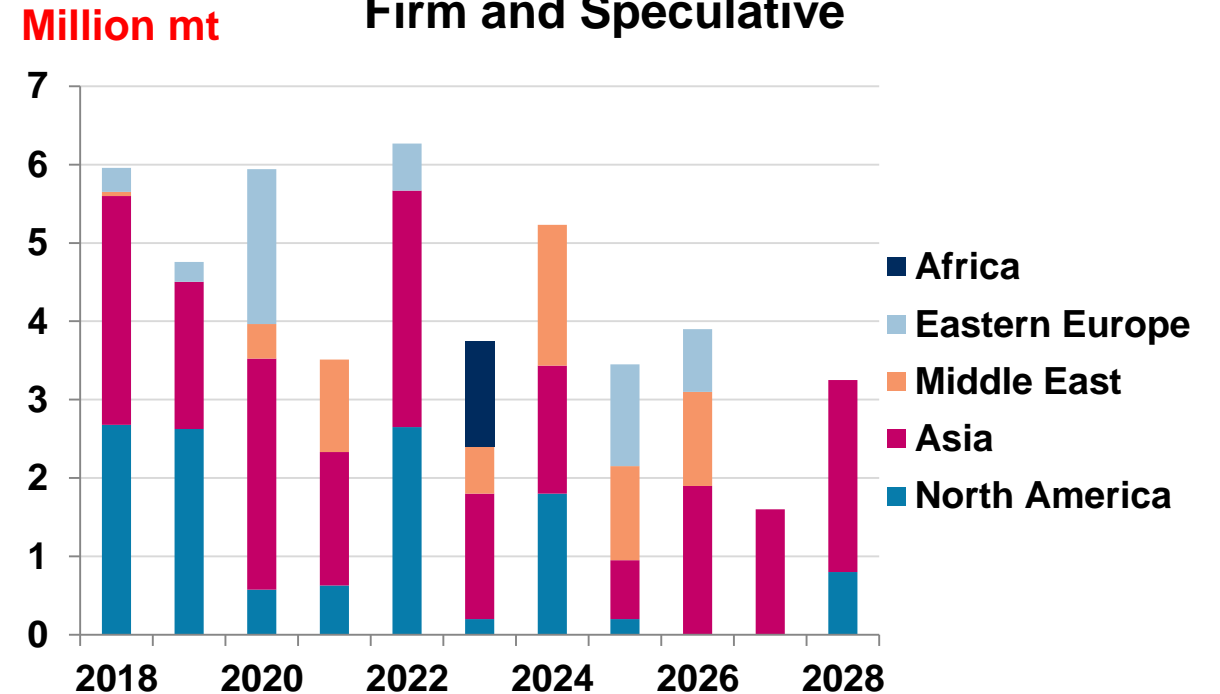
Low cost and high growth demand regions will be the main hubs of PE investment with HDPE and LLDPE leading the way

Close to 47 million mt to come on stream over the next ten years of which **6.5 million** is speculative to meet future demand growth

PE Investments by Region 2018-2028

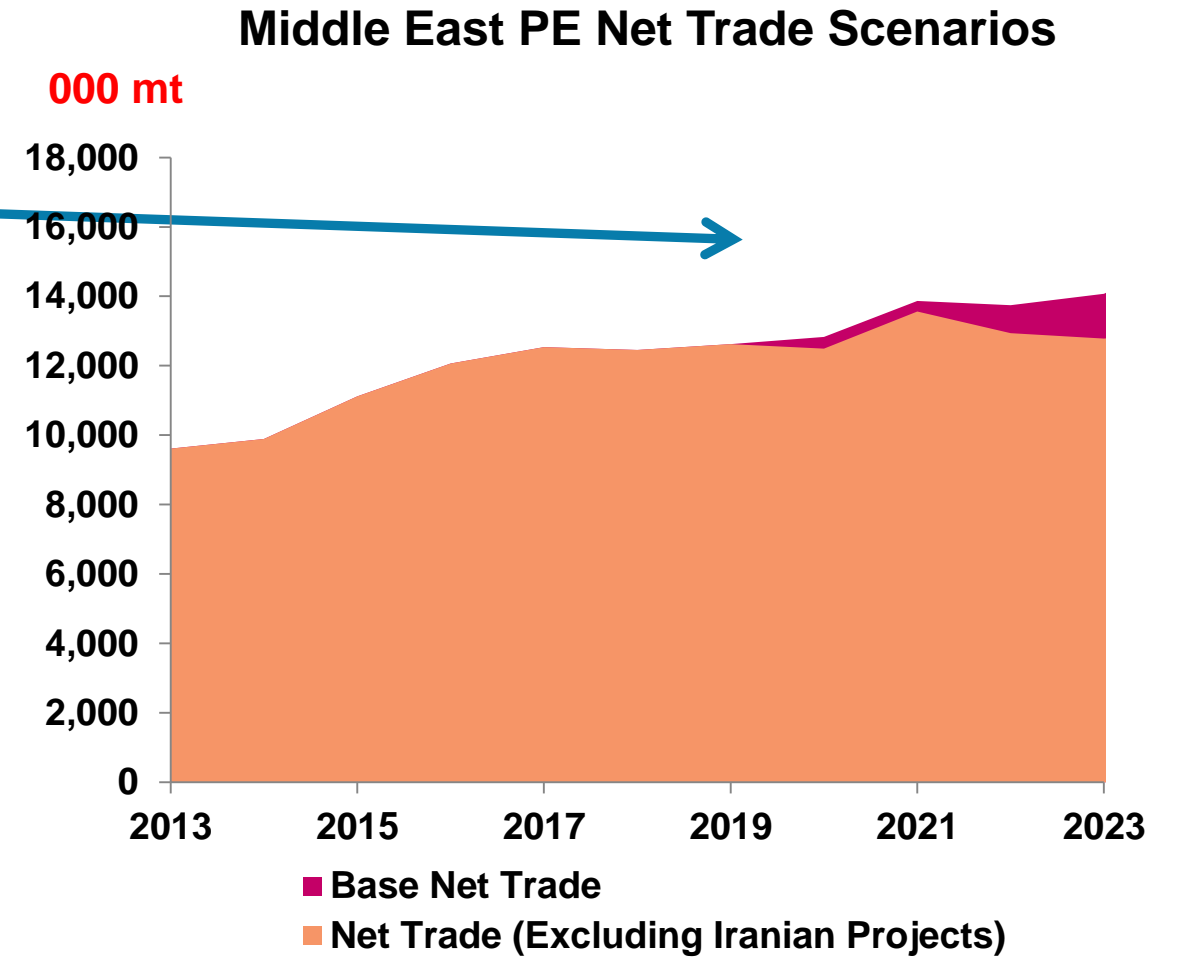
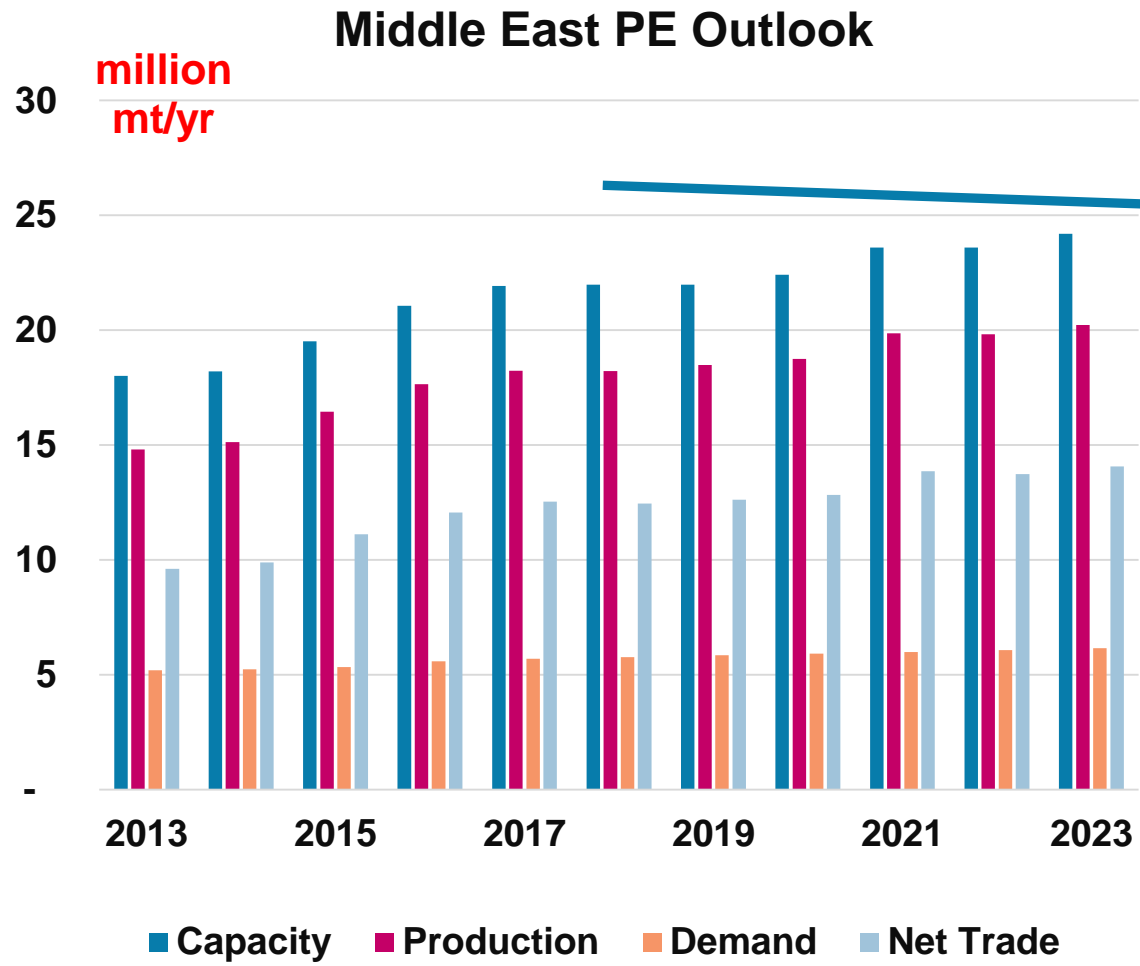


Regional Capacity Additions 2018-2028
Firm and Speculative

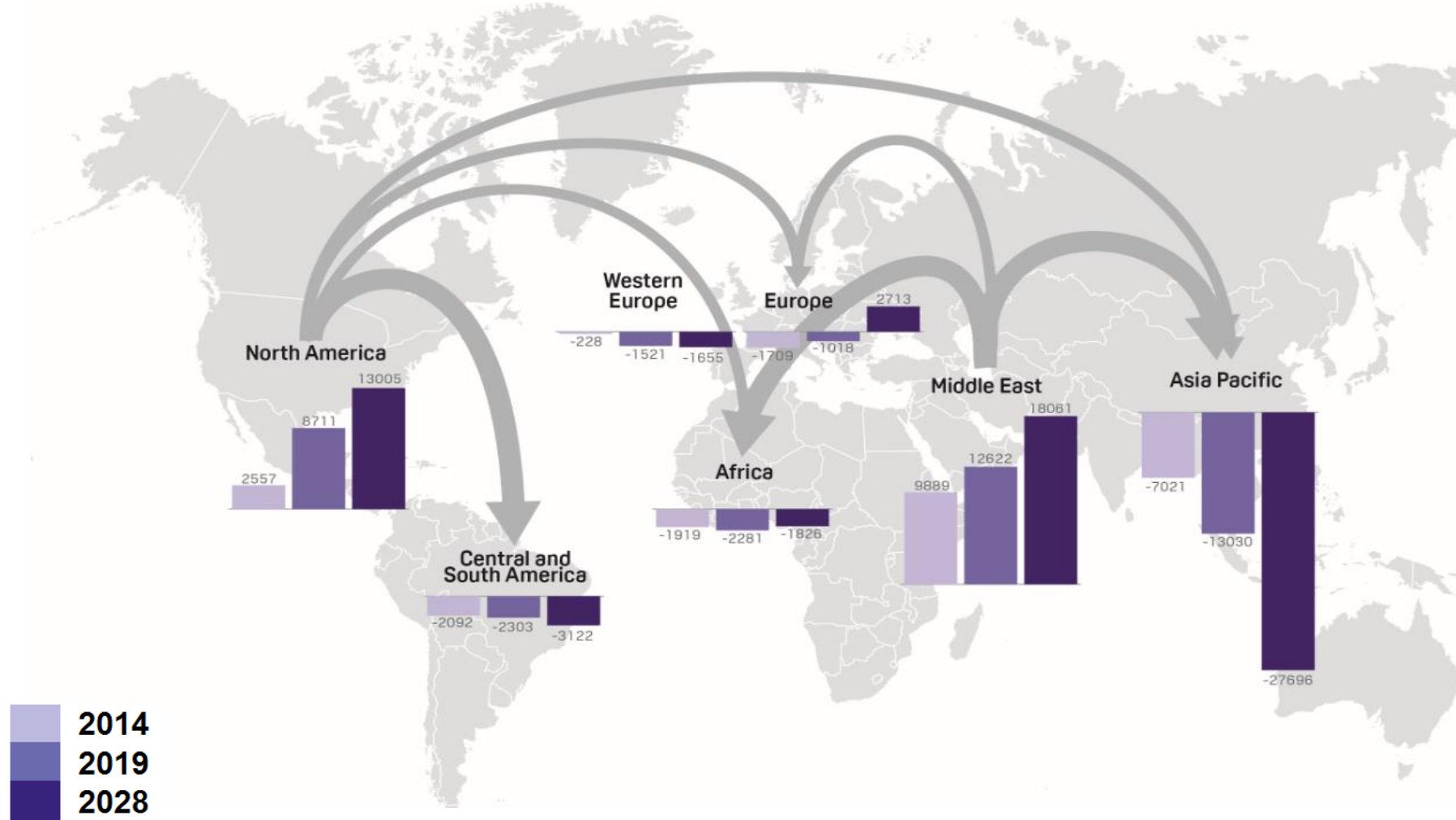


Source: S&P Global Platts Analytics

Middle East to maintain its position as the largest exporter as Iran builds out, however re-emerging sanctions could be a major caveat

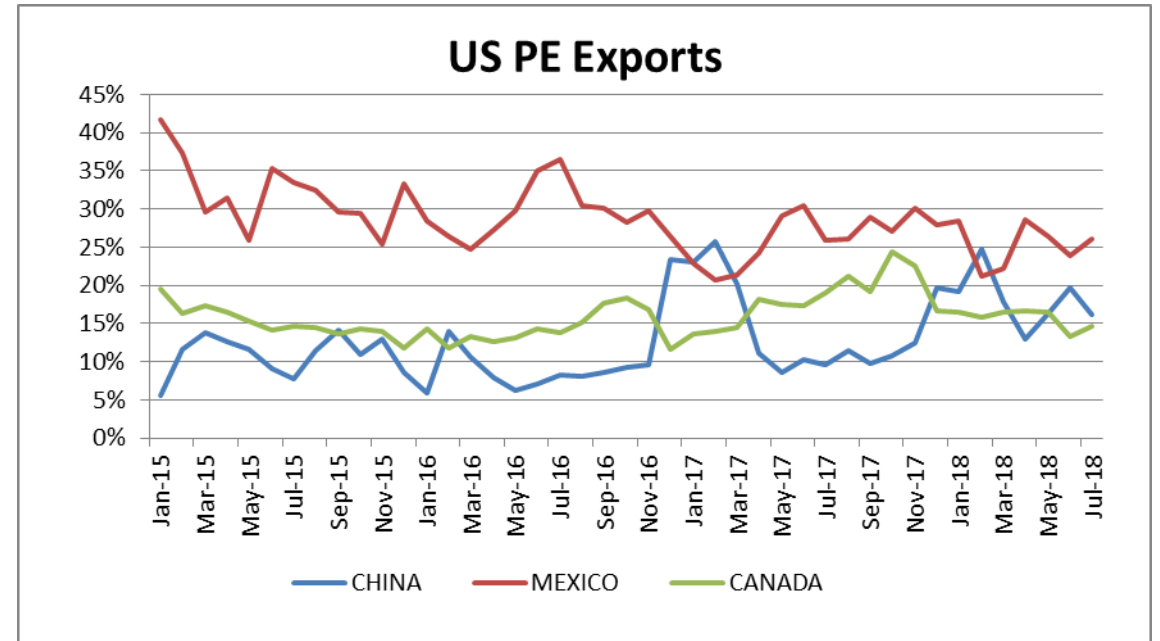
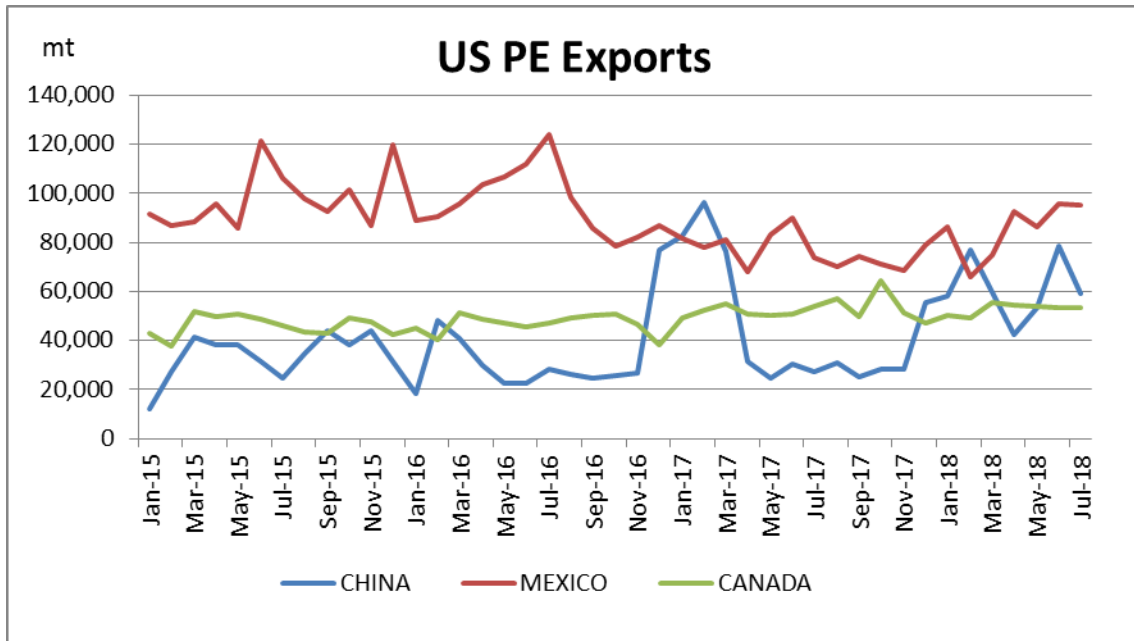


Overall, the Middle East and the US will continue to be major PE exporters while Asia will dominate imports



Impact of China HDPE & LLDPE 25% US import tariffs

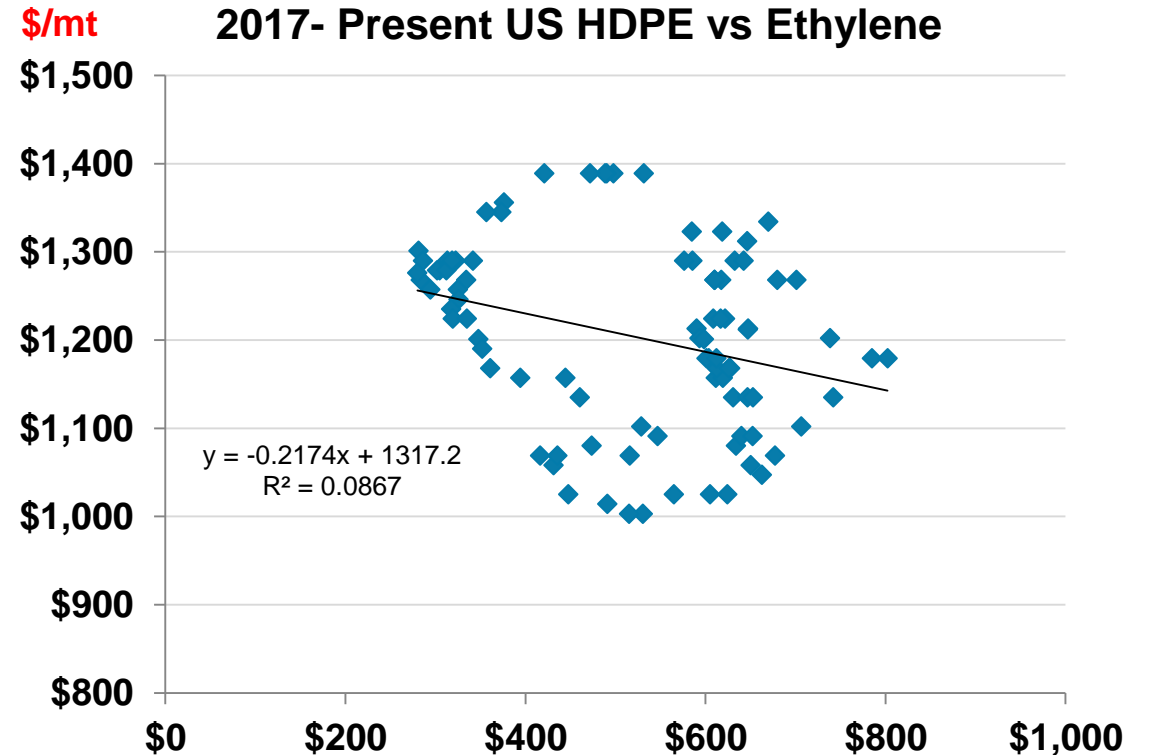
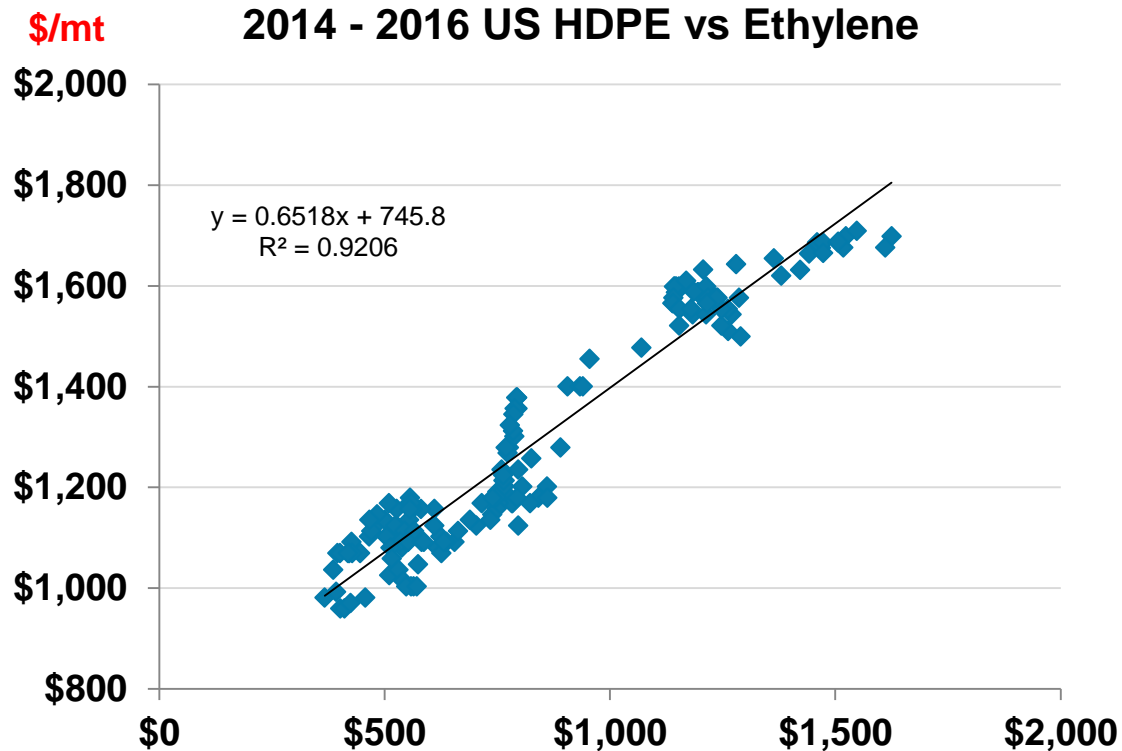
2018 YTD monthly US exports to China averaged 61 kmt (135 million lbs) and 18% of total PE exports



Source : US Census Data

BE CAREFUL WITH CORRELATIONS!

When ethylene was tight during 2014-2016, HDPE was highly correlated to ethylene. However when ethylene became long, the recent correlation broke down to zero.

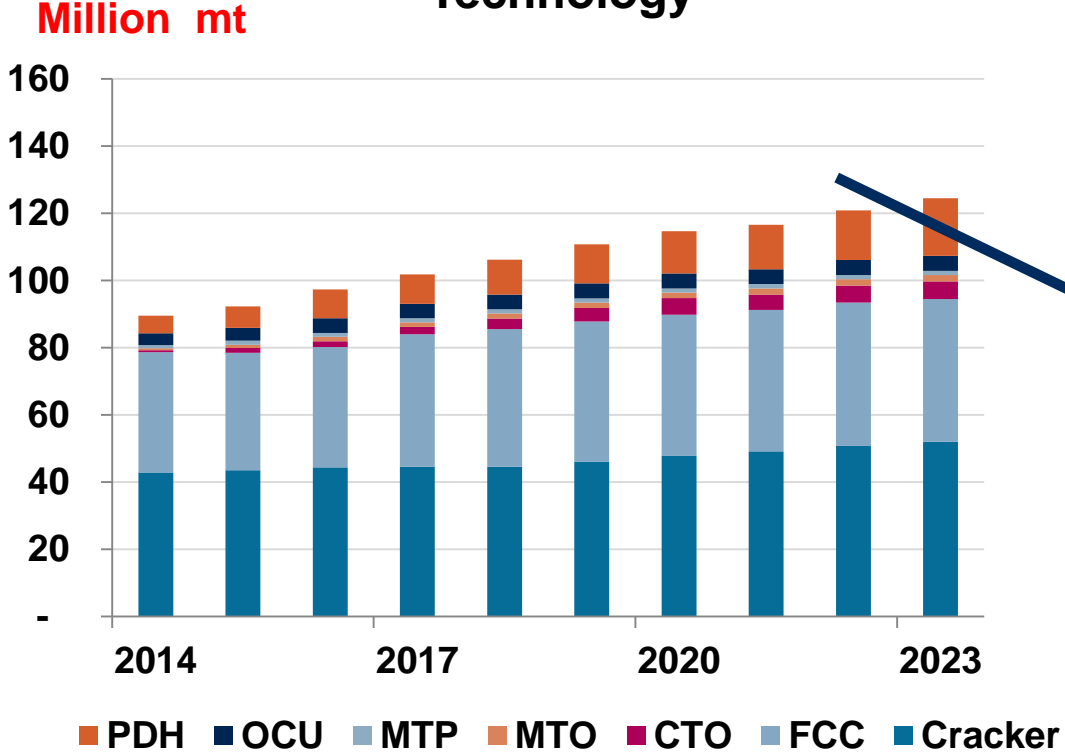


Source: S&P Global Platts Analytics

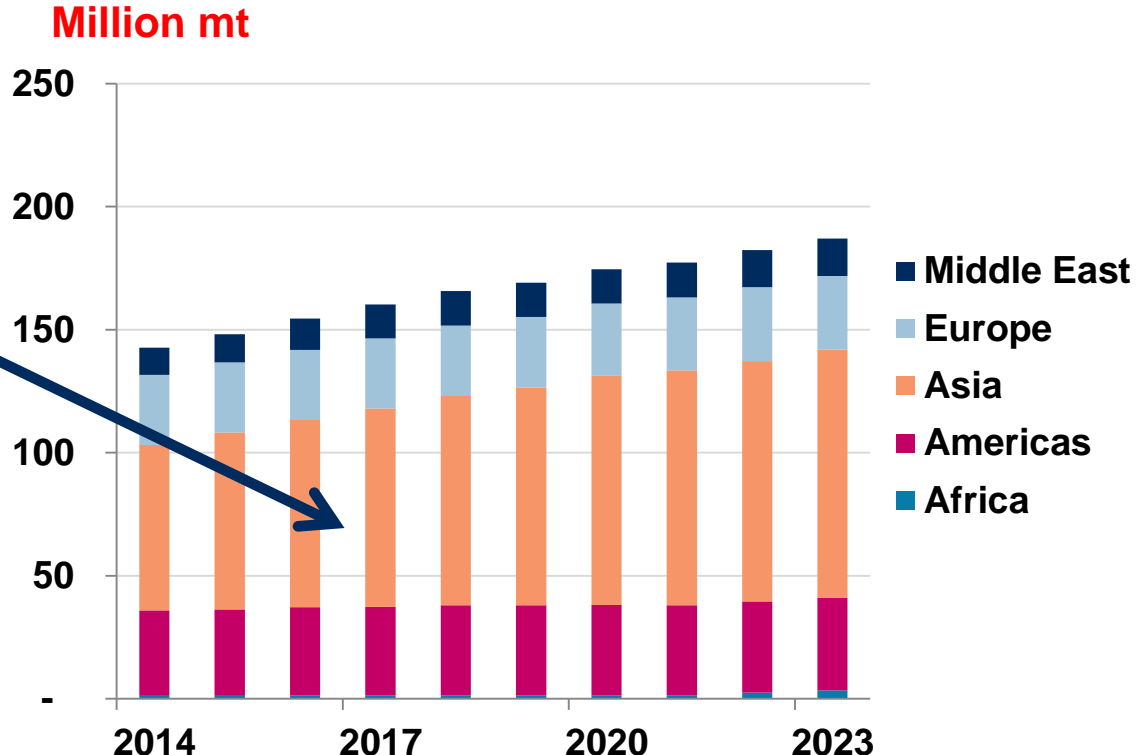
Propylene/Polypropylene

USGC ethane cracker projects has led to the emergence of more on-purpose propylene production in Asia and the Americas

Global Propylene Production by Technology

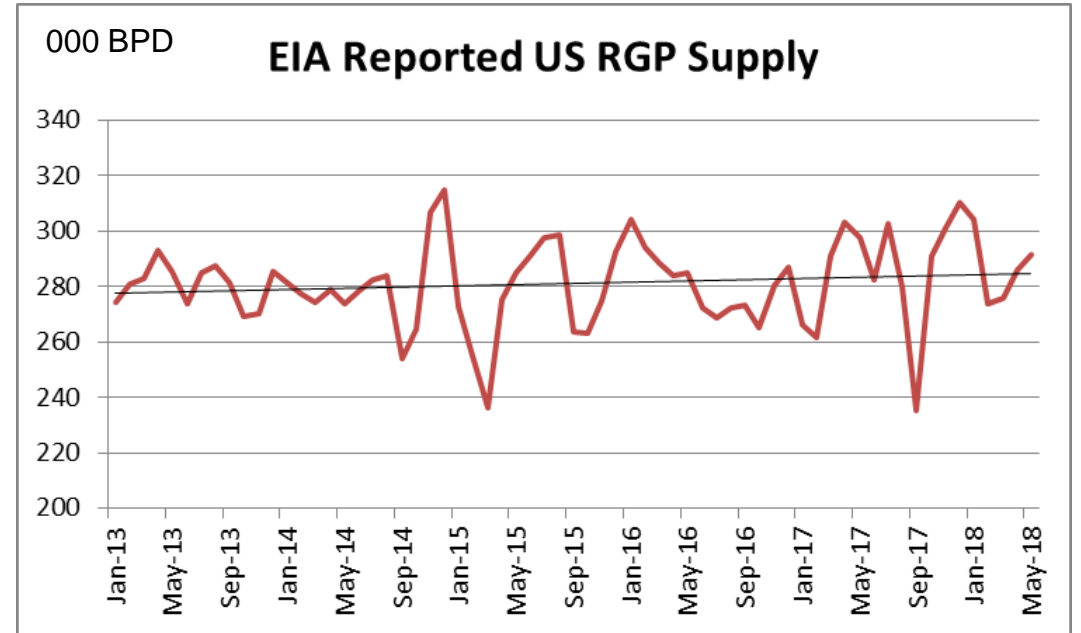
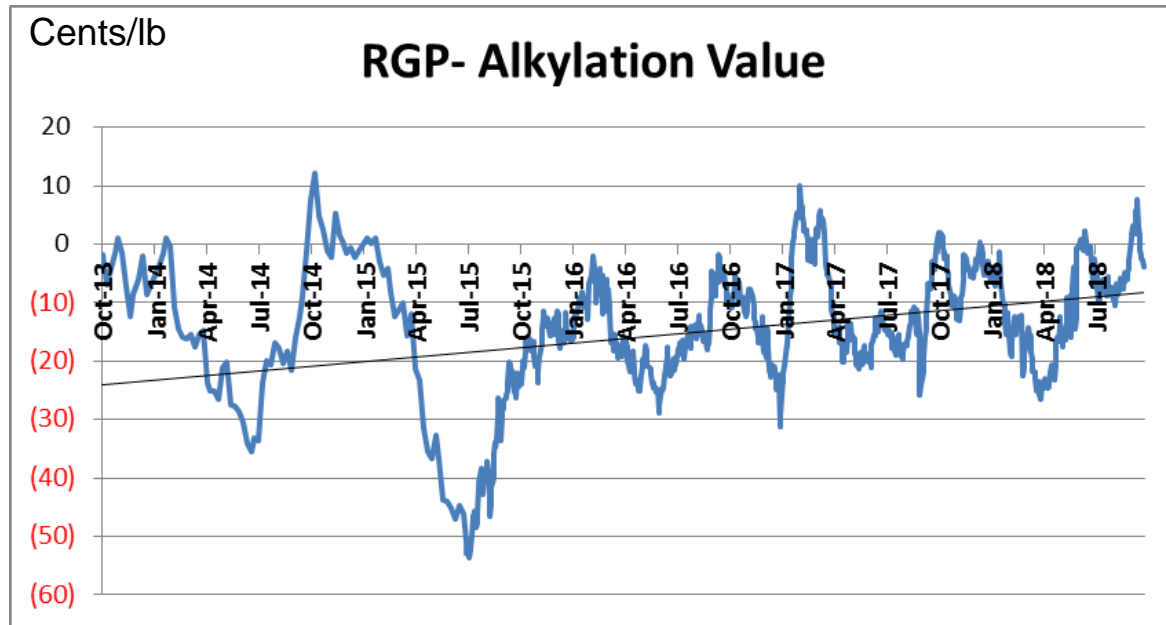


PDH Propylene Capacity Led by Asia



Source: S&P Global Platts Analytics

US Refinery Grade Propylene (RGP) has priced at a significant discount to its alternative value as C3 alkylate for the past 5 years.

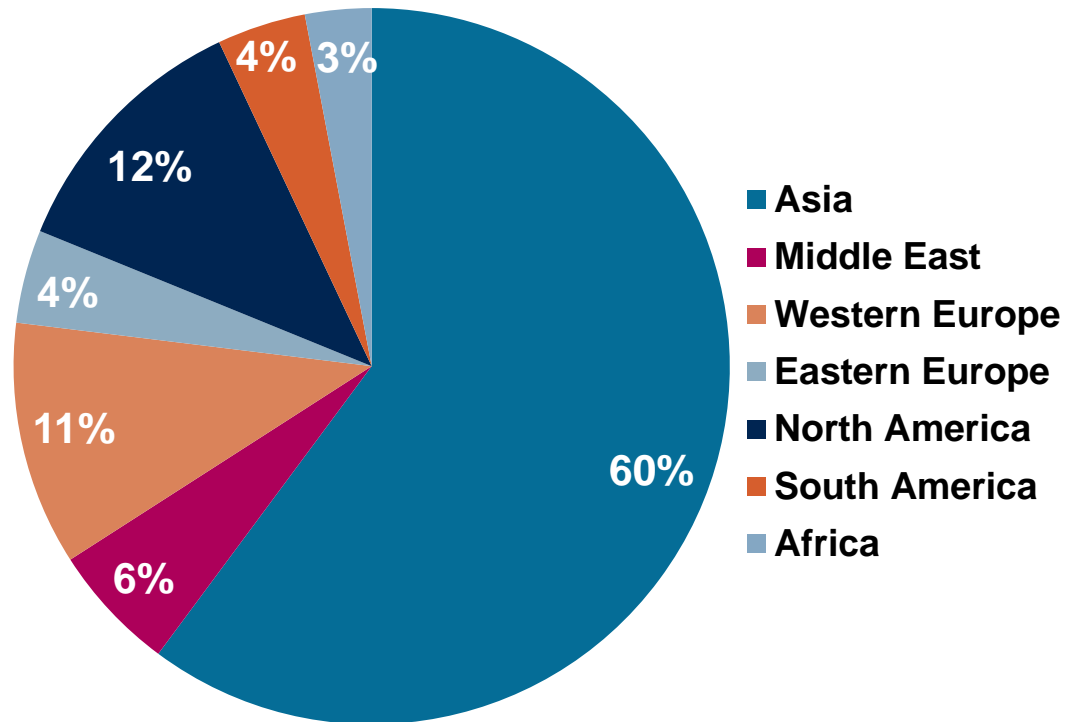


However, RGP supply has been surprisingly constant at 280,000 BPD. IMO 2020 could require RGP prices to increase above the alkylation value to maintain supply.

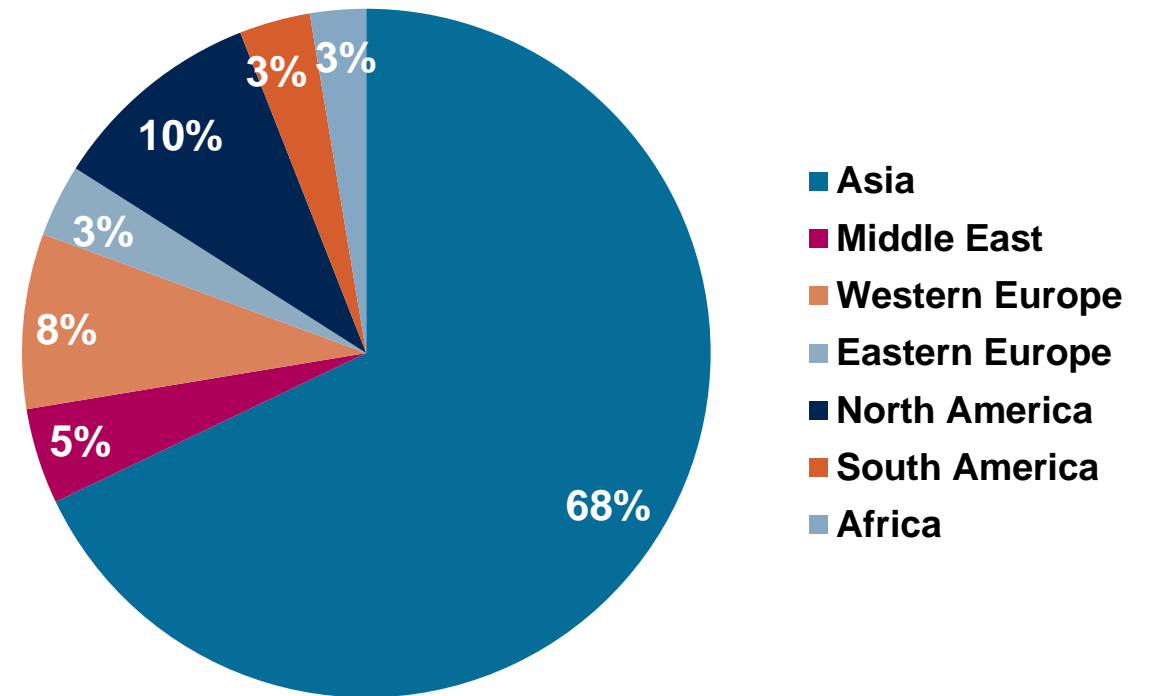
Source : EIA and S&P Global Platts Analytics

Asia will dominate PP demand, accounting for close to 70% of global consumption by 2028

Global PP Demand Breakdown-2018



Global PP Demand Breakdown-2028

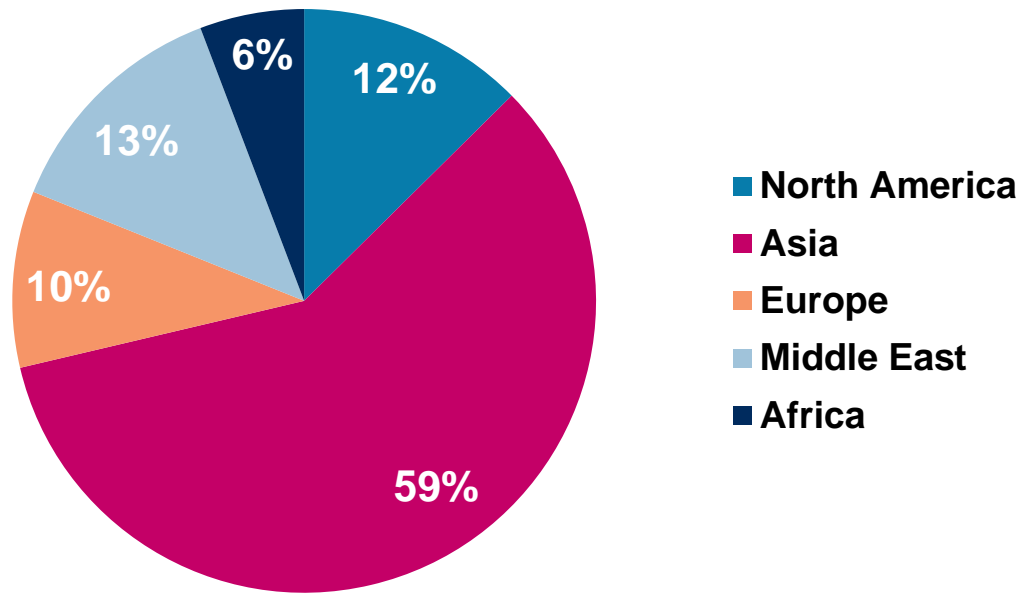


Source: S&P Global Platts Analytics

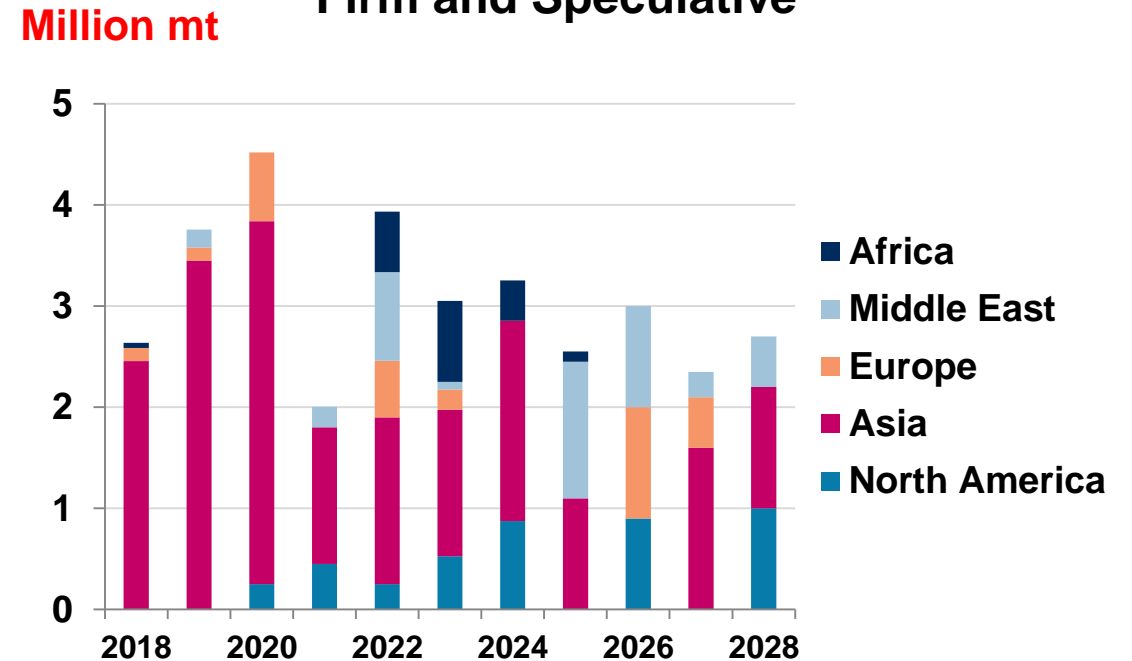
Asia to account for majority of PP capacity additions

Close to 34 million mt to come on stream over the next ten years of which **10.6 million** is speculative to meet future demand

PP Investments by Region 2018-2028

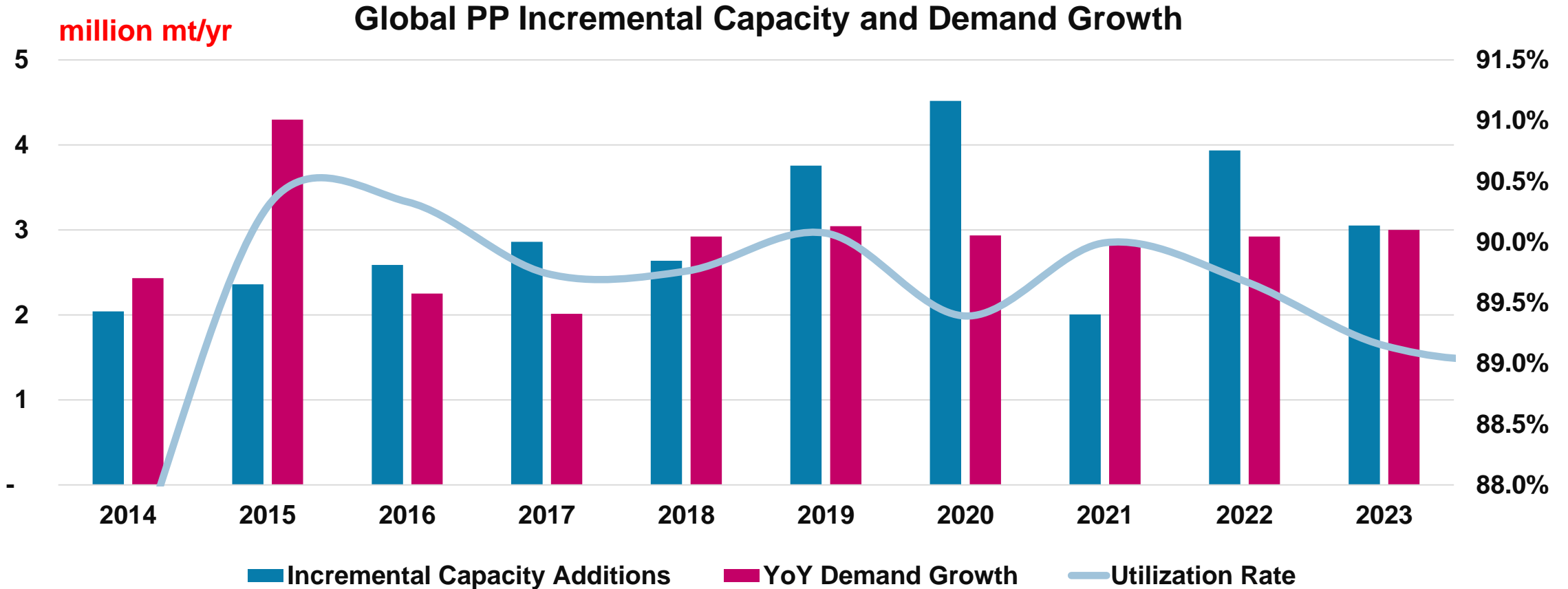


Regional Capacity Additions 2018-2028 Firm and Speculative



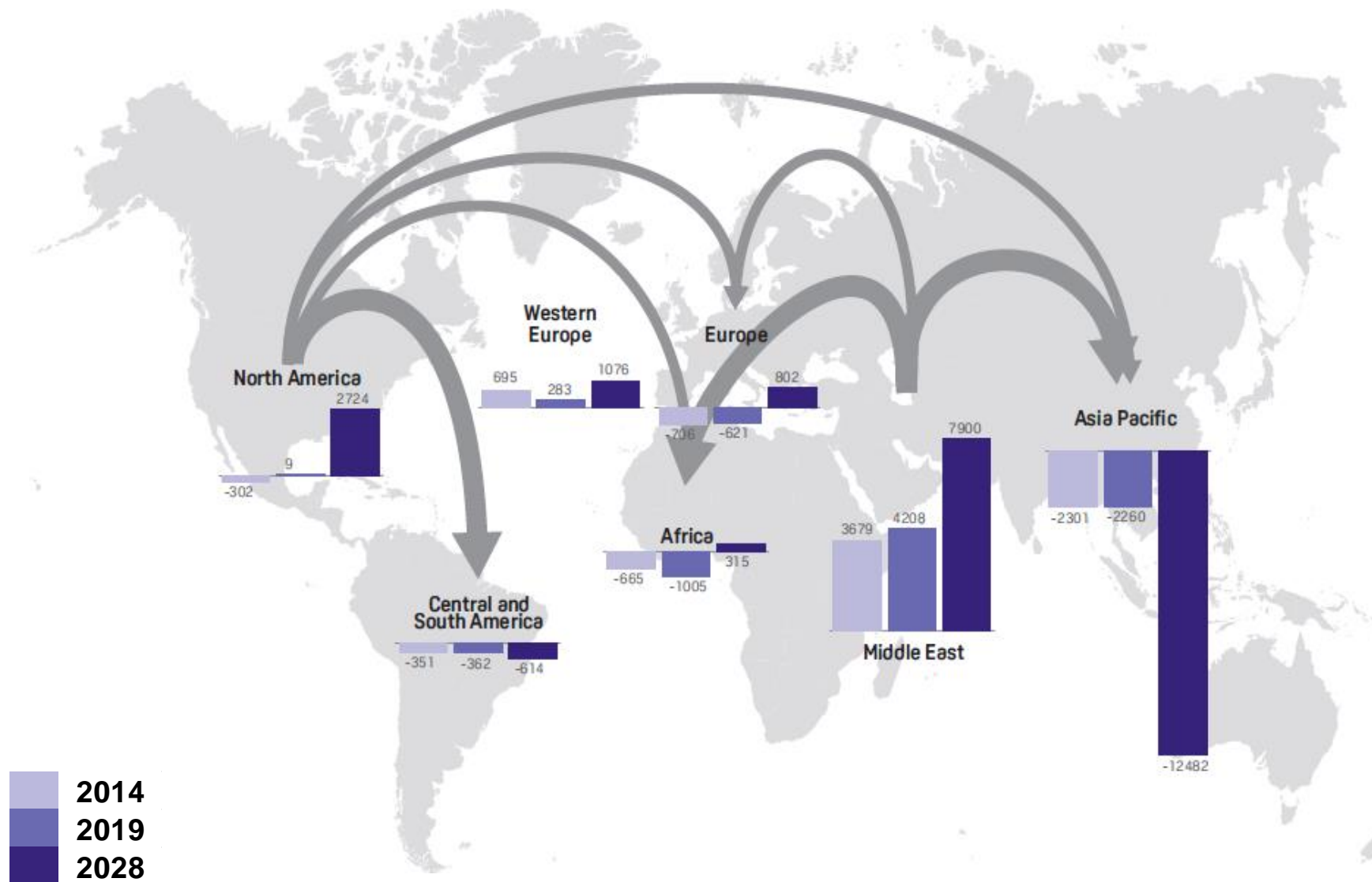
Source: S&P Global Platts Analytics

US PP market expected to be balanced to tight in the short term as Asia adds the majority of capacity



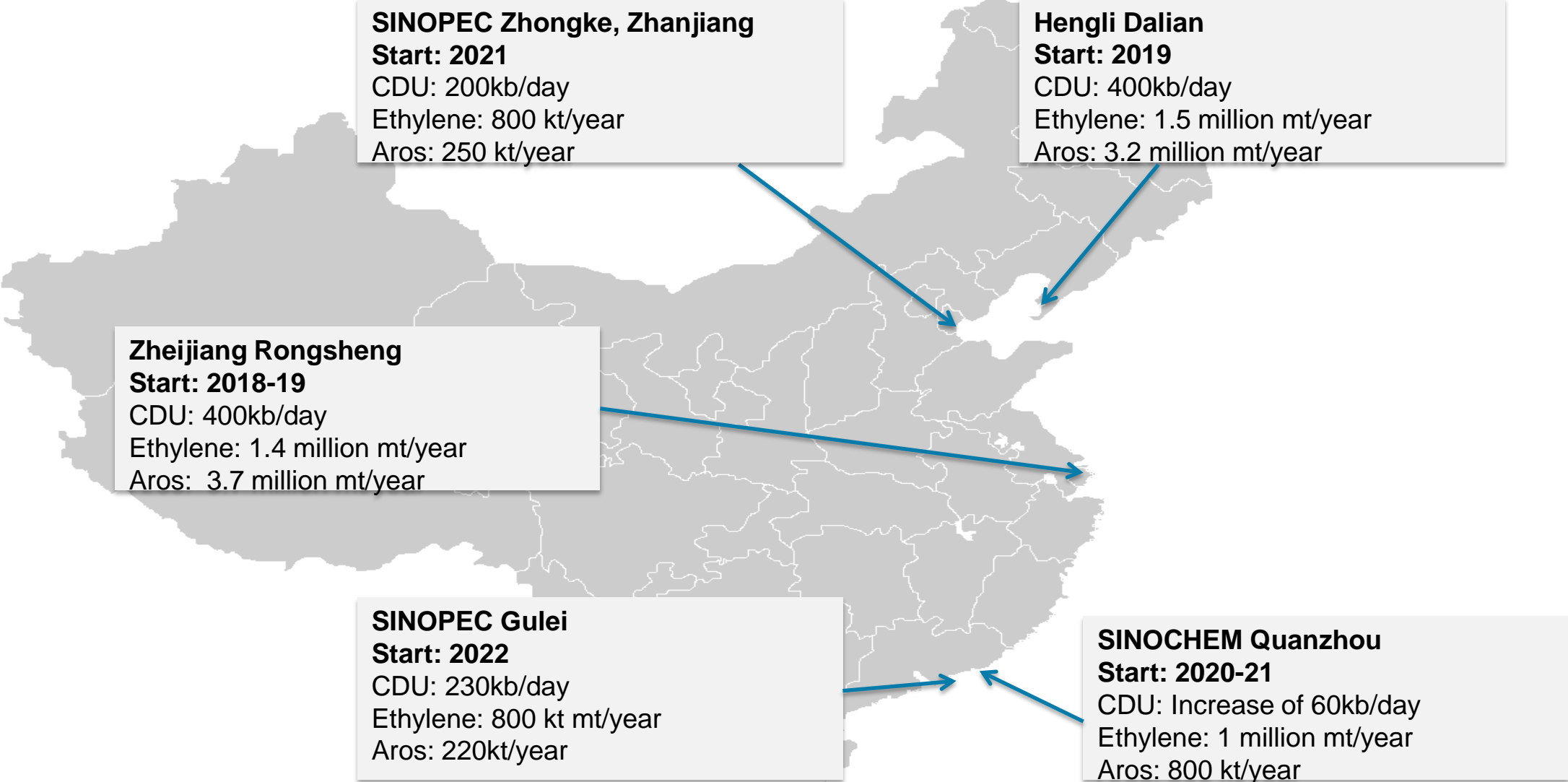
Source: S&P Global Platts Analytics

PP Regional Trade Flows – A delicate balance in 2019

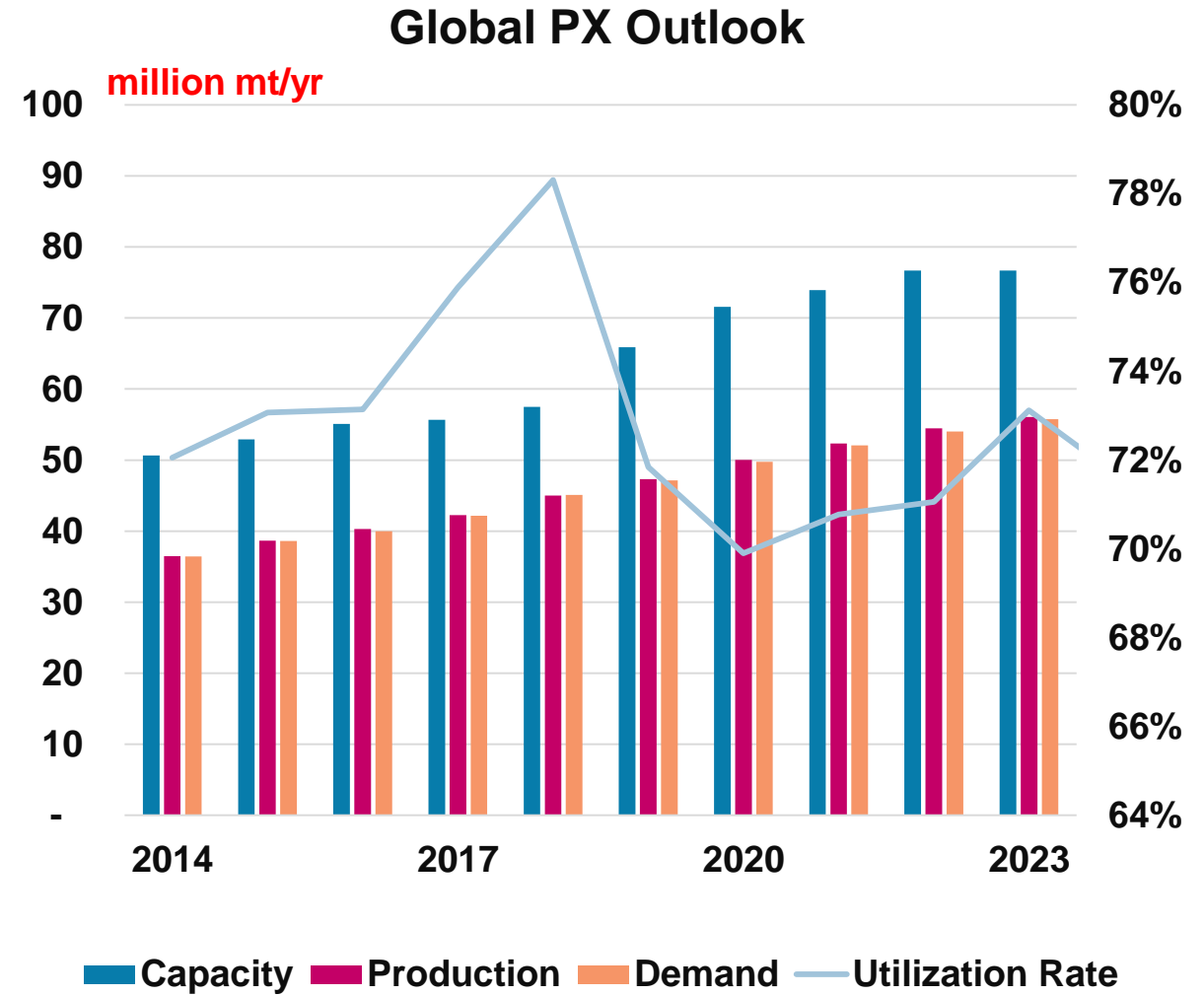
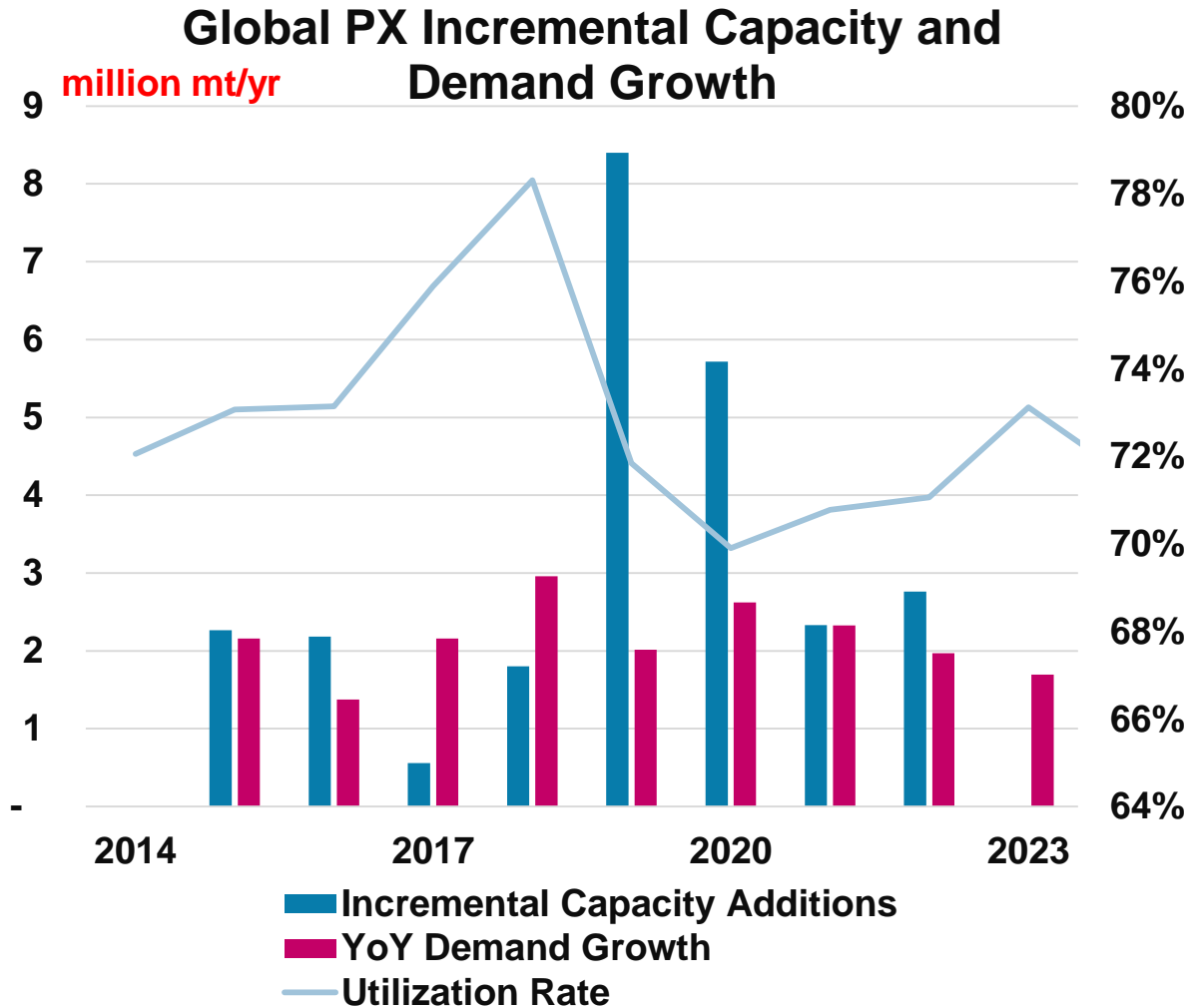


Paraxylene/PET

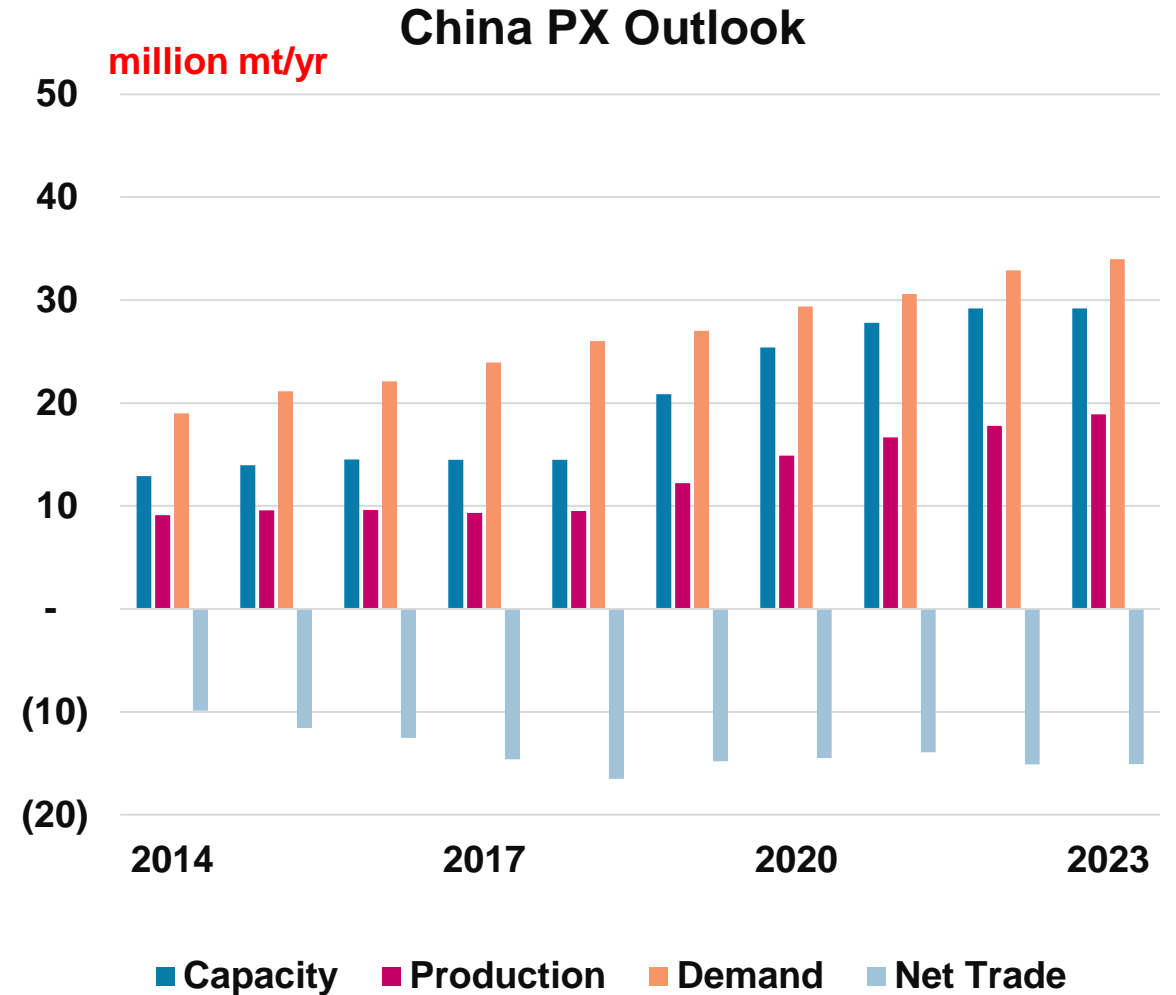
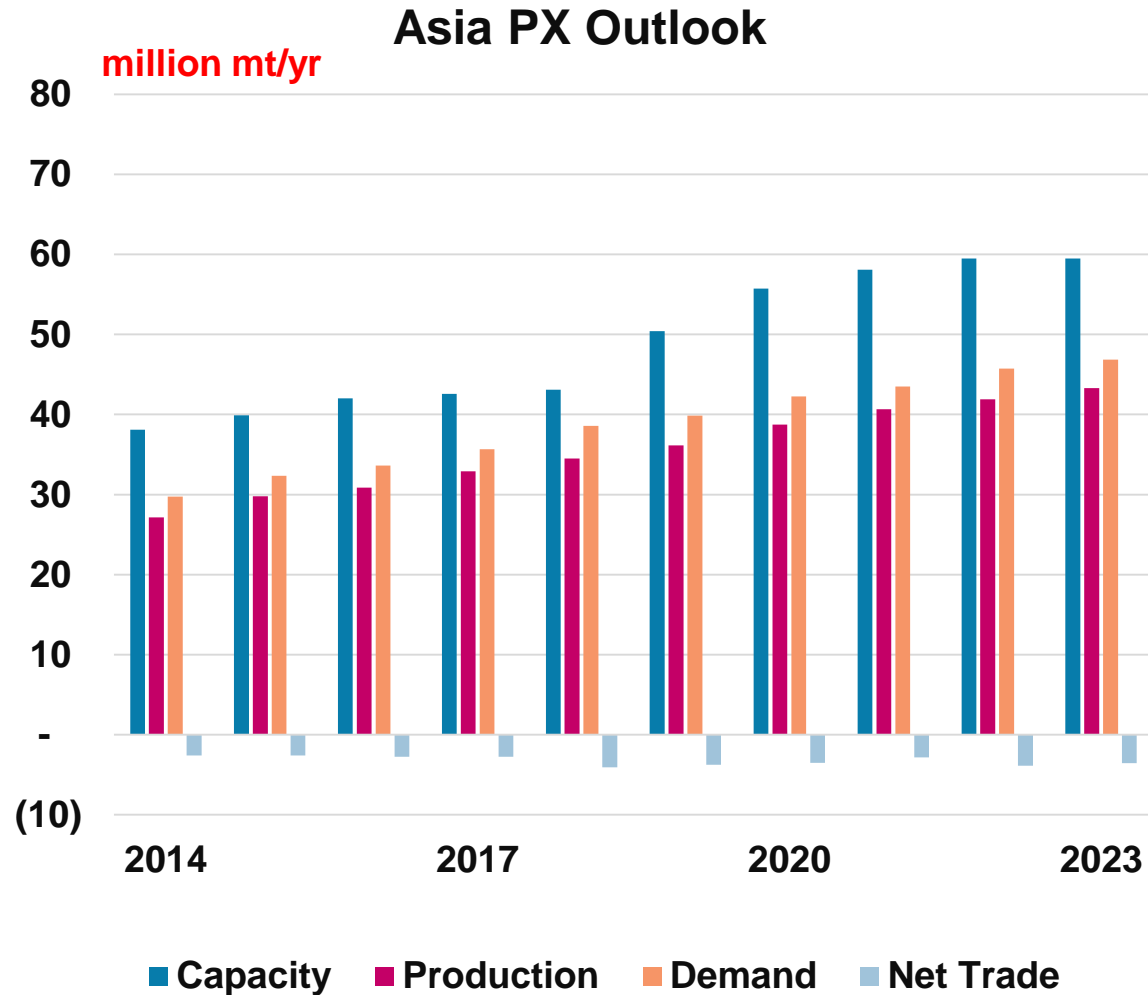
More refinery/petrochemical integrated projects to diversify the feedstock slate to increase petchem production



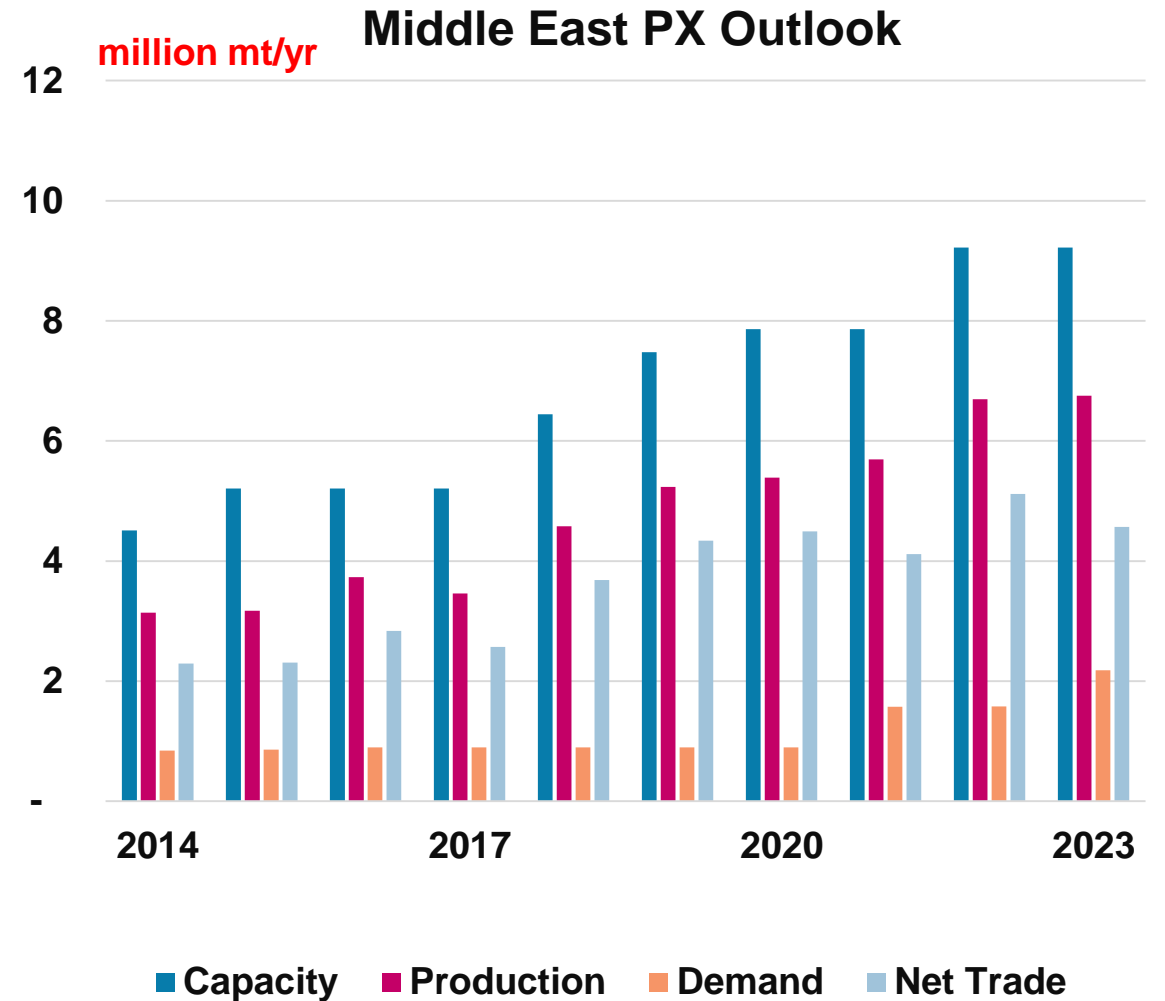
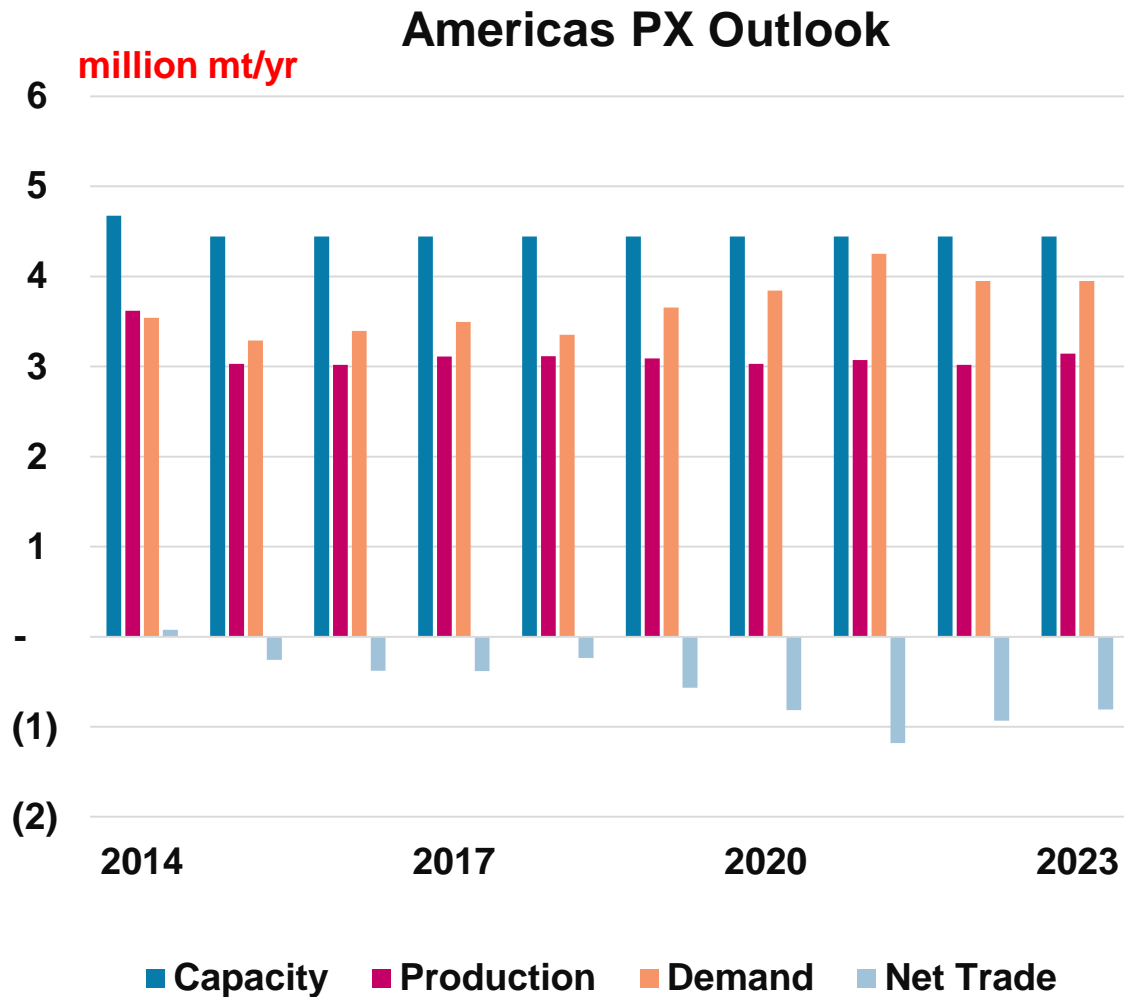
A surge of PX capacity coming on line over the next two years



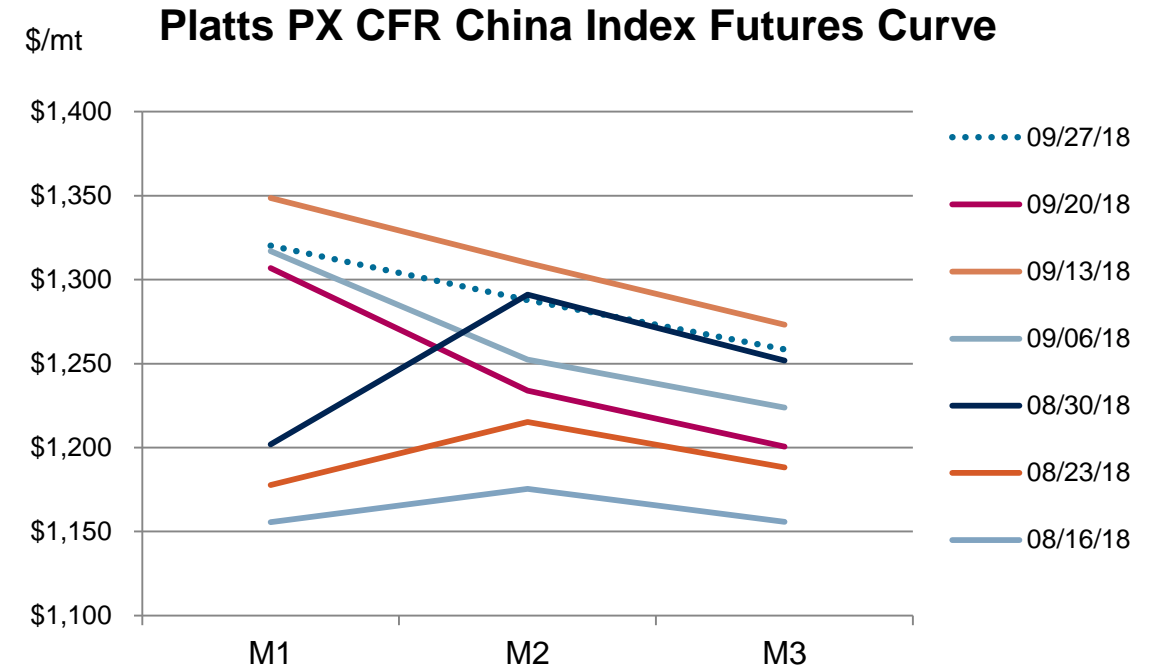
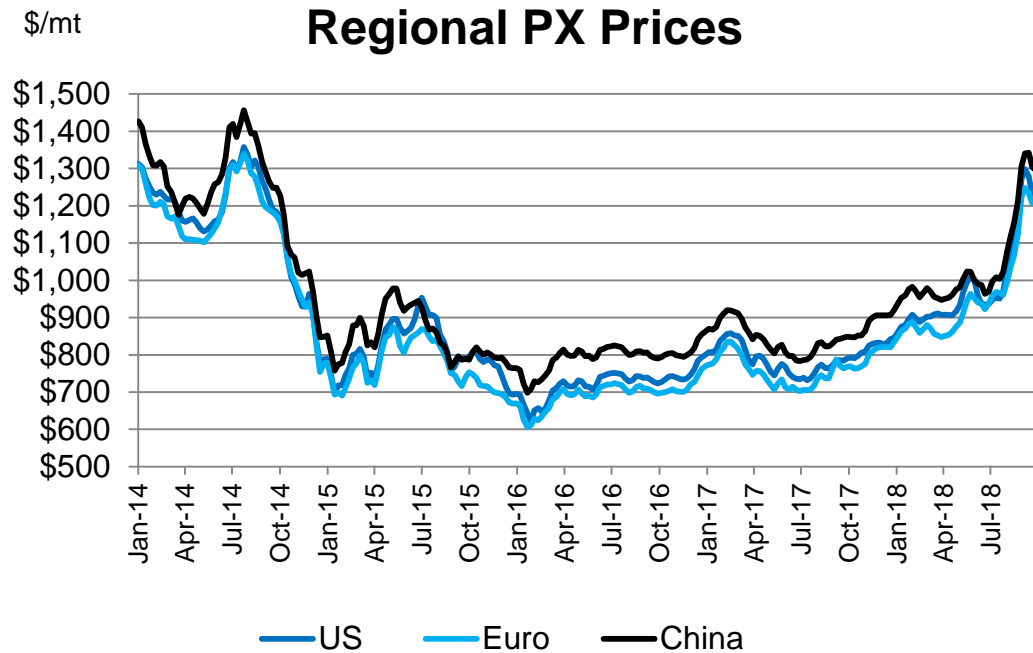
Asia, lead by China, is expected to remain a net importer of PX



The Americas will continue to be a net importer while the Middle East will double PX exports from 2017 to 2022



SGX Petrochemicals - Paraxylene AsiaClear Platts PX CFR China Index Futures

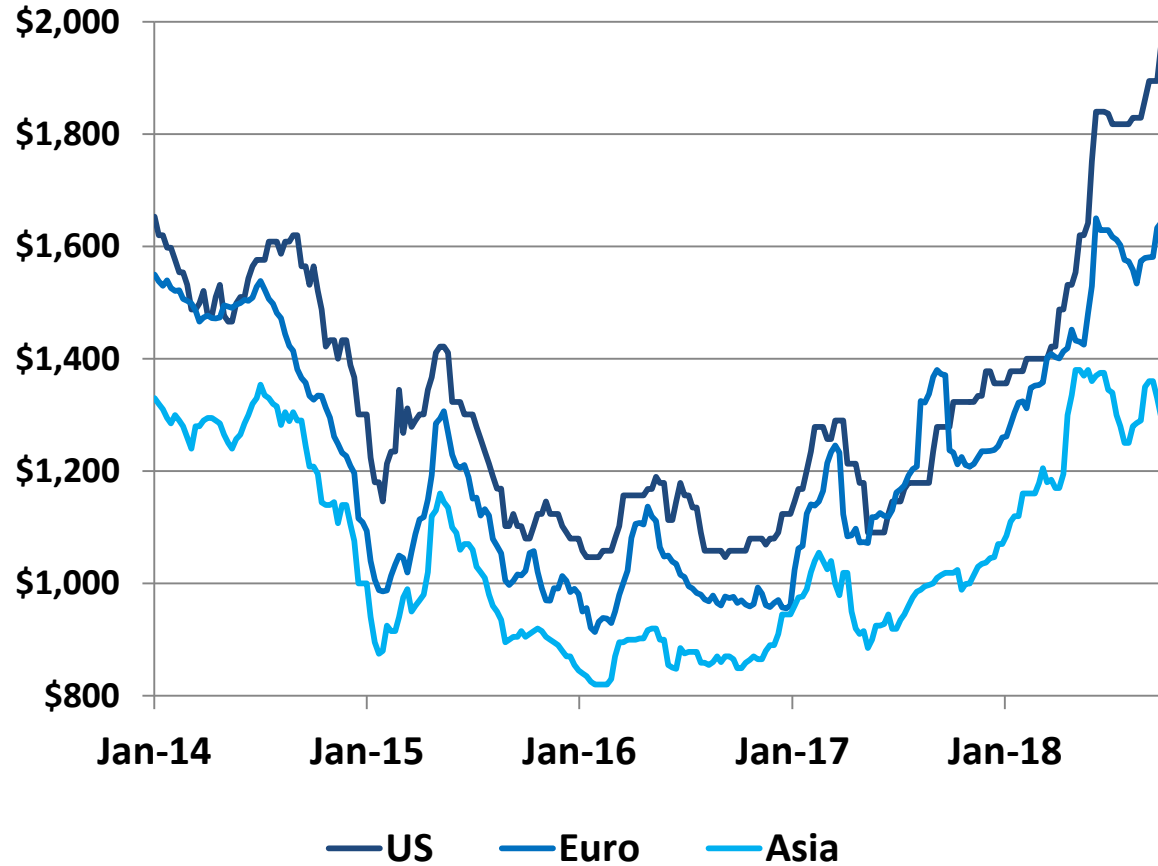


SGX cleared futures market to manage Asian benzene and paraxylene price risk

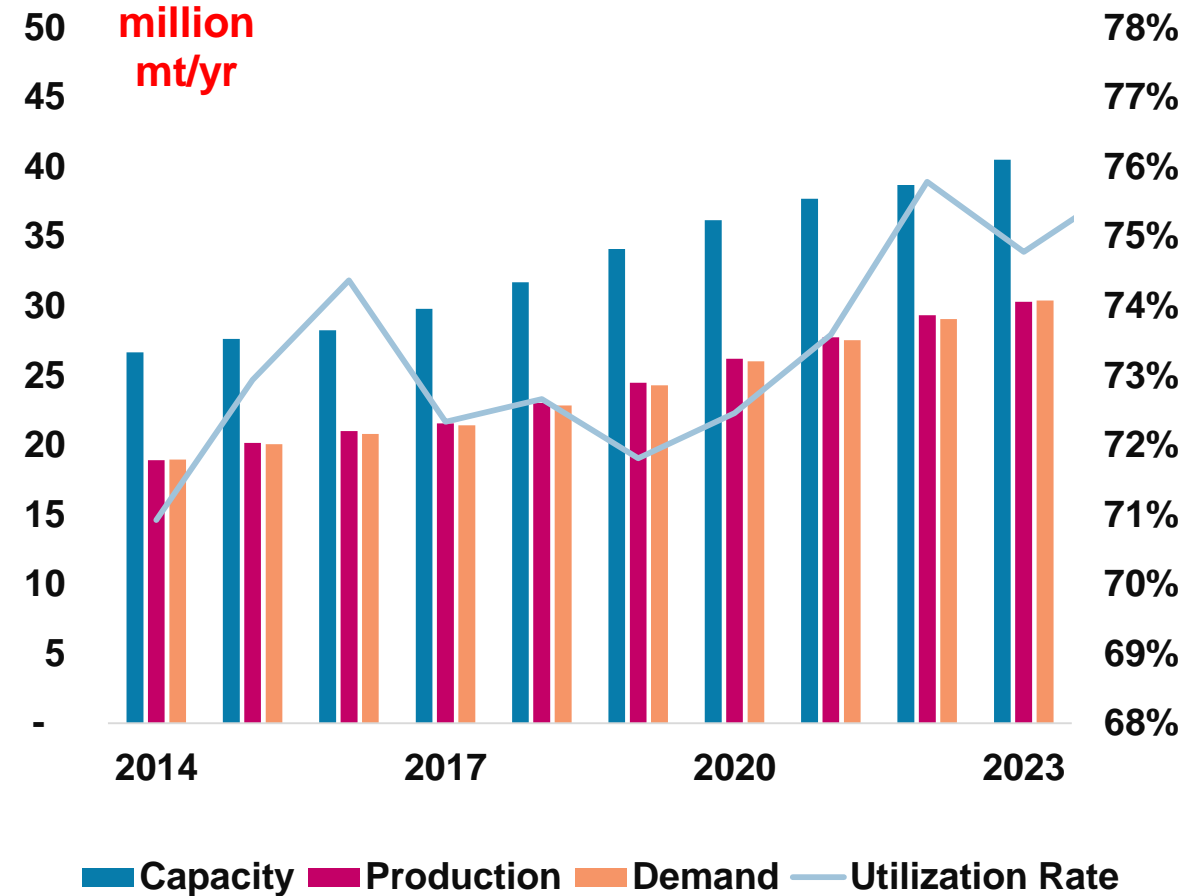
Source : S&P Global Analytics and Singapore Exchange

Like PX, PET resin capacity additions peak in the next two years

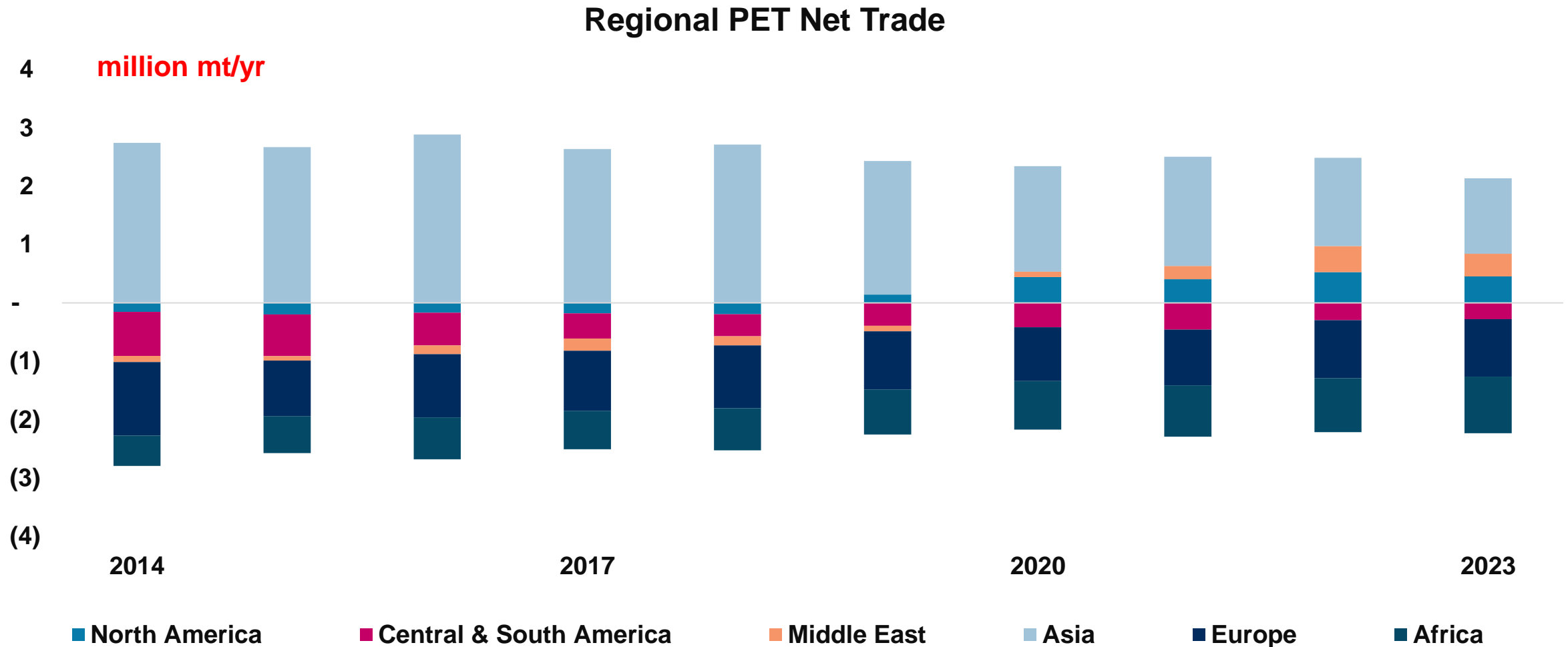
\$/mt Regional PET Bottle Resin Prices



Global PET Resin Outlook



PET resin net trade is relatively stable as the location of capacity additions are consistent with demand growth



Plastics recycling

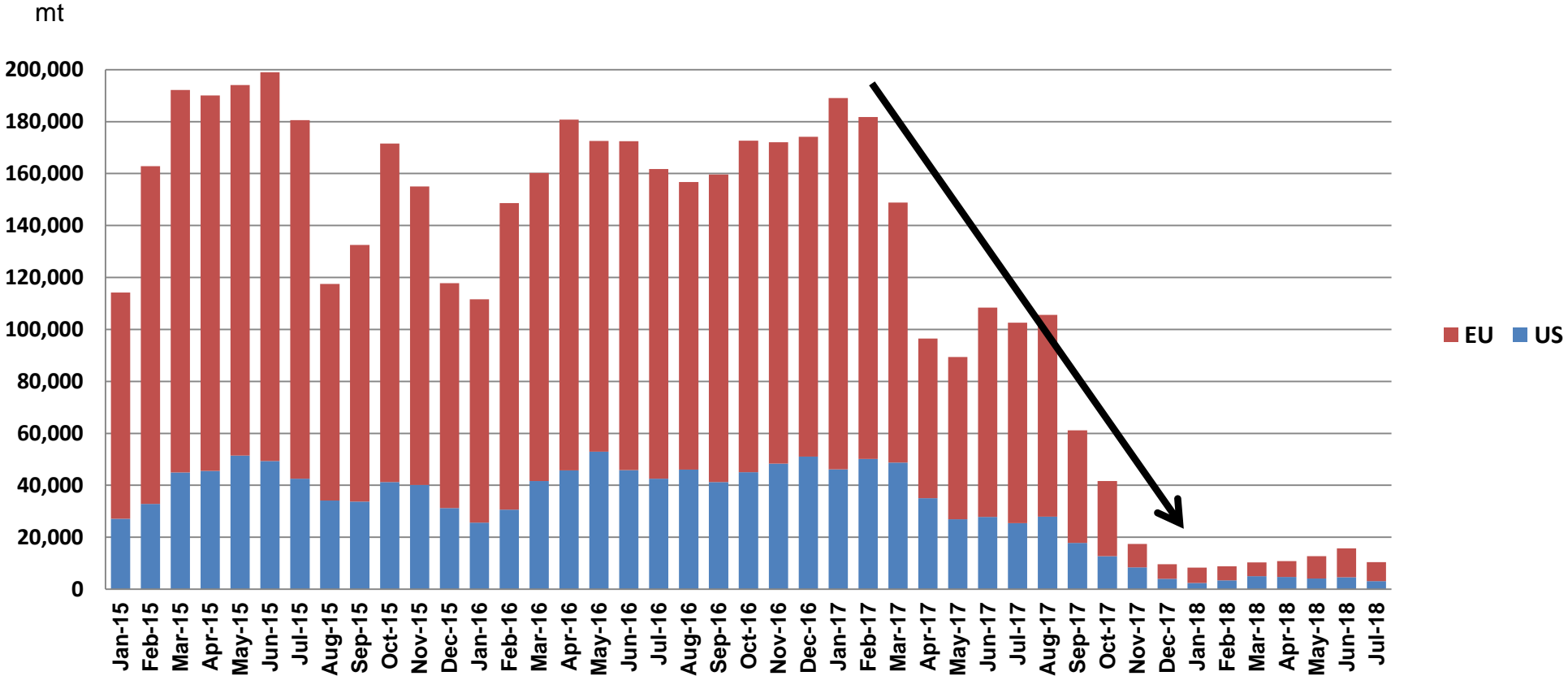
30+ years of US plastics recycling history

- 1971 Woodsy Owl “Give a hoot, don’t pollute” slogan introduced
- 1972 first residential plastics recycling facility opens in Pennsylvania
- 1980s major cities begin curbside collection
- 1984 plastics recycling exceeds 100 million lbs
- 1988 Resin Identification Code (RIC) was developed by the Society of the Plastics Industry
- 1990s PET recycled content in consumer bottles and polyester fibers
- 2000s major recycling centers accepted mixed plastics collections, no need to separate different types of plastic wastes
- 2008 ASTM took over the administration of the RIC system and issued ASTM D7611— Standard Practice for Coding Plastic Manufactured Articles for Resin Identification
- 2013 access to plastic bottle recycling centers reaches over 90% of population



January 2018 China ban on imported plastics waste streams

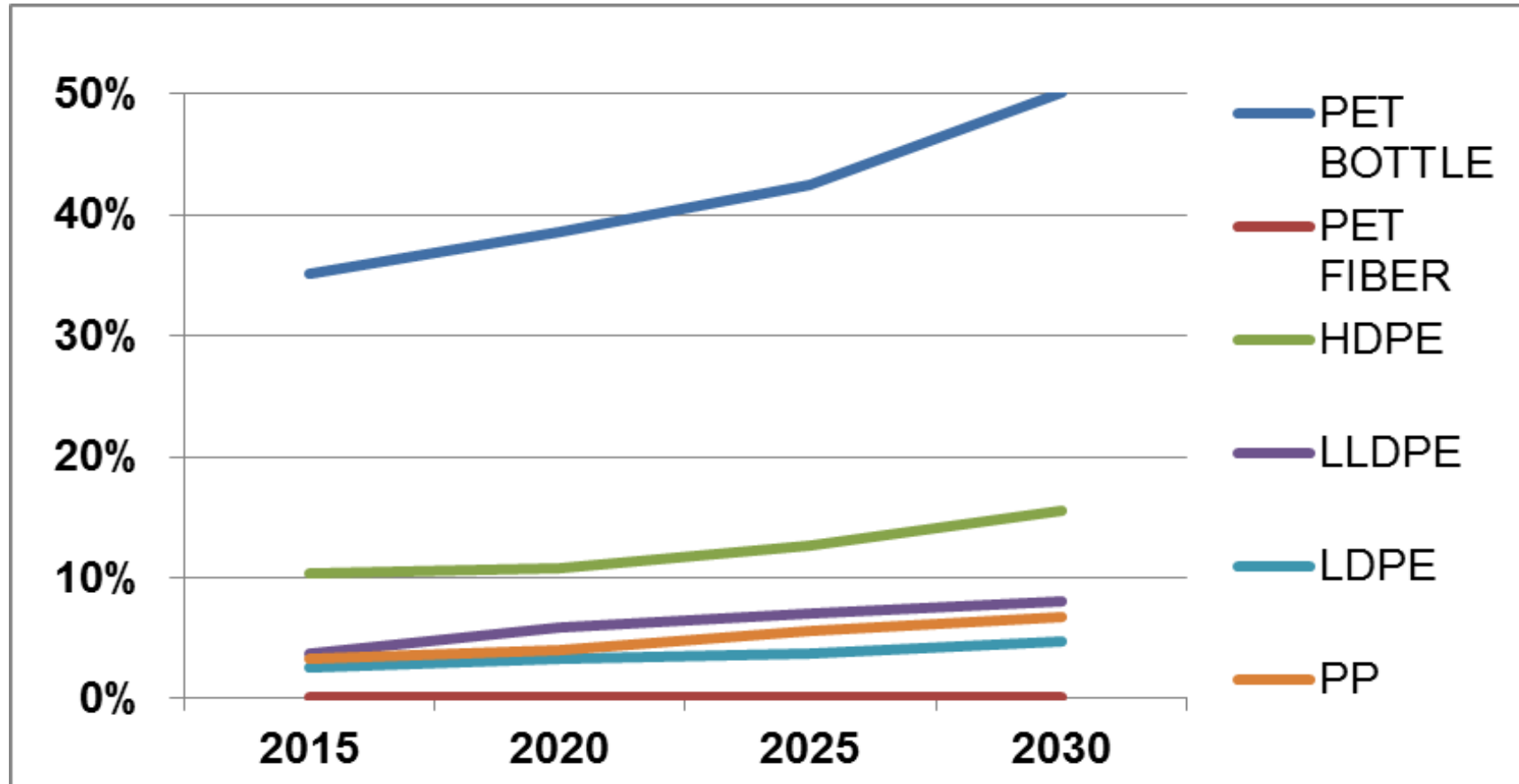
WASTE, PARINGS AND SCRAP, OF POLYMERS OF ETHYLENE



Source : Eurostat & US Census data

Global Recycled Plastics

Recycling defined as volume of recycled plastics that displace virgin material



Source: S&P Global Platts Analytics

Conclusion

- **IMO 2020 is expected to reduce refinery supply for olefins & aromatics**
- **Ethylene/PE margins will be under pressure for the next few years and prices will be set by high cost naphtha crackers and outages**
- **Propylene/PP margins will be set by Asian PDH units (cash cost & operating rates) and gasoline values. The US RGP price may need to increase above its alkylation value.**
- **Aromatics/PET prices will be set by the gasoline blending value floor and PET ceiling set by substitution. Battle between gasoline and petrochemicals for reformer octanes**
- **Plastics recycling – Monitoring the impact of Chinese import ban. Expect industry to aggressively respond but virgin polymer demand growth will continue**

Innovative market **insights**

Driven by analytics, powered by fundamentals