S&P Global
Commodity Insights

Global Chemical Industry Outlook

Managing new and old challenges in the Climate Change Era

Prepared for AIHA CANADIAN PETROCHEMICAL SUMMIT
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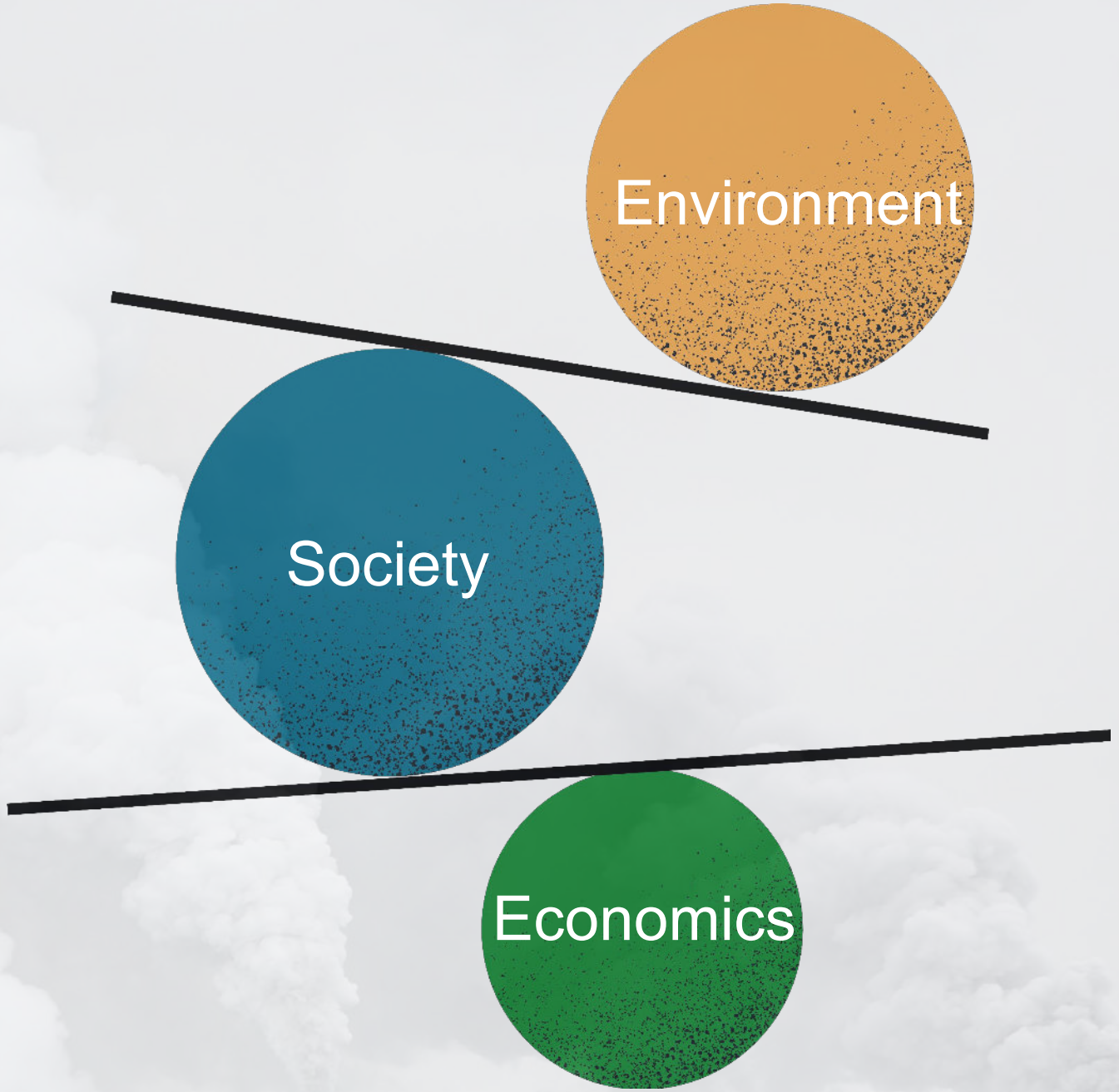
Today's challenge of climate change and its link to methane and carbon dioxide emissions is an added complexity for downstream investment consideration

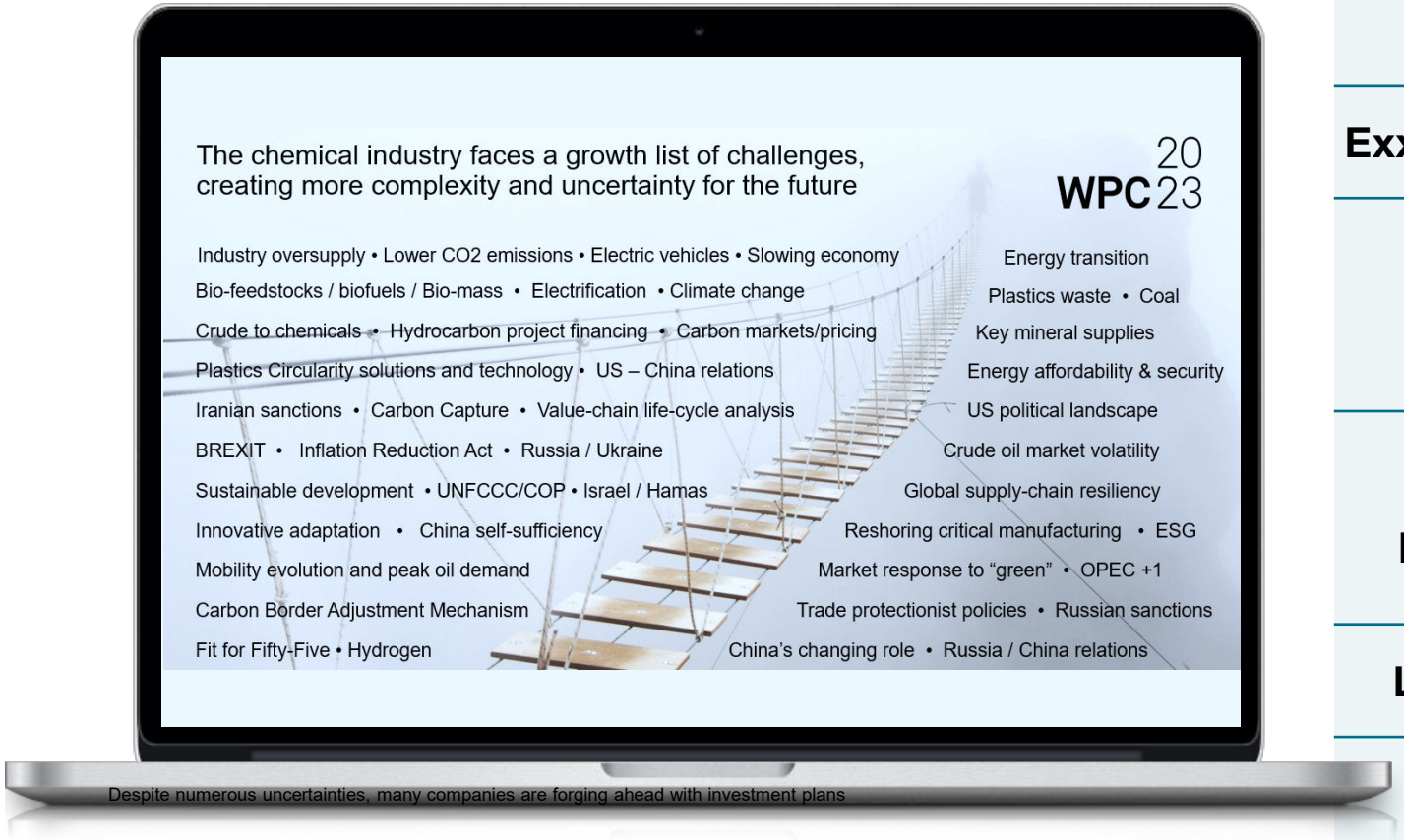


Regardless of your viewpoint we all share a common goal:

Lower emissions

Energy Transition investment decisions represent major new challenge for global chemical industry

Despite numerous uncertainties, many companies are forging ahead with investment plans



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Dow	Finalizes plans for net-zero cracker in Canada – Dec 2023
ExxonMobil	Enters lithium, targets top position by 2030 – Nov 2023
KBR	To license blue ammonia tech for USGC low-carbon production, export project – Jan 2024
Air Products	To proceed with blue hydrogen in Louisiana, capex increases to $7B – November 2023
LG Chem	Targets $22B of battery material sales in 2030 – May 2023
Sabic	Approves planned $6.4B Fujian, China, cracker complex – Jan 2024

Agenda

Old challenges: **New market dynamics**

Todays challenges: **In the headlines**

New challenges: **On the horizon**

Summary and wrap-up

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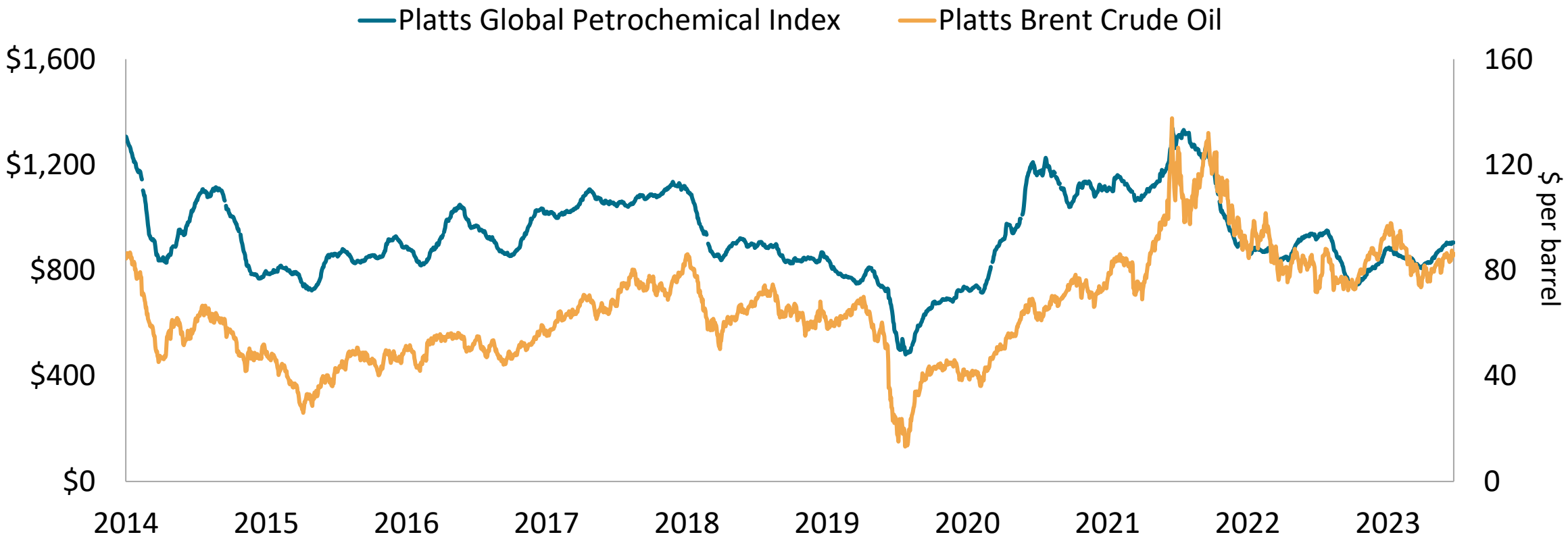
Old challenges: New market dynamics

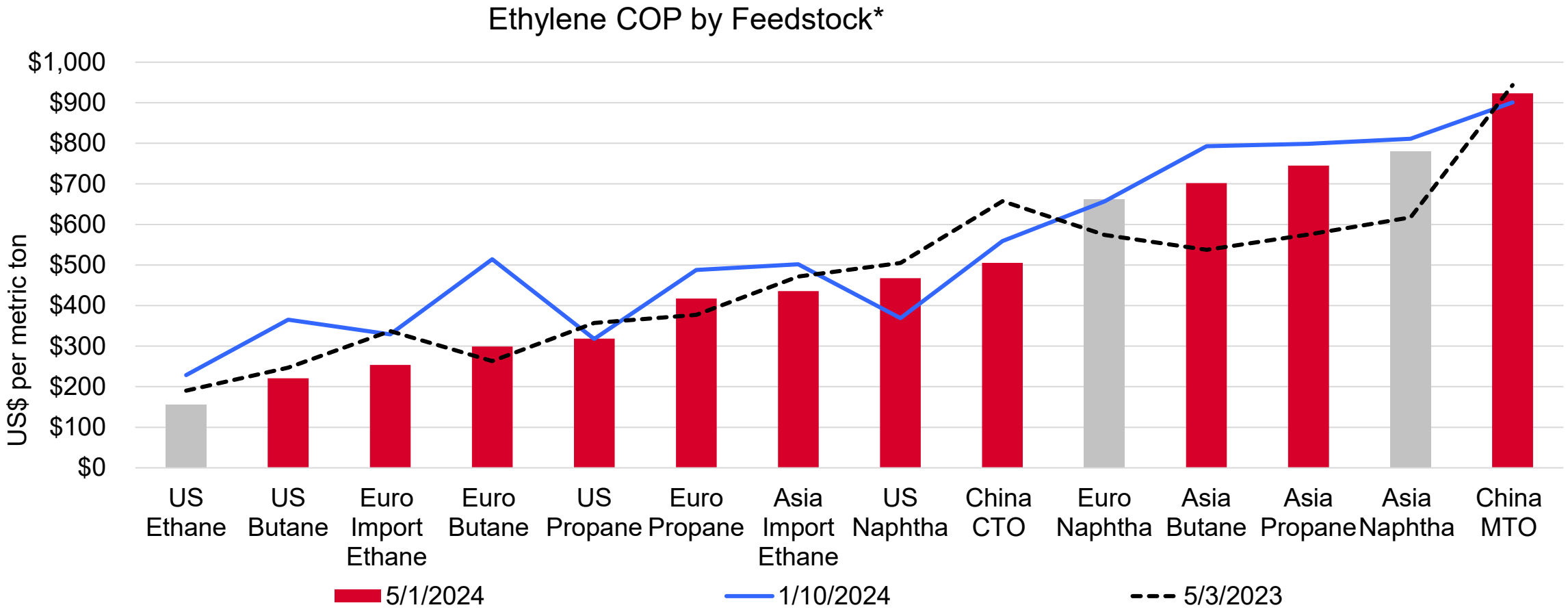
High crude oil prices push chemical markets to elevated levels and naphtha-based derivatives face severe margin pressure

Platts daily pricing trends: petrochemicals ($/metric ton); crude oil ($/barrel)



Source: S&P Global Commodity Insights; PGPI, derived from global pricing data for C2, C3, benzene, toluene, PX, LD and PP

Higher oil prices increase the general level of petrochemical and polymer pricing. US ethane feedstock advantage versus international naphtha at $400-600/mt



*Ethylene COP = feedstock - coproducts + (variable + fixed plant costs)

China added 47% of new ethylene capacity from 2019-2024 as global supply growth outpaced demand growth by 16 million tons

Robust global demand growth estimated to reach 200 million tons by 2027

Recent demand growth average 5.5 million tons/year, slower than expected post-Covid

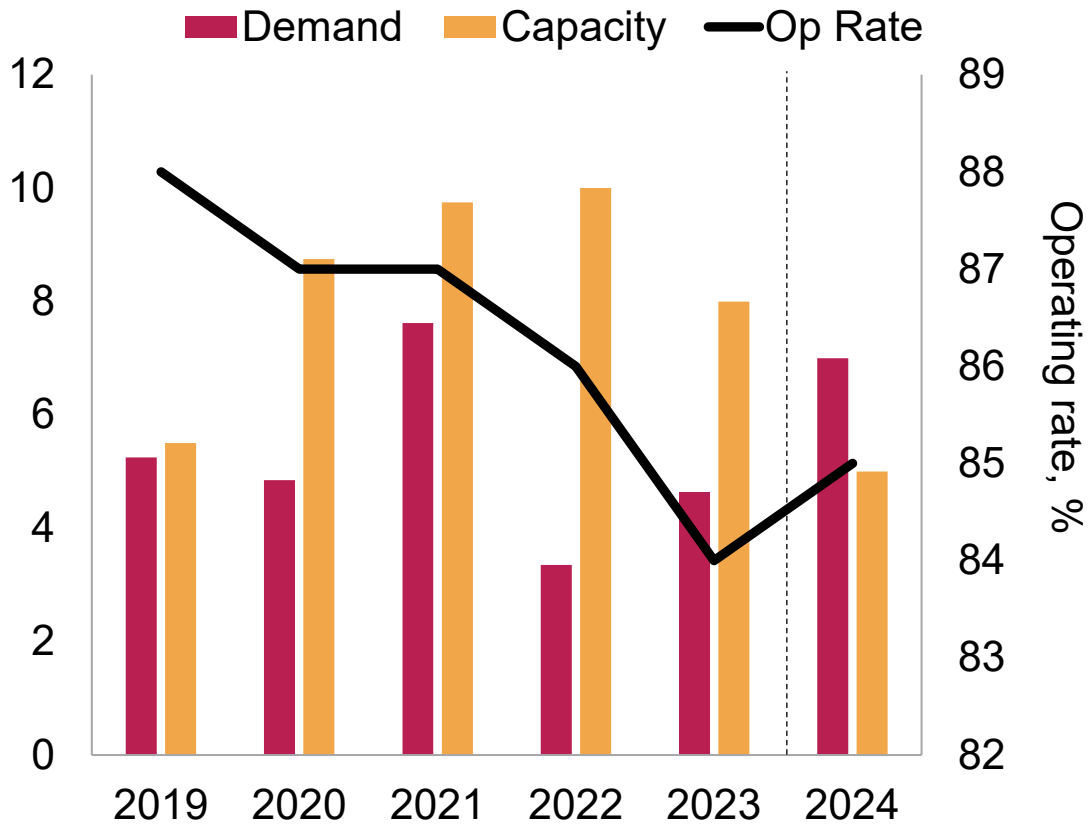
50 million tons new capacity vs 32 million tons demand growth

Cumulative surplus since 2019 reached 16 million tons

China started up 47% of new global capacity

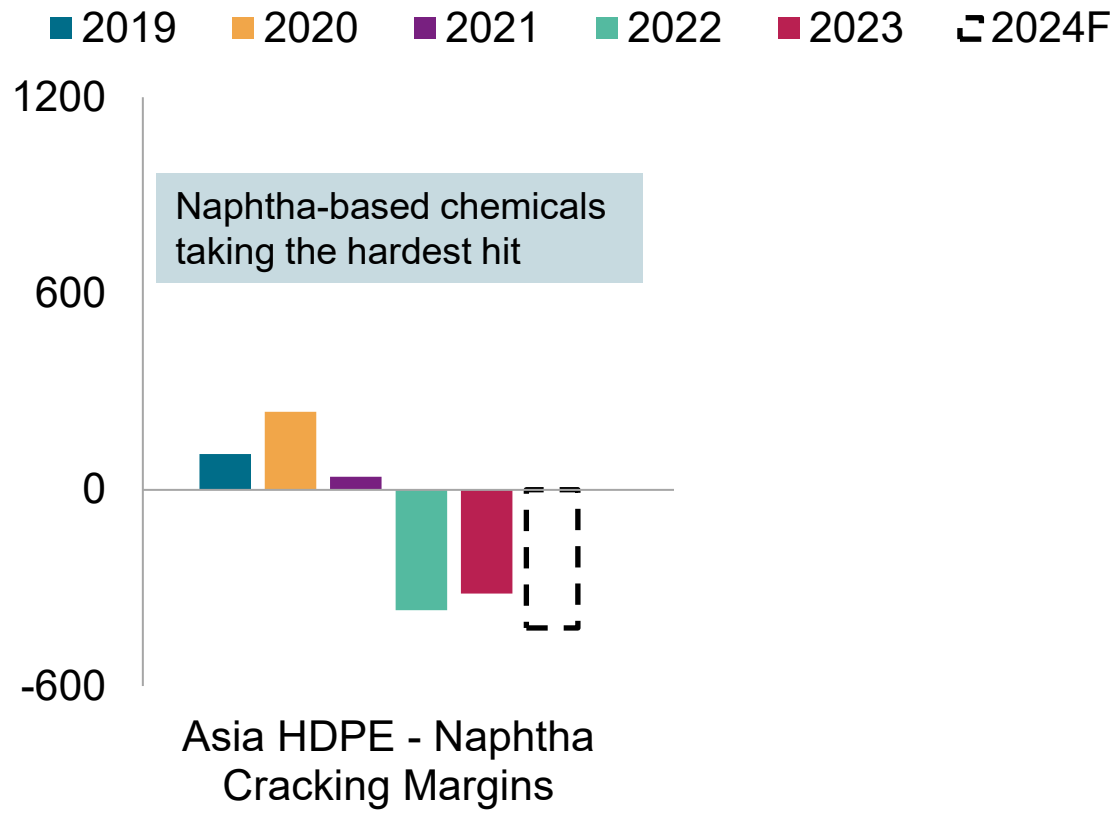
Operating rates fell to 84% in 2023

Global ethylene supply/demand growth and operating rates



Poor performance in the chemical sector dominated headlines for past two years and 2024 shows little signs of improvement

HDPE Integrated margins ($/metric ton)



Source: Chemical Week by S&P Global

Chemical Week
by S&P Global

2023 Select Headlines

Specialty earnings mixed on weak industrial activity	Europe, China weigh on US Q4 earnings and 2024 outlook
Destocking, weak China rebound, muted outlook mark Q2 earnings	Soft demand, lower prices dent European firms' earnings
Weak demand, pricing weigh on results, but outlook hopeful	Lackluster demand, pricing dent earnings, sales in Europe

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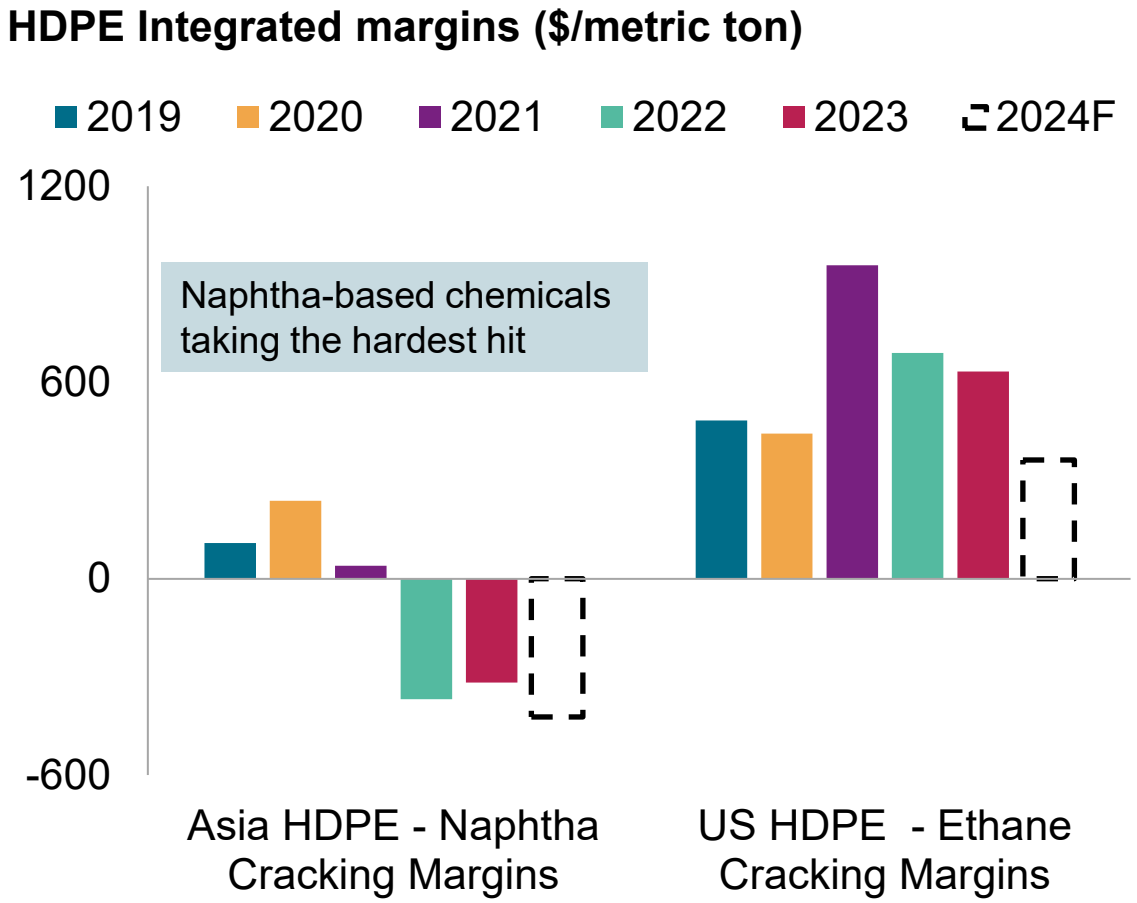


Source: Chemical Week by S&P Global

Chemical Week
by S&P Global

Ytd-2024 Select Headlines

No 2024 recovery for Europe's **crisis-ridden** chemical industry

Challenging H2 outlook: **imbalance to remain** unless start-ups are delayed

Bleak manufacturing forces European petrochemical closures

Europe's ethylene **rationalization** begins, more closures likely

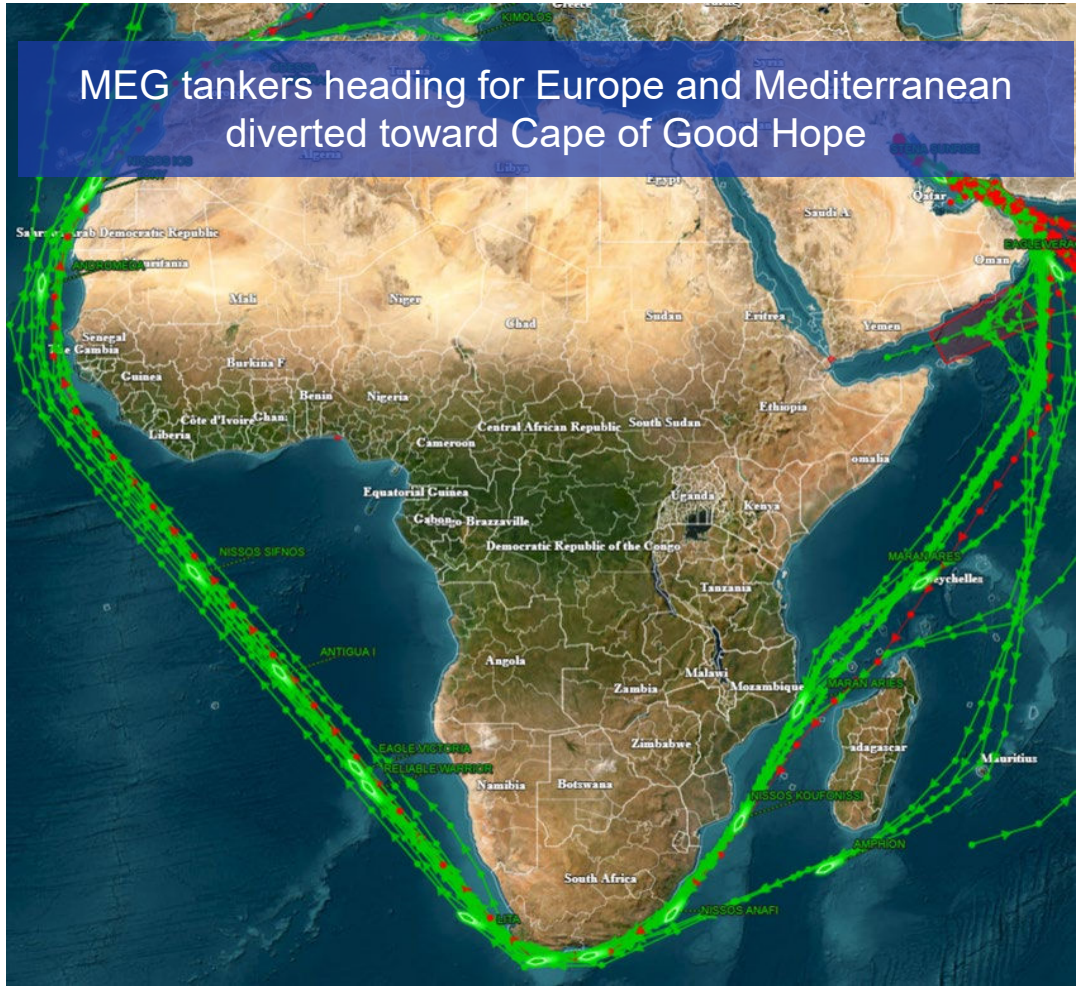
Europe faces **long haul back to profit**: Petchems sector in fight for survival

Recovery remains elusive in Europe:**Weak demand, high costs** curb growth

Today’s challenges: In the headlines

Supply-chain disruptions continue as Red Sea turmoil shakes up global trade

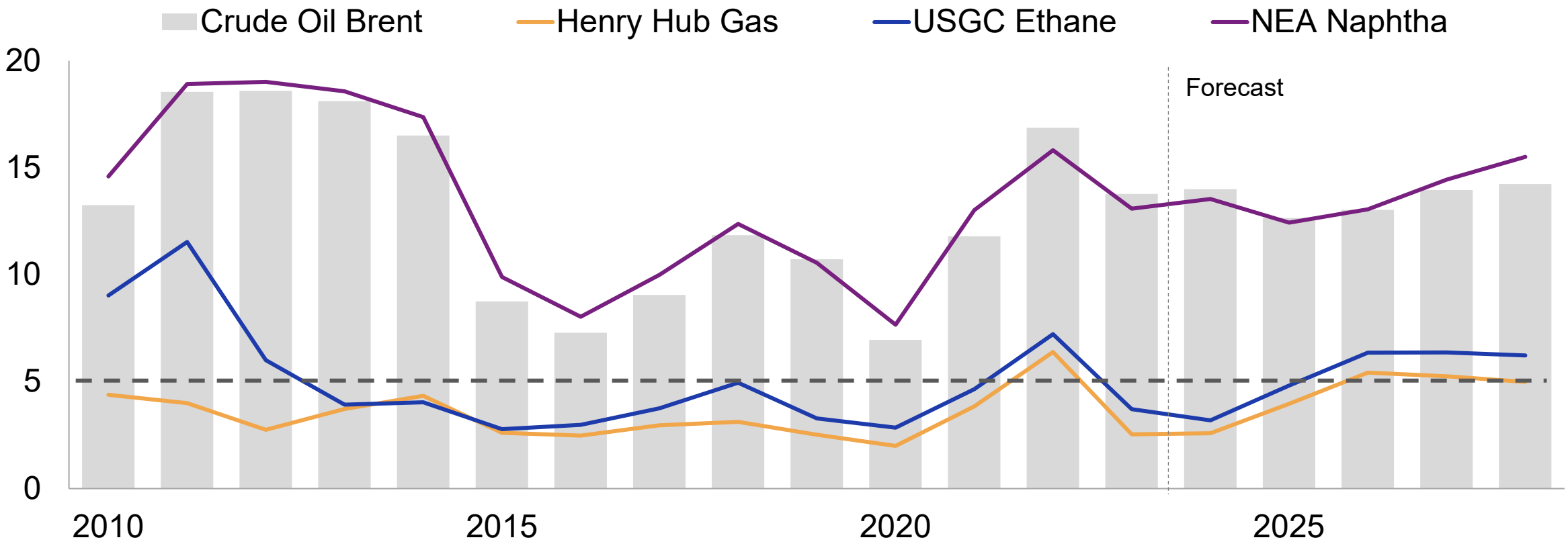
Weaponization of shipping chokepoints is a threat to global commodity supply chains



Source: S&P Global Commodities at Sea

Near-term crude and gas forecast reveals a significant advantage for gas-based chemical products

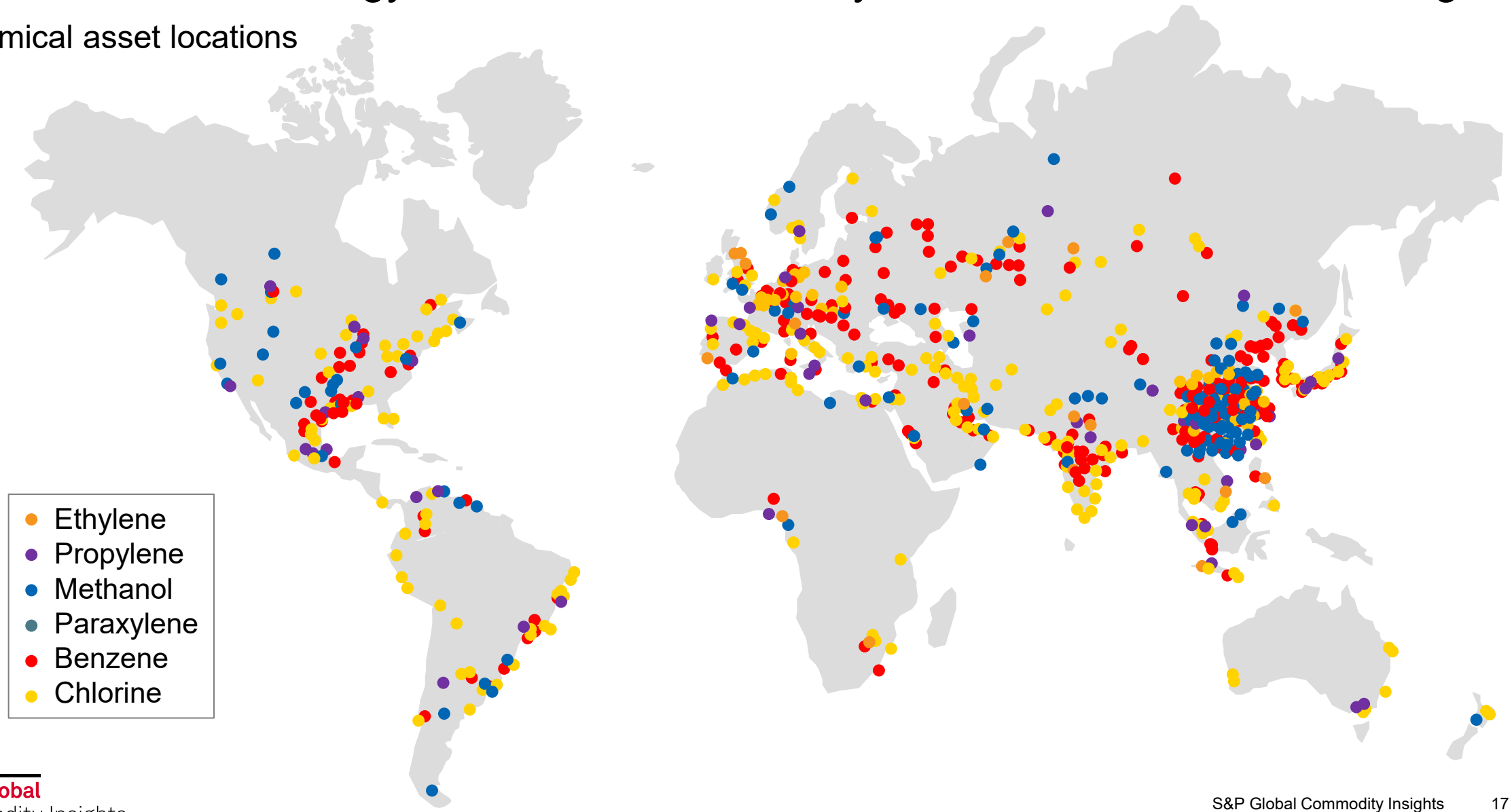
Base energy and chemical feedstocks (US $/MMBTU)



Data compiled Mar. 1, 2024.
Source: S&P Global Commodity Insights

CAPEX location strategy in the chemical industry seeks a sustainable advantage

Chemical asset locations



Petrochemical investment decisions have been driven by four key drivers

1. Energy & feedstock advantage
2. Current world-scale technology
   – Including competitive CAPEX
3. Access to markets and trade routes
4. Leverage an integrated position

5. Provide effective carbon management

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New challenges: On the horizon

China chemical industry has scale and global impact; changes underway

Stricter environmental policies will slow pace of new projects

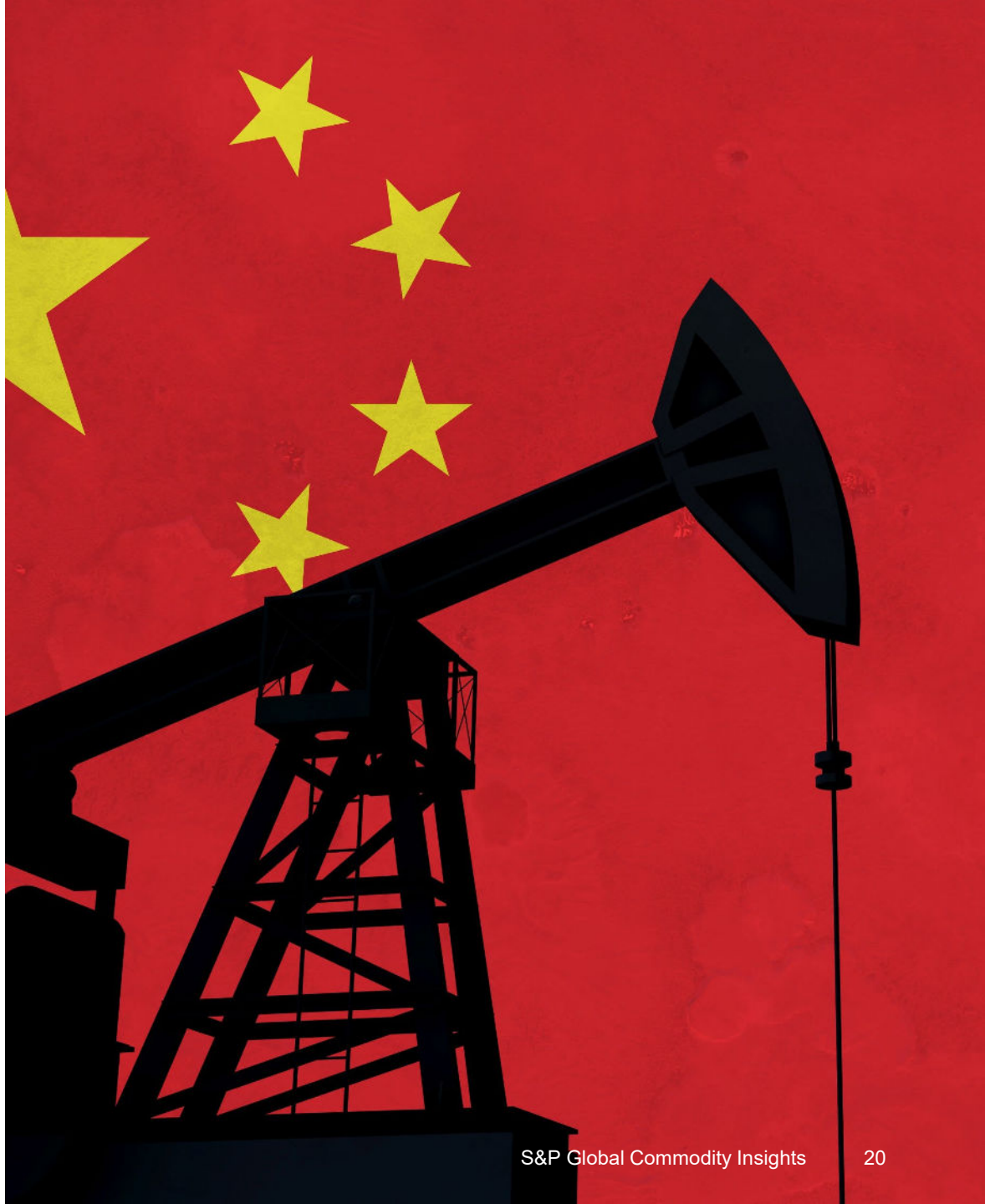
Balance of chemical company ownership between government and private sector

Value-chain integration and self-sufficiency along with specialty chemicals are priority investments

Technology development & conventional/ non-conventional capacity

Significant capital cost and project execution advantage

One Belt/One Road in face of US and Europe ambitions to nearshore critical materials



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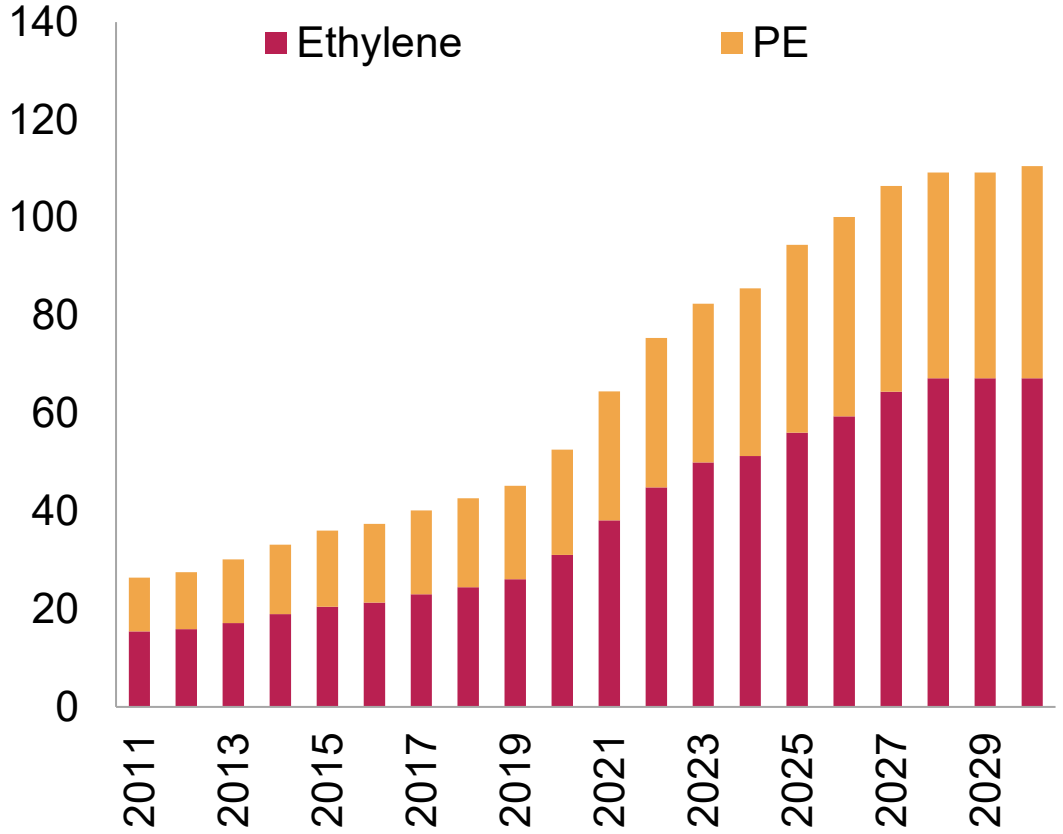
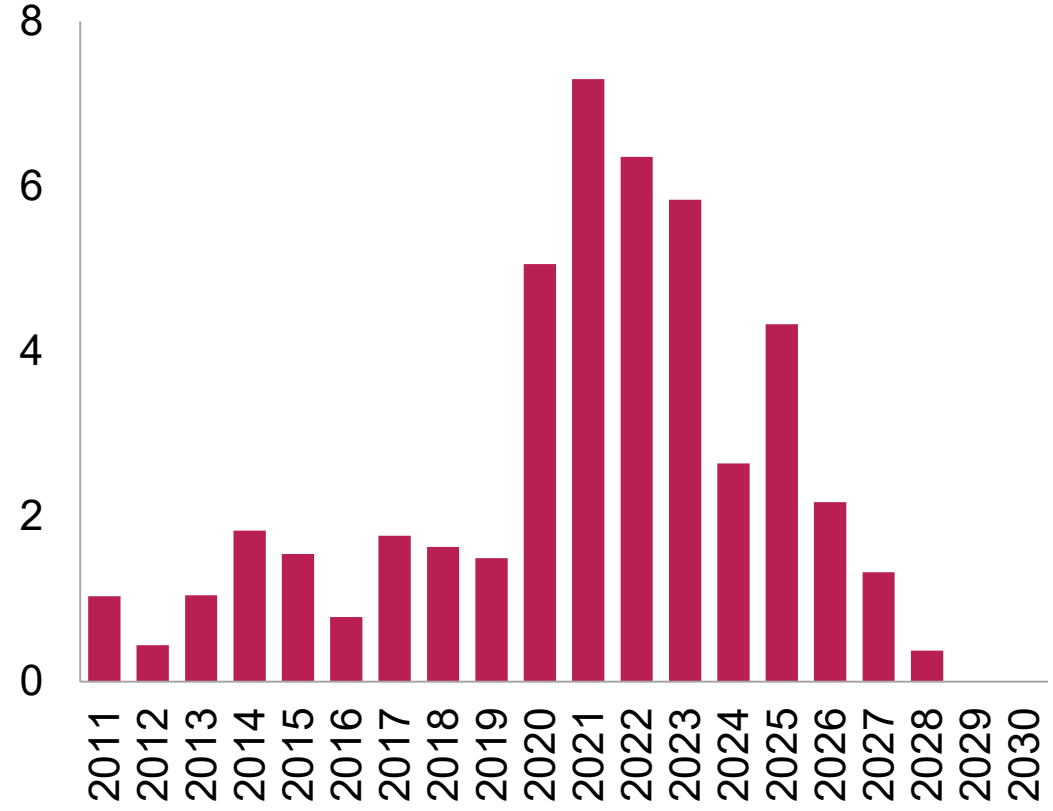
China’s aggressive plans to expand in major chemical value-chains will carry over until later this decade

Mainland China capacity (million metric tons)



Ethylene capacity expansion (million metric tons)

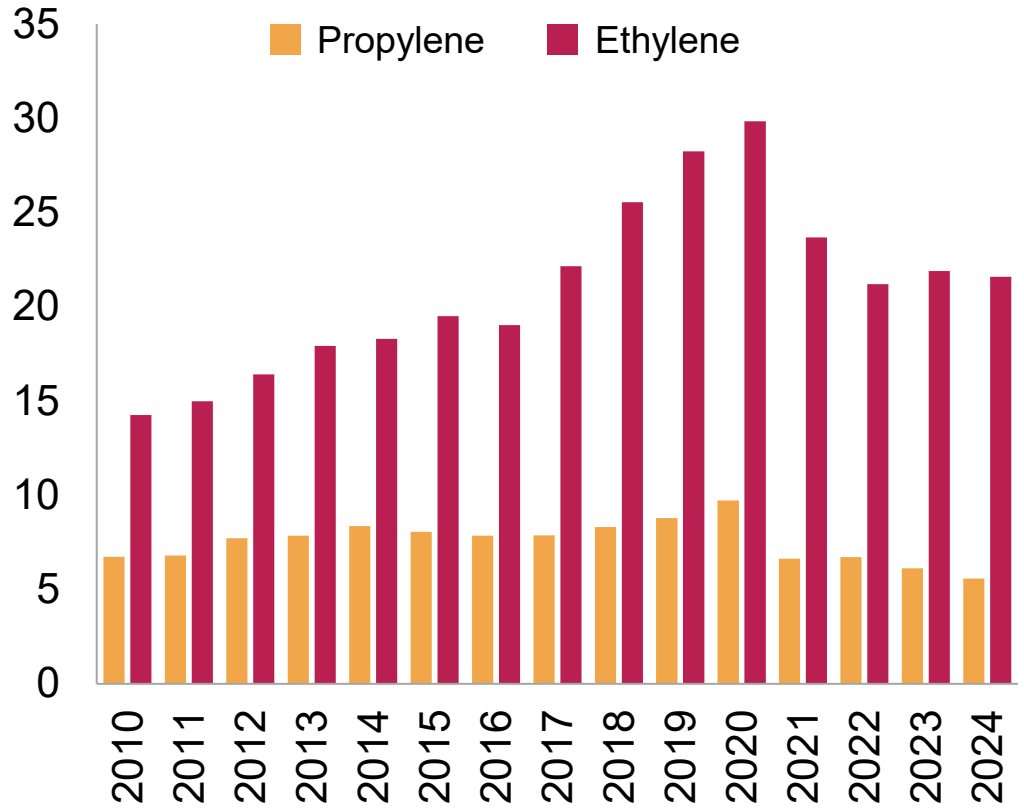


As of Nov. 22, 2023.
Source: S&P Global Commodity Insights.

Mainland China capacity investments increase self-sufficiency, resulting in major impact on global trade

- Trade balance for light olefins derivatives noted major shift in 2021
- The shift to lower net imports being felt in many regional markets
- Declining need for net imports will disrupt “build low cost/ship to high demand” model
- Near-shoring by markets in US and Europe will add to disruption on balance of trade

Mainland China net equivalent light olefins imports (million metric tons)



Energy transition is a global balancing act complicated by geopolitics

Global population 8 billion = growing demand for energy and consumer goods

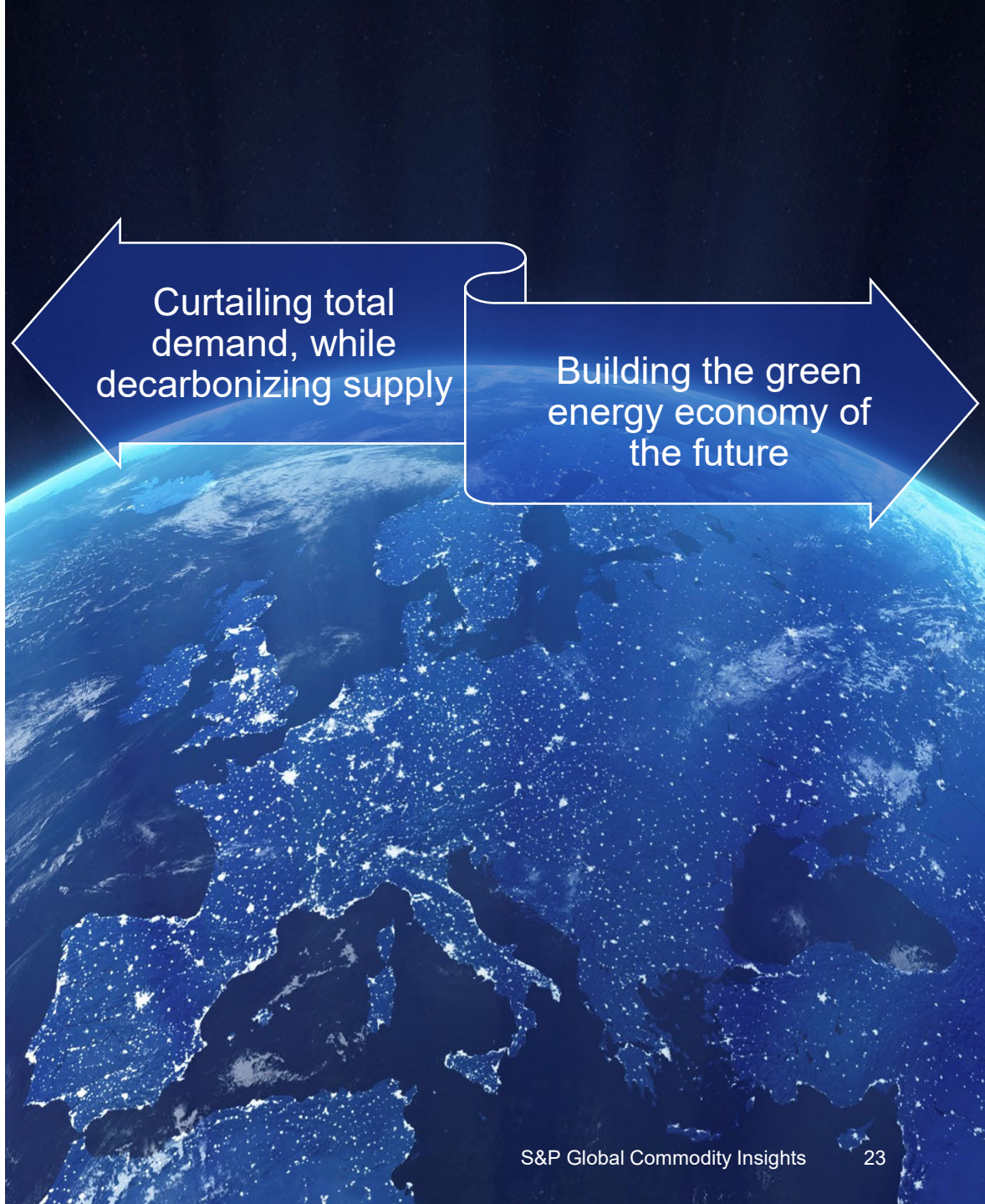
North-South divide continues; developing world put priority on low-cost and secure energy

Energy security emerged as high priority

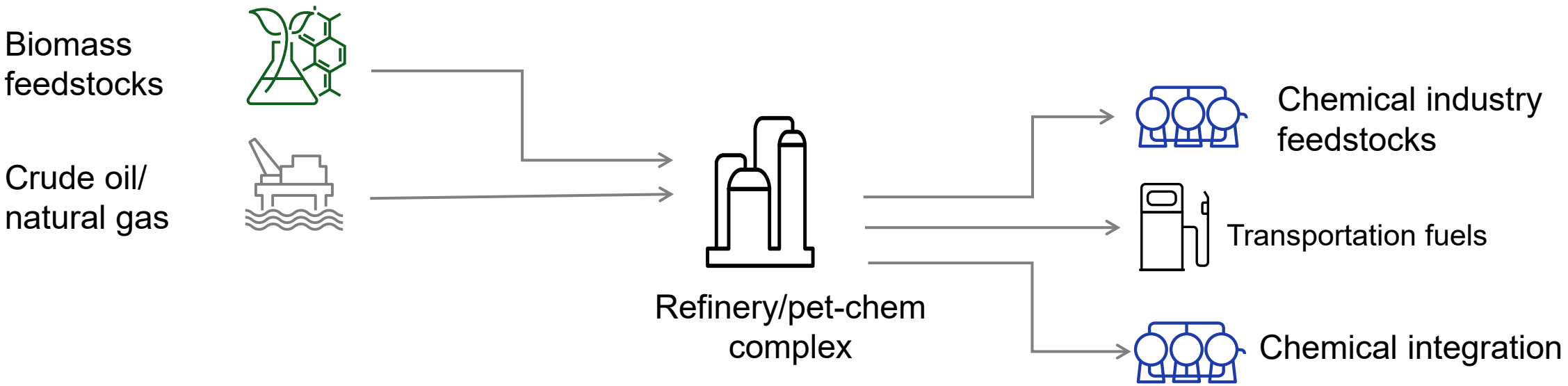
Traditional supply of hydrocarbon-based materials being challenged

Companies balancing capital to meet today's growing markets…

…simultaneously, secure funding for large-scale clean energy and low-carbon feedstocks



Pathways to Net Zero – many options available today for the downstream industry, while uncertainty remains regarding return on higher cost investments



Notes: H2 = hydrogen, list of options shown non exhaustive
Source: S&P Global Commodity Insights

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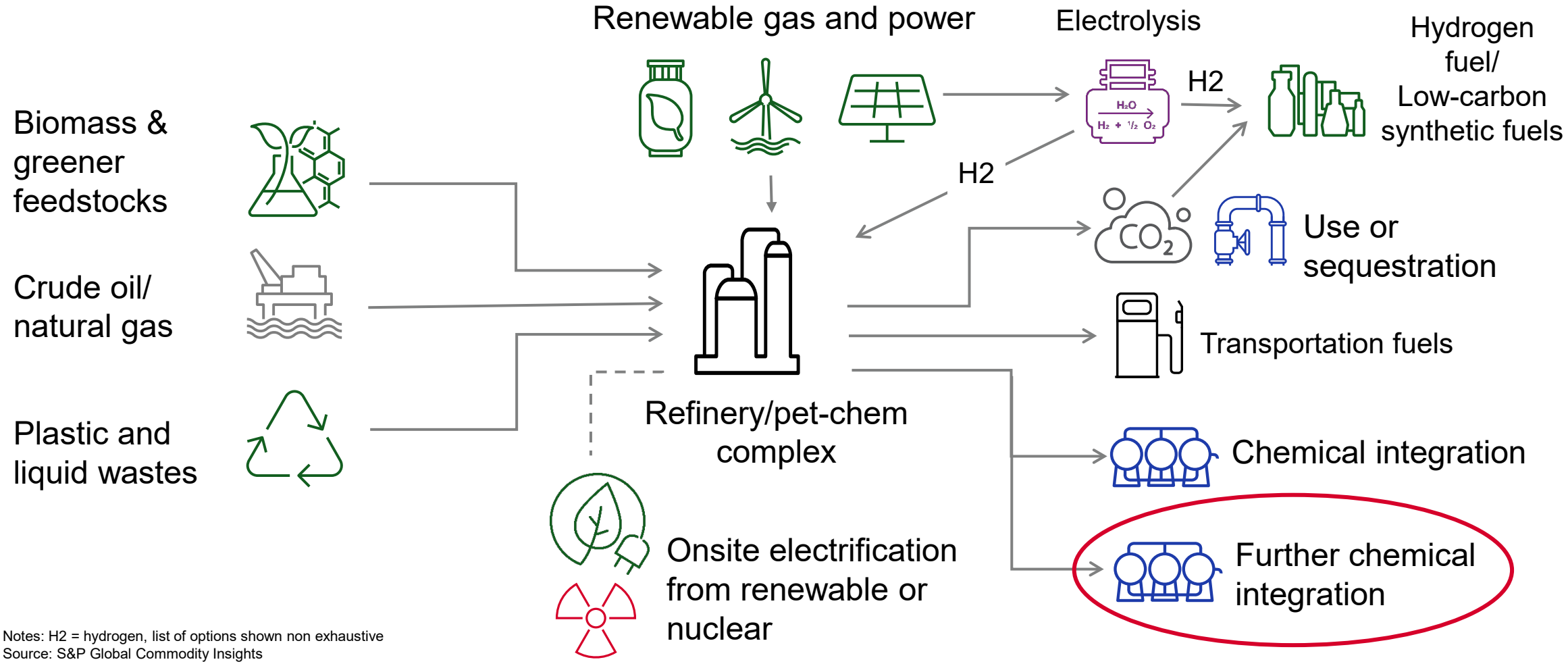
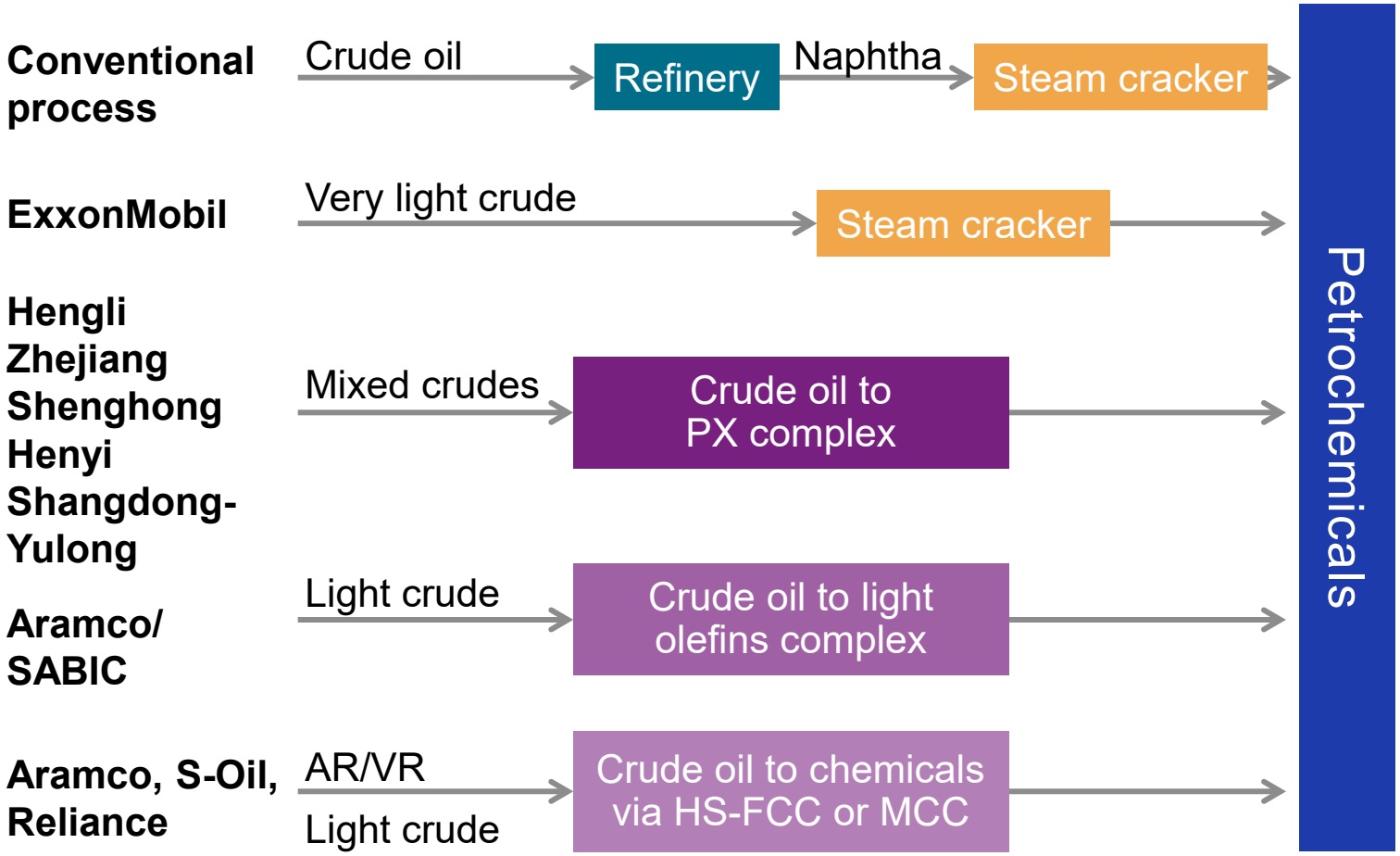


Notes: H2 = hydrogen, list of options shown non exhaustive
Source: S&P Global Commodity Insights

Liquids to chemicals leverages existing technology and new process design to bring “refining scale” to the chemical industry



The trend to maximize chemical production from crude oil will change the future build-cycles for the chemical industry due to the scale of new capacity increments compared to traditional steam cracker capacity.

Source: S&P Global Commodity Insights Process Economics Program (PEP)

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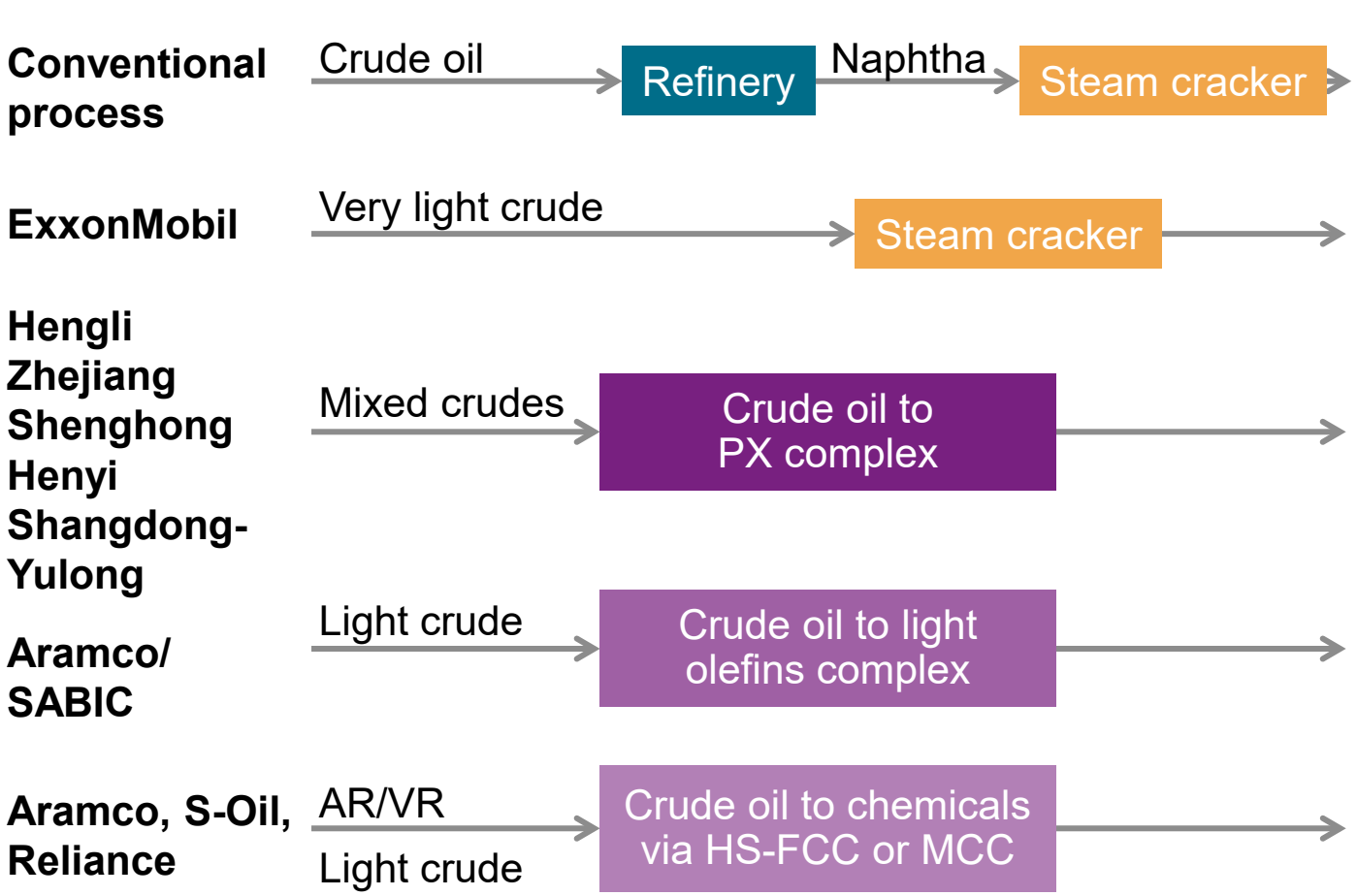
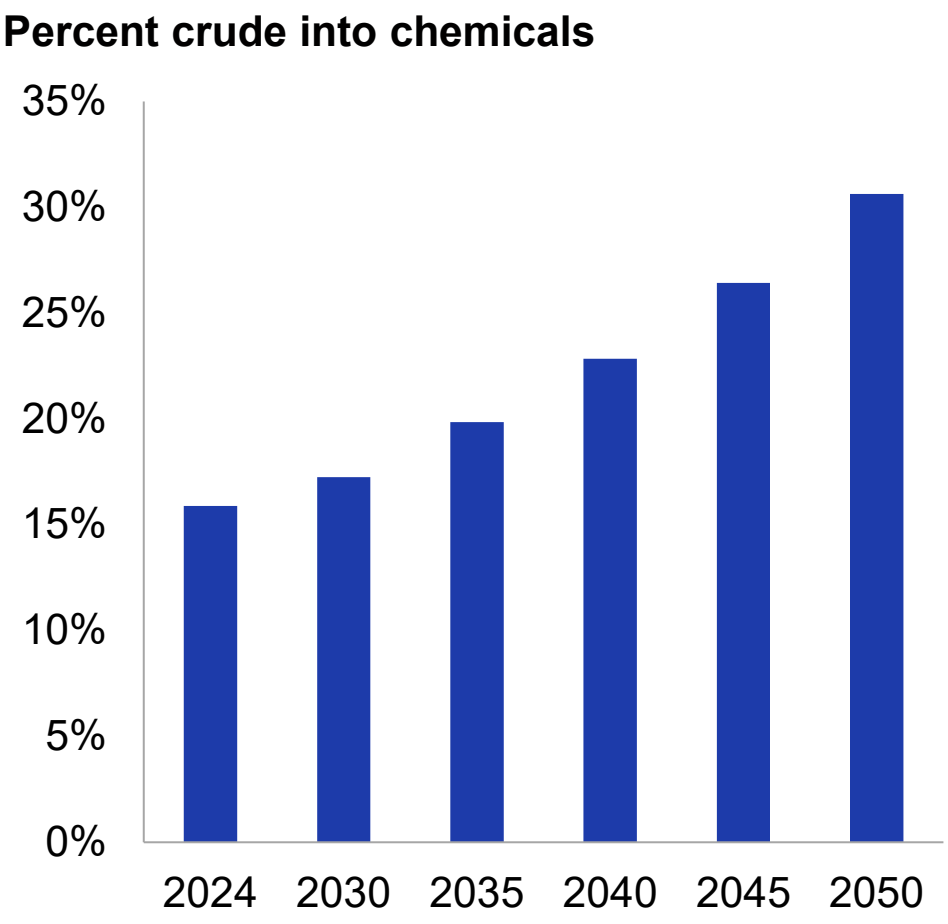


Source: S&P Global Commodity Insights Process Economics Program (PEP)



Data compiled March, 2024.
Source: S&P Global Commodity Insights.

Technology pathway to net zero - 2024 research agenda

Key challenge: Can the cost of a low carbon solution achieve acceptable return

Carbon capture economics

Carbon capture for coal gasification

Thermal crude to chemicals

Retrofitting for hydrogen as a fuel

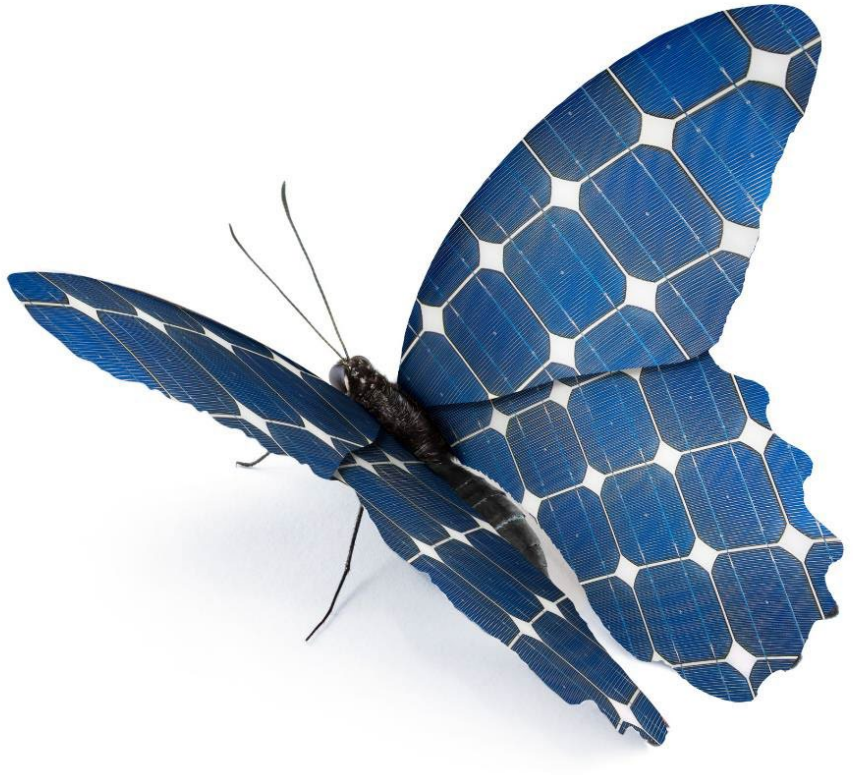
Ammonia cracking for hydrogen

Chemicals and feeds from renewables

Advanced plastic recycling

Ethylene e-cracker analysis

Batteries for energy storage



Source: S&P Global Commodity Insights Process Economics Program team

Pathway to net zero requires us to rethink business models and evaluate low carbon inputs along with end-of-life solutions for consumer goods

Need to create models with **incentives** instead of penalties

…incentives mobilize capital investment

Need more **pragmatic** approaches…

…consumers more focused on managing their waste (key to circularity models)

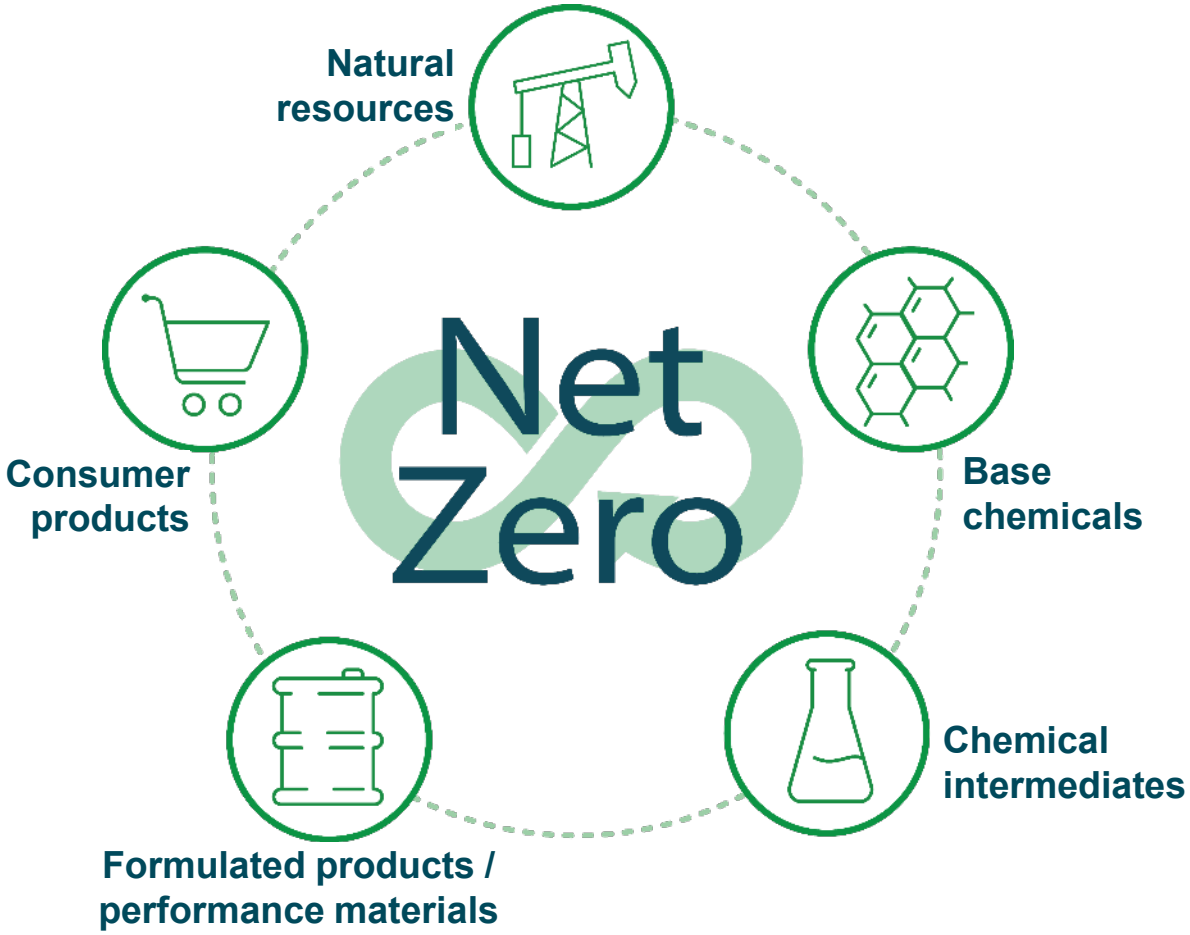
…vs their “carbon footprint” when they fly

Emphasize need for **multiple solutions** for achieving net-zero

…need hydrocarbons for consumer goods

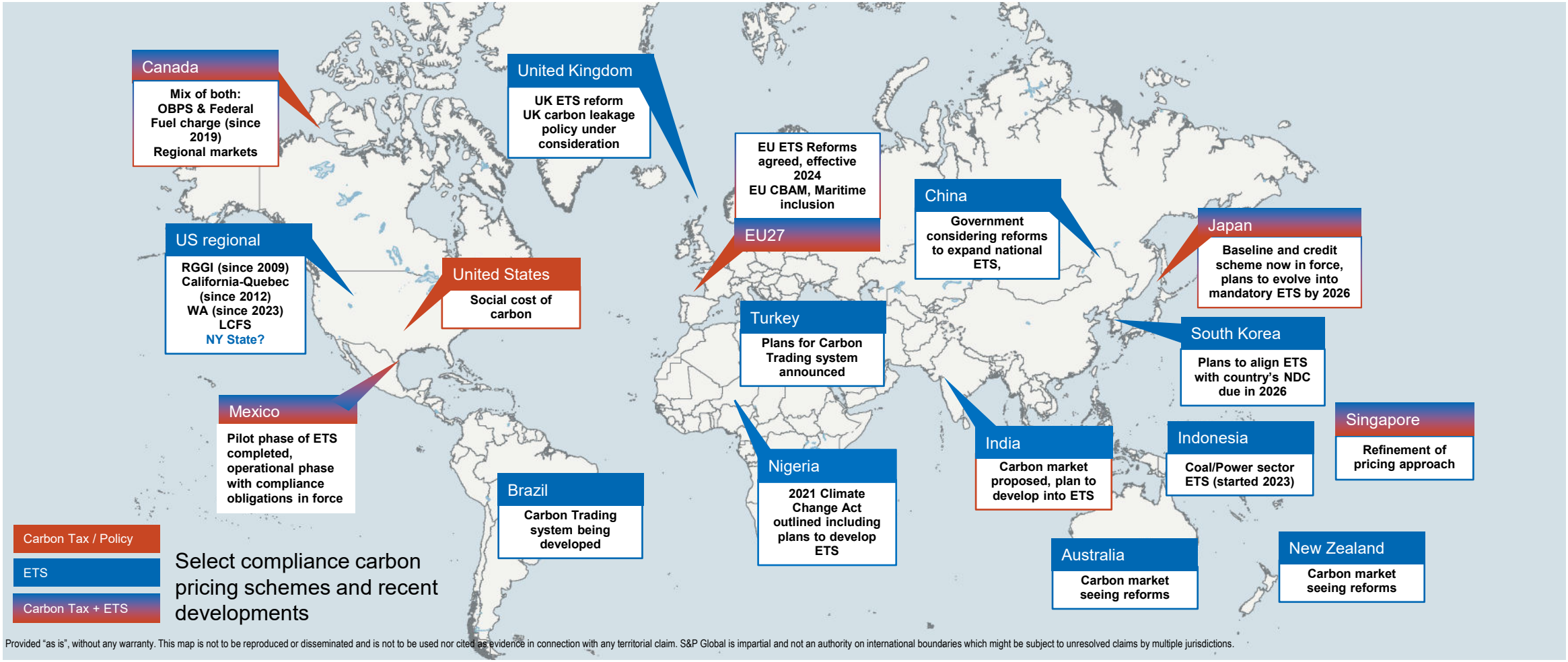
…need ammonia to feed the world

…need plastics for light-weighting



Many countries have compliance carbon pricing, more are likely to follow

25% of global emissions covered by carbon pricing



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25% of global emissions covered by carbon pricing

> "Nations in both developing and developed world are increasingly activating plans to use carbon pricing and markets to help achieve these reductions in more efficient and less expensive ways."
>
> Roman Kramarchuk, Head, climate market and policy analysis, S&P Global Commodity Insights

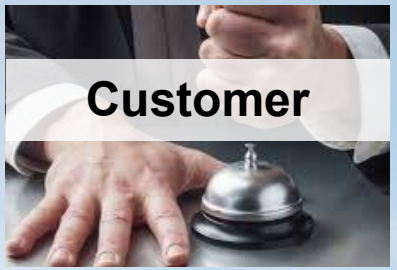
Summary and wrap up

Environment

Society

Economics

Trust the…



Over time, the industry achieves significant advances and success when these pieces work together

Learn more about Chemicals Resources at S&P Global