



International Petrochemical Industry Forum

13 September 2018 | Chengdu, China

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Agenda



Key Topics

The outlook for the economy

Refining dynamics – IMO & Mobility

Key chemical industry trends

Challenges and risks to the outlook

Global economic growth is expected to hold near its fastest pace since 2010; policy mistakes are the biggest threat to growth

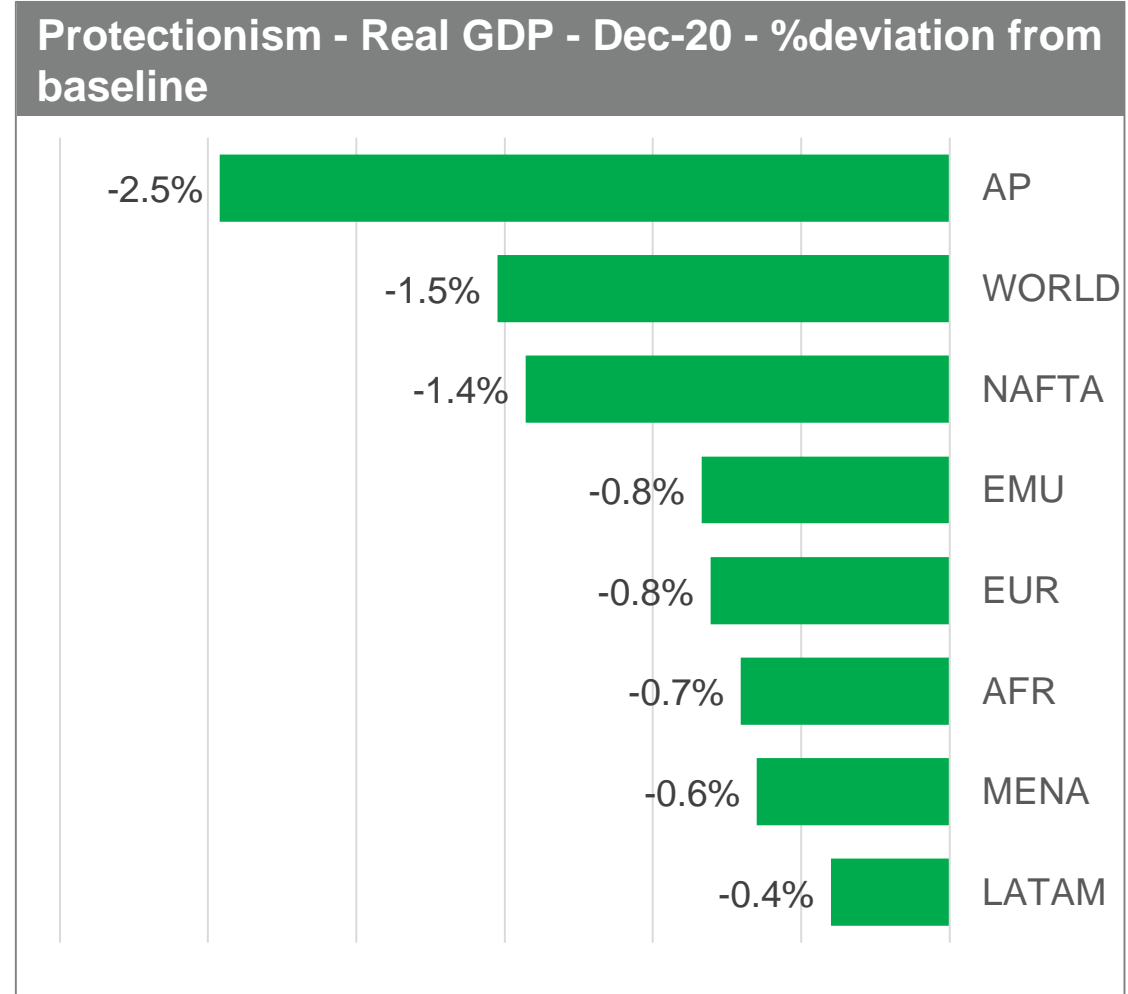
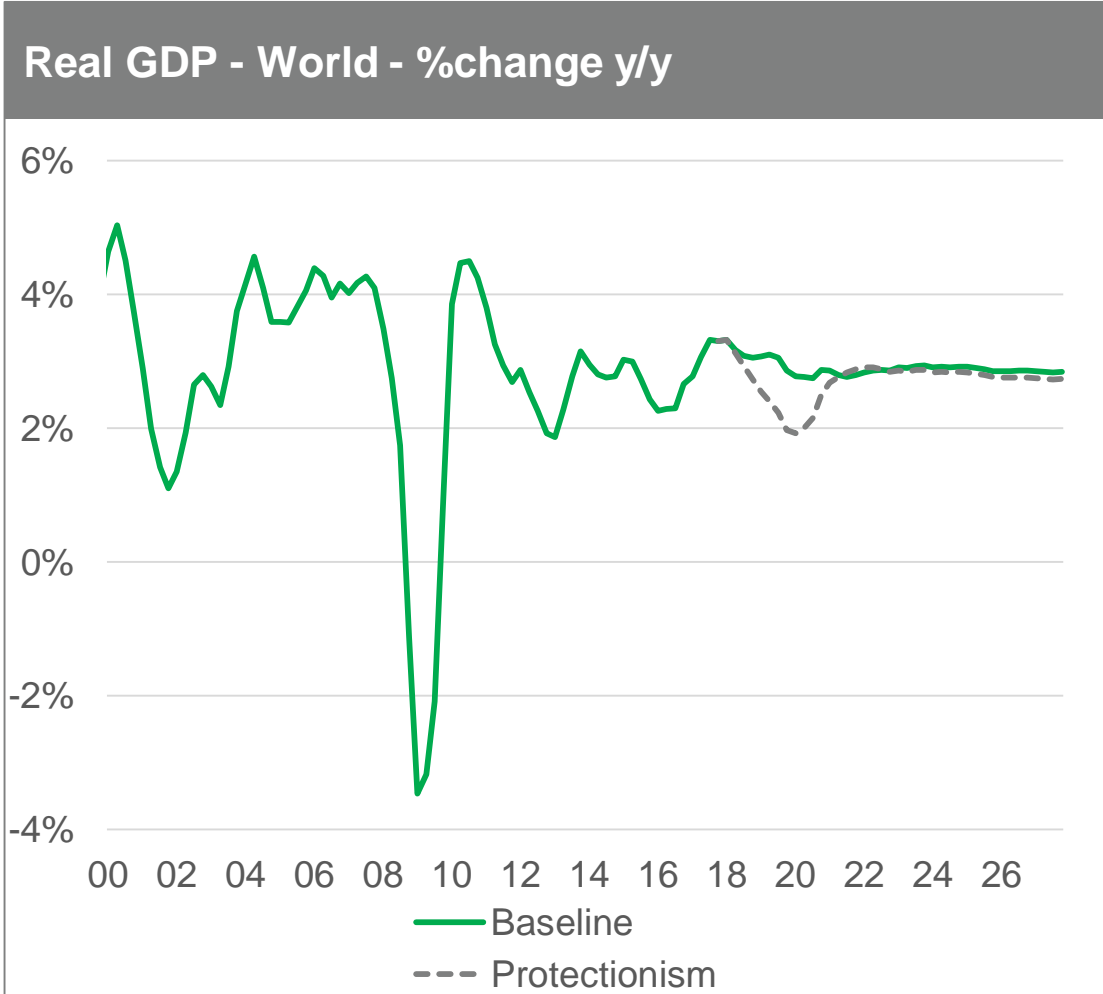
- **Global** outlook is brighter, but energy and geopolitical risks are rising
- **United States:** Trade tensions ratchet up amid strong economic momentum
- **Europe:** Growth is beginning to peak as political risks increase
- **Japan:** The momentum through the end of the year will remain solid
- **China:** The mild slowing trend is likely to continue this year
- **Bottom line:** Global growth remains on a good trajectory, but inflation risks and the potential for policy mistakes (e.g. trade wars) have risen

Real GDP					
Percent change	2016	2017	2018	2019	2020
World	2.6	3.3	3.3	3.1	2.9
United States	1.5	2.3	3.0	2.7	1.7
Canada	1.4	3.0	2.2	2.3	2.2
Eurozone	1.8	2.5	2.0	1.7	1.5
United Kingdom	1.8	1.7	1.2	1.1	1.4
China	6.7	6.9	6.7	6.3	6.1
Japan	1.0	1.7	1.1	1.0	0.4
India*	7.1	6.7	7.1	7.3	7.2
Brazil	-3.5	1.0	1.7	2.5	2.9
Russia	-0.2	1.5	1.8	1.7	1.8

* Fiscal years starting 1 April
Source: IHS Markit

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World real GDP growth slows significantly in the early years of full US-based protectionism. Asia and NAFTA are the most affected regions.



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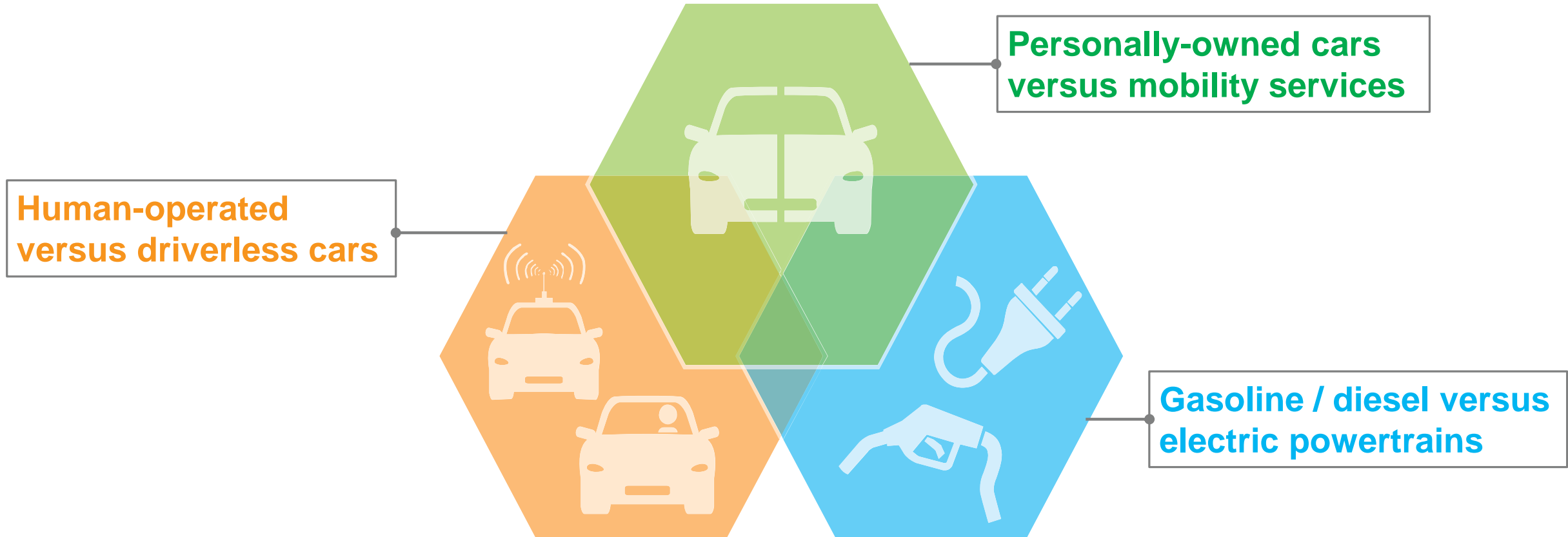
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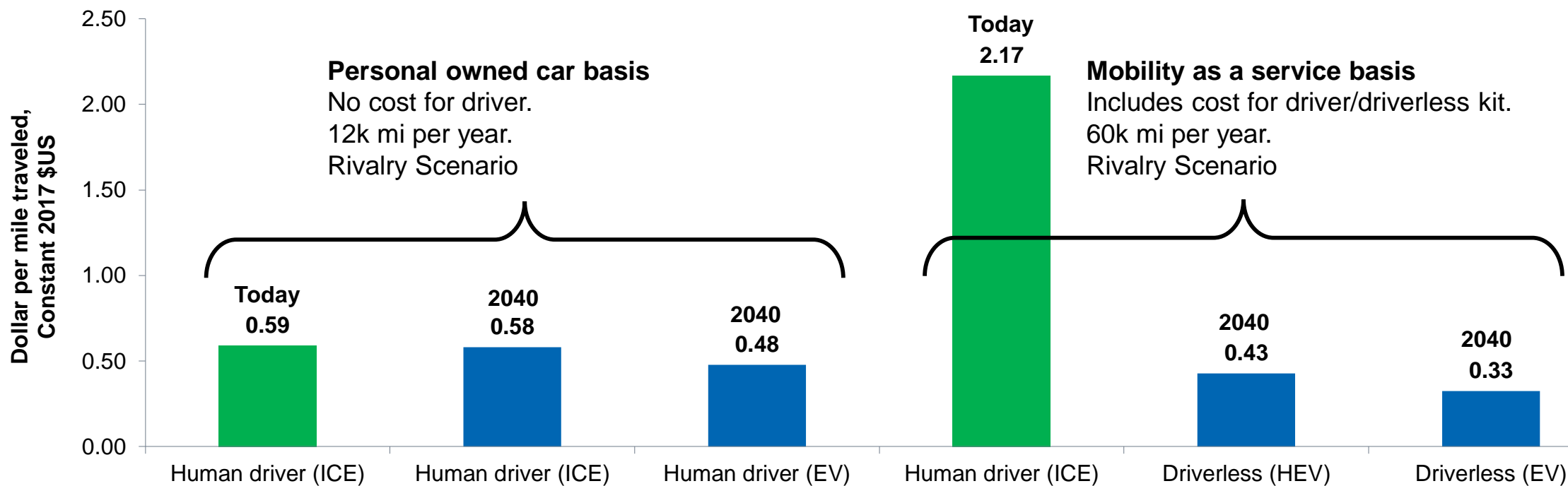
Mobility services, driverless technology, and electric cars are likely to disrupt the driving model across all modes of transport



Selling oil-powered cars to consumers for personal use is challenged by new mobility services and powertrain options

Driverless technology is disruptive for several reasons: Lowering the cost of mobility via the car is among the most important

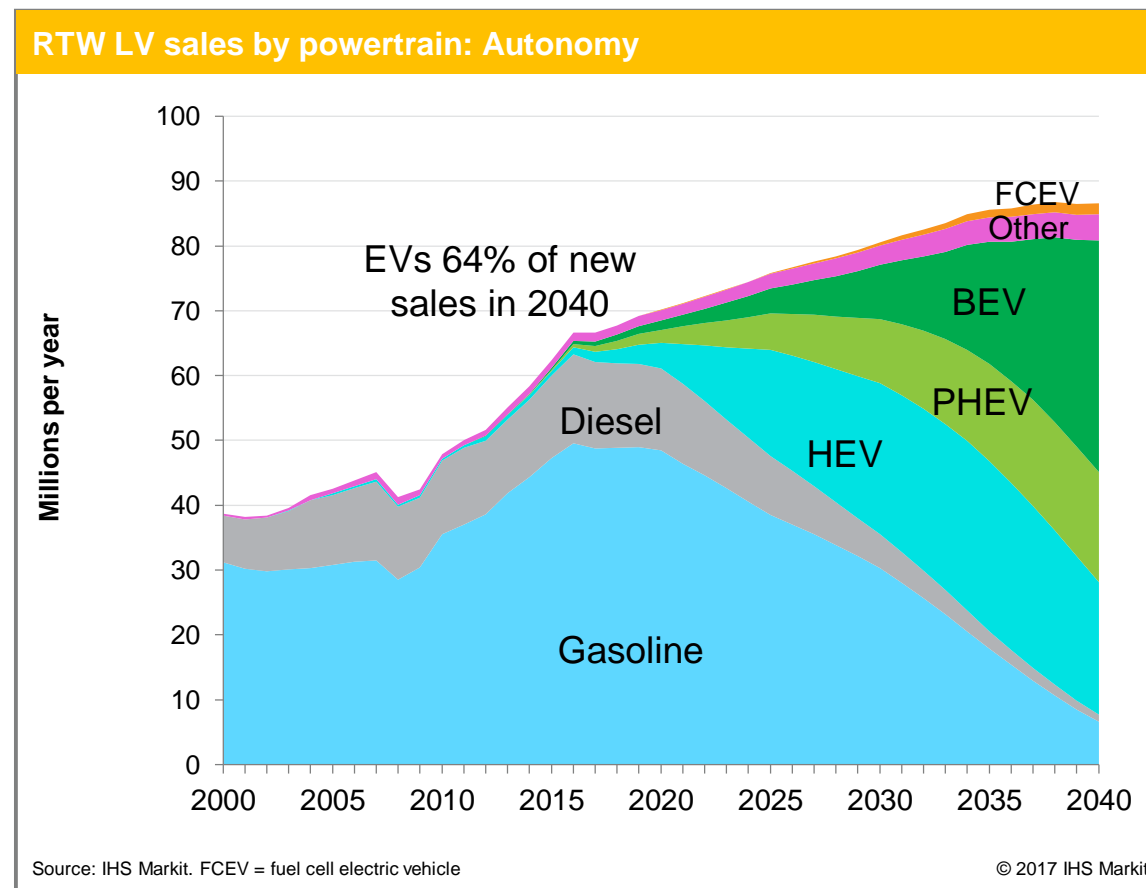
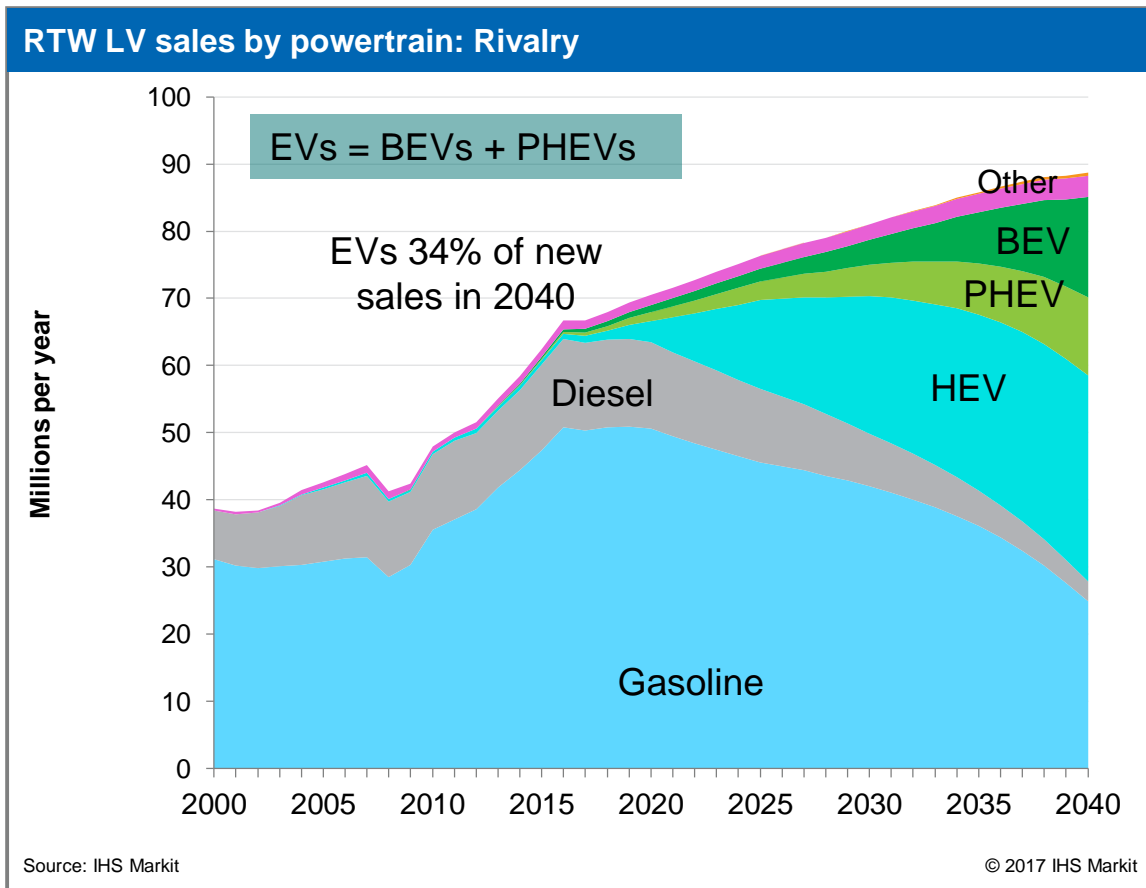
Cost of mobility by car for U.S. market



Notes: BEV = battery electric vehicle. Hybrid = gasoline/electric with internal combustion engine. ICE = internal combustion engine.

Source: IHS Markit

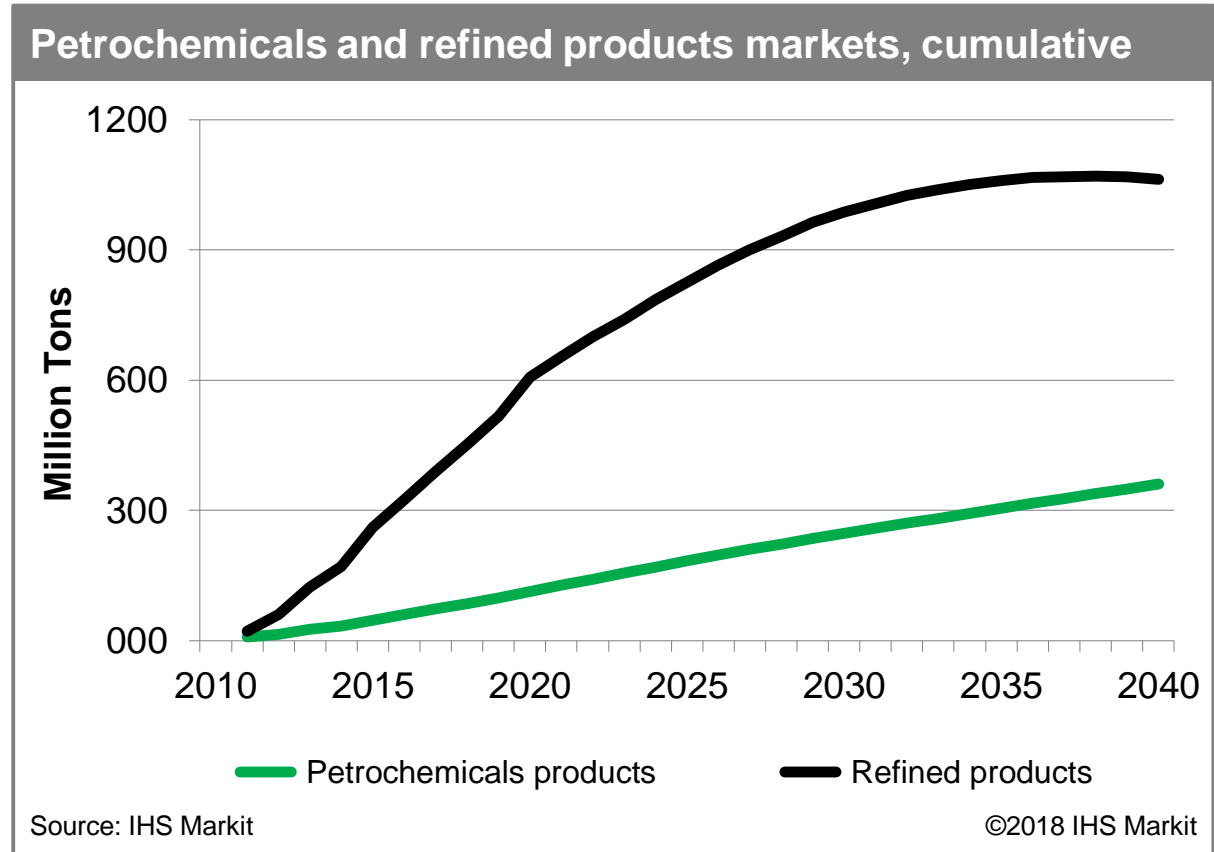
In Autonomy, adoption of driverless cars and growth of mobility service companies boost sales of EVs and lower the volume of new cars sold compared to Rivalry.



FCEV = fuel cell electric vehicle. BEV = battery electric vehicle. PHEV = plug-in hybrid electric vehicle.
HEV = hybrid electric vehicle with gasoline ICE

Next stage in the evolution of refinery & petrochemical integration

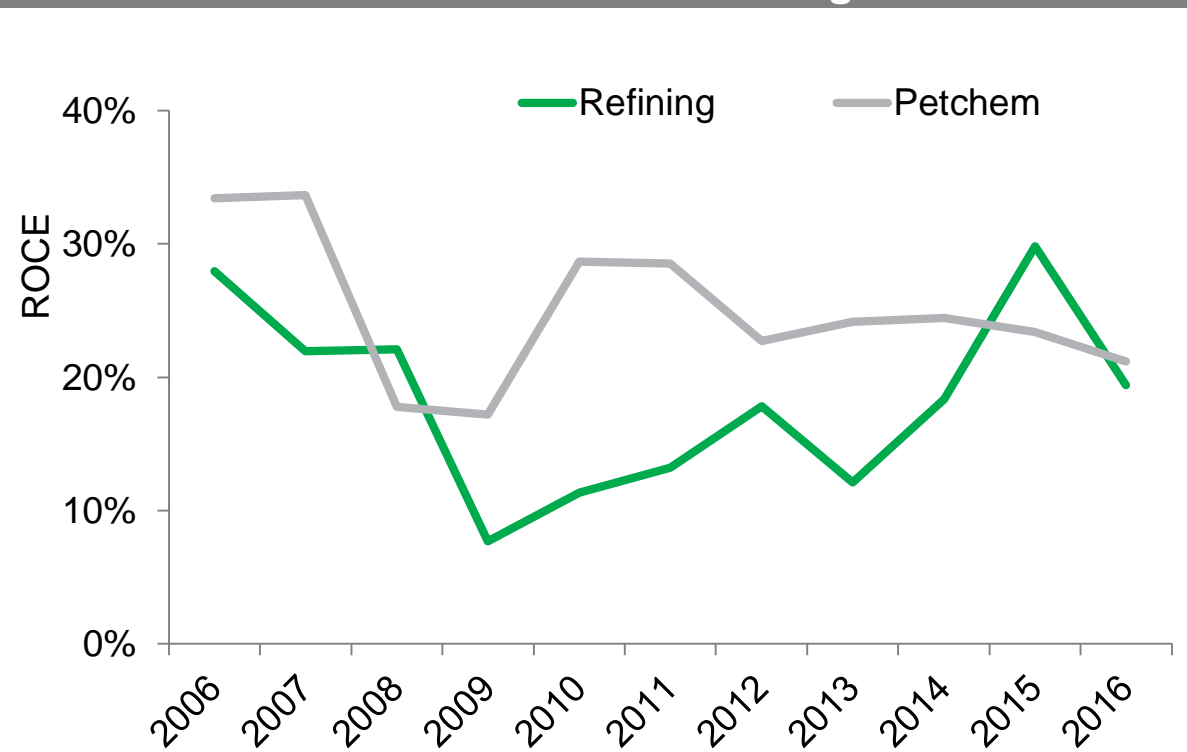
- Higher fuel efficiency and increased use of EV's create a forecast for a declining growth rate in the demand for refined products.
- Forecast is causing many refining companies to re-think their petrochemical strategy.
- Options range from continued but growing feedstock supply relationships to major 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 forecasts to grow at a multiple above GDP, as economies expand and urbanization increases. **Refined products** growth is forecast to flatten by 2030.

From a financial standpoint, diversification and integration lead to more competitive and stable financials

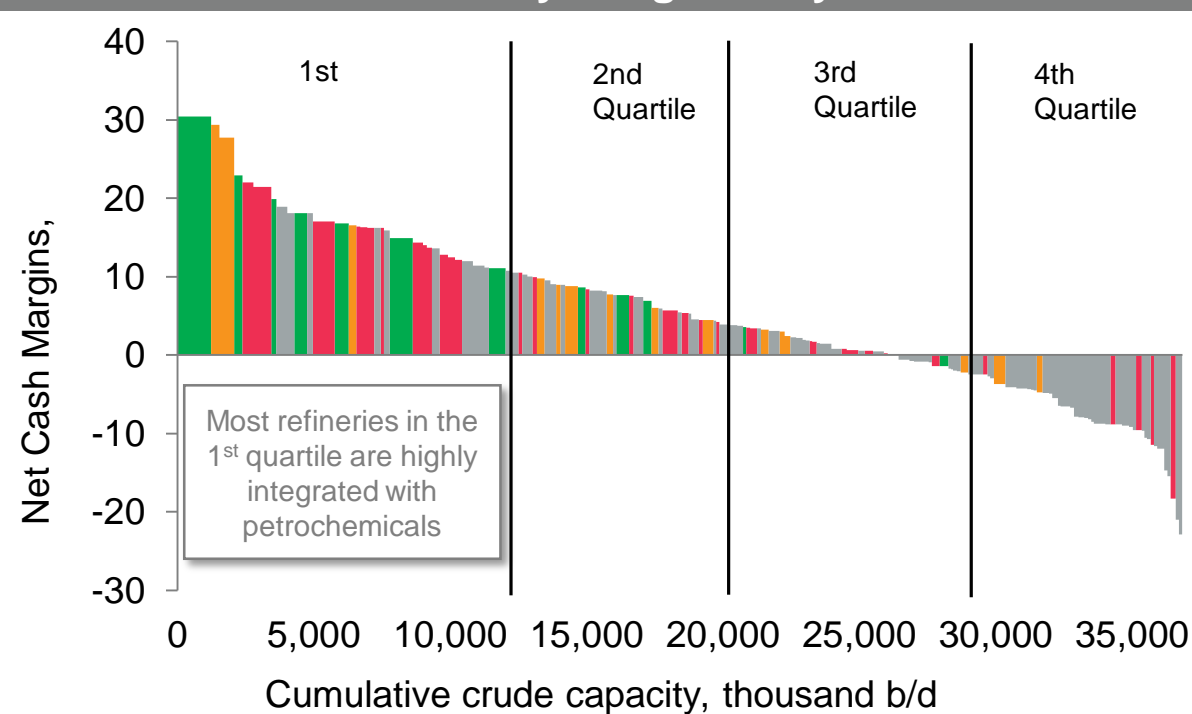
Historical ROCE – chemicals and refining



Companies Included: ExxonMobil, BP, Shell, Chevron, P66
Source: IHS Markit

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2020: East-of-Suez refinery margin analysis



Legend: Fully Integrated (Green), Ethylene Integrated (Orange), Paraxylene Integrated (Red), Non Integrated (Grey)

Source: IHS Markit

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IMO bunker fuel quality rules



The global ship fleet will need to reduce bunker fuel S from 3.5% to 0.5% beginning in 2020 - a major disruption to the “bottom” of oil markets

Switch to compliant low-sulphur bunker fuel



Four pathways

Switch to liquefied natural gas



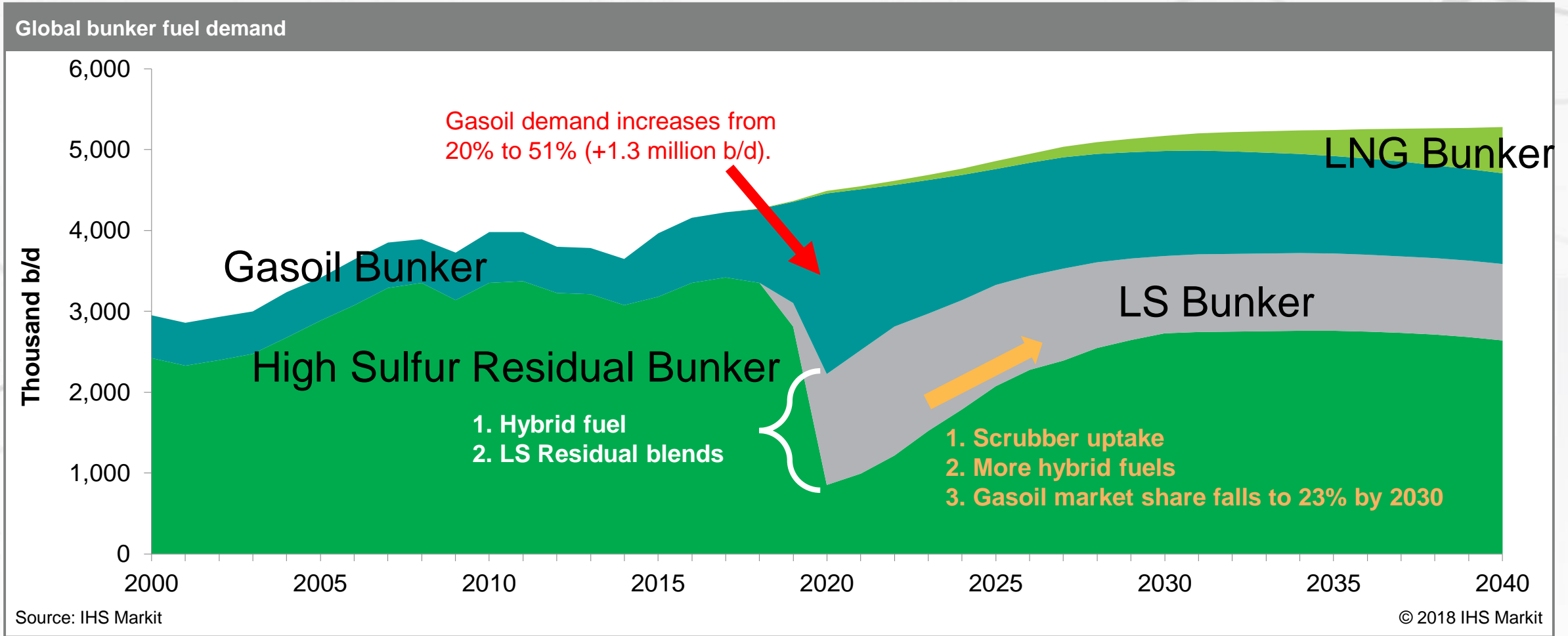
Install exhaust gas cleaning systems, aka scrubbers



Non-compliance, sanctioned or otherwise (Not a true pathway)

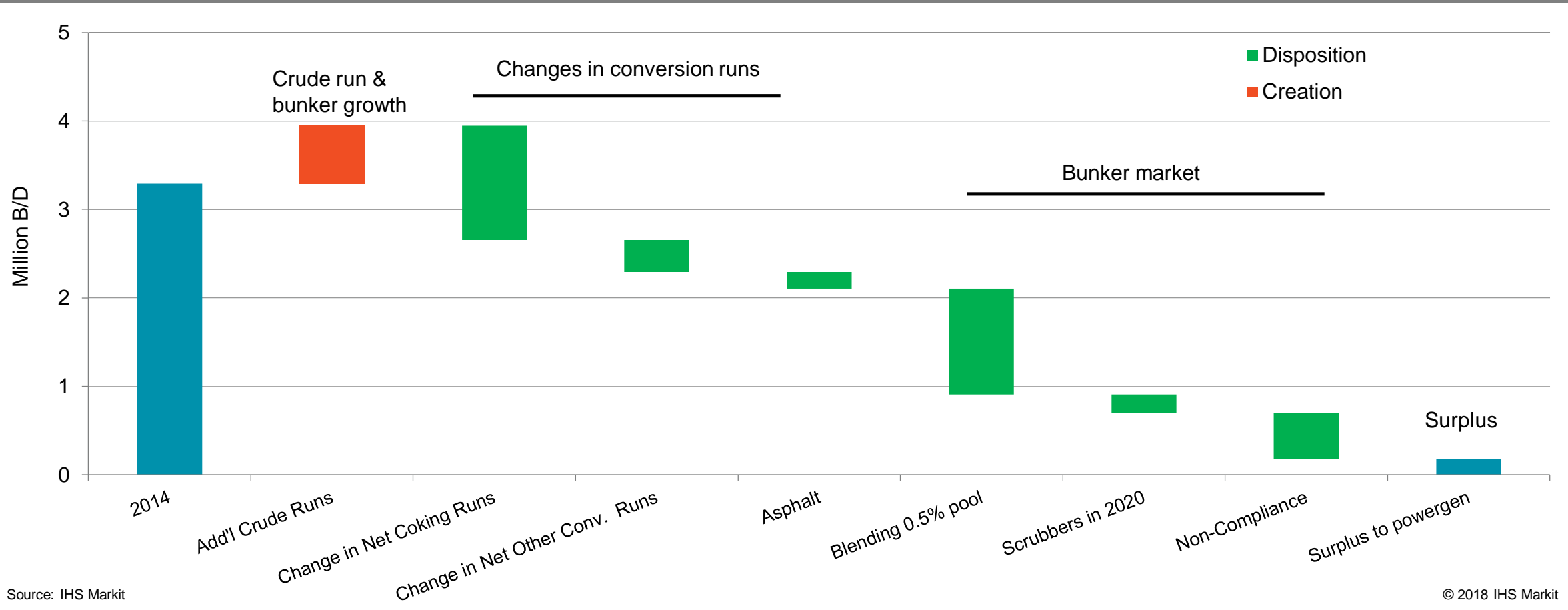


IMO Bunker fuel rules will create a spike in gasoil demand...real issue is residual disposal



Our residue balance is in excess of around 200,000 b/d in 2020 assuming a large price signal to optimize the global system

Global residue in bunker sector – 2014 to 2020



IMO Bunker S spec change from 3.5% to 0.5% disruptive to refining AND chemicals

- Supports higher overall crude prices
- Increases production of straight run naphtha
- FCC runs reduced as LSFO redirected to meet new bunker fuels
 - Reduced production of RGP
 - Increase gasoline cracks
- Reduces netback margins for exporting countries
- Increases needs for high octane blends
 - Higher baseline value of aromatics

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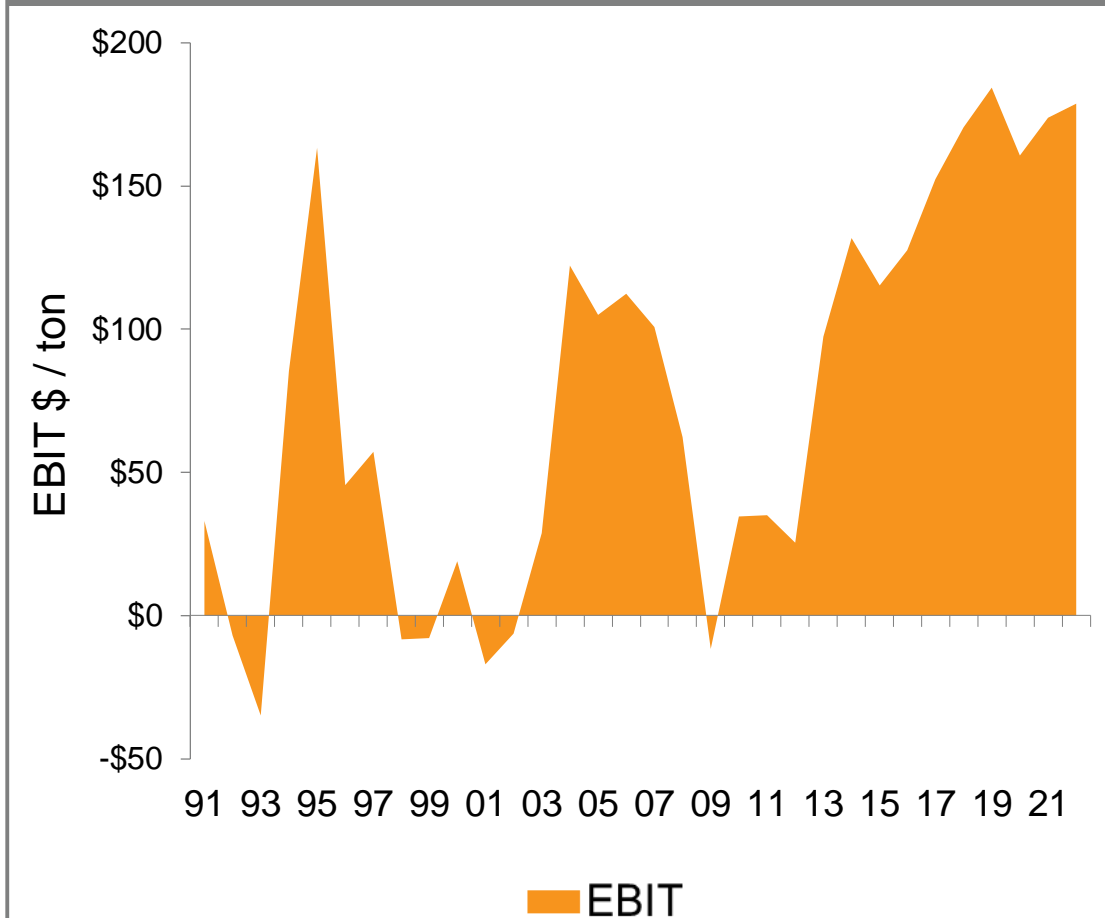
Key chemical industry trends

Challenges and risks to the outlook

Chemical industry in a sustained and unprecedented peak of earnings

- Steady global economic expansion driving growth across most markets
- Oil volatility, reduced Chinese reinvestment and a focus on M&A has constrained global build
- Extended up-cycle is one major Harvey-type event away from triggering a 'super-cycle'
- Wider oil to gas spreads support margins for N. American and Middle East gas-based producers
- Primary near-term risks are economic and policy related
- Watching developments on developing supply-side risks post 2021

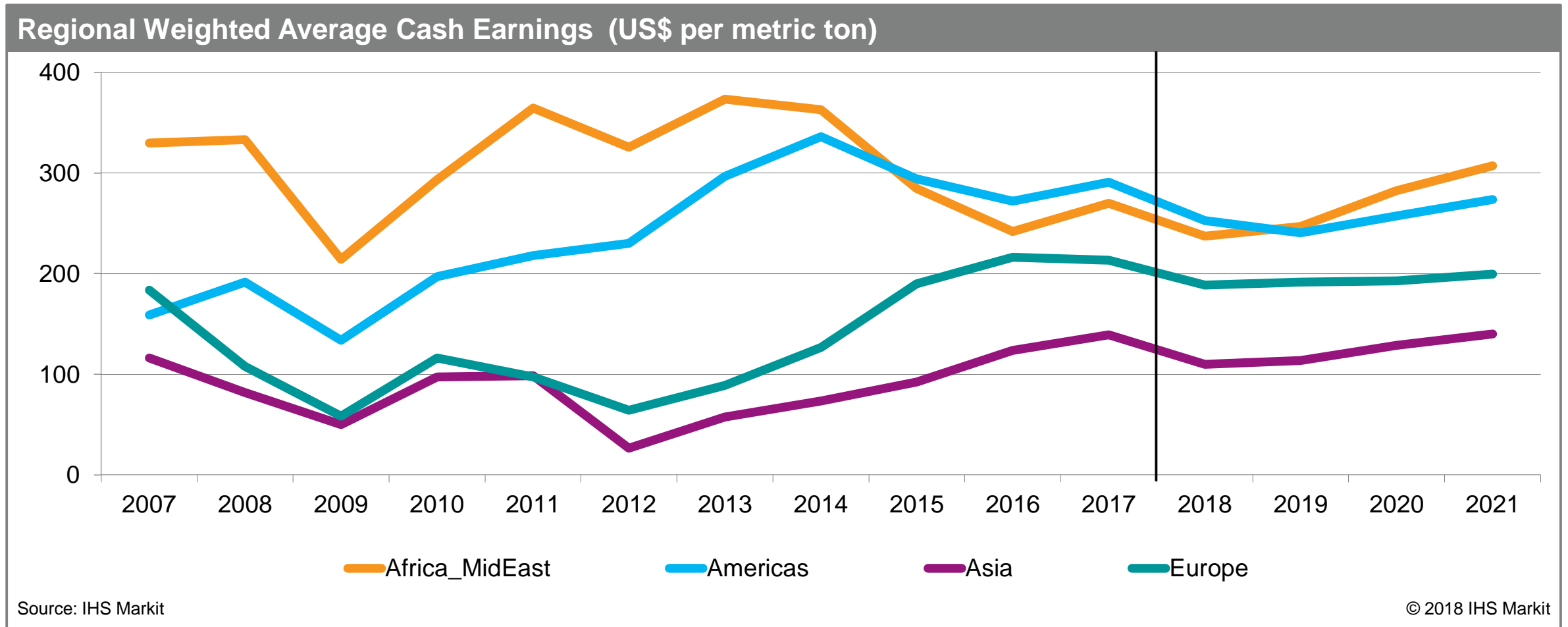
Chemical Industry Weighted average earnings, \$/Ton



Source: IHS Markit

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Base planning case show earnings to be elevated, stable, for extended period across all regions



Major trends shaping the future of the global chemical industry

STRUCTURAL

CYCLICAL

	Sustainability	Developing world = center of growth	Technological change	Plateauing fuels demand	Protectionism	Capital vs feedstocks vs labor optimization	Relative feedstock valuation	Cyclical pace and nature of investment
Trend								
Influencing mechanism	Regulations, public opinion	Demographics, economic development	Market opportunity / process risk	Policy, technology	Policy	Demographics, economic efficiency	Energy markets, policy	Chemical markets, economic
Impact	Investment risk, operating cost, and demand growth	Consumer preferences, market access	Investment risk, Relative competitiveness, CAPEX/OPEX	Market structure/disruption	Investment risk	Supply chain structure, investment location	Relative competitiveness	Margin volatility
Examples	<ul style="list-style-type: none"> Plastics waste Pollution Circular economy 	<ul style="list-style-type: none"> Size and growth of OECD vs non-OECD 	<ul style="list-style-type: none"> AI & IOT Siluria Coal-to-olefins Crude to Chemicals 	<ul style="list-style-type: none"> Aramco/ADNOC chemical investment 	<ul style="list-style-type: none"> Anti-dumping Trade wars Non-tariff barriers 	<ul style="list-style-type: none"> Ethane fungibility US CAPEX MTO in Canada to China 	<ul style="list-style-type: none"> Coal-to-oil & Coal-to-gas differentials Naphtha vs LPG 	<ul style="list-style-type: none"> China provincial Refinery integration

Winning in chemical markets requires long-term sustainable competitive advantage

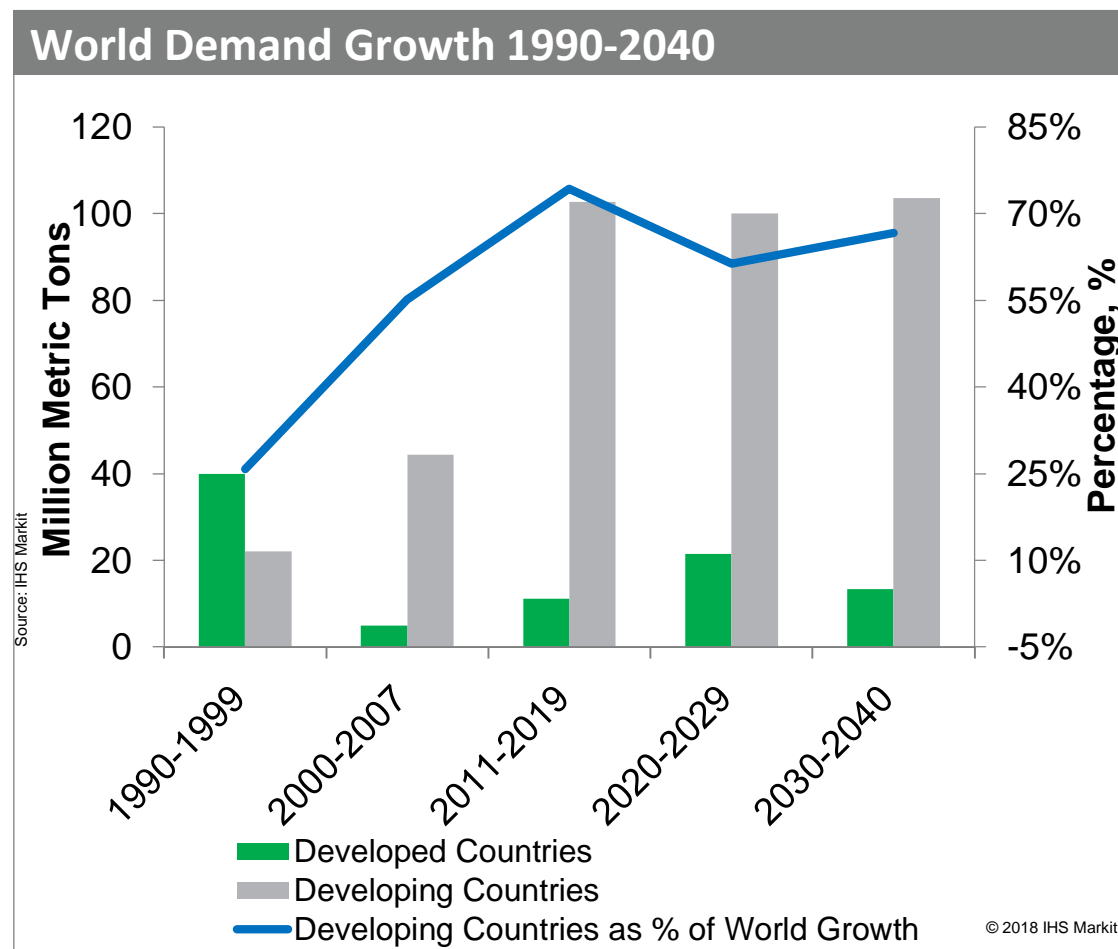
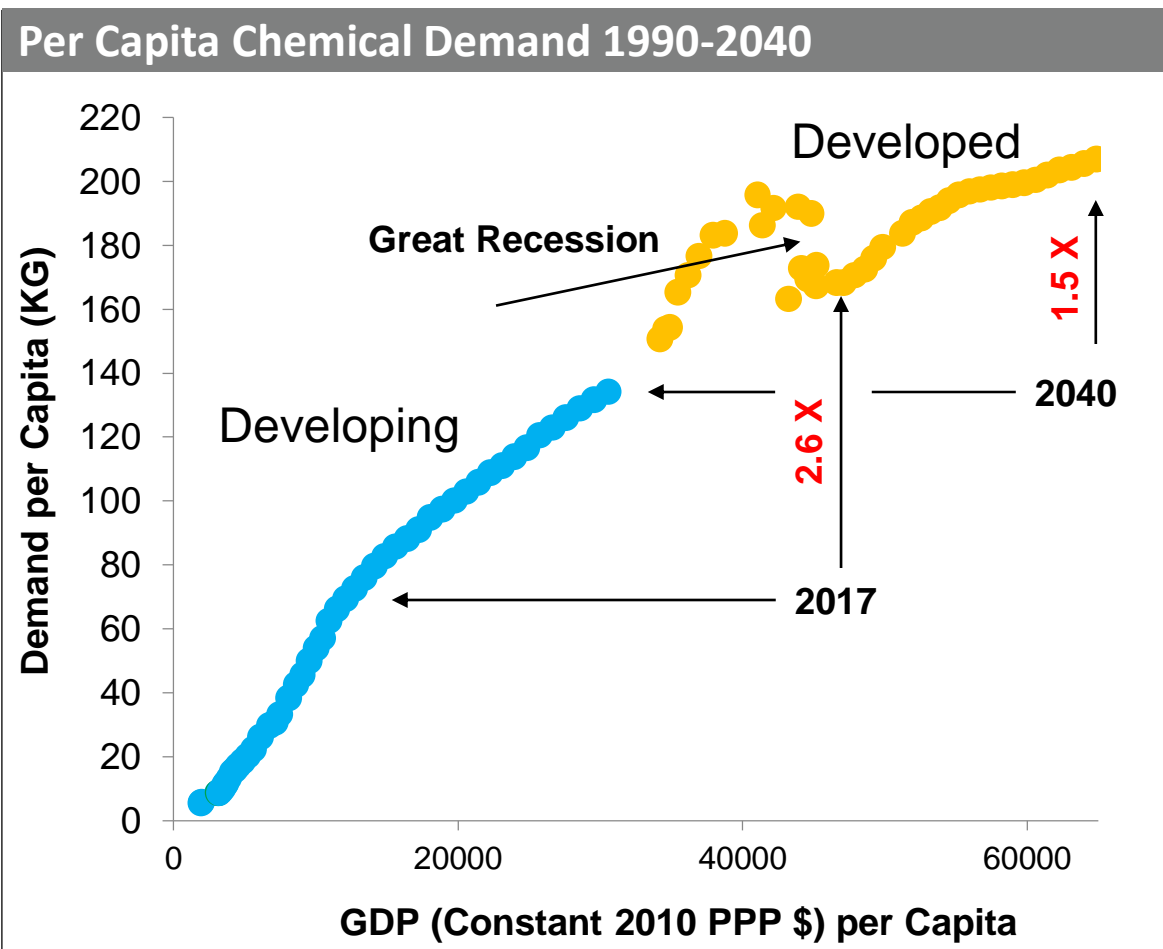
Chemical Investment “Drivers”

- Build to leverage an upstream, downstream or horizontally integrated position
- Secure an energy & feedstock advantage
- Invest with proximity to local markets and/or access to efficient and open supply chains
- Leverage current world-scale technology and efficiently deploy capital cost
- A ‘friendly’, stable and predictable regulatory framework

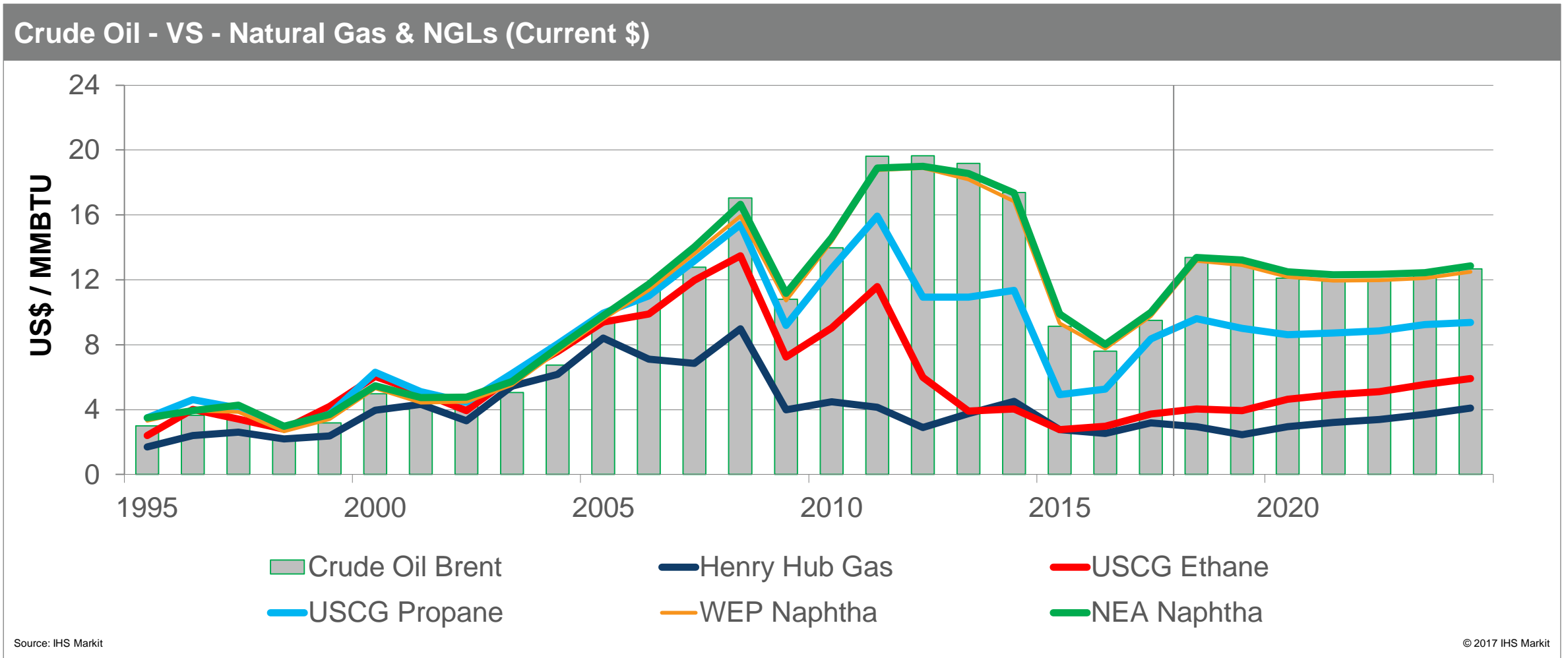
BASF/Yara
Ammonia
Freeport, Texas

Photo courtesy of BASF

Enabled by trade in finished goods, economic growth in emerging markets is the key driver to petrochemical demand growth



Rising crude oil prices will continue to favor U.S. gas-based producers

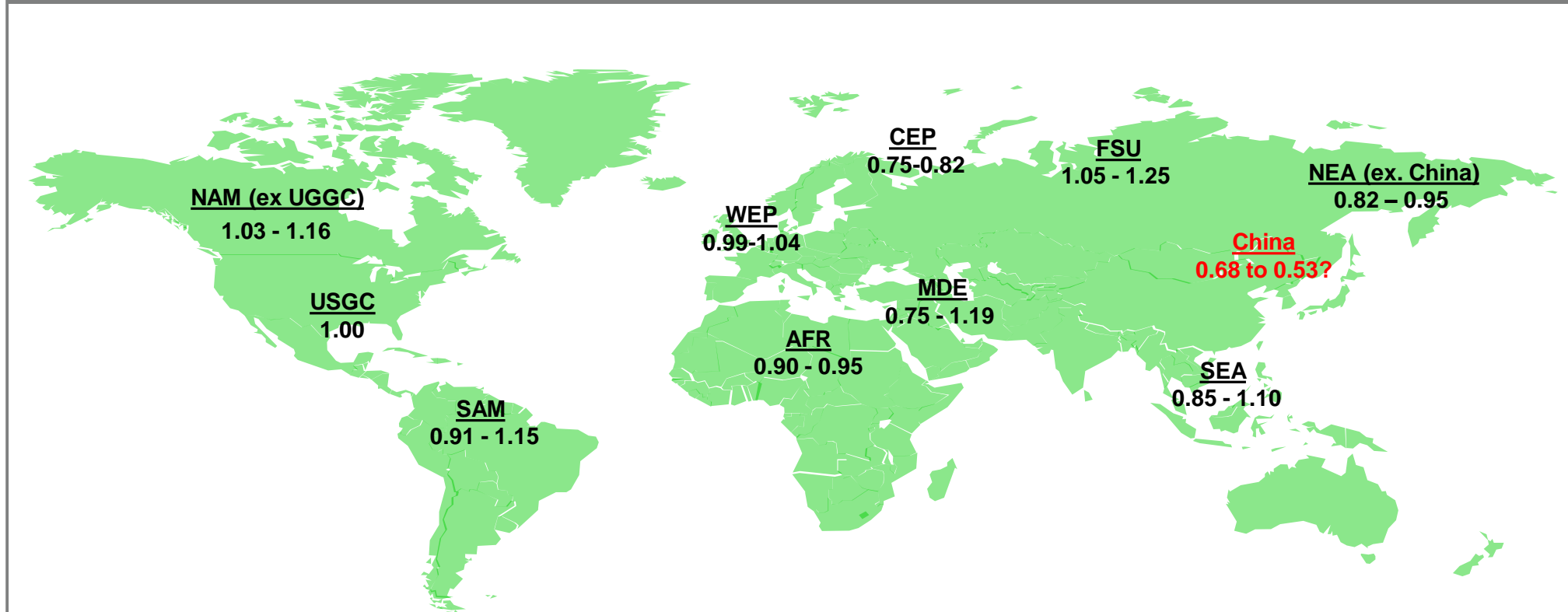


But CAPEX advantages costs favor APAC investment

Drives capacity additions in regions with an advantage capital cost structure.

Can China maintain this level of advantage in the longer run? This would/could change supply location & trade.

Construction Location Factors (2017)



Should location factors re-equilibrate? Could change Western economics on assets at some point.

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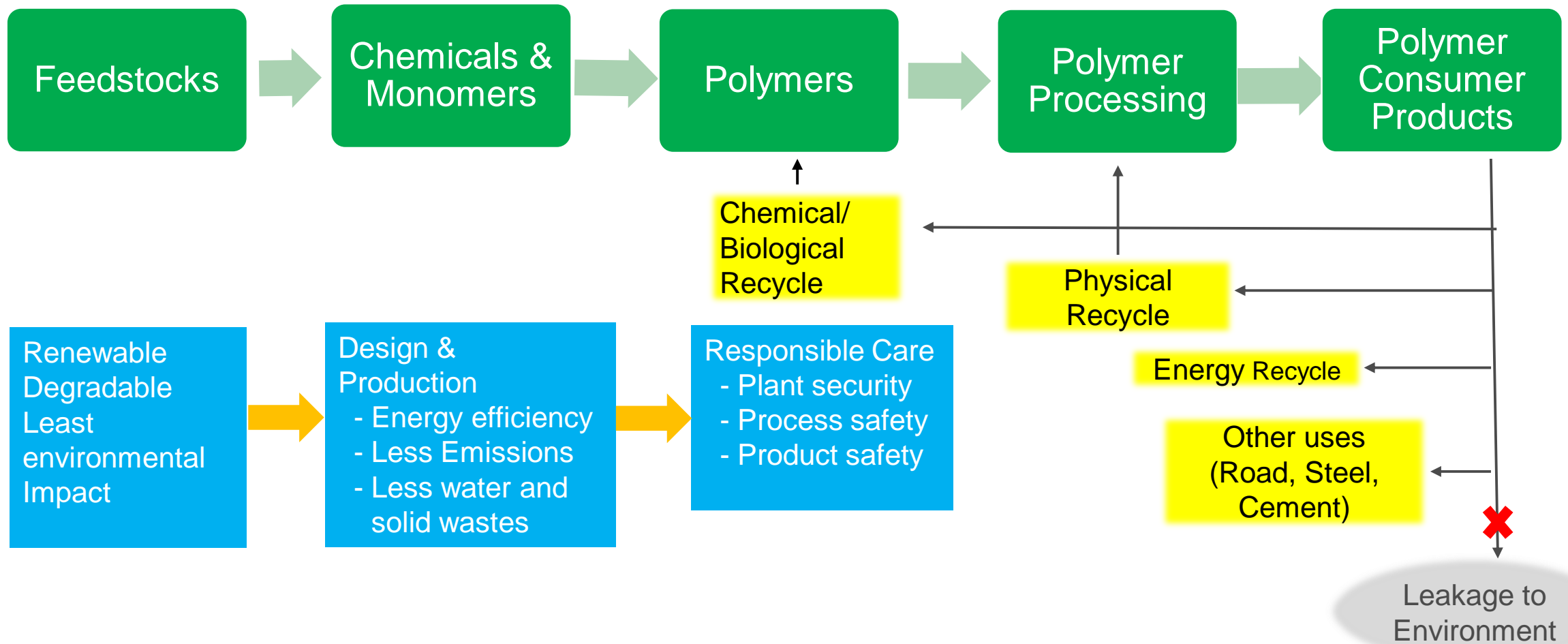
Challenges and risks to the outlook

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.



Chemical companies can contribute to sustainability goals in many ways



Conclusions

- **Global economies remain strong**, but trade-related policies **increase uncertainty**
- Base case projects **strong and stable earnings** across most value chains and regions
- **Variability** of demand growth, market access, capital costs and feedstock costs **creates risks and challenges to investment**
- **Policy and regulatory dynamics** add additional complexity
- **Strategies must consider a variety of potential scenarios and outcomes**



Thank you

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