



Outlook for Asian Plastics Industry, *Global Megatrends and its Implications for the Plastics Industries*

Bangkok, Thailand
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of the Fortune
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of the Fortune
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Economy and Energy

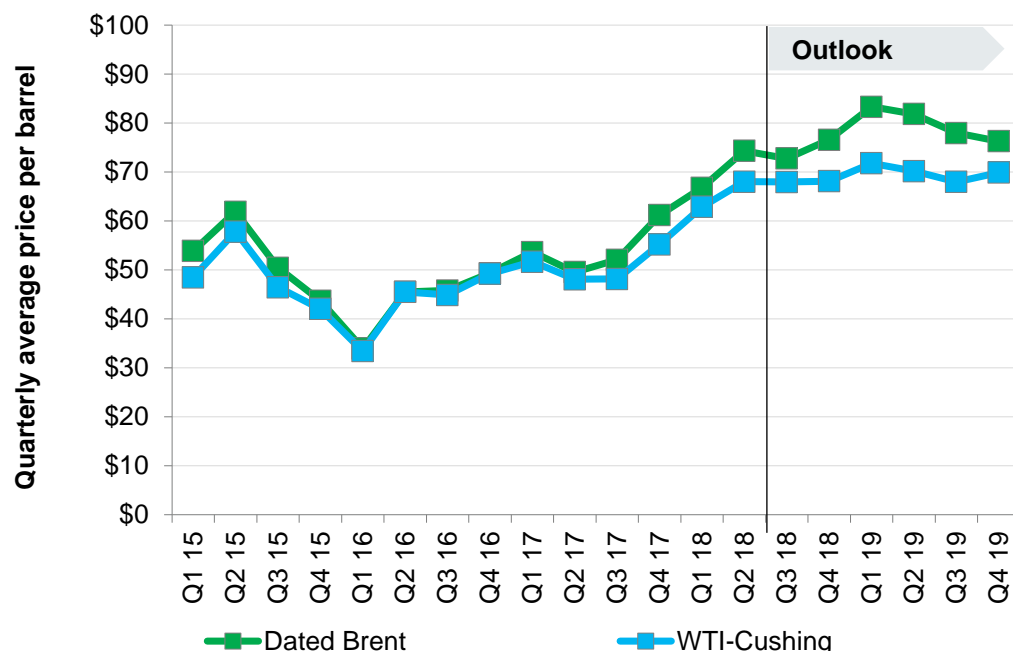
Global economic growth is peaking

- Global economic growth is expected to hold near 3.2% this year before easing to 3.1% in 2019 and 3.0% in 2020.
- The United States is getting a boost from fiscal stimulus and strengthening business investment in 2018–19, but inflationary pressures and policy tightening will restrain growth in 2020–21.
- Europe's growth is slowing but remains above trend; risks include higher oil prices, political changes in Italy and Spain, and the financial crisis in Turkey.
- China's growth is slowing as a result of excesses in industrial capacity, debt, shadow banking, as well as rising US-China trade friction.
- Asia's other emerging markets are expected to sustain solid growth.
- Emerging markets that depend on external finance (such as Turkey, Argentina, South Africa, and Brazil) are vulnerable to capital flight.



Narrow spare capacity cushion to support Dated Brent in roughly \$75-\$85 band in base case

Dated Brent and WTI-Cushing crude oil price outlook to 2019



Notes: WTI = West Texas Intermediate.
Source: IHS Markit, Argus Media Limited (historical)

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Assumptions

- World demand.** Global liquids demand growth remains strong at 1.6 MMb/d in 2018 1.5 MMb/d in 2019, fueled by gains from non-OECD Asia and the United States.
- Iran and Venezuela output.** Strictly-enforced US sanctions reduce Iranian crude output by 1.3 MMb/d over the next year; Venezuela's output falls a further 400,000 b/d by end-2018 as its oil infrastructure continues to decay.
- Gulf-3 production and spare capacity.** The Gulf-3 boosts crude output by nearly 1 MMb/d between May 2018 and December 2018 to help offset expected shortfalls from Iran and Venezuela; indicative Gulf-3 spare production capacity falls below 2 MMb/d in 2H 2018.
- US output.** US crude output rises at a rapid annual average pace of 1.3 MMb/d in 2018 and 1.2 MMb/d in 2019, despite logistical bottlenecks into 2019, as WTI prices remain well above average breakeven thresholds in key plays.

Benchmark crude price outlook (dollars per barrel)

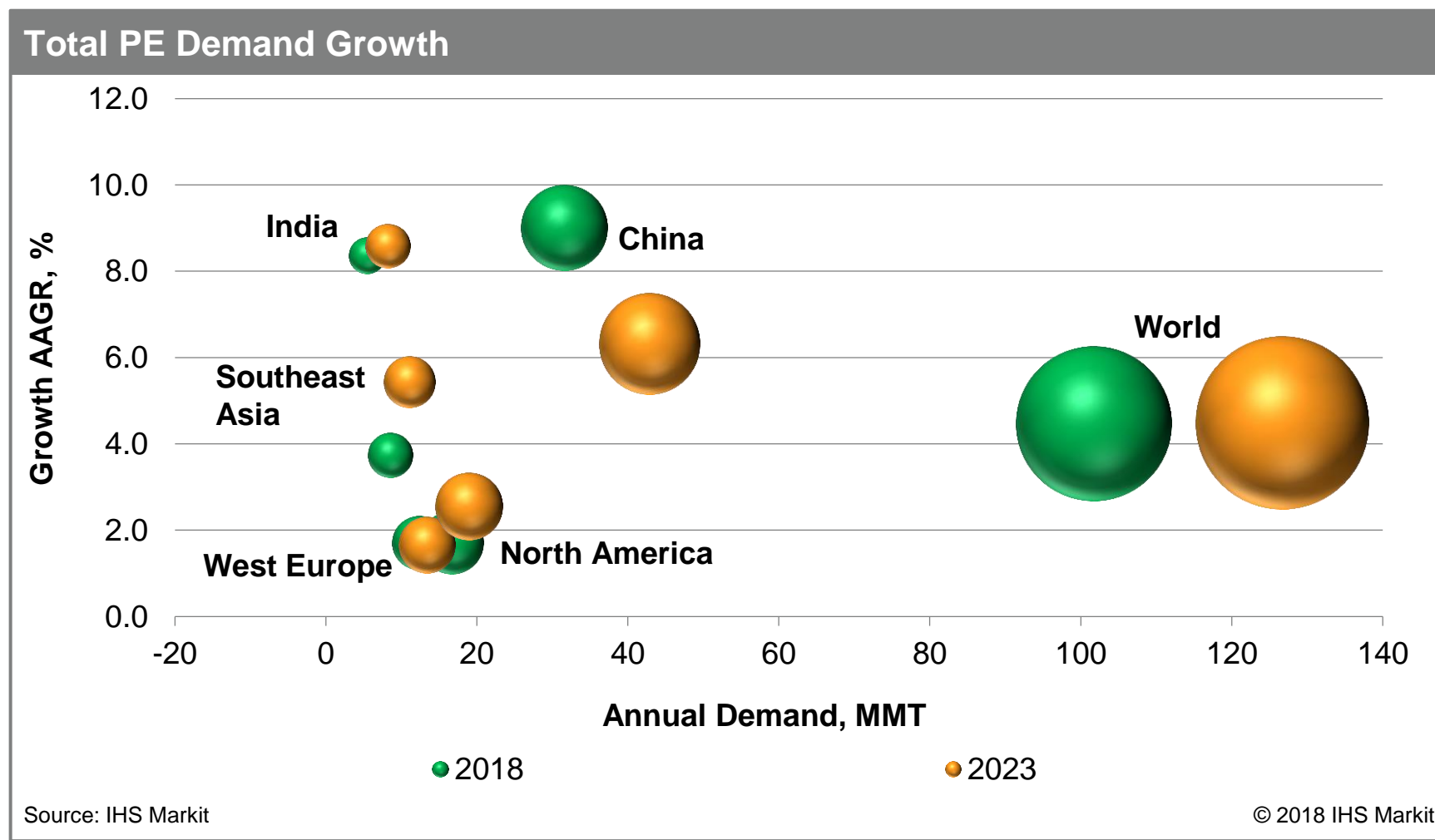
	3Q 2016	4Q 2016	1Q 2017	2Q 2017	3Q 2017	4Q 2017	1Q 2018	2Q 2018	3Q 2018	4Q 2018	1Q 2019	2Q 2019	3Q 2019	4Q 2019
Dated Brent	\$45.80	\$49.35	\$53.66	\$49.58	\$52.07	\$61.22	\$66.79	\$74.36	\$72.78	\$76.59	\$83.34	\$81.87	\$77.98	\$76.31
WTI	\$44.88	\$49.23	\$51.70	\$48.11	\$48.16	\$55.23	\$62.89	\$68.03	\$67.98	\$68.13	\$71.79	\$70.18	\$68.00	\$69.88

Source: IHS Markit, Argus Media Limited (historical)

Note: For our monthly Dated Brent and WTI price outlook, please see the accompanying "IHS Markit Outlook for Global Oil Market Fundamentals" file.

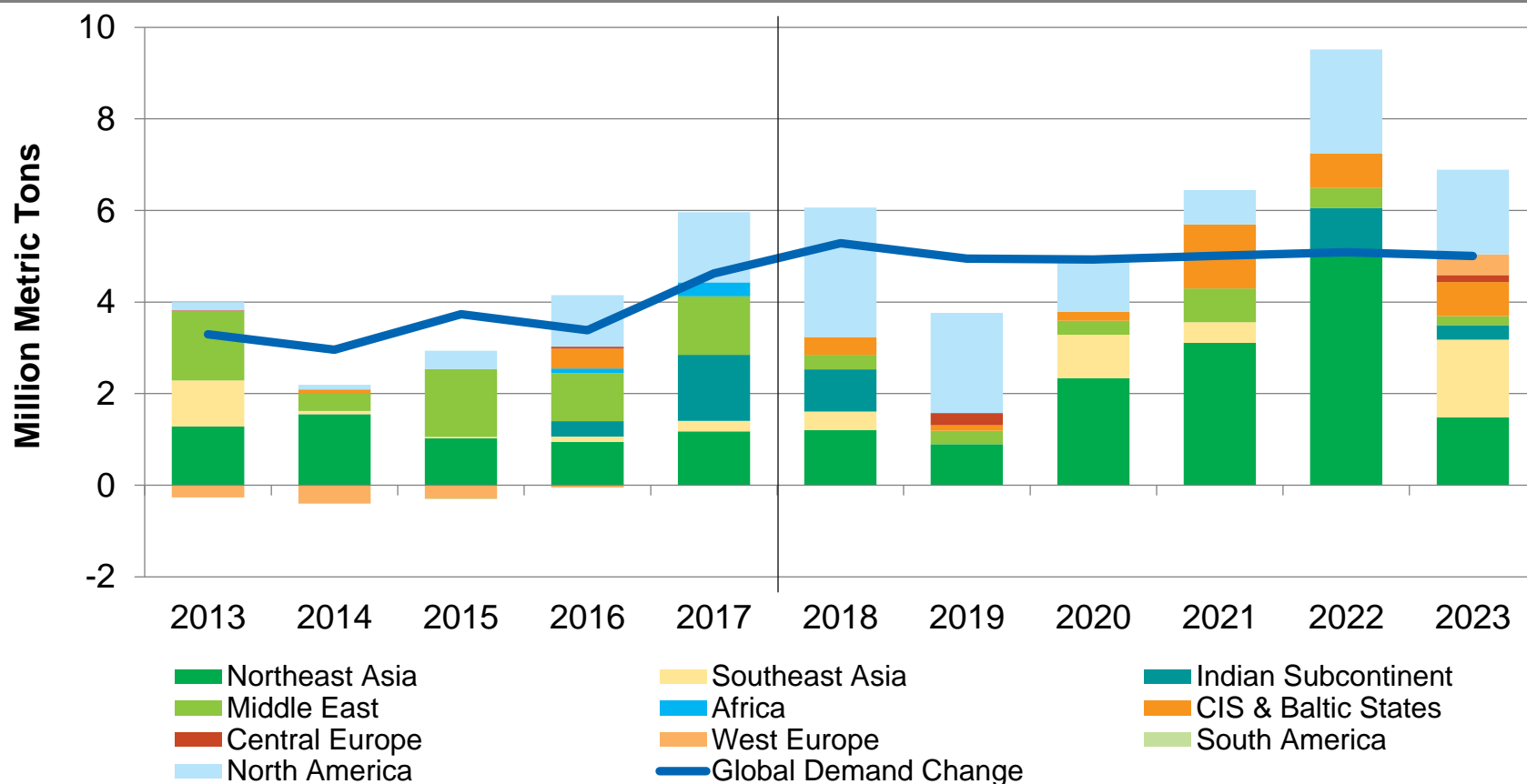
PolyEthylene (PE)

Global PE demand continues to be healthy...



...however incremental supplies will exceed demand growth early next decade

Global PE Incremental Supply/Demand

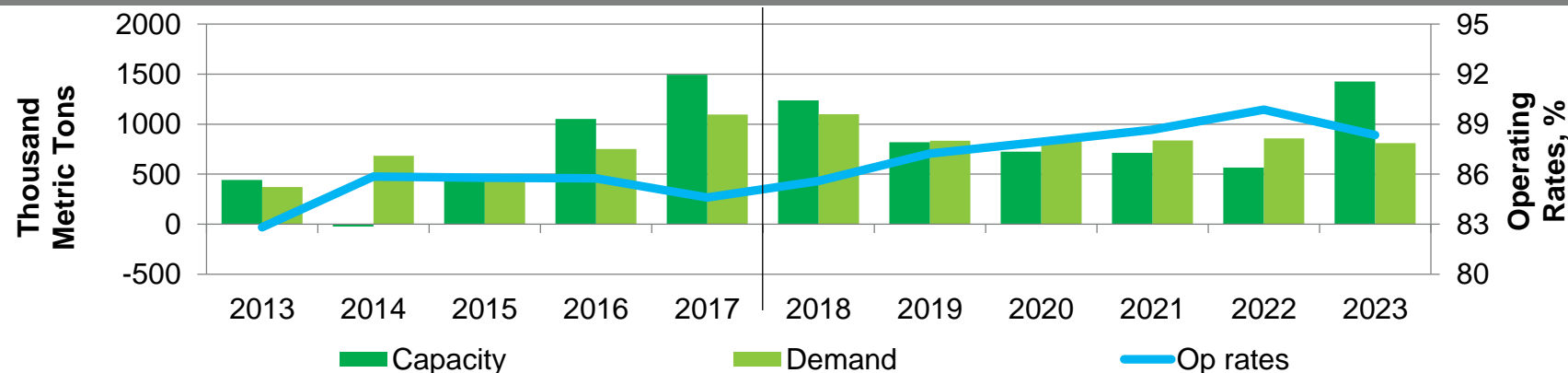


Source: IHS Markit

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Longer LDPE/LLDPE supplies during 2017 - 2018

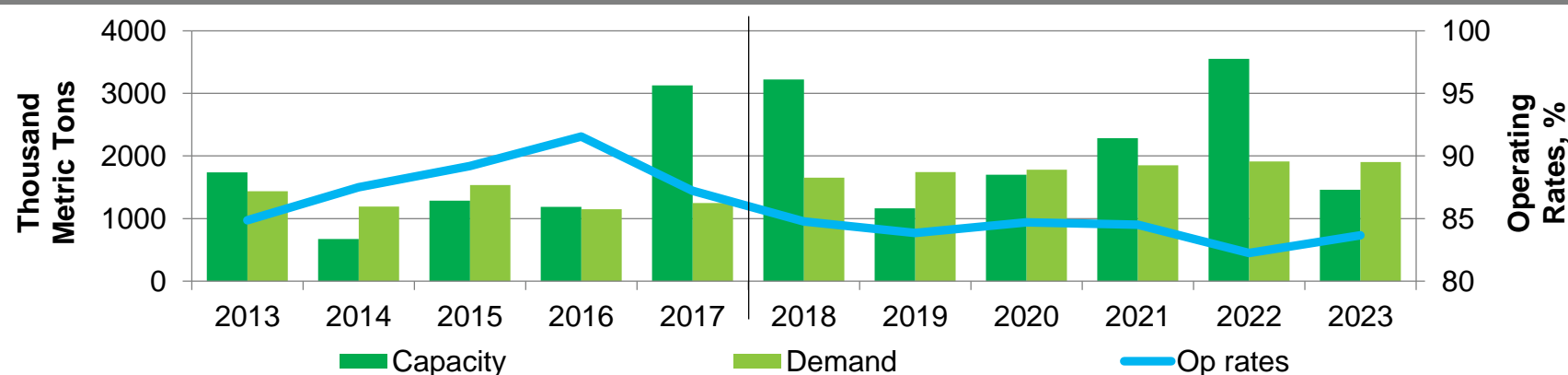
World Incremental LDPE Supply/Demand



Source: IHS Markit

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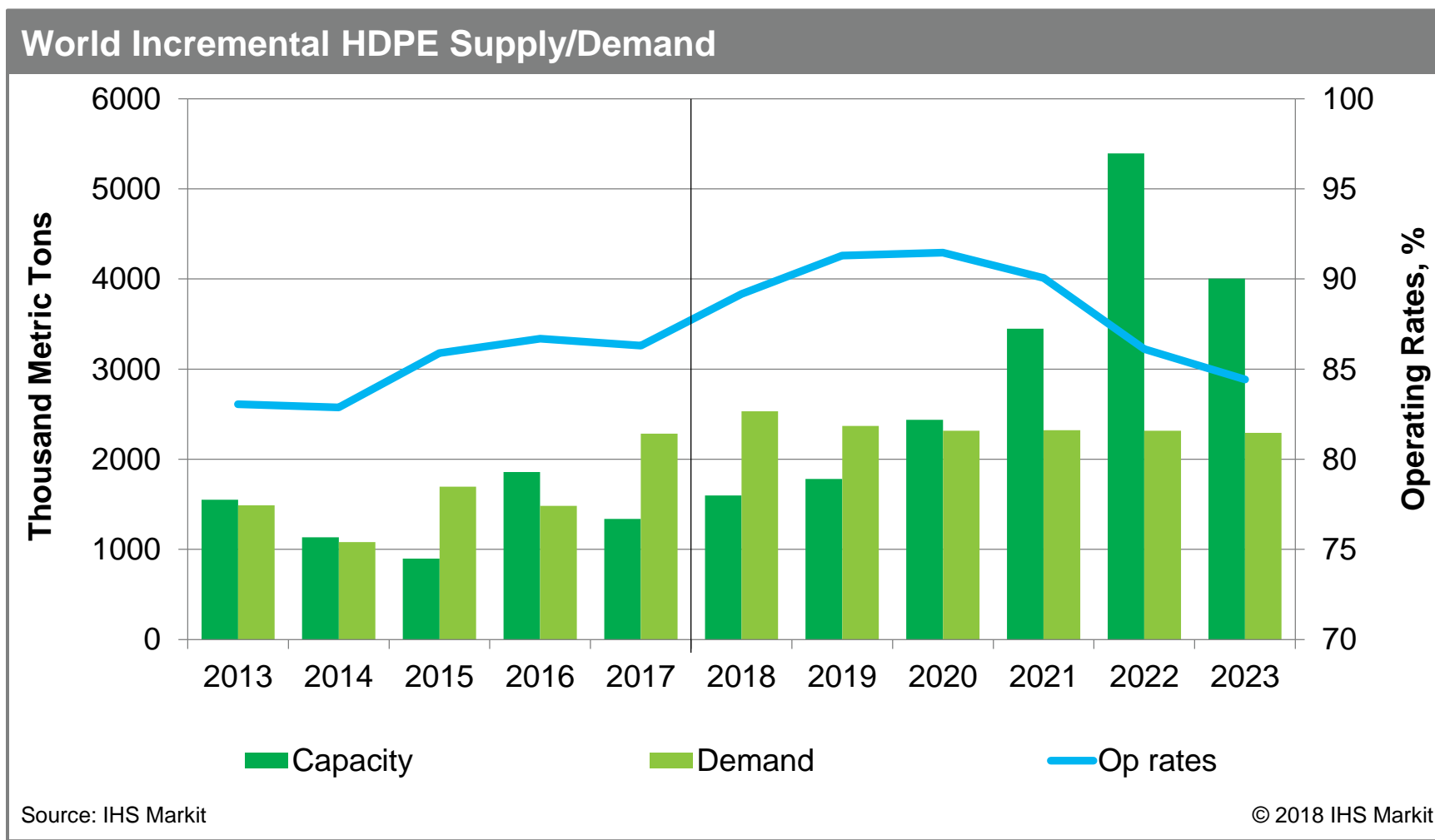
World Incremental LLDPE Supply/Demand



Source: IHS Markit

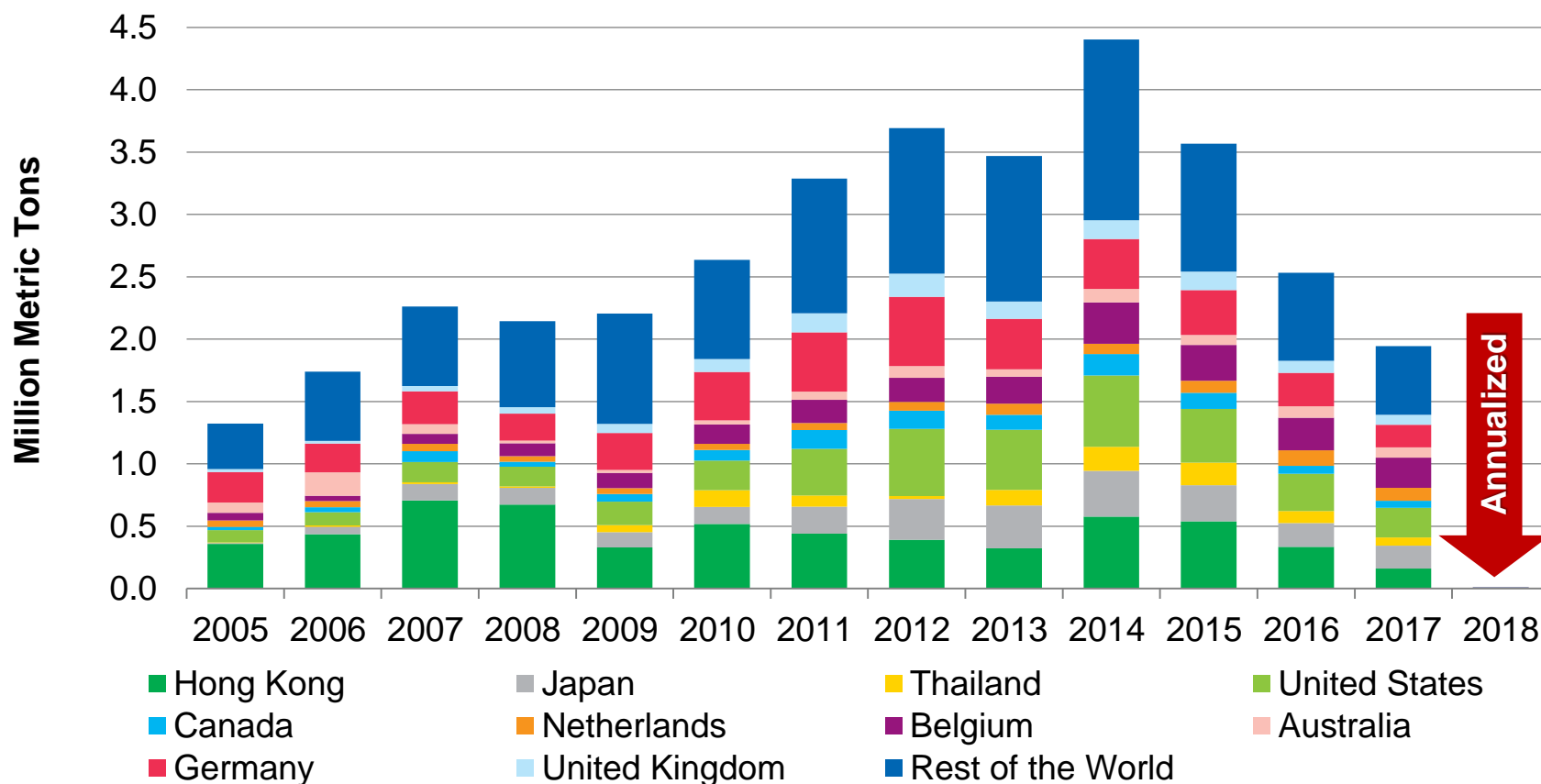
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But tighter Global HDPE availability until 2019



China PE scrap imports by country of origin – Sharp decline in 2018 expected

China PE Scrap Imports by country of origin

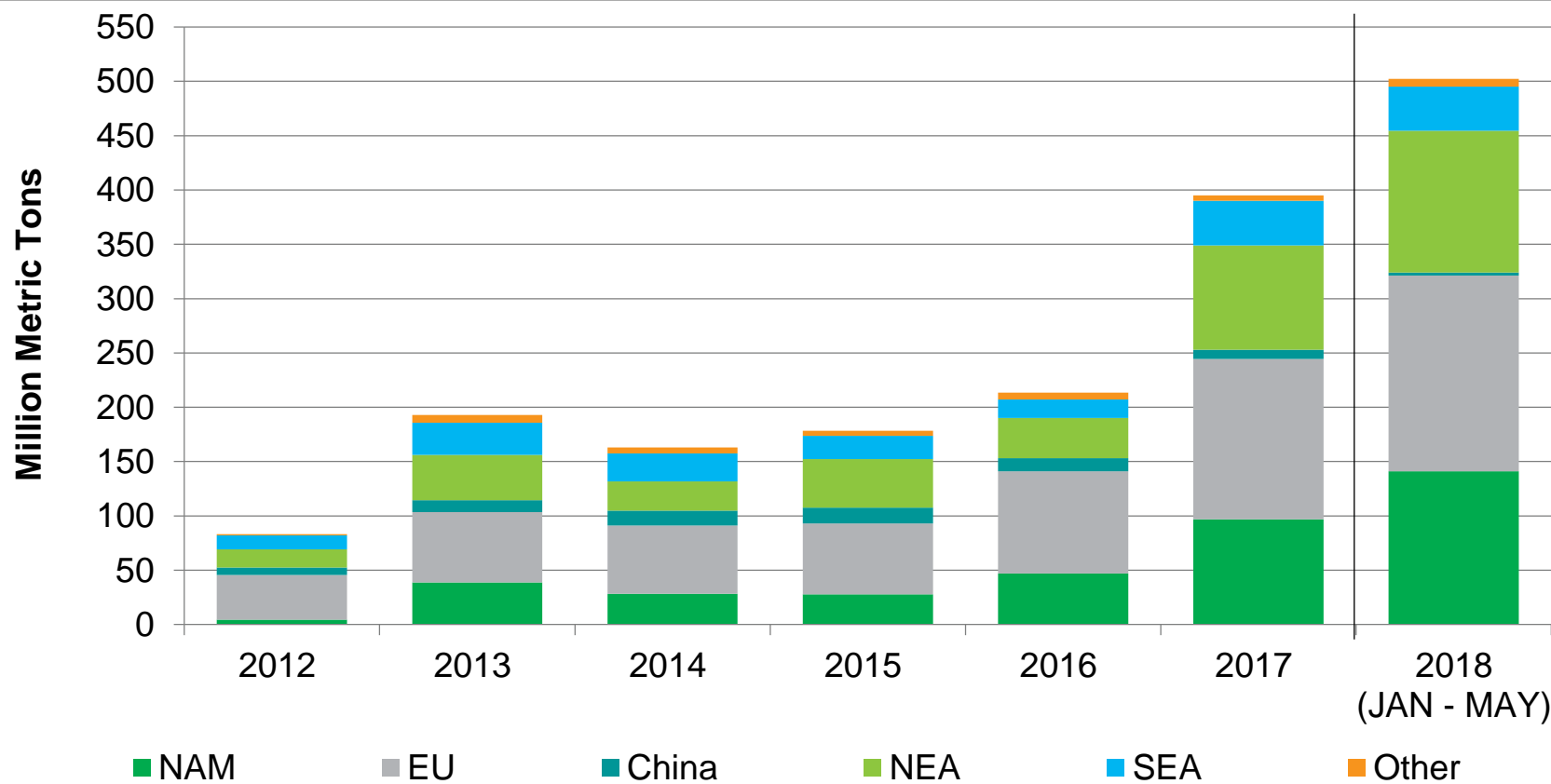


Source: IHS Markit

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More PE Scrap headed towards Southeast Asia

PE Waste Imported by Thailand, Malaysia and Vietnam



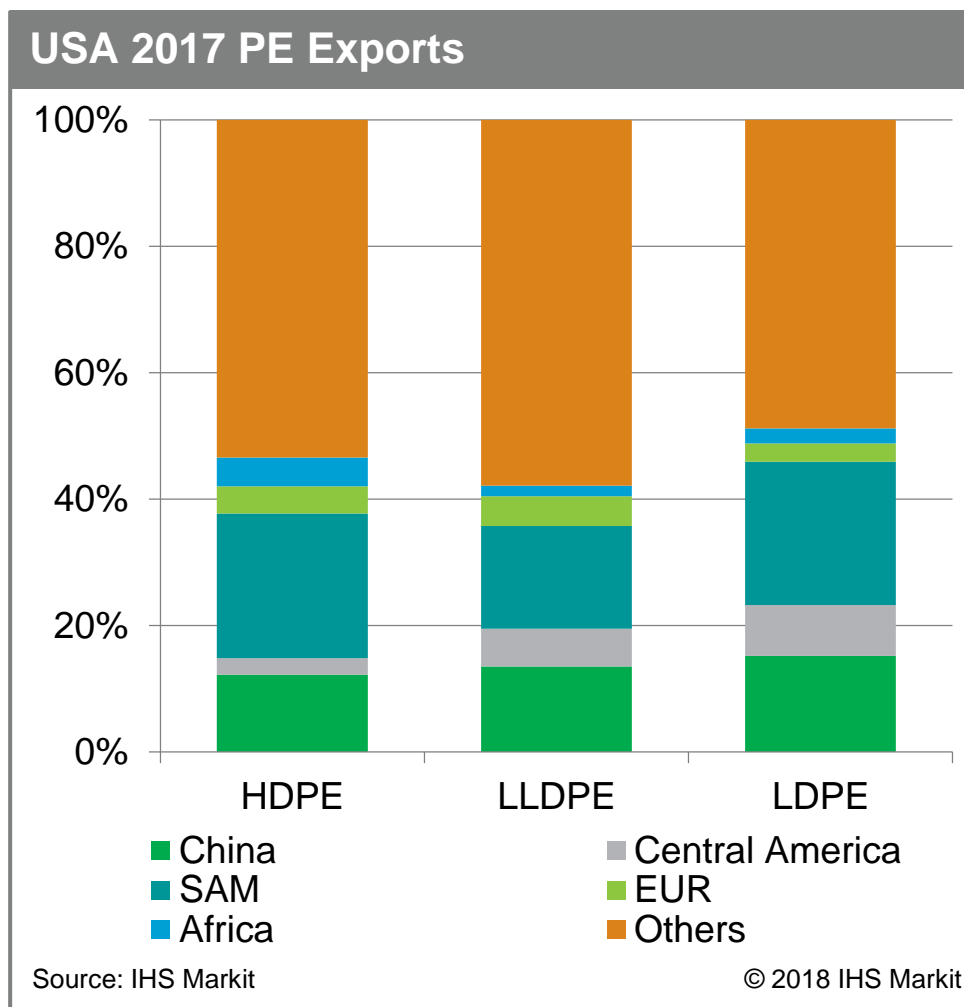
Source: IHS Markit

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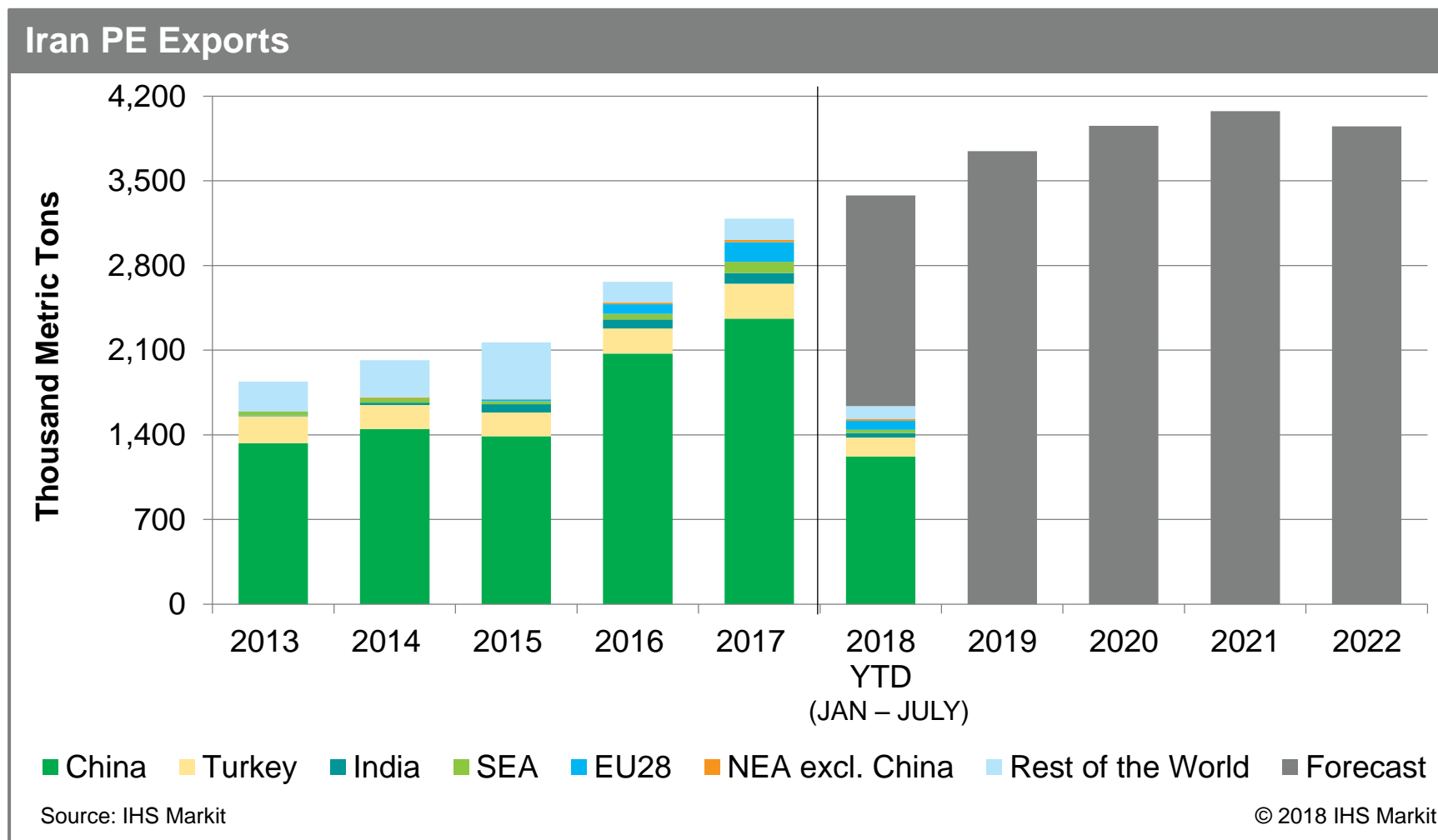
Impact limited until now due to limited China - US PE Trade

- *Major HS codes included in the latest proposal*

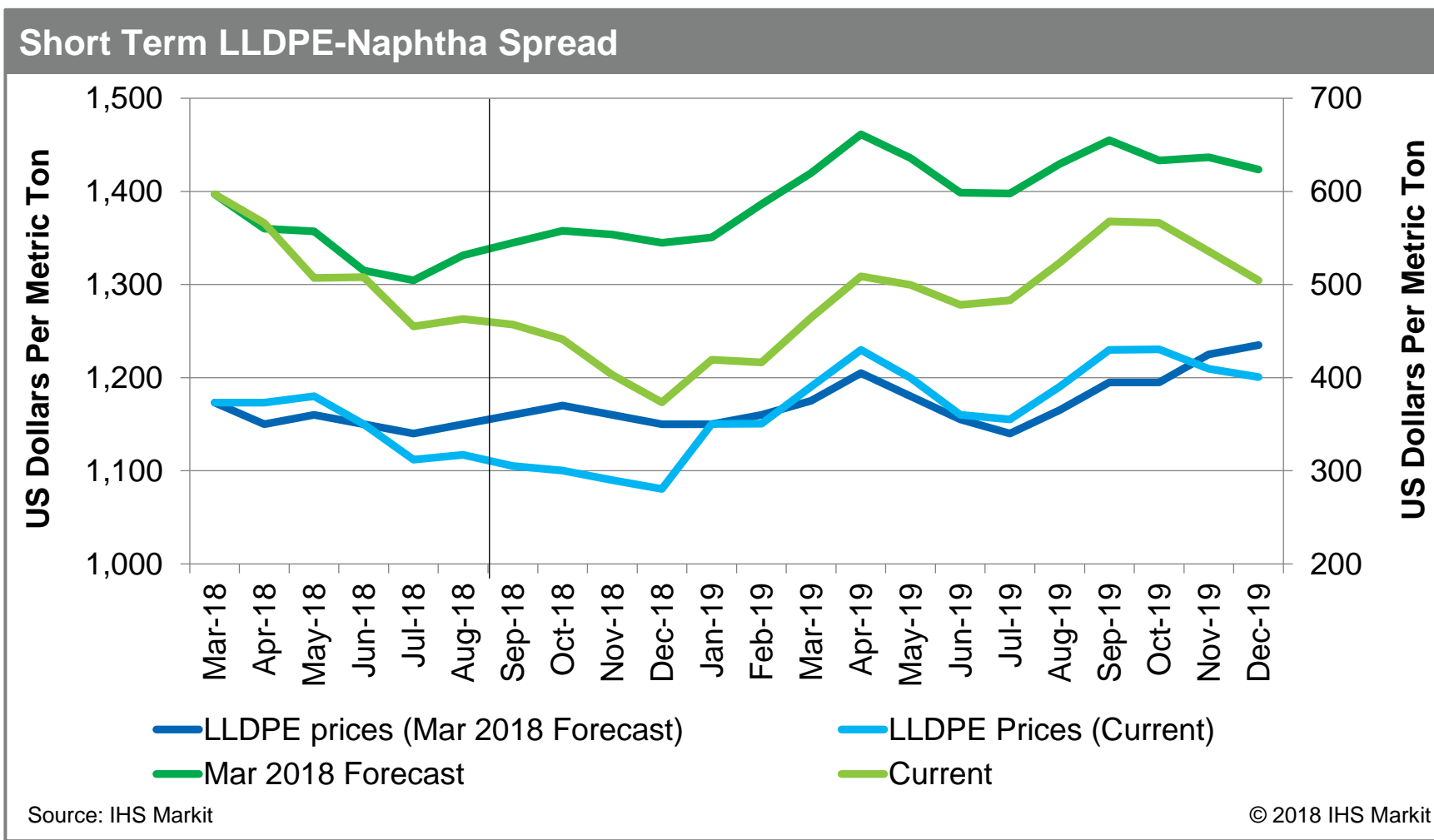
- 39012000 (HDPE)
- 39013000 (EVA)
- 39014020 (LLDPE)



Iran PE Exports will face challenges once US sanctions are imposed

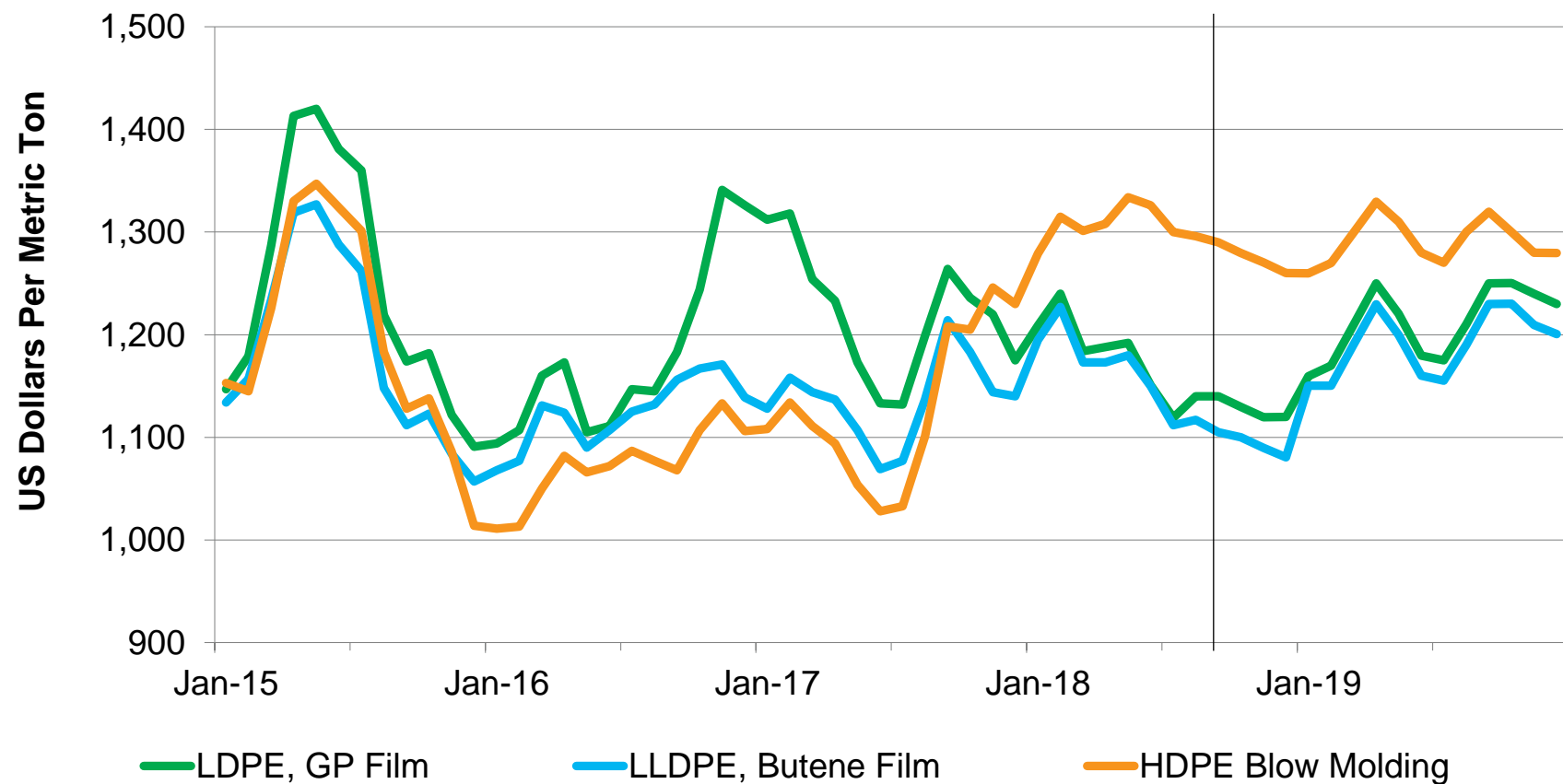


Despite higher oil prices PE price outlook is stable..



Twist of fate for HDPE prices

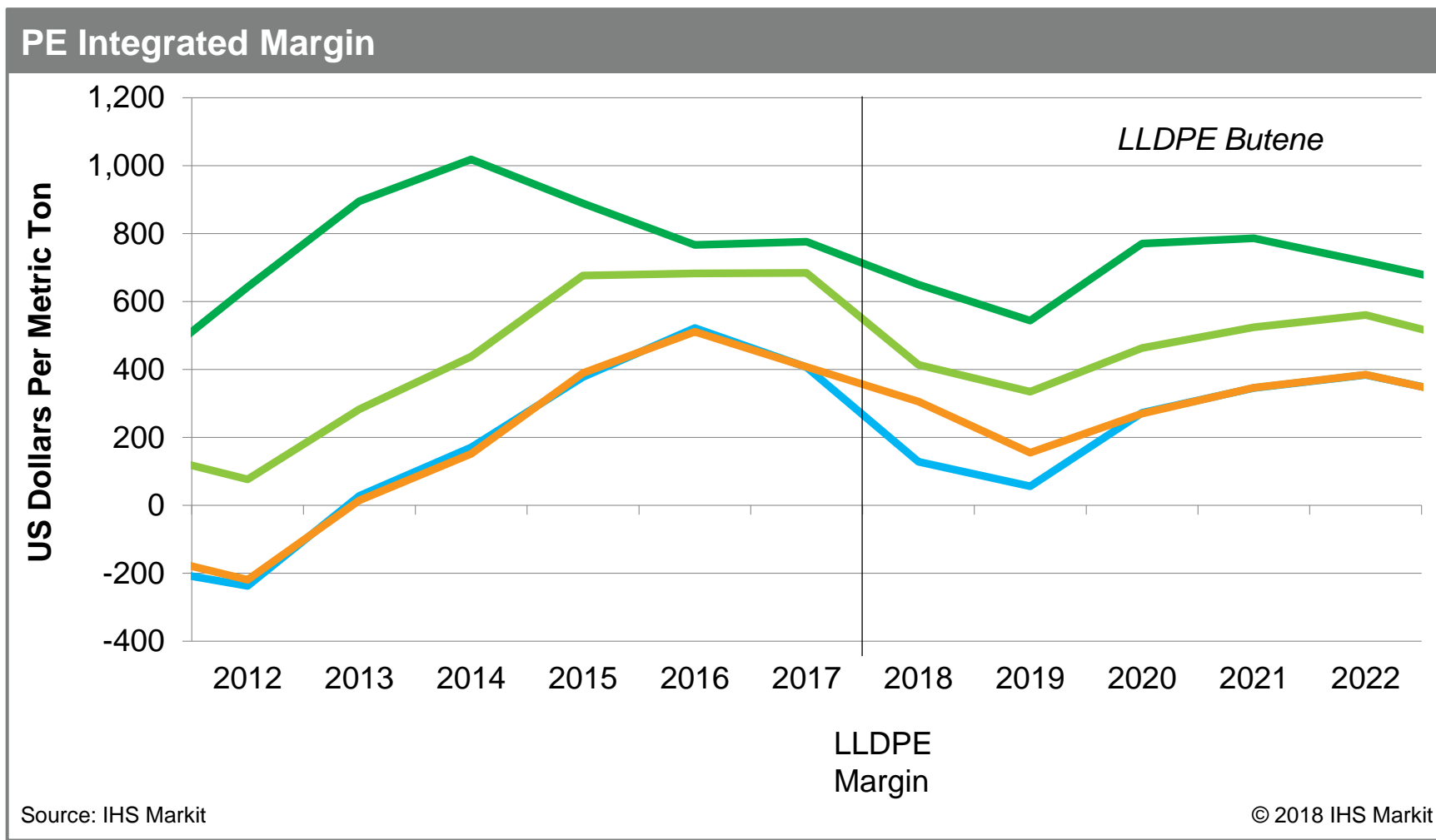
Northeast Asia PE CFR China Prices



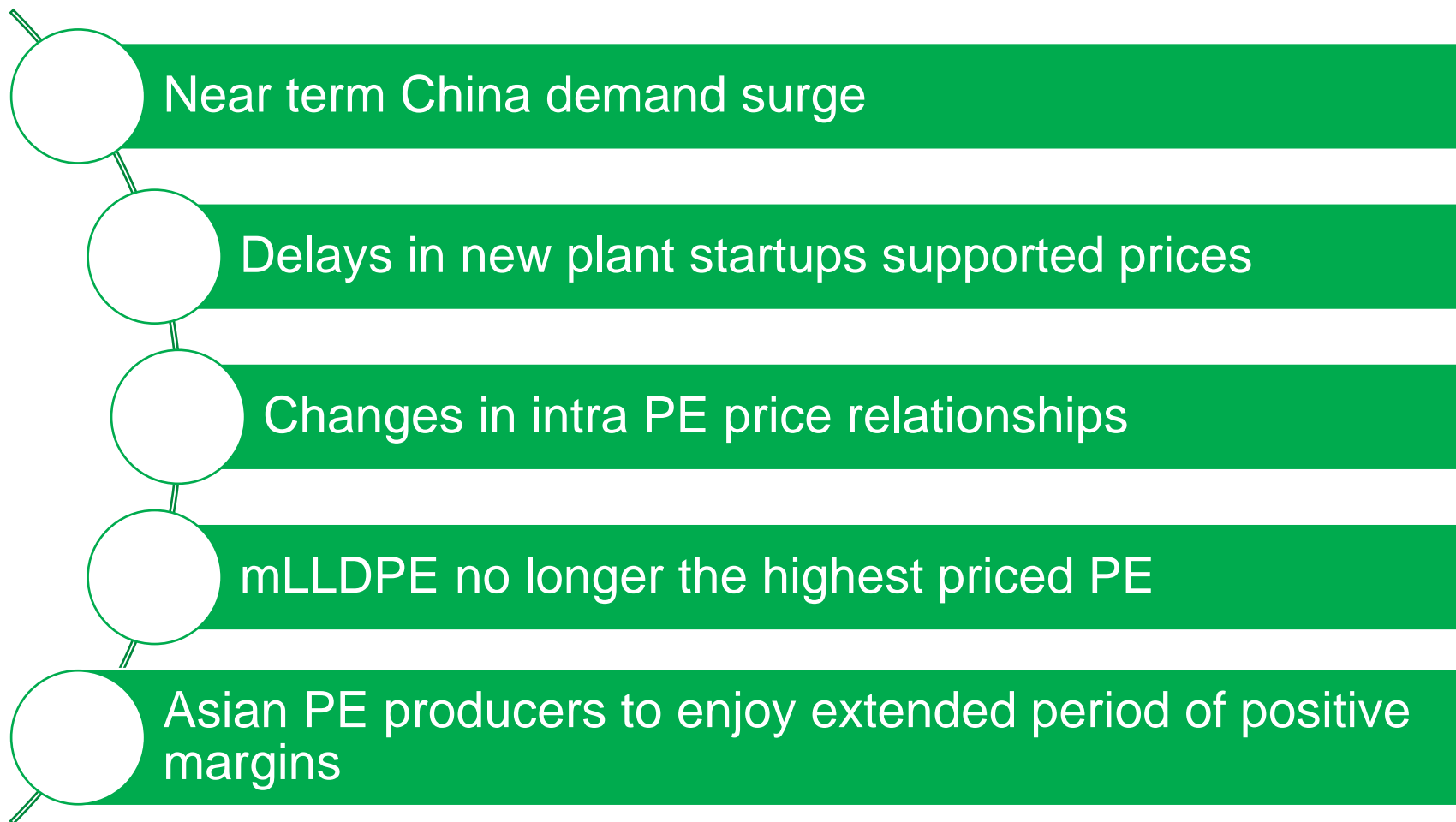
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Despite challenges PE margins remains healthy over the next 5 years

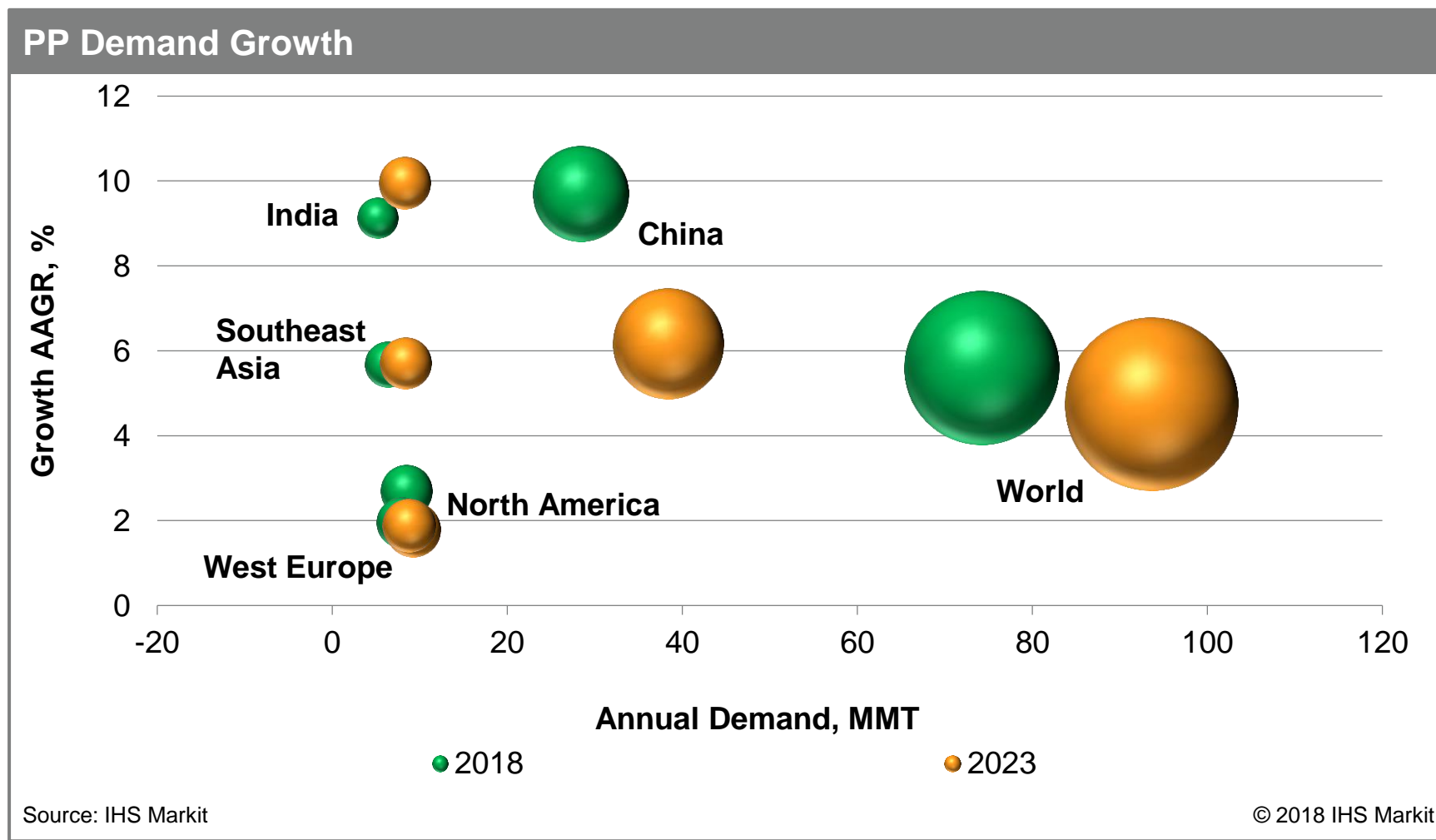


Polyethylene Key Takeaways



Polypropylene (PP)

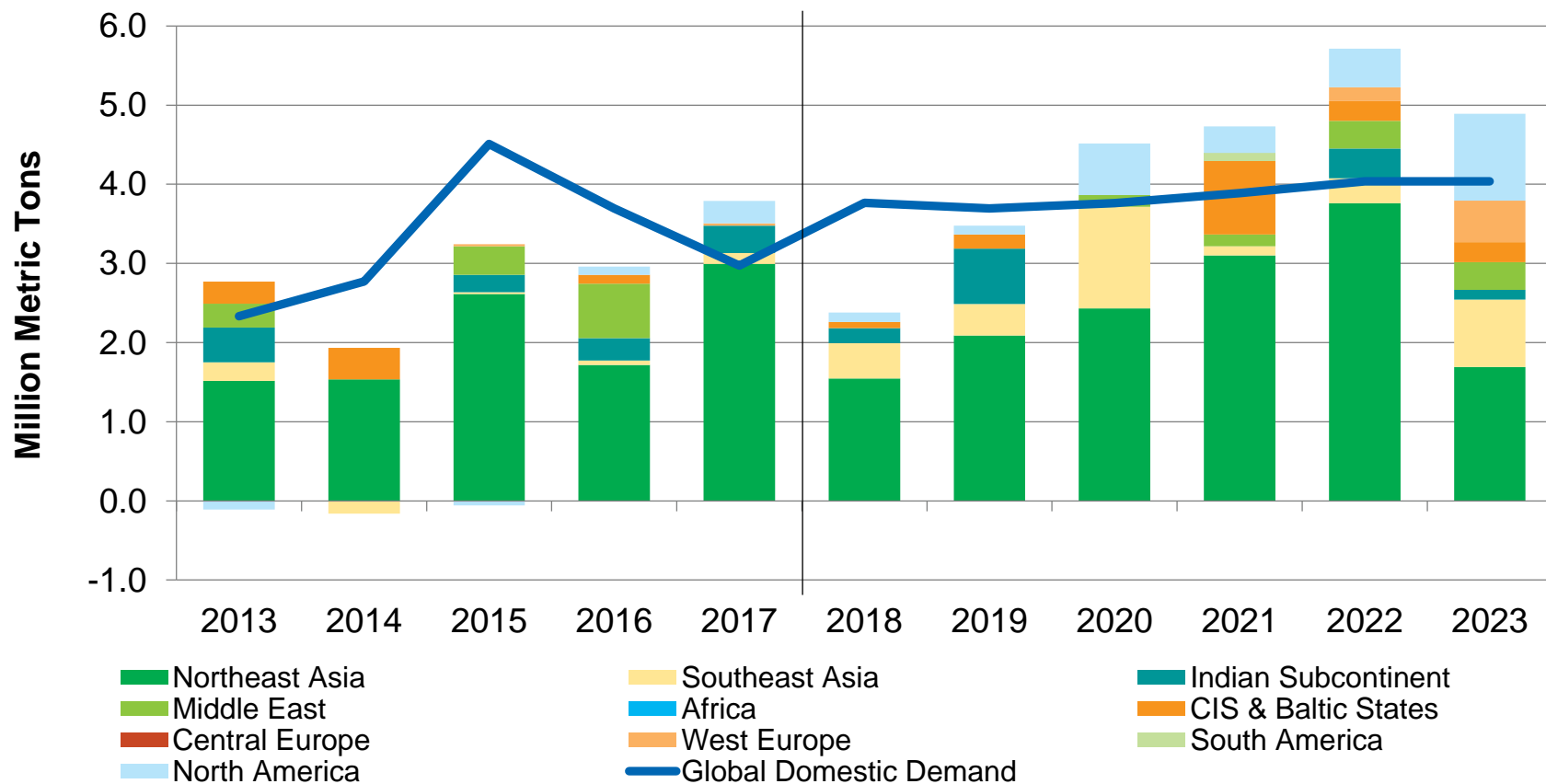
PP demand growing faster than any other polymer



PP Capacity and Demand Growth

China capacity builds lead to significant trade shifts

Global PP Incremental Supply/Demand

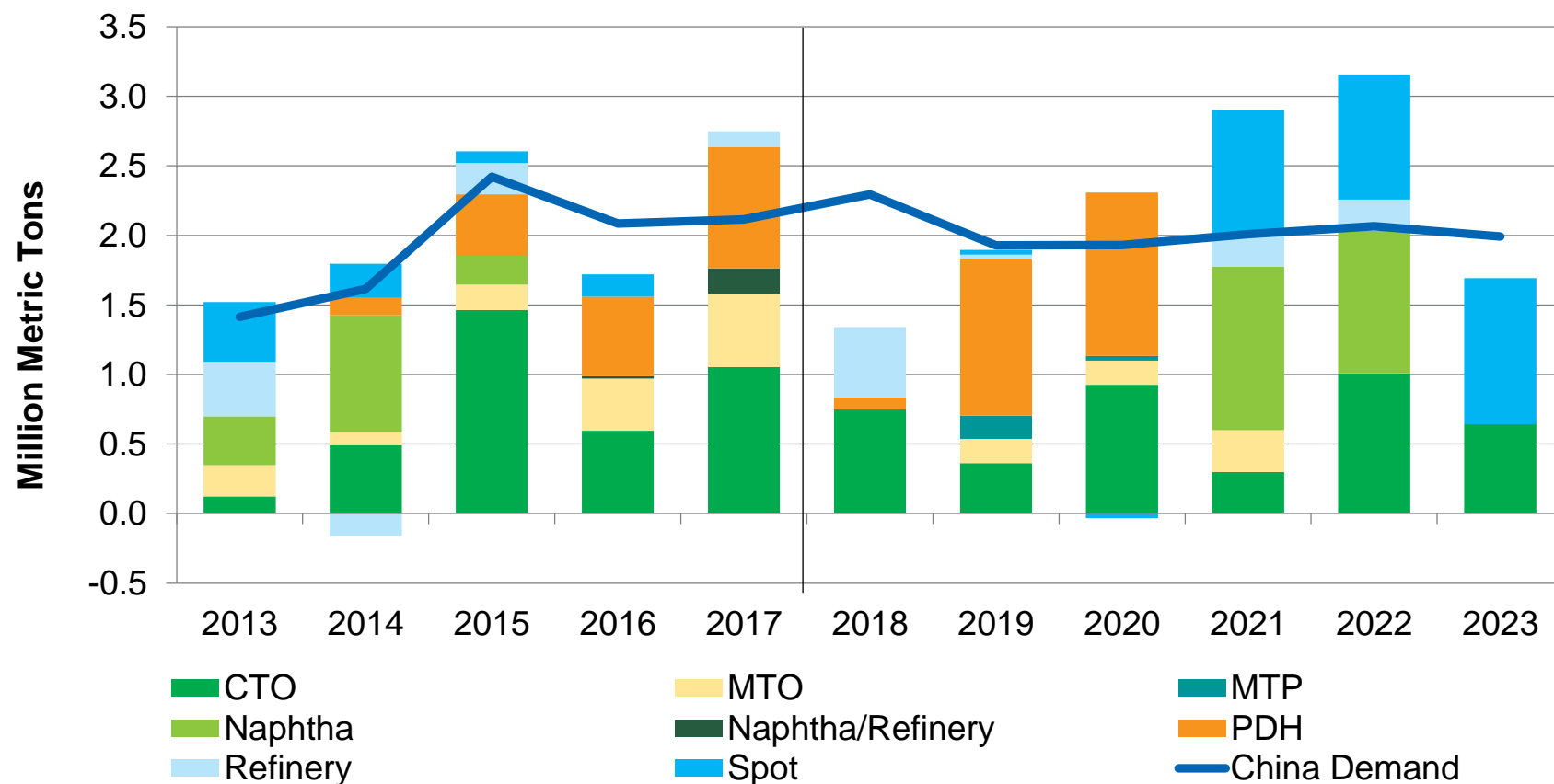


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The fear of overcapacity build in China is fading in the short term...

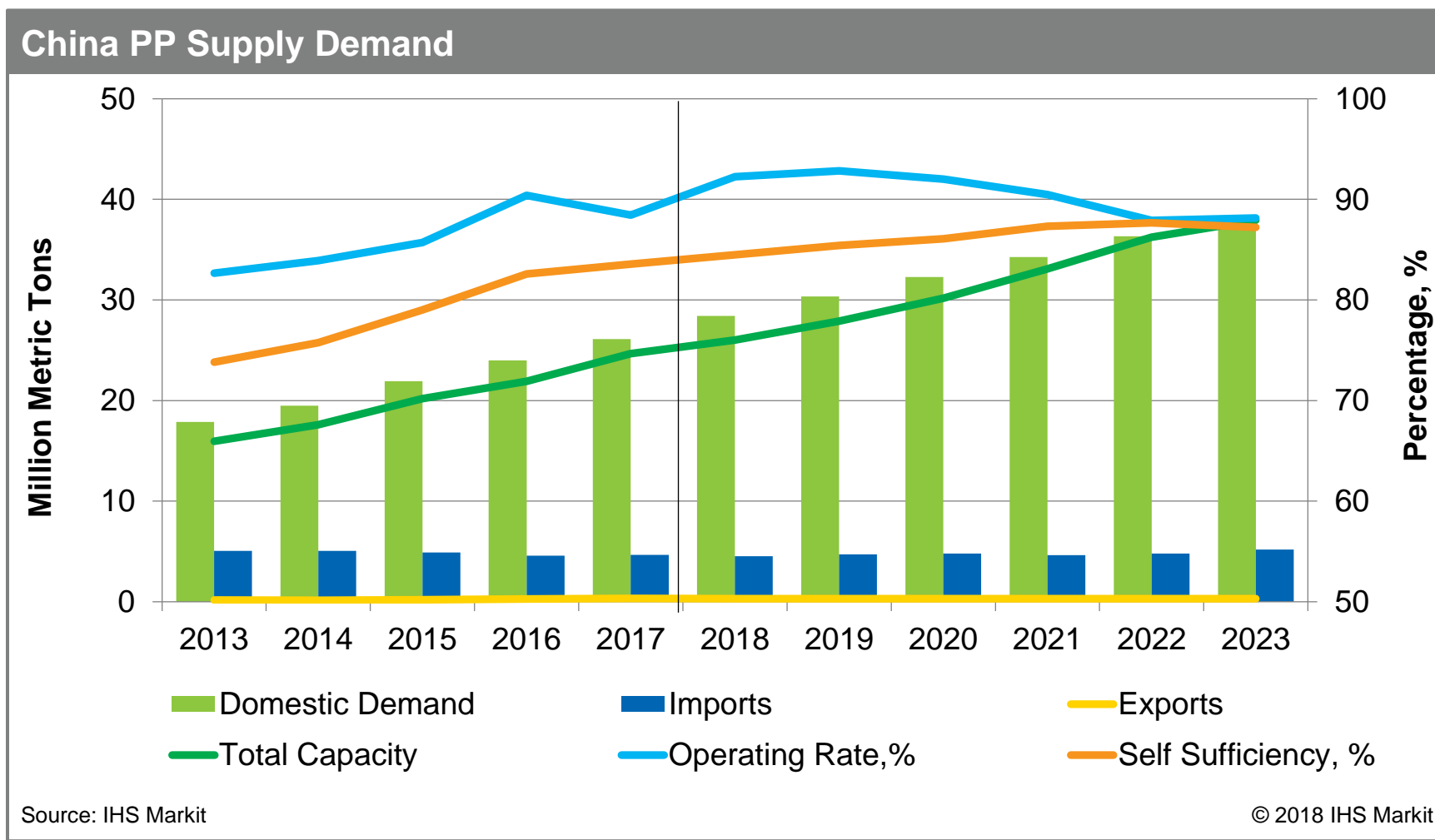
China Incremental PP supply/demand



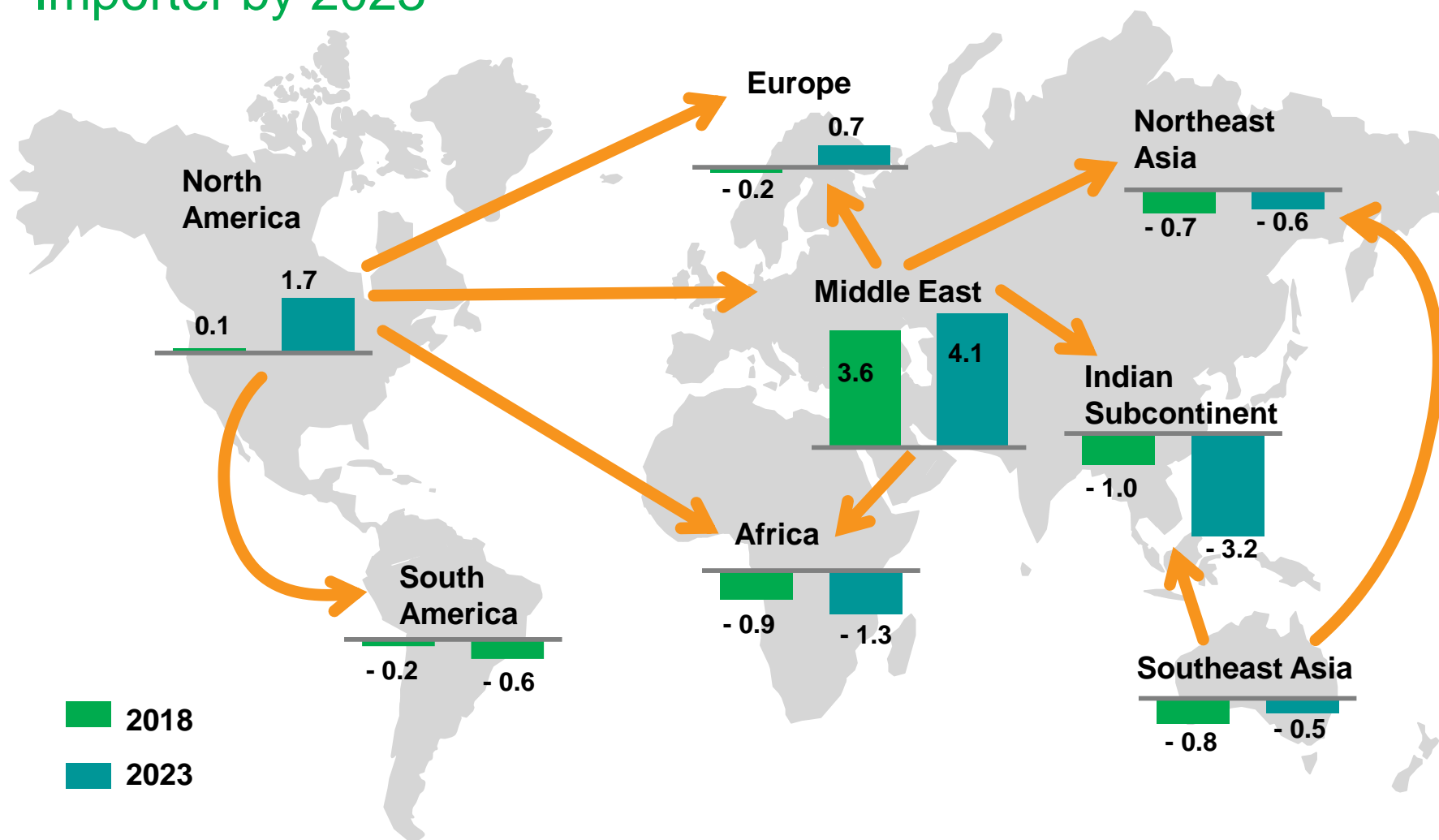
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China PP self sufficiency is nearing the peak

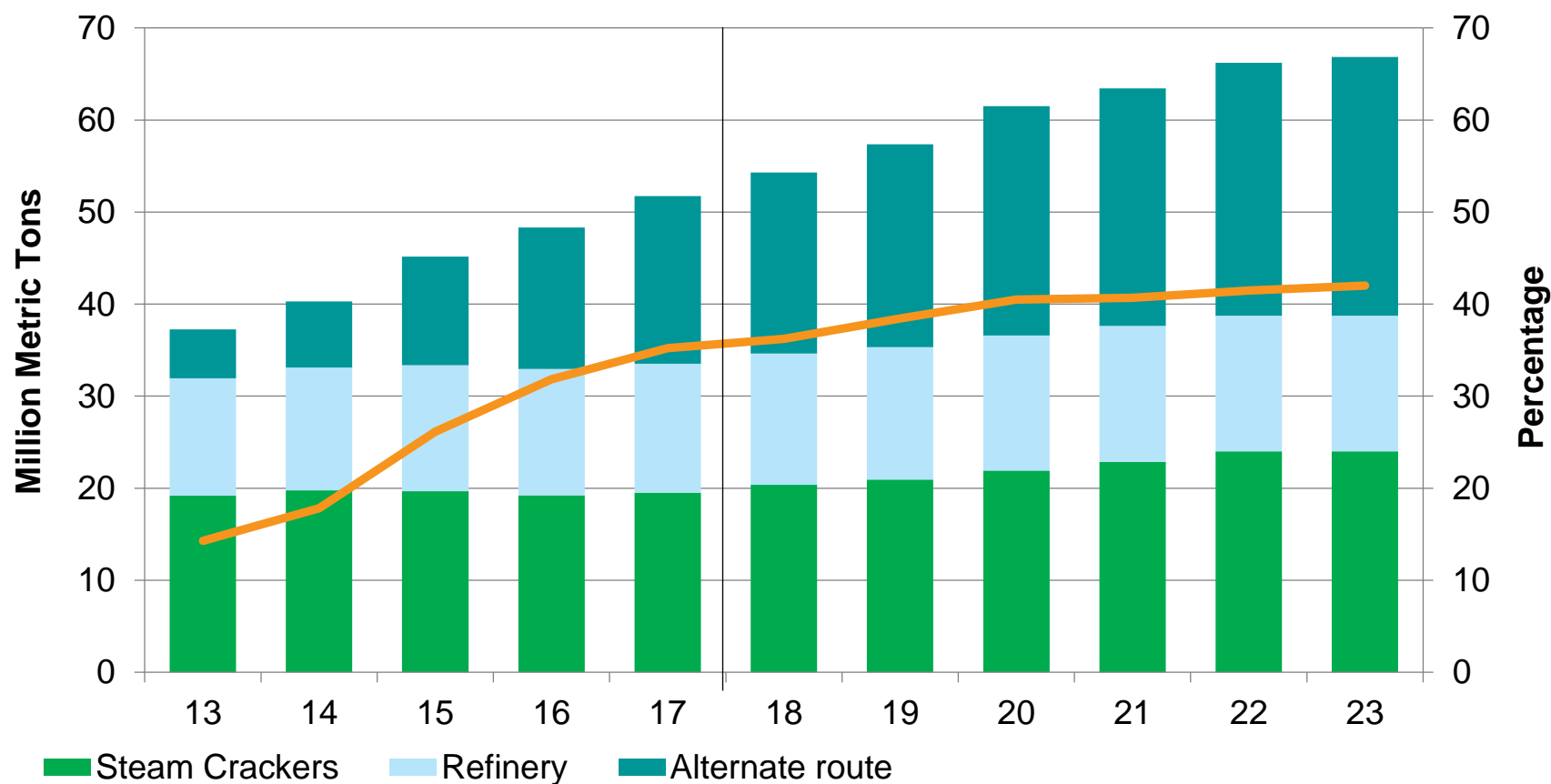


Indian Subcontinent forecast to be the largest PP Net Importer by 2023



Dependence on alternate technologies for propylene in rising in Asia

Northeast Asia Propylene capacity

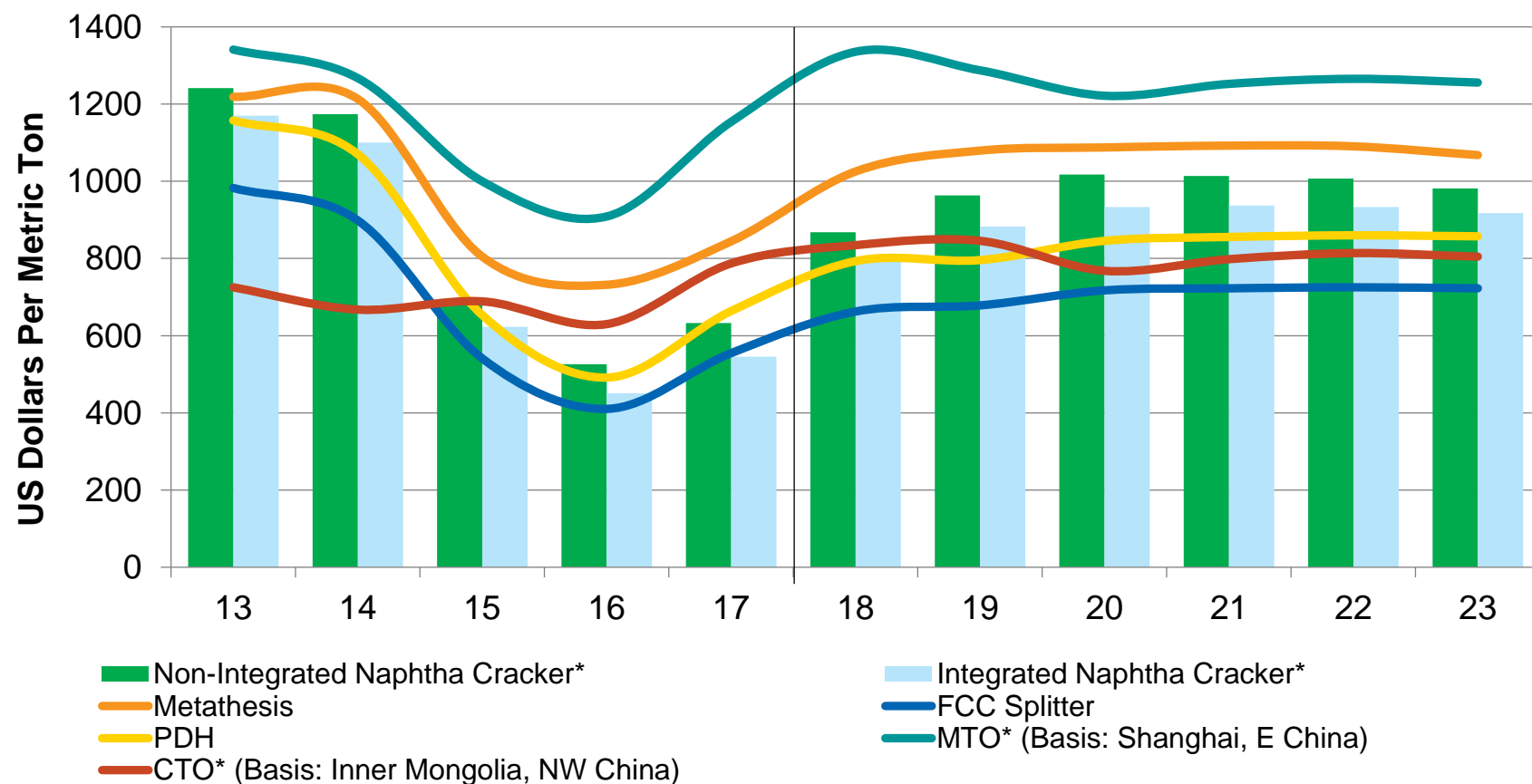


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Refinery linked PP Plants shall remain most profitable.

NEA On-Purpose Propylene Production Cost

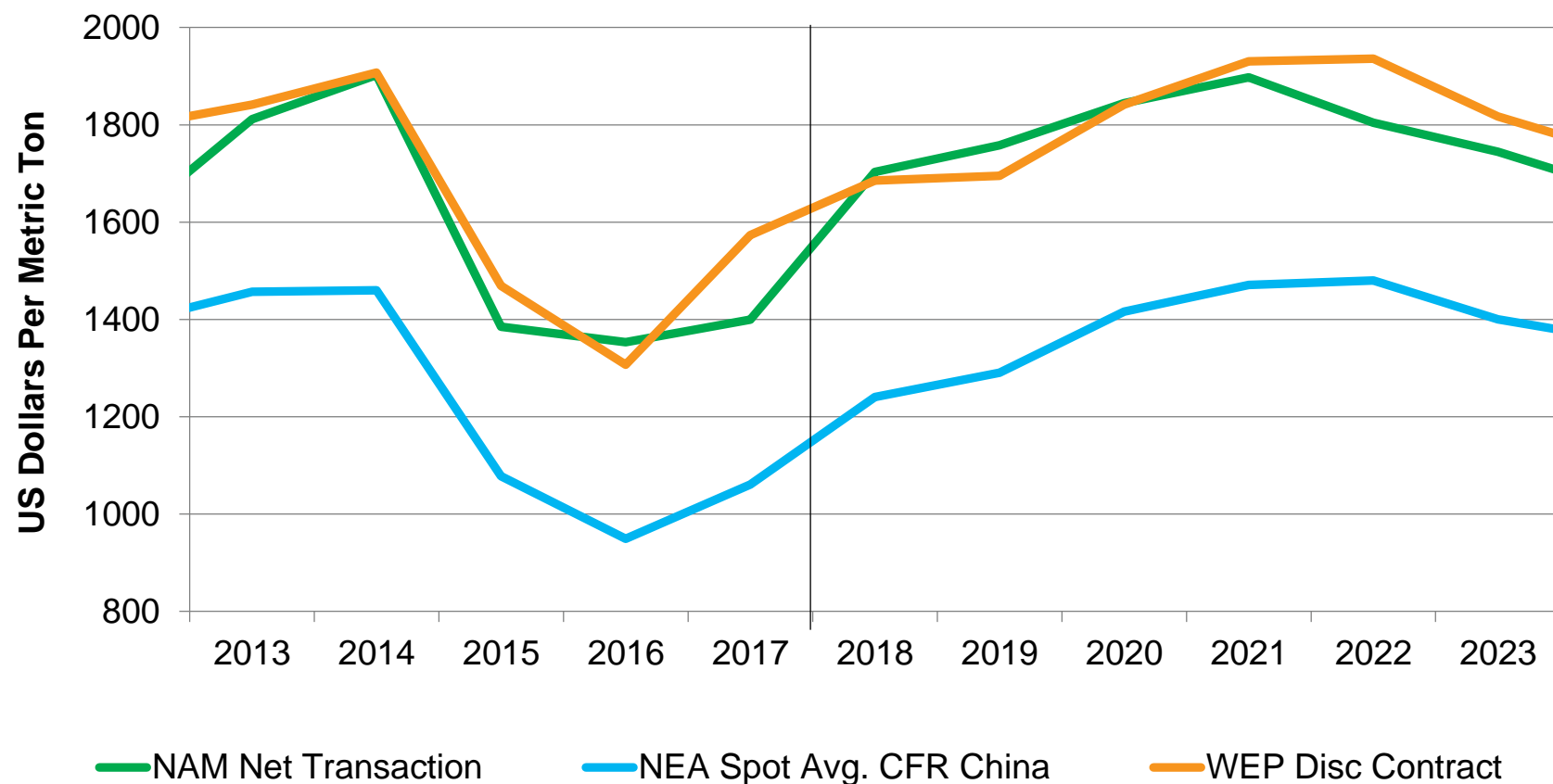


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China PP price will remain the most competitive and set global PP prices


Regional PP Homopolymer Price



Source: IHS Markit

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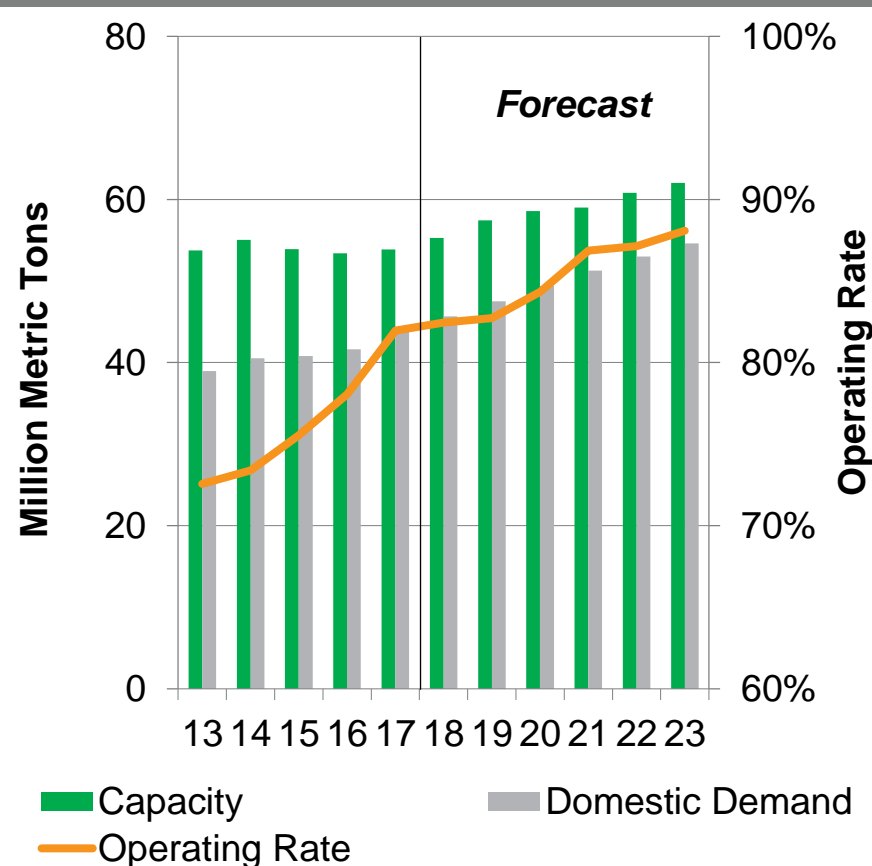
Polypropylene Key Takeaways

- 
- Chinese capacity expansions to slow down in 2018
 - North America capacity additions to gain momentum next decade
 - China Self Sufficiency level nearing the peak
 - Global Operating rates are expected to remain above 90 pc until early next decade
 - Integrated margins for Refinery-PP producers are expected to remain healthy

Poly Vinyl Chloride (PVC)

Globally, 5 years demand growth trajectory beat supply expansion

World: PVC Supply & Demand

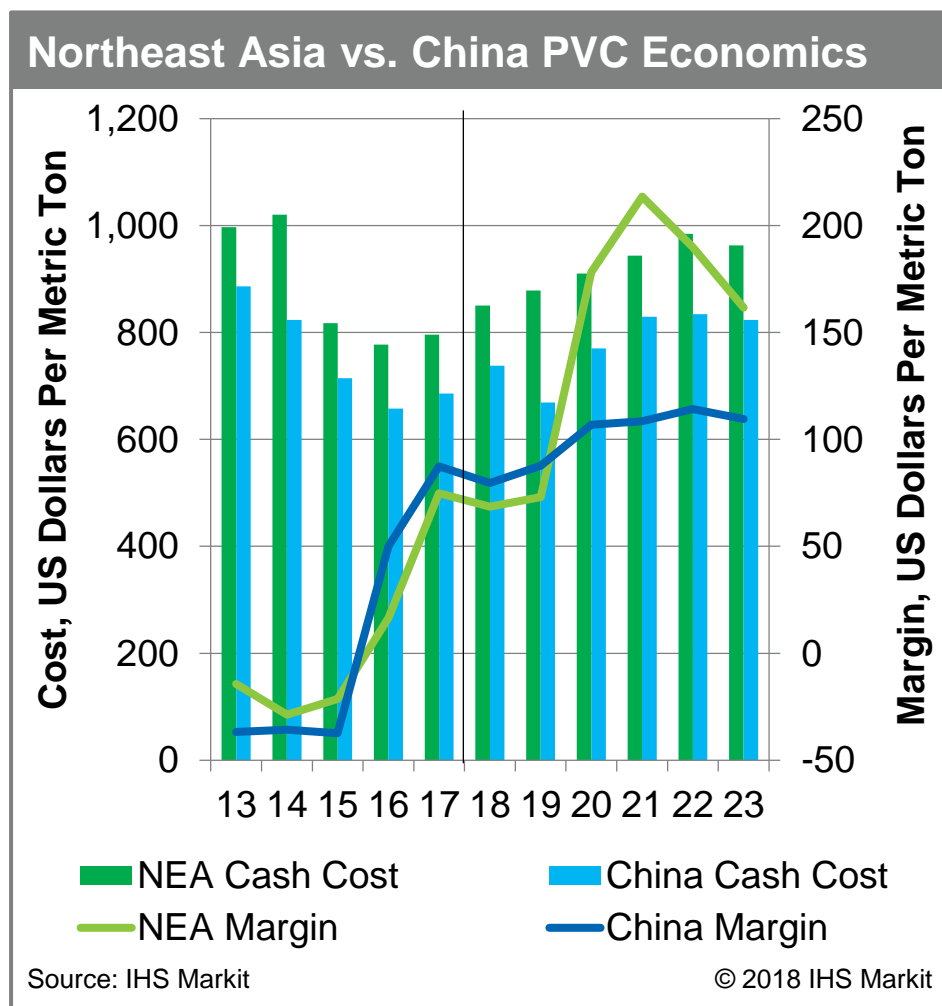


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- Healthy global GDP of 3-3.5% through 2020 support fiscal activities and demand for PVC
- Less visibility on supply expansion after 2020
- Cycle peak expected in 2022-23 period
- Previous peak ops rate was back in 2007, 88% - before the explosion of acetylene-route PVC

Carbide-based cost advantage, better margins



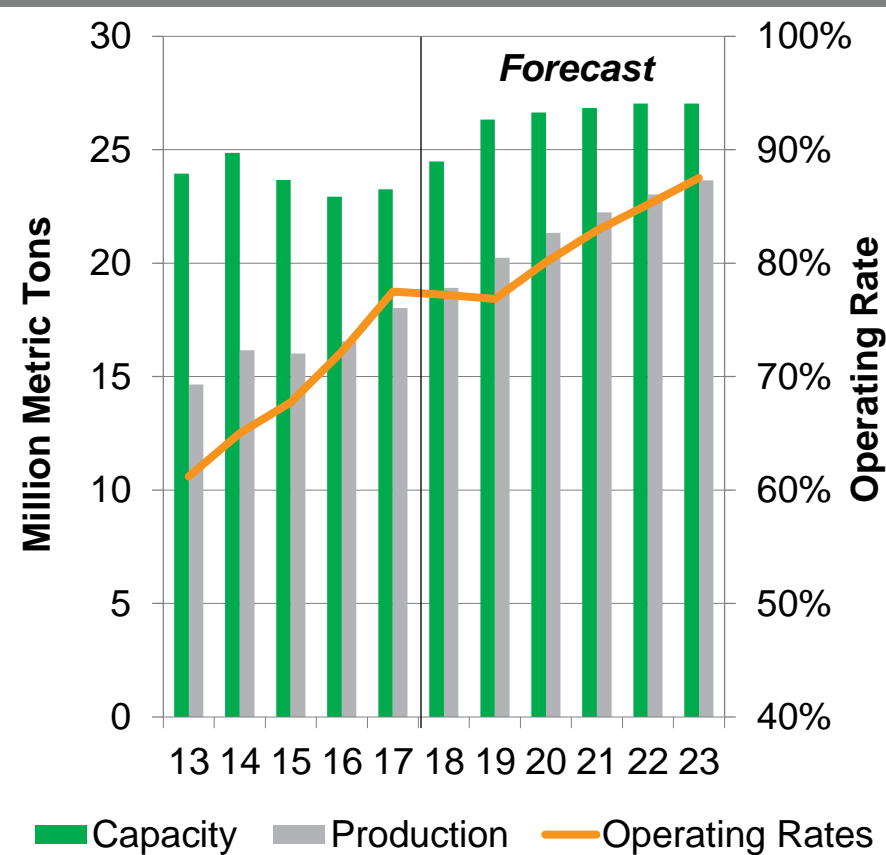
- Carbide PVC has cost advantage over NEA ethylene-based PVC
- High ethylene opportunity cost remain a challenge for Asia.
- Margins on PVC alone yet to reach reinvestment level return

A handicap when comes to competing for investment dollar for the vinyls value chain

China's rationalization key in transforming the regional balance



China PVC plant operating rate



Source: IHS Markit

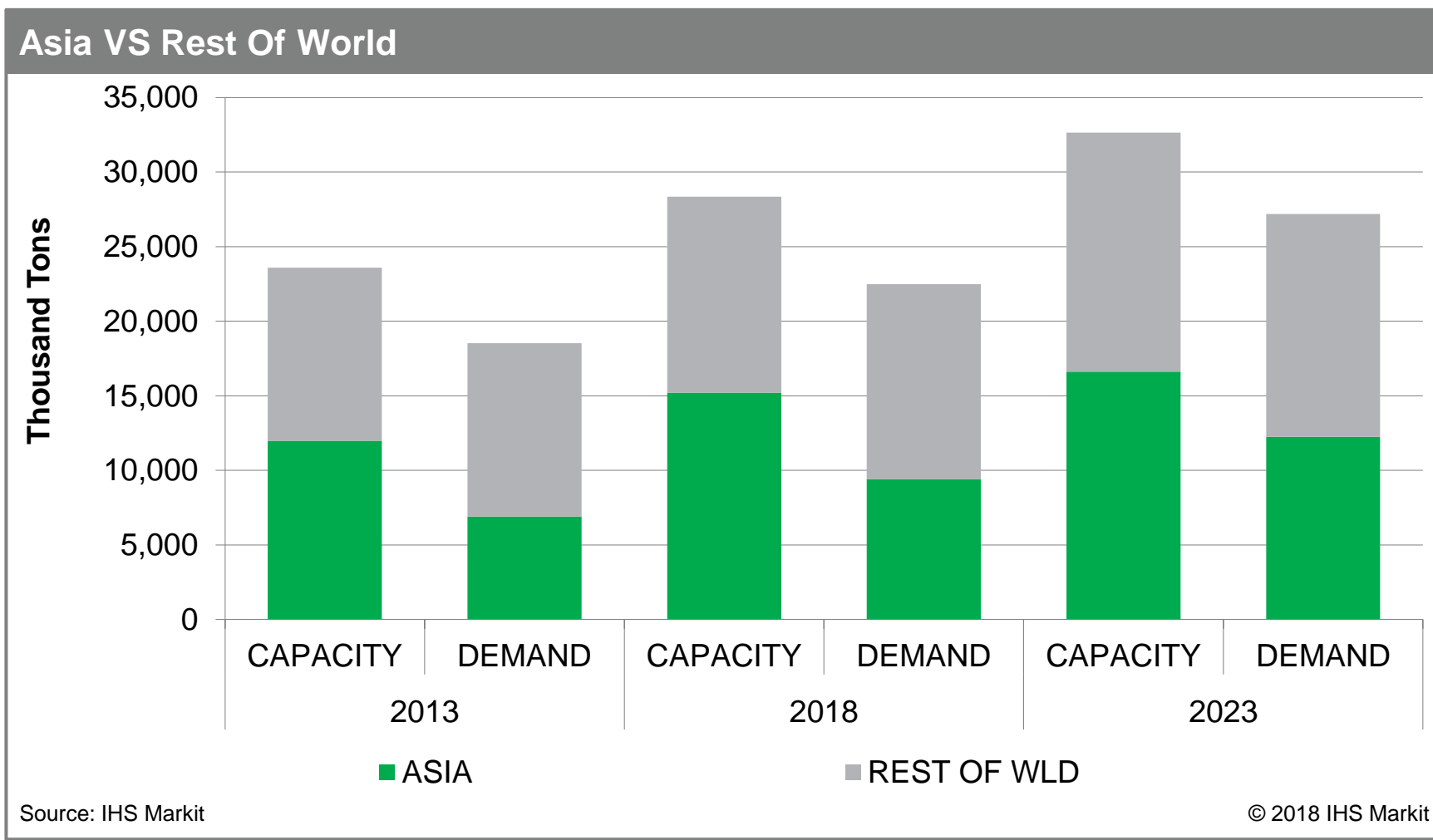
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PVC Key Takeaways

- 1 Stable to strong global economy will drive PVC demand growth
- 2 Next 5 years demand growth projection outstrip supply expansion
- 3 China act to put its domestic market in order augurs well for the rest
- 4 The World needs more PVC
- 5 Investment opportunity is now, challenge is where?

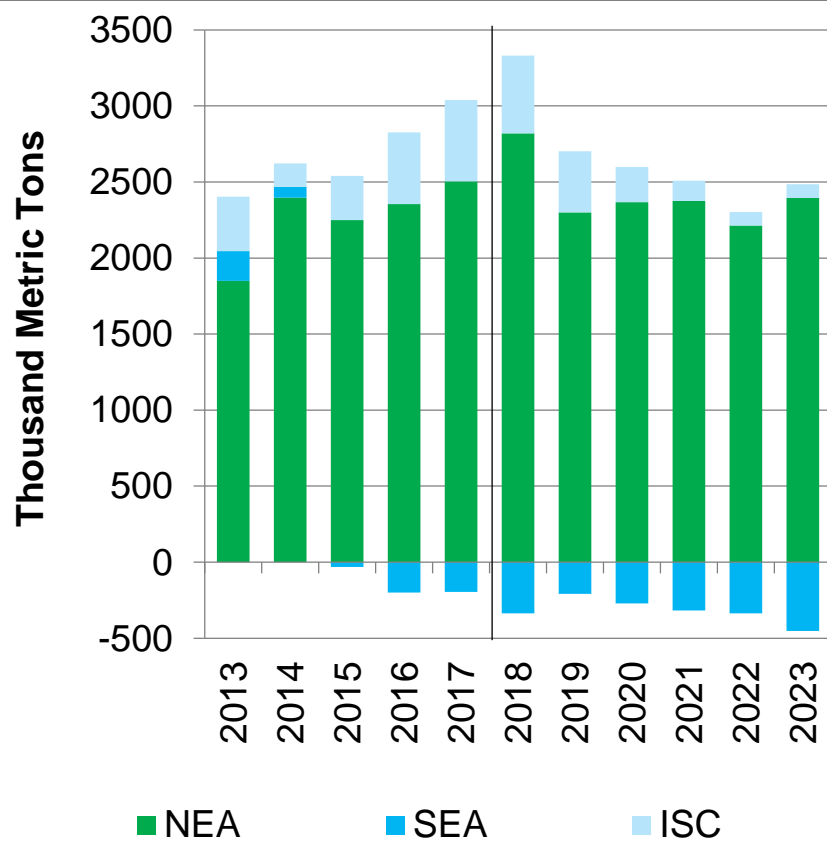
PolyEthylene Terephthalate (PET)

Asia continues to play a significant role in both PET supply and demand



Increased market length is sending exports from Asia to a new high

Net PET Trade By Region



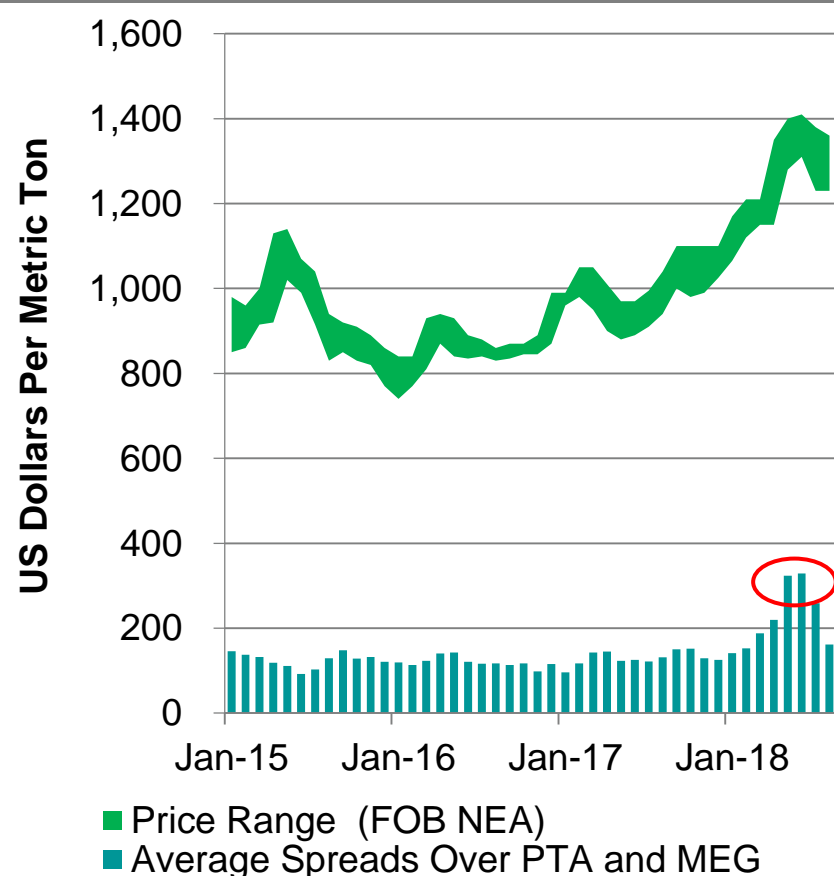
Source: IHS Markit

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- Southeast Asia was the only region that has seen some structural change in net trade over the past 10 years, though the new plant at Viet Nam will bring some change.
- Northeast Asia captured the vast majority of incremental net exports, spurred by fast growing domestic capacity that is simply not able to be absorbed locally.
- Following the latest capacity expansion, India has become a more significant supply source to multiple markets, including the Middle East, Africa and South America. The potential for a further increase in net export appears limited due to robust domestic demand growth.

Feedstock costs are the key factor driving PET prices

PET Prices and Economics



Source: IHS Markit

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- Oversupply and the necessity of export have fundamentally limited pricing flexibility apart from cost driver.
- The change in regional price disparity mirrors the intensity of competition. A widening price range usually reflects that some exporters have easier access to certain markets due to the advantage offered by ocean freight charges or more importantly, tariff policy.
- Outage-related global supply tightness led to a three-month surge in PET economics, but with the subsequent capacity addition/recovery world widely, margins have corrected down drastically.

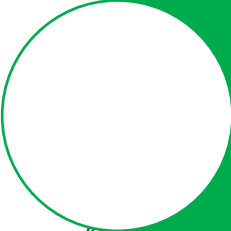
PET Key Takeaways



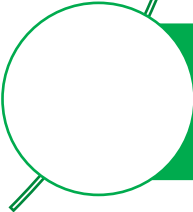
Excess capacity in Asia will continue to grow, with rationalization within China highly expected.



Incremental exports to Japan and the US will help mitigate the impacts from new plants in Southeast Asia.



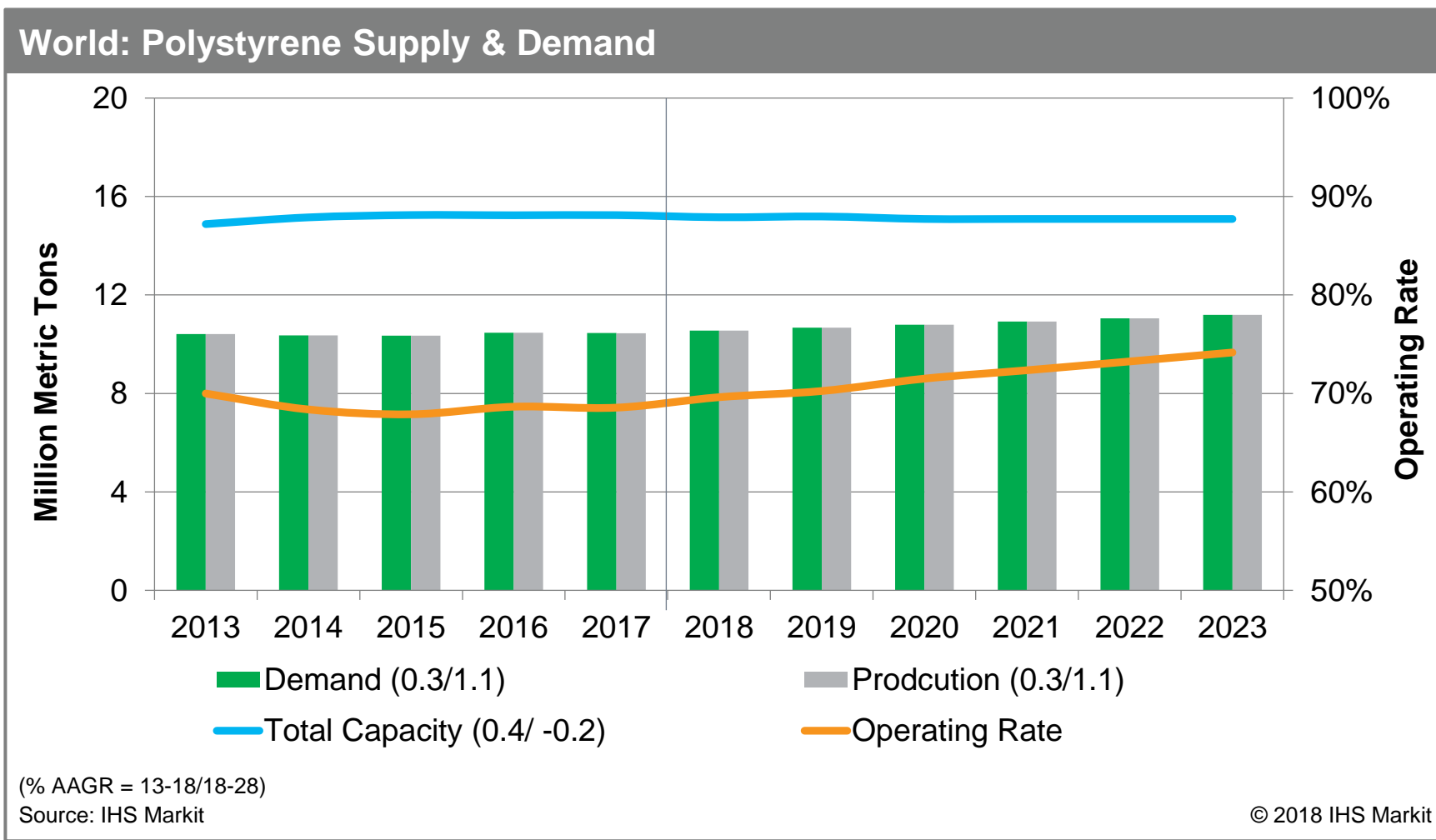
Operational capacity outside NEA has been increasing for a couple of months and will grow further following the restart at EIPET; a pullback in NEA exports appears inevitable.



Feedstock costs will remain the key price driver, with no significant change expected in terms of margins.

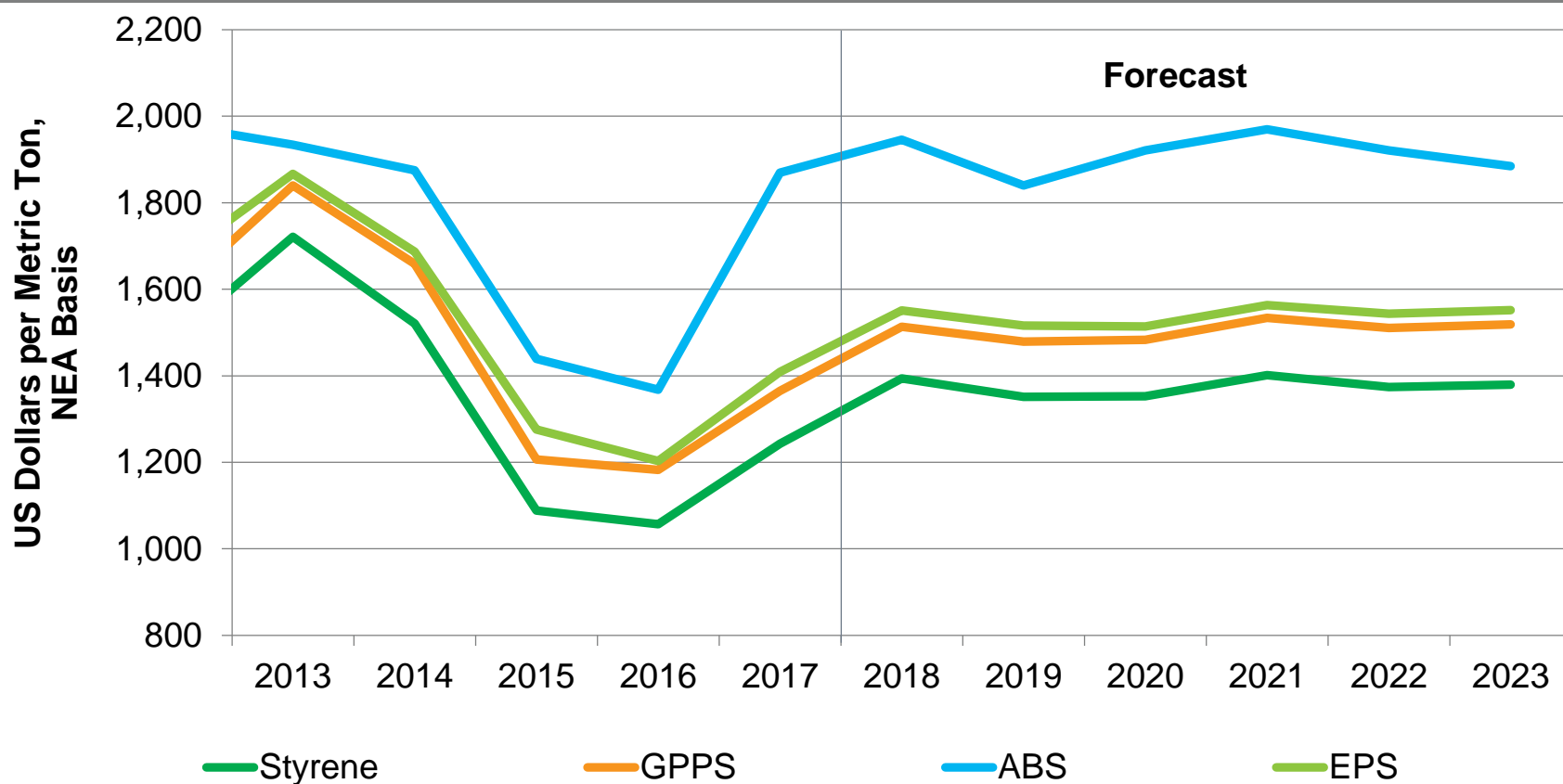
PolyStyrene (PS)

Global Polystyrene Operating Rates are rising



High Correlation of Styrene with GPPS / EPS Prices but not ABS

Styrene, GPPS, ABS & EPS Prices

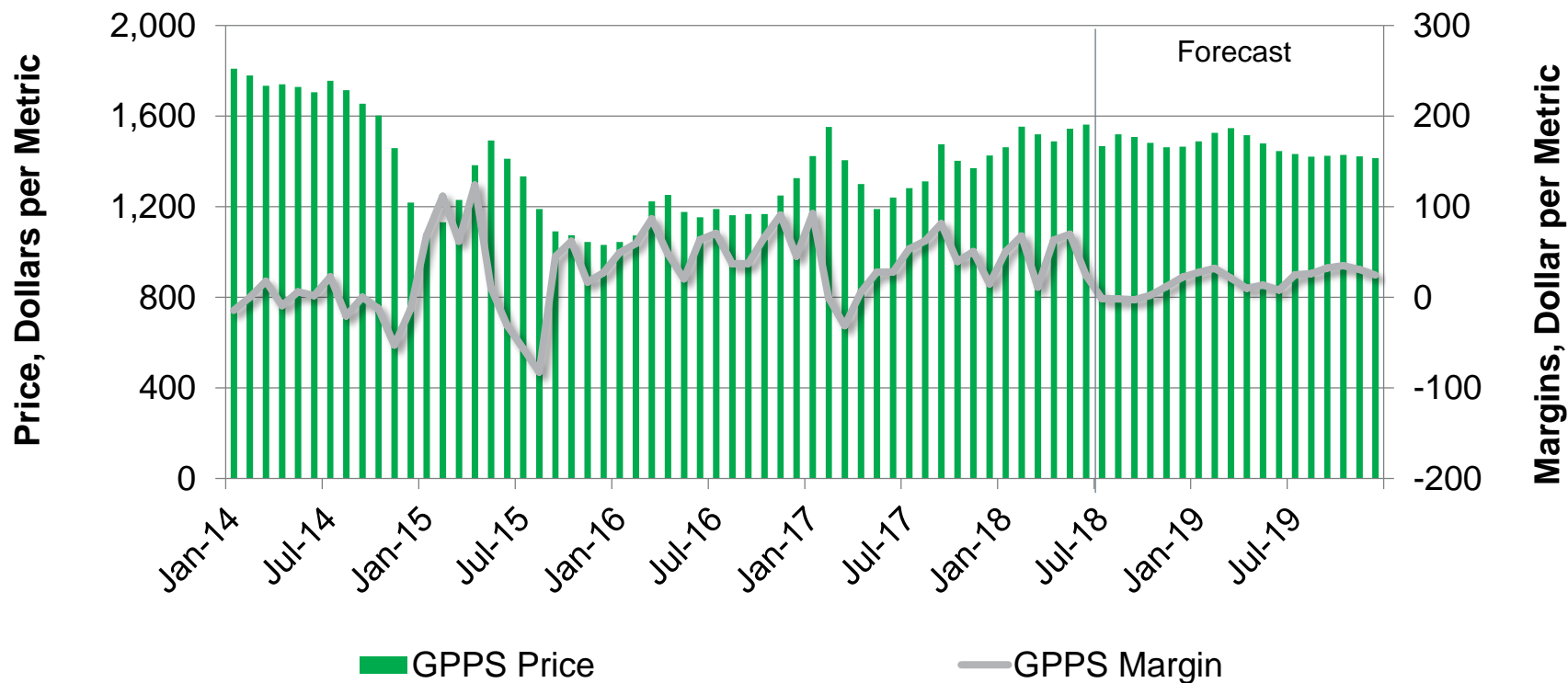


Source: IHS Markit

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GPPS margins outlook continue to remain lacklustre

Price & Margins of GPPS



Source: IHS Markit

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PS Key Takeaways

- 1 Global Operating Rates to increase from below 70% to mid 70% during the forecast period
- 2 PS producers in China will benefit from higher domestic supplies of Styrene
- 3 In the event of extended period of US – China Trade tensions, demand for durable goods exports will slow down thus impacting PS demand
- 4 Relatively low operating rates will weigh on margins of PS producers in the region

Global Megatrends

- Sustainability



- Mobility



- Oil to Chemicals



Sustainability

Sustainability focus turns to plastics with major media attention

- The most critical issue that will influence the industry during the decade of the 2020's.
- Local communities exploring bans on single-use plastic applications as the issue of plastics waste in the oceans has become an international media issue: CNN, Economist, National Geographic's, BBC
- United Nations “World Environmental Day” had plastics waste as a central theme.
- The solutions will come from a cooperative, approach that brings all the stakeholders together to solve this very complex issue.
- A slowdown (versus history) in growth for commodity plastics demand must now be considered in long term forecasting.

EU Circular Economy Package

Adopted in May 2018

- Packaging and Waste Direction
- To be implemented by the member states within two years
- ❑ New Extended Producers Responsibility (EPR) requirements
- ❑ New recycling targets for packaging

Recycling Targets	2025	2030
All Packaging	65%	70%
Plastic	50%	55%
Aluminum	50%	60%
Paper/ Cardboard	75%	85%
Ferrous Metals	70%	80%
Glass	70%	75%

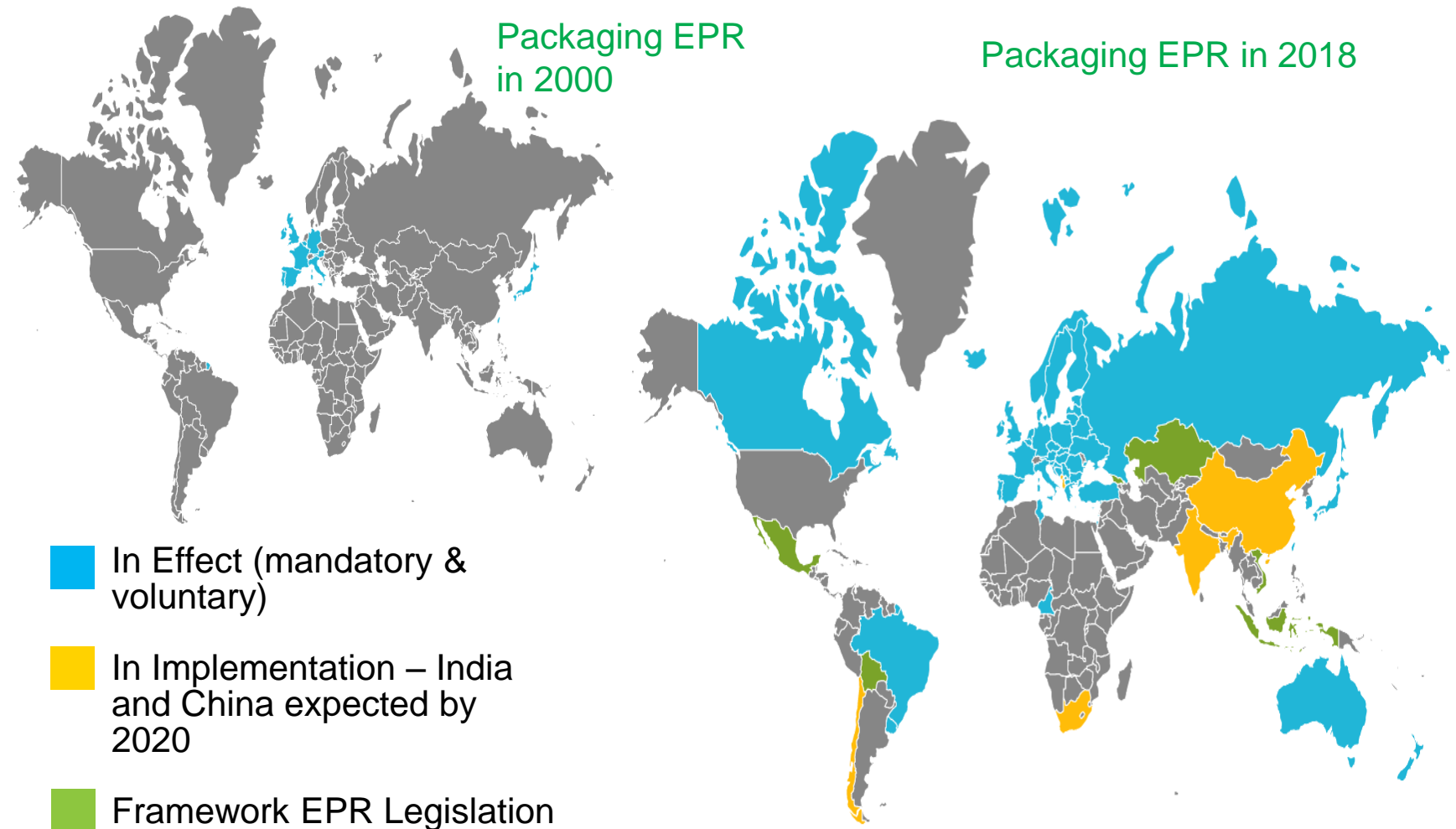
EU Plastics Strategy

Key Objectives:

1. Make Recycling profitable for business
 2. Curb Plastic waste and stop littering at sea
 3. Drive investment and innovation
 4. Spur change across the world
-
- By 2030, all plastics packaging placed in the EU market is either reusable or can be recycled in a cost-effective manner

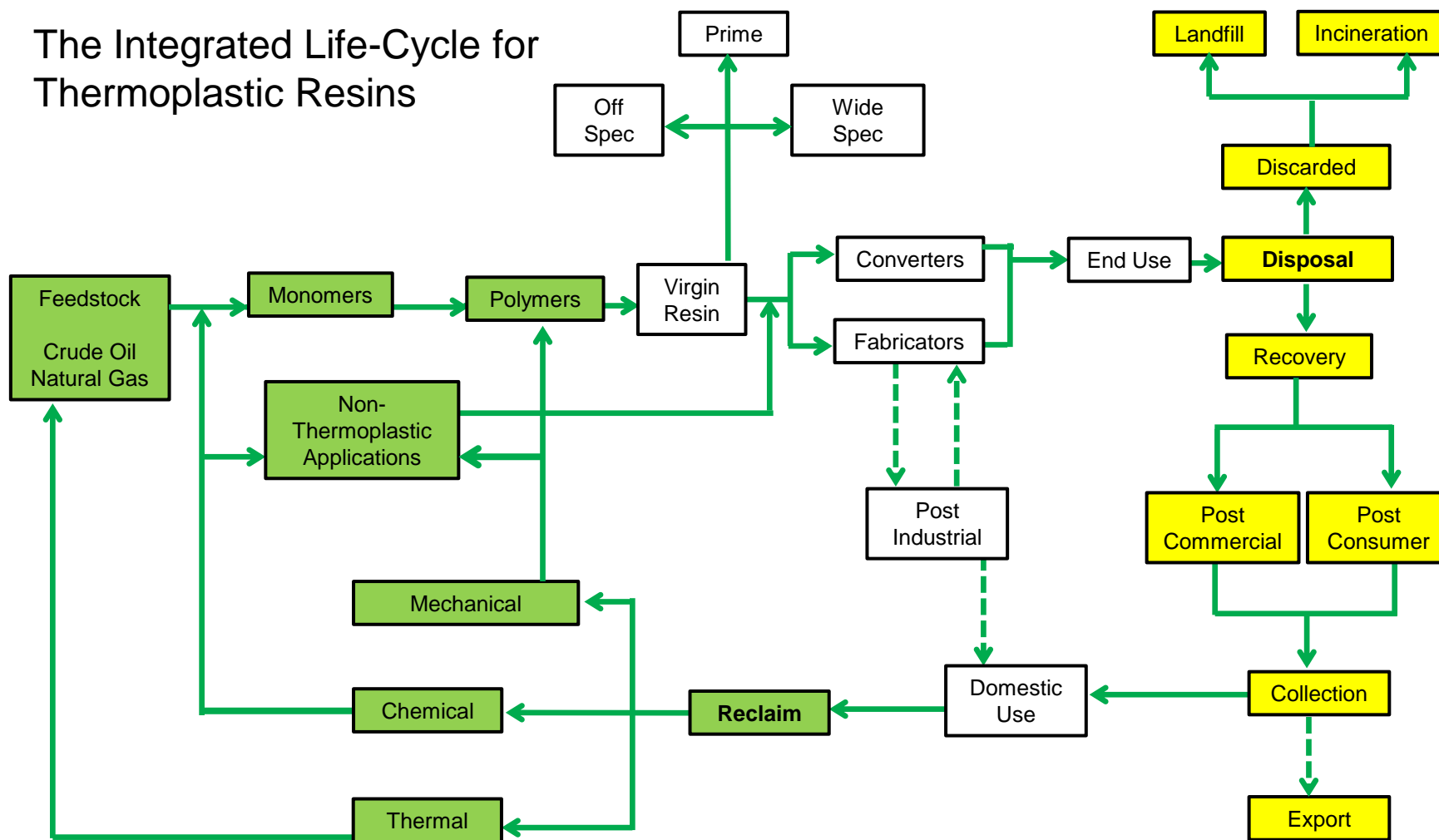
Packaging Extended Producer Responsibility (EPR)

Fees on all packaging and certain plastic products paid by manufacturers; used to develop recycling infrastructure and encourage recycled content.



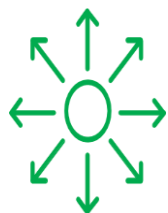
Complexity of the chain

The Integrated Life-Cycle for Thermoplastic Resins



Potential demand change in plastics cascades through the value chain

A 10 million ton demand loss in polyethylene results in ...



**A 10 mmt
PE
demand
loss**



A 10 mmt
loss for
ethylene,
reducing
operating
rates **3-5%**
equivalent to
2 years of
demand




A 35
mmt /
700K
bls/day
loss for
naphtha



Impact in crude
throughput will
require refinery
re-configuration

Sustainability Key Takeaways for Plastics Industry

- 
- How much demand for virgin polymers will get destructed
 - What is the outlook for mechanical recycling
 - What is the outlook for chemical and feedstock recycling
 - What will be the impact on new capacity additions
 - What will be the impact on plastics cost, price and margins

Mobility

Reinventing the Wheel

The impact of the automotive industry's mobility transformation on the chemical industry

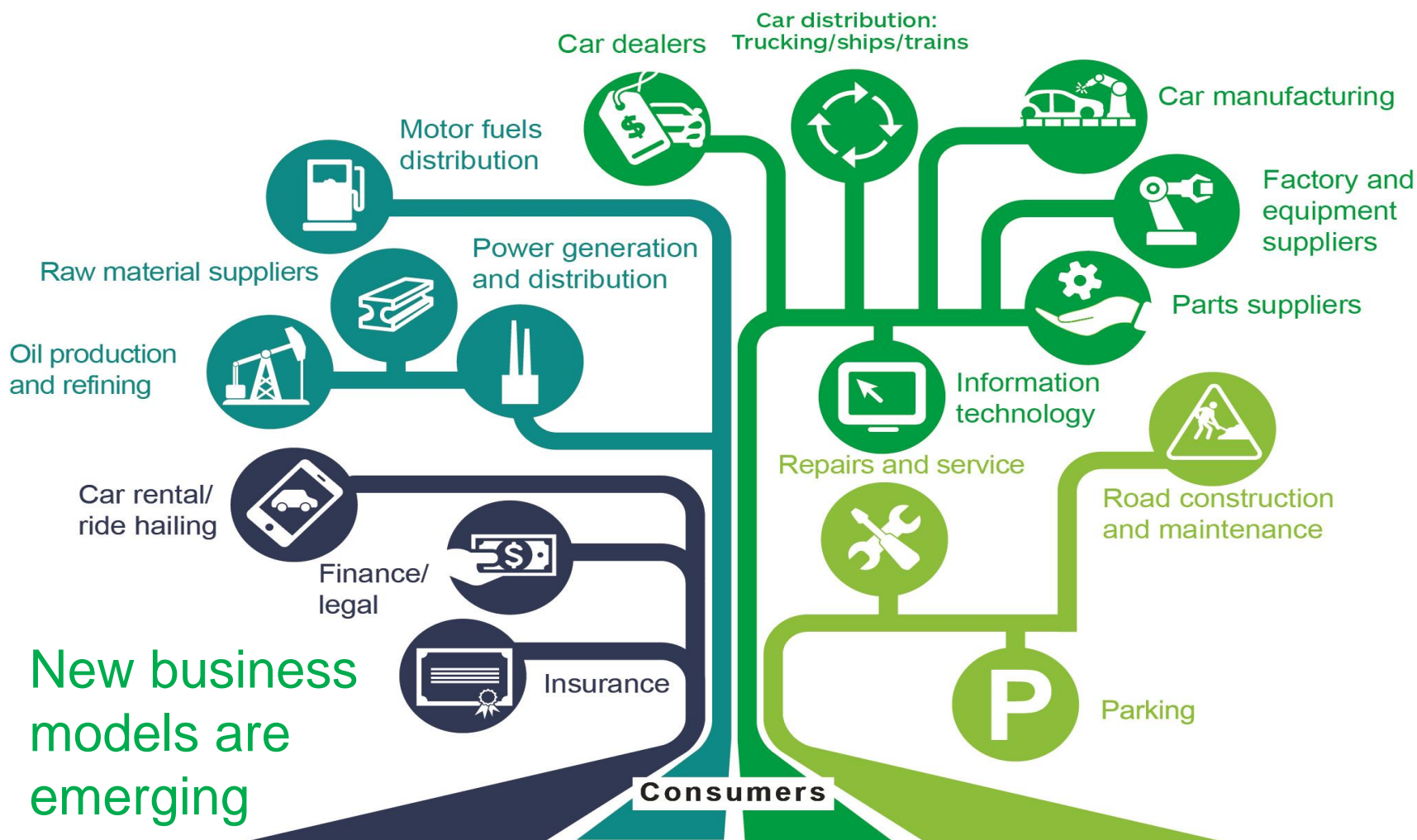


A multi-client study by IHS Markit conducted by a combined Automotive, Energy and Chemicals research & consulting team; with input from major Auto, Energy and Chemical companies

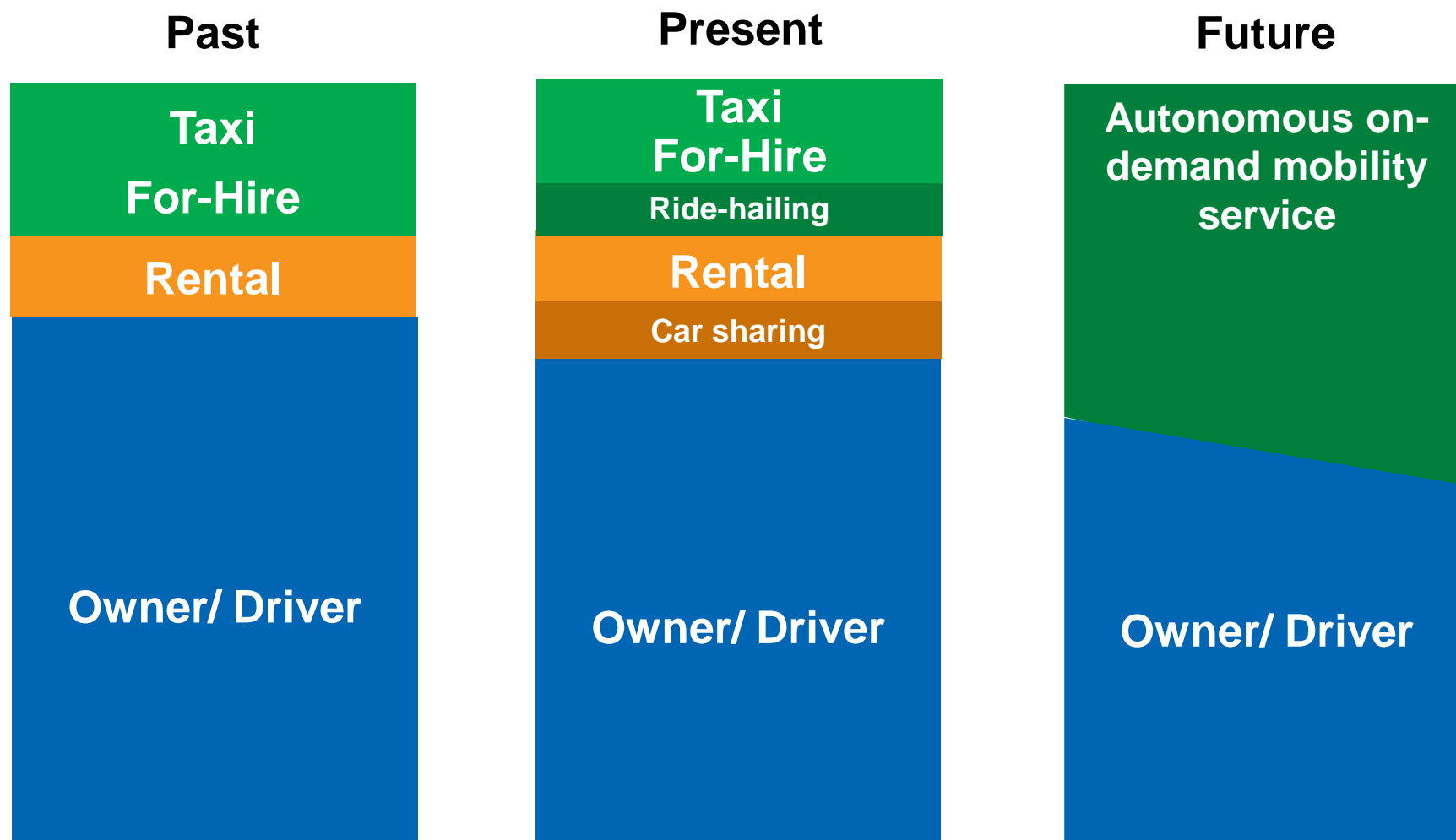
Might the future of mobility be the next major disruptor for the global chemical industry?

Automotive ecosystem goes beyond car manufacturers.

Technology and society drive fundamental changes with global impact



Autonomous capability exists today. Implementation will blur the lines between business models and use cases



Reinventing the Wheel: Defining characteristics of our two scenarios to 2040



Rivalry

Oil v. Electricity Rivalry

- Electric vehicles (EVs) mainstream, but not dominant
- Internal combustion engines (IECs) remain competitive, but lose market share
- Personal car ownership still accounts for most car sales
- Ride-hailing revenue grows to \$1+ trillion
- Slow, but gradual consumer acceptance of autonomous cars



Autonomy

Mobility Revolution

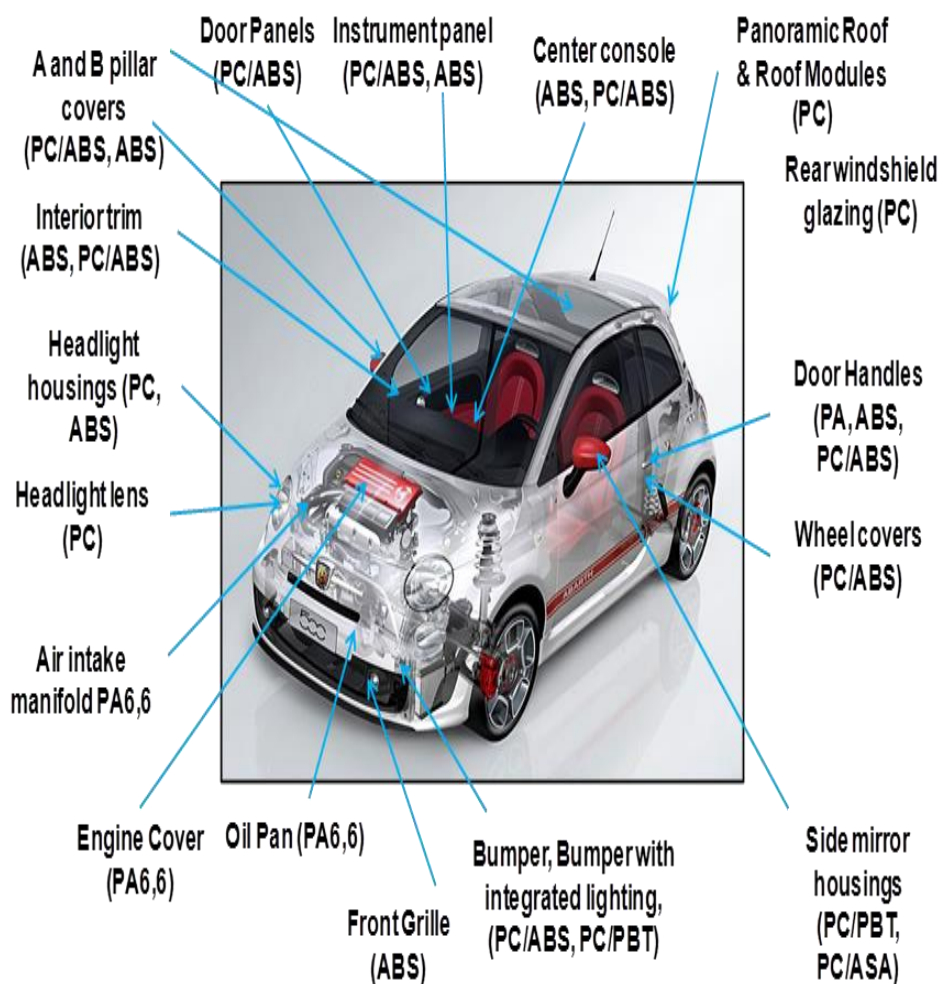
- Convergence of EVs, ride-hailing, and driverless technology fuel a mobility revolution
- Congestion and poor urban air quality leads to aggressive policies that encourage use of driverless electric cars (DECs)
- Driverless Electric Cars accelerate EV adoption; EVs lower cost than ICEs
- Restructured industrial eco-system
- Social stress; mismatch between job destruction and creation
- Fleet sales overtake personal vehicle sales

How will new mobility trends impact *Automotive*?



- **Vehicle sales will be impacted.**
 - > Shared mobility may reduce vehicle sales while new business models may increase utilization and market size.
- **Electrification will continue to increase its market share.**
 - > Climate change and air quality policy will continue to drive fuel economy and low emission technology.
- **The vehicle construct changes including powertrain and vehicle attributes.**
 - > Changes driven by technology, policy, cost, and consumer preferences. The vehicle of the future could look very different than today's offerings.

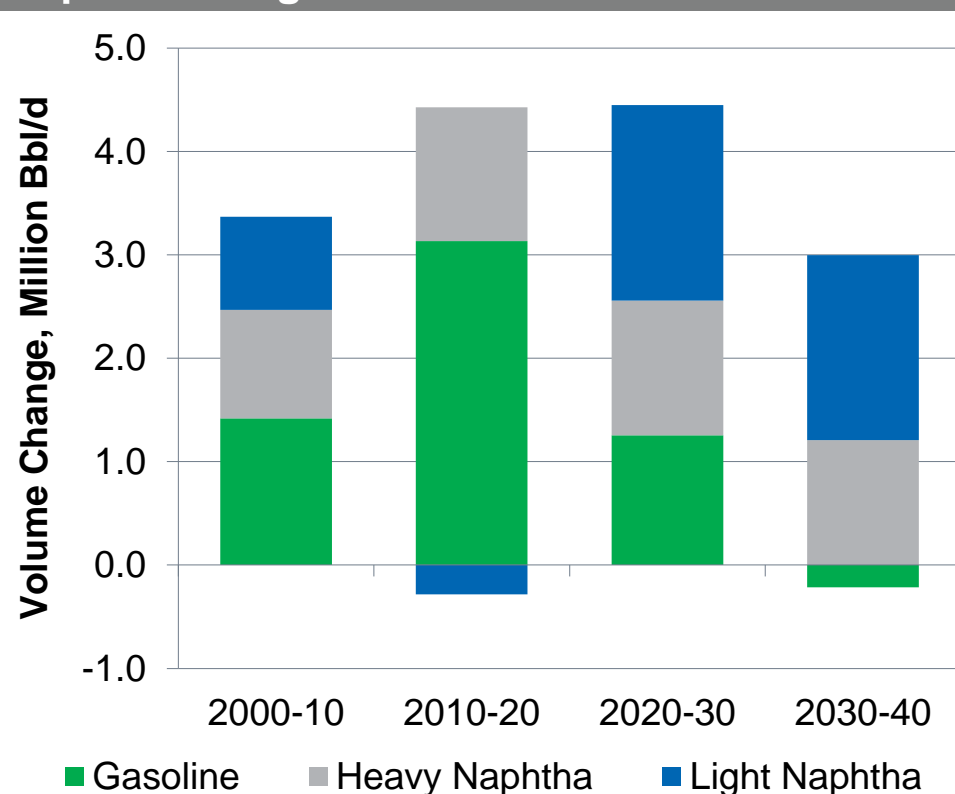
Big questions and choices facing the *Chemical Industry*



- **Changes in geographic distribution of the auto energy supply** will affect the global refining and gas processing industries
 - > Reduction in available NGL's
 - > Shifting feedstock competitiveness
- **New (autonomous electric vehicle) design concepts and sales** will impact the type and quantities of materials required from the chemical industry.
 - > Reduced demand for HDPE and high-temperature materials such as nylon

As gasoline demand growth wanes, refining system will need to shift yields to produce more feedstock for petrochemicals

Change in global production of petchem naphtha and gasoline



Notes: Light & heavy naphtha production from refining complex to petrochemicals
Source: IHS Markit

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- Demand for chemicals, plastics and polyester fibers is growing at a higher rate than fuels demand
- NGL and other non-crude feedstocks augment supply but crude-derived naphtha remains the primary source
- Most new refineries are integrated refining / petrochemical complexes

Final thoughts on transformation of mobility

- A significant change is already happening
- Computing power advances are enabling autonomous vehicles viable today
- New mobility models and autonomous vehicles drive the move to electric vehicles
- Electric vehicles usage fundamentally changes energy / refined product demand and therefore chemical feedstocks availability and pricing models in the future

Yesterday



Today



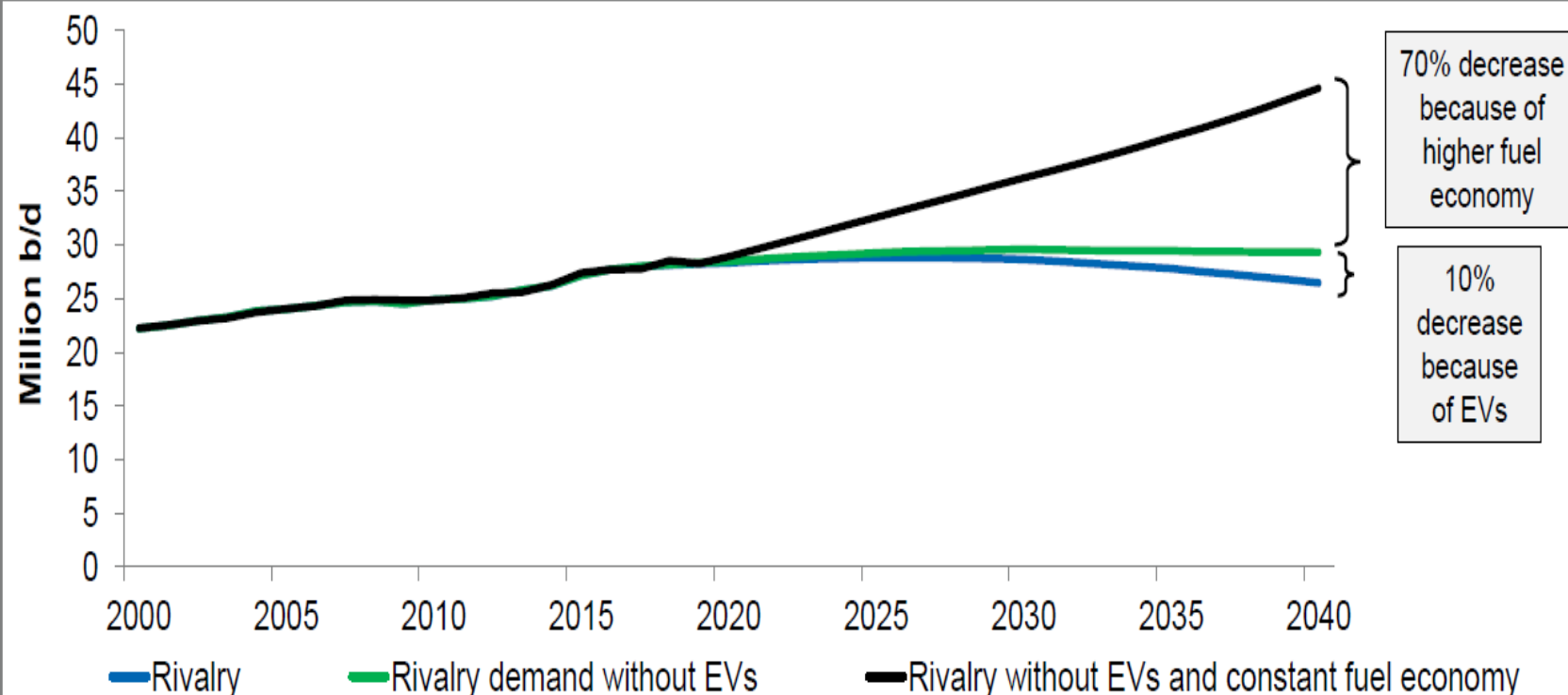
Tomorrow



Oil to Chemicals

Fuel economy standards – not just EV penetration – have the biggest impact on oil demand

Global LDV gasoline and diesel demand: Rivalry



Notes: This is an illustrative example of how much gasoline EVs displace vs improving fuel economy

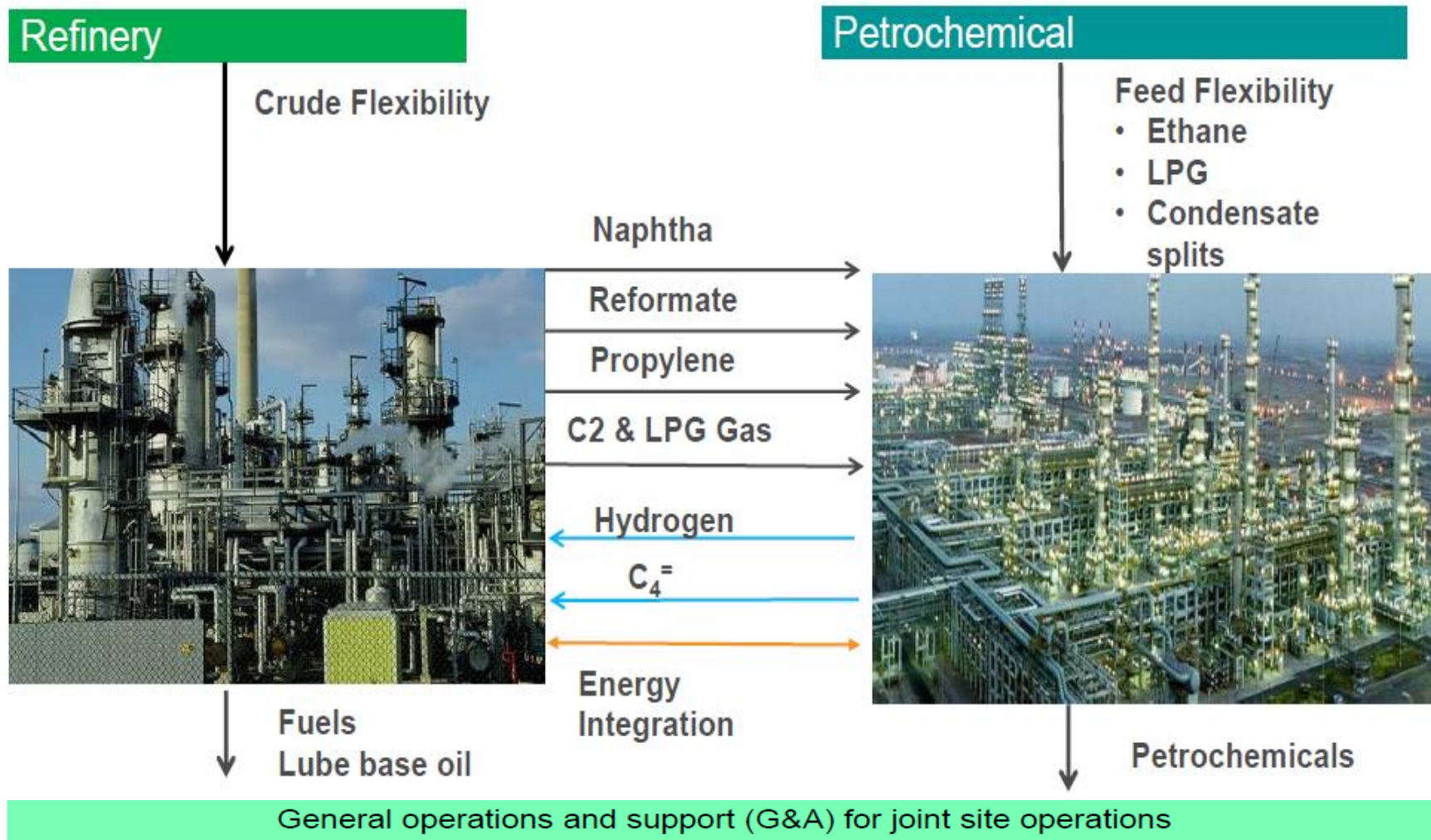
"Rivalry without EVs" is calculated by assuming all global electric miles are instead driven by gasoline HEVs

"Rivalry without EVs and constant fuel economy assumes" that all global LDV miles are travelled by vehicles with a constant 25 mpg fuel economy from 2020 out 2040

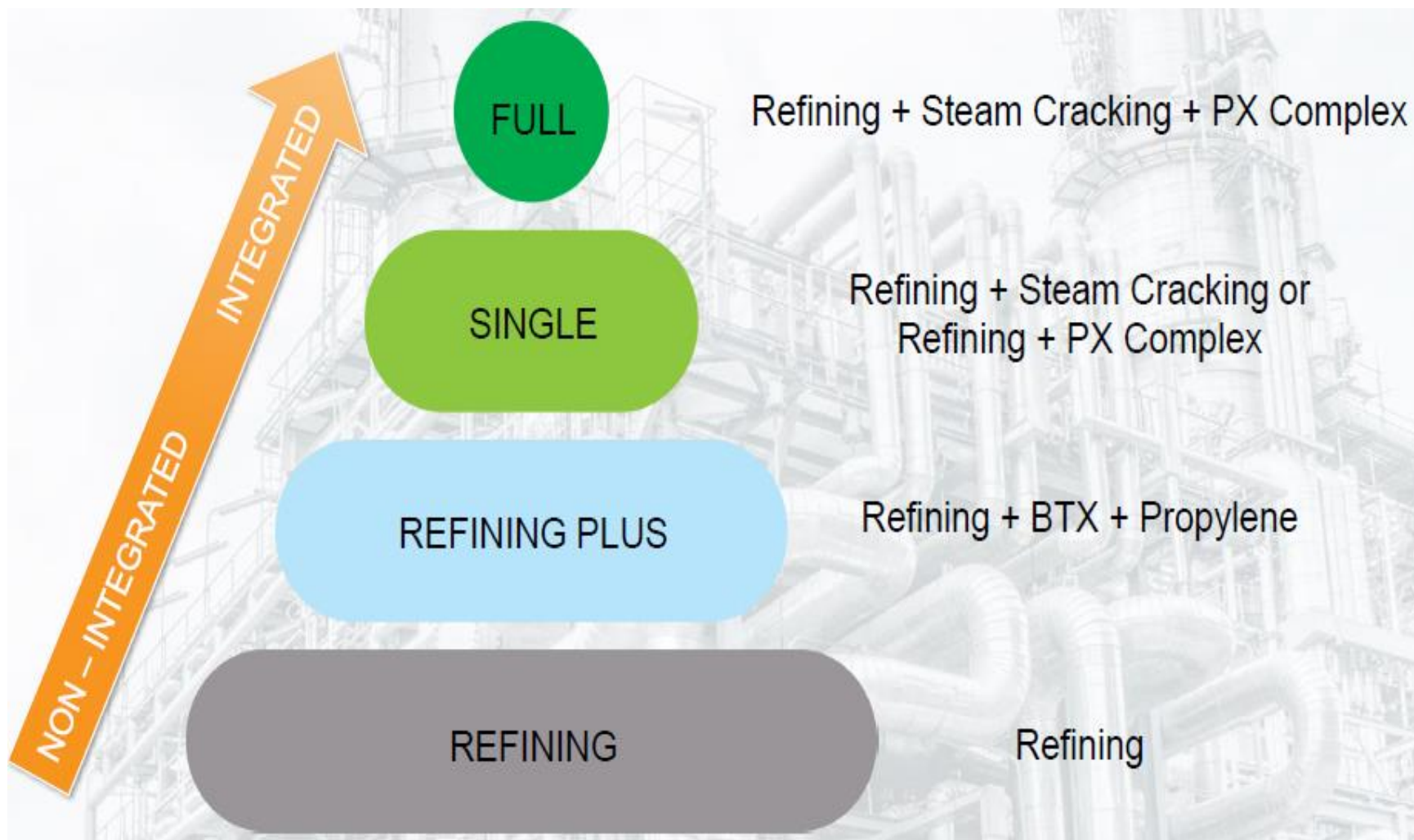
Source: IHS Markit

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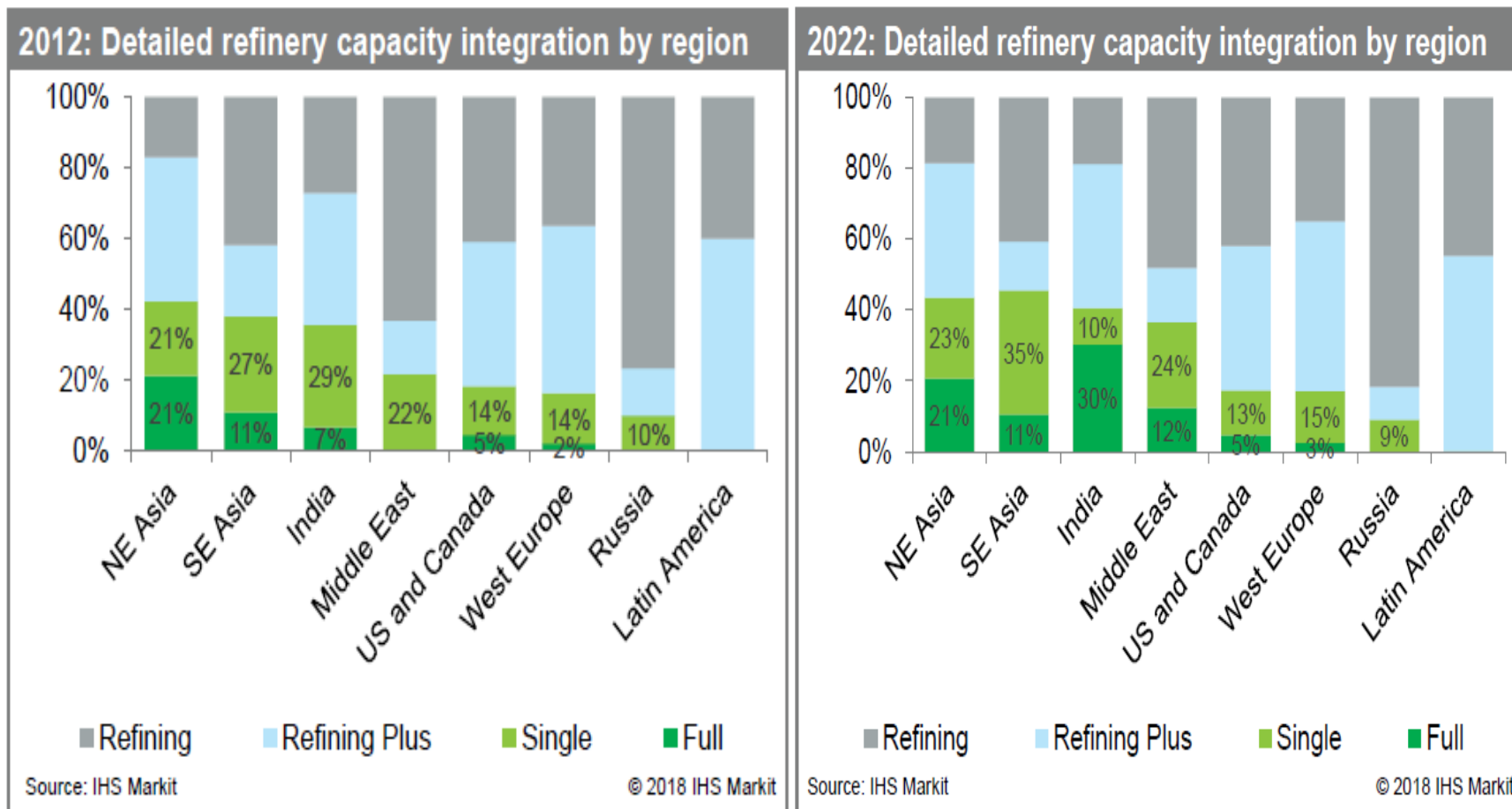
Refinery and petrochemical plants have achieved various degree of integration



Review of refinery integration levels

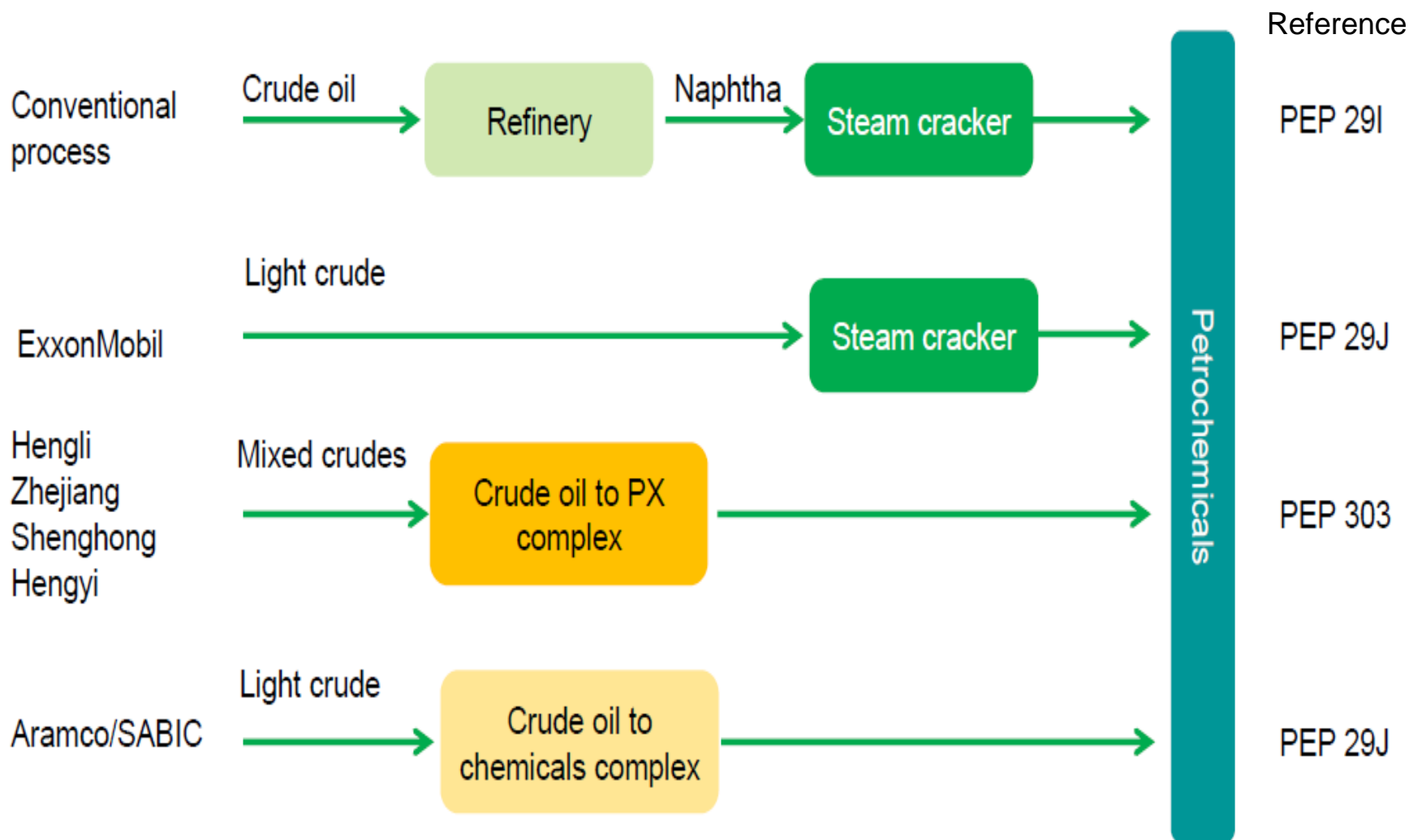


Steady growth in refinery integration from 2012 to 2022



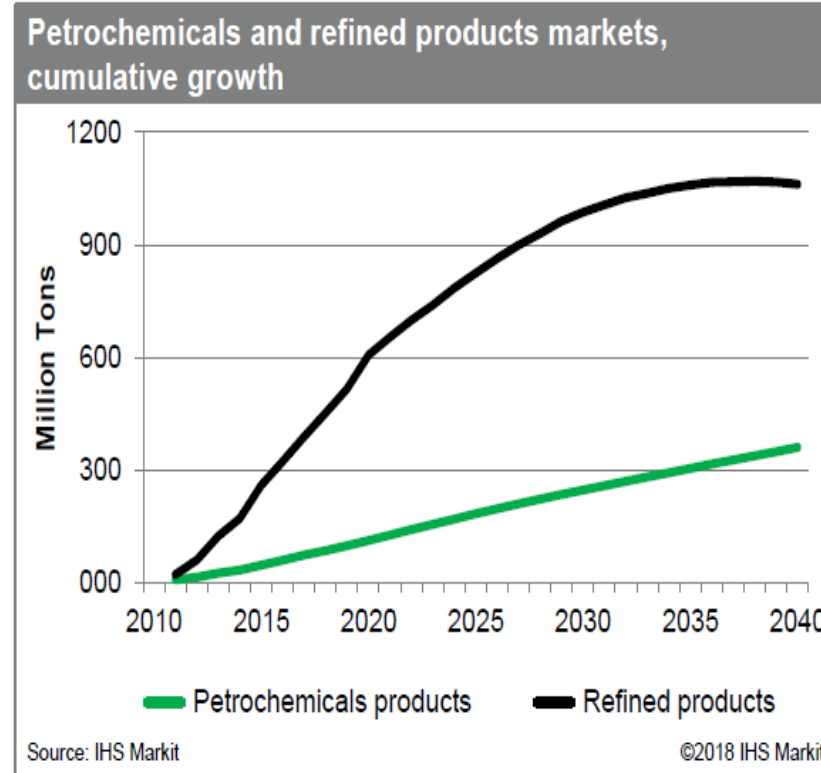
Integrated = Full + Single Integration; Non Integrated = Refining + Refining Plus
 SE Asia = Indonesia, Malaysia, Philippines, Singapore, Vietnam, Myanmar, Thailand, New Zealand, Australia
 NE Asia = China, South Korea, Japan, Taiwan

Crude oil to chemical routes



Next Stage in the evolution of refinery & petrochemical integration

- Higher fuel efficiency and increased use of EV's create a forecast for a declining growth rate in the demand for refined products.
- Forecast is causing many refining companies to re-think their petrochemical strategy.
- Options range from continued but growing feedstock supply relationships to major direct investments in the sector.
- Current assets being built in China and others in the planning stages, seek to enter the petrochemical market with significant scale.
- Petrochemicals market demand continues to rise based on numerous demographic, economic, and durable/non-durable goods consumption trends.



Petrochemicals forecasts to grow at a multiple above GDP, as economies expand and urbanization increases. **Refined products growth** is forecast to flatten by 2030.

Global Megatrends – Key Takeaways

- These Megatrends will be highly disruptive
- There will be fundamental change in the way the entire value chain operates
- Demand for Plastics in Single Use Applications will be challenged
- Demand for plastics in several other applications will continue to grow...net growth will remain positive
- There will be threats as well as opportunities for every player in the industry

THANK YOU

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