

# PetroChemical Outlook

Alberta's Industrial Heartland Association

Kananaskis, Alberta

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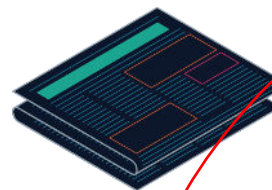
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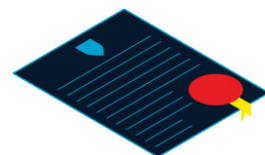
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ENERGY, CHEMICAL &  
SUSTAINABILITY INSIGHTS

- | Global Economy
- | Energy
- | Chemical Industry Dynamics
- | Sustainability: energy transition, Net Zero, Circularity
- | Alberta

# Global Economic Outlook:

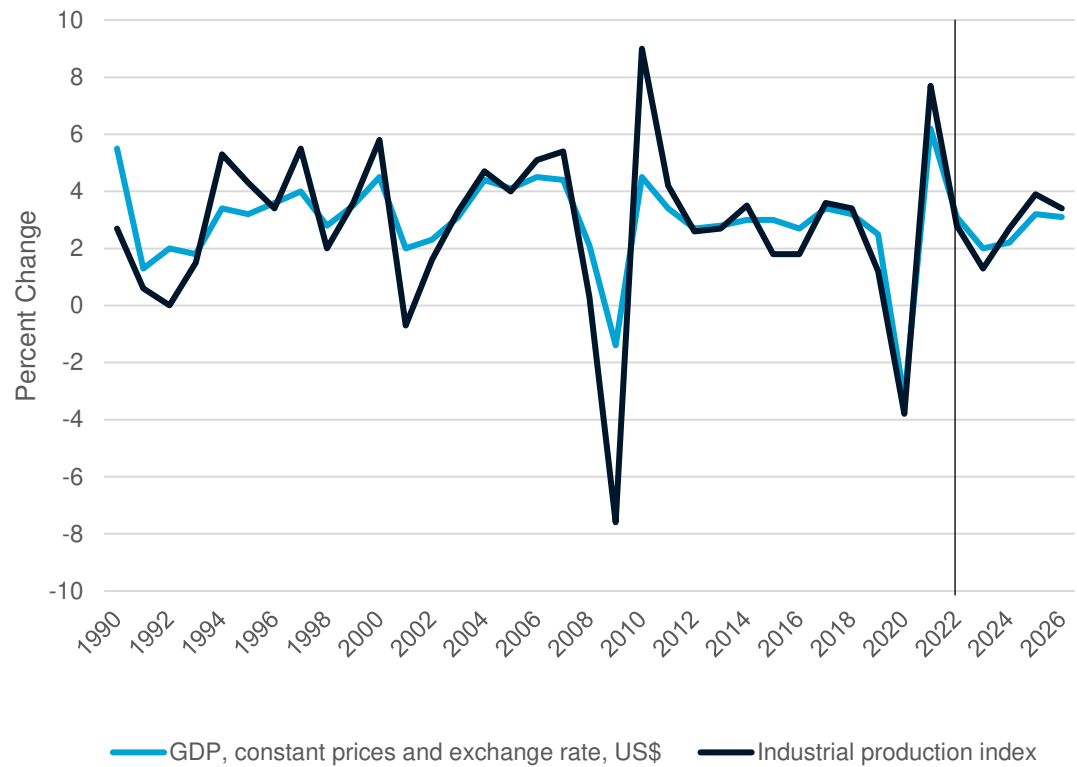
*Near Term Challenges With Higher Hopes for the Midterm  
and Longer Term*



# Global economic growth is slowing as interest rates rise

*2023 is the forecast bottom, 2024/25 bounce back*

Global Real GDP and Industrial Production



Source: Oxford Economics

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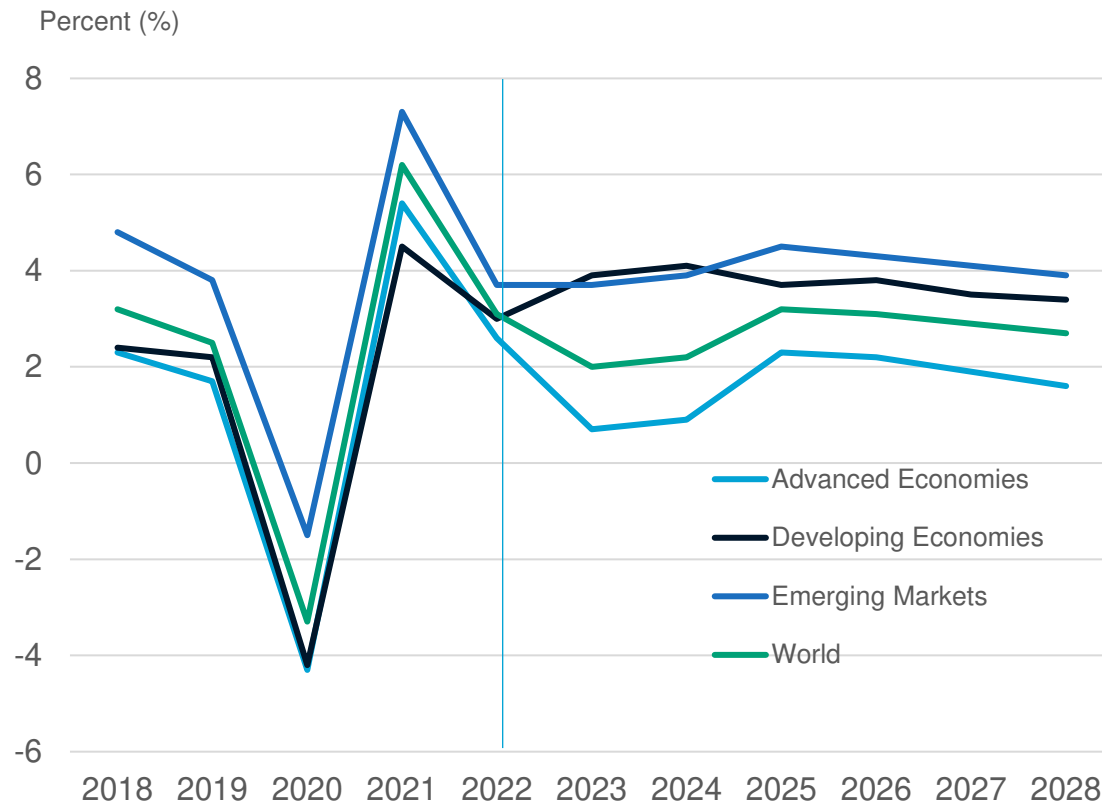
## Real GDP

Percent Change	2021	2022	2023	2024
Brazil	5.30	3.00	0.90	1.90
Canada	5.00	3.40	-0.20	0.80
China	8.50	3.00	5.50	4.60
Eurozone	5.30	3.50	0.80	1.00
India	8.90	6.70	4.90	6.30
Japan	2.20	1.00	0.60	1.10
Russia	5.60	-2.10	0.70	1.70
Ukraine	3.40	-29.10	2.30	7.20
United Kingdom	7.60	4.10	0.40	1.30
United States	5.90	2.10	0.50	0.40
World	6.20	3.10	2.00	2.20

Source: Oxford Economics

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# The Global Economy is in a Sustained Period of Weakness



Source: Oxford Economics

- We expect global GDP growth to pick up to 2.2% in 2024, but this would still represent a lackluster performance, even by the standards of the post global financial crisis period
- Recent activity data for advanced economies have generally continued to surprise to the upside although from a low baseline, this could shift outlook up over course of next few months
- Most developing market economies, as noted, will slow markedly this year, as weak external demand weighs on export performance and high inflation limits consumer spending, China brings weighted average up.

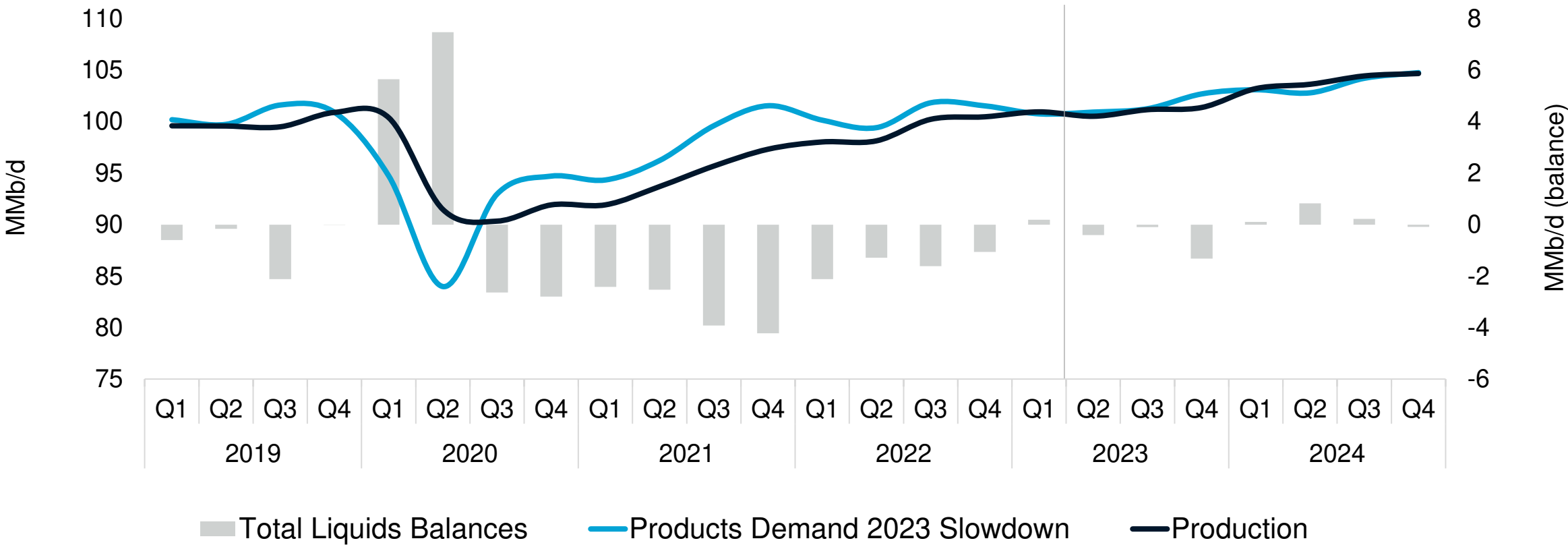


# Energy Market

# Oil/NGL's - Increasing uncertainties lie ahead

*Outlook may skew down further if/when a recession arrives*

Global oil (total liquids) supply and demand



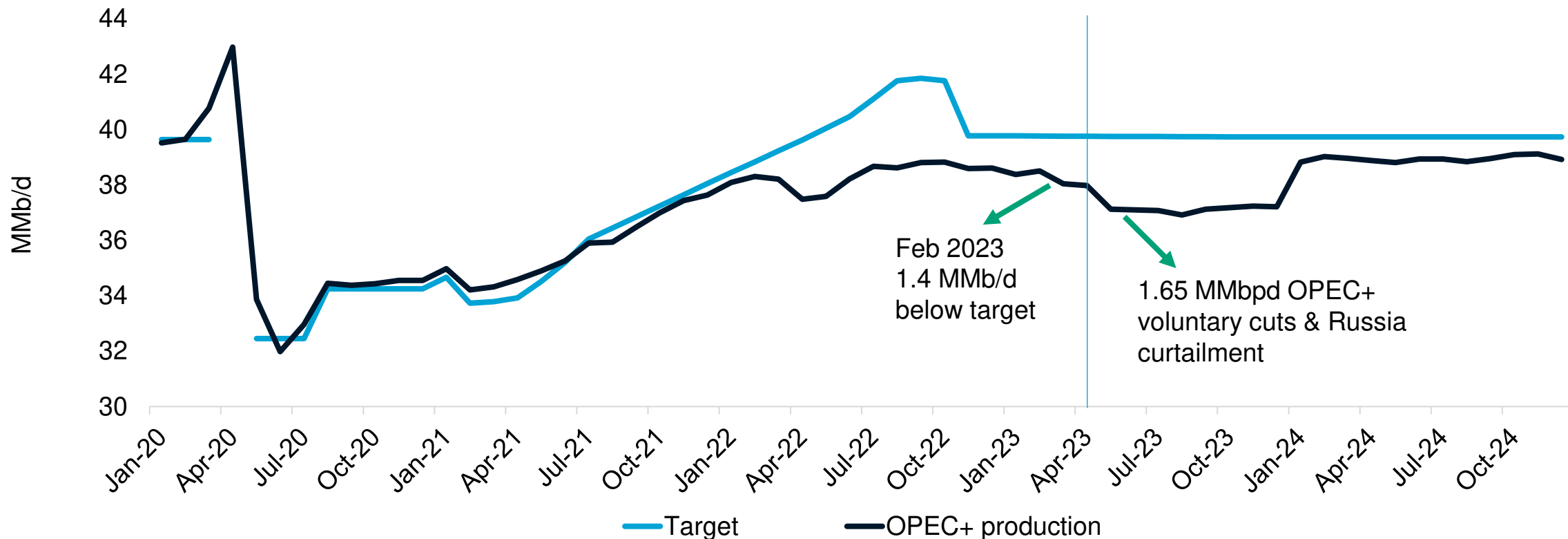
Source: Chemical Market Analytics by OPIS, Rystad Energy

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# OPEC Targets vs Actual Production

*Projected supply remains below target even more after the recent voluntary production cuts*

## OPEC+ crude supply



Note: OPEC+ figures on this chart refer to the combined crude oil production for countries subject to cut. Iran, Venezuela, Libya and Mexico are not included. There is no target production set for these countries.

Source: Chemical Market Analytics by OPIS, Rystad Energy

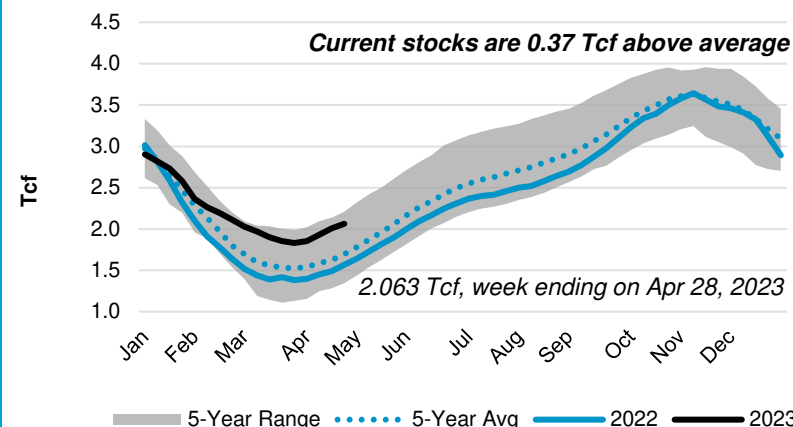
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# Natural Gas: Bearish sentiment dominates

*Continued above-normal temperatures & comfortable gas inventories*

- US gas market sees strong storage injections packed by reducing demand
- No new major US LNG plants until 2024 prompting stronger inventory builds after winter
- Henry Hub prices are set lower in the short term, averaging \$2.9 for 2023
- Europe gas holds a robust stockpile exiting the winter
- Europe's ability to import more LNG has been boosted by new and upcoming regasification capacity since late 2022
- Focus shifting to '23 / '24 winter season when Asia is set to rebound and compete for LNG

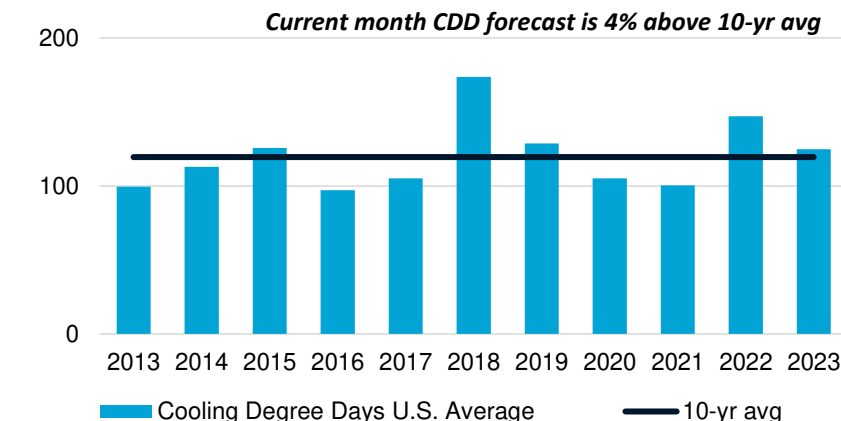
L48 Working Underground Storage



Source: U.S. Energy Information Administration

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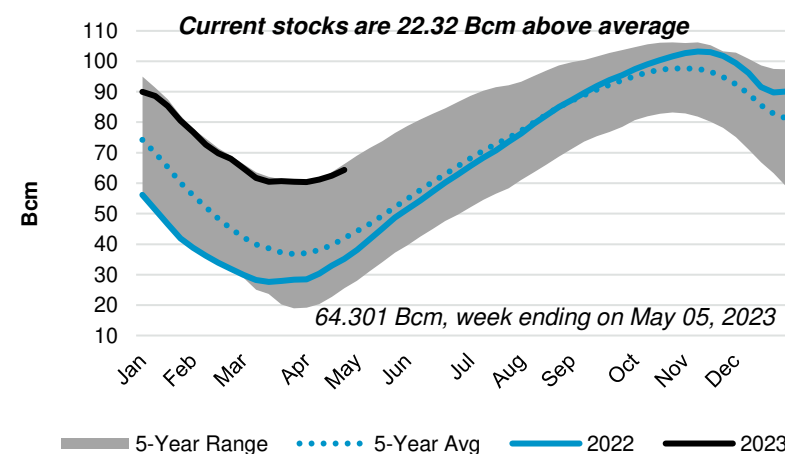
Cooling Degree Days U.S. Average - May



Source: EIA

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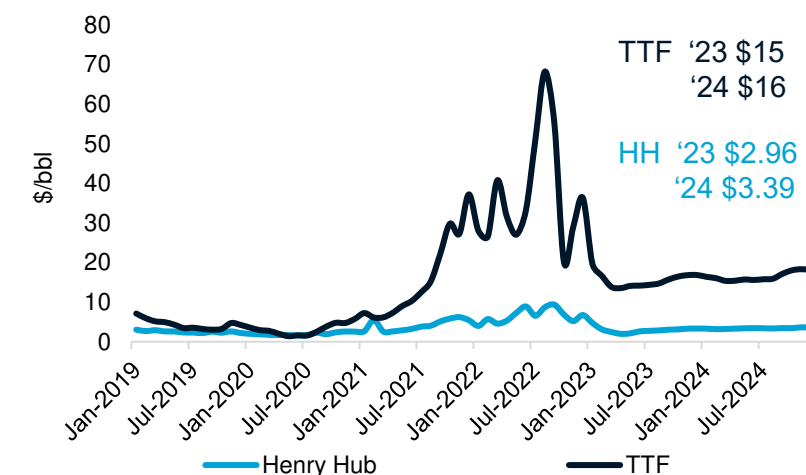
Europe Working Natural Gas Storage



Source: GIE-AGSI

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North America and Europe natural gas prices



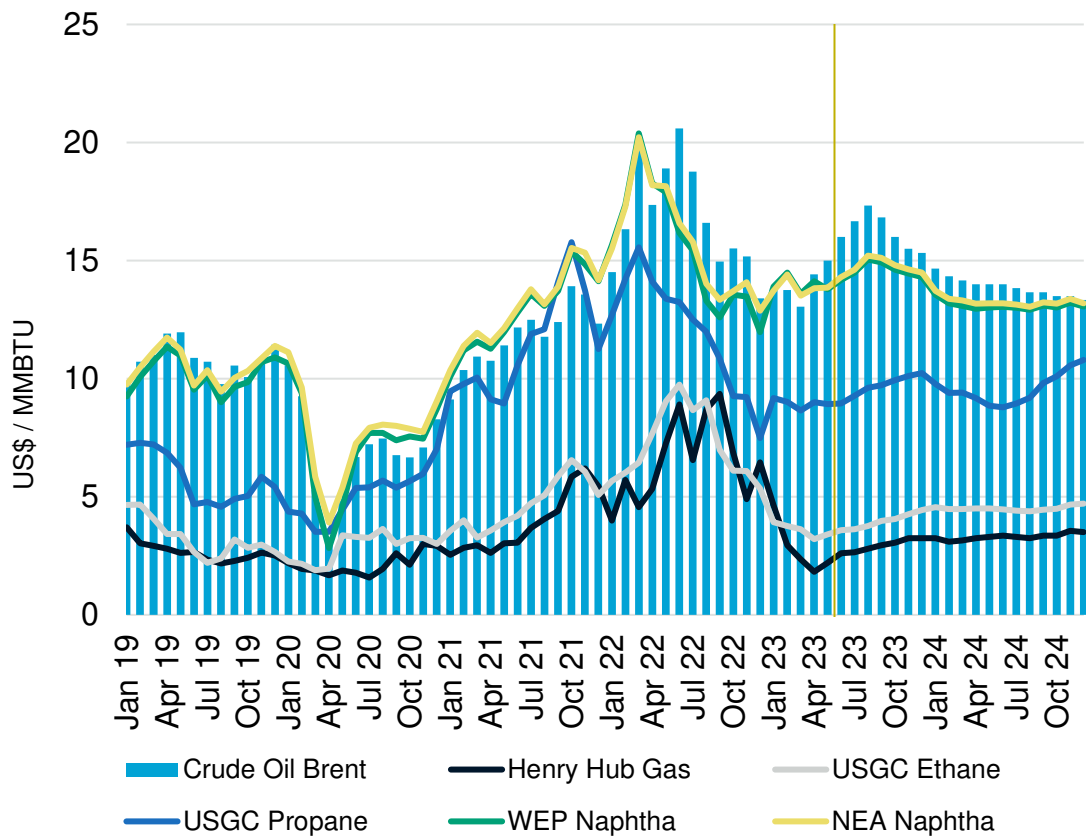
Source: Chemical Market Analytics by OPIS, Rystad

# Putting it All Together: Feedstock price outlook

*Naphtha crack continues to be depressed*

*Ethane inching up with NG and demand increases, Propane depressed versus recent history*

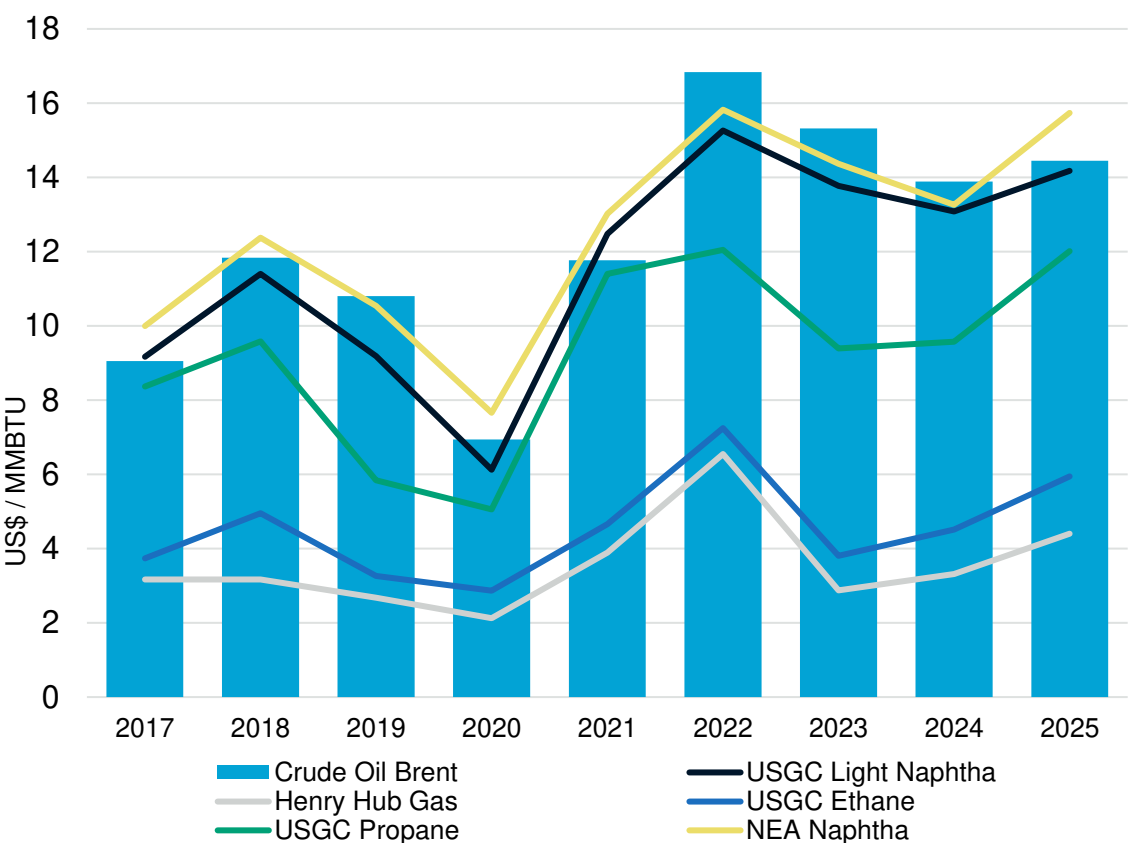
Crude Oil - VS - Natural Gas & NGLs



Source: Chemical Market Analytics by OPIS

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Crude Oil - VS - Natural Gas & NGLs (Current \$)



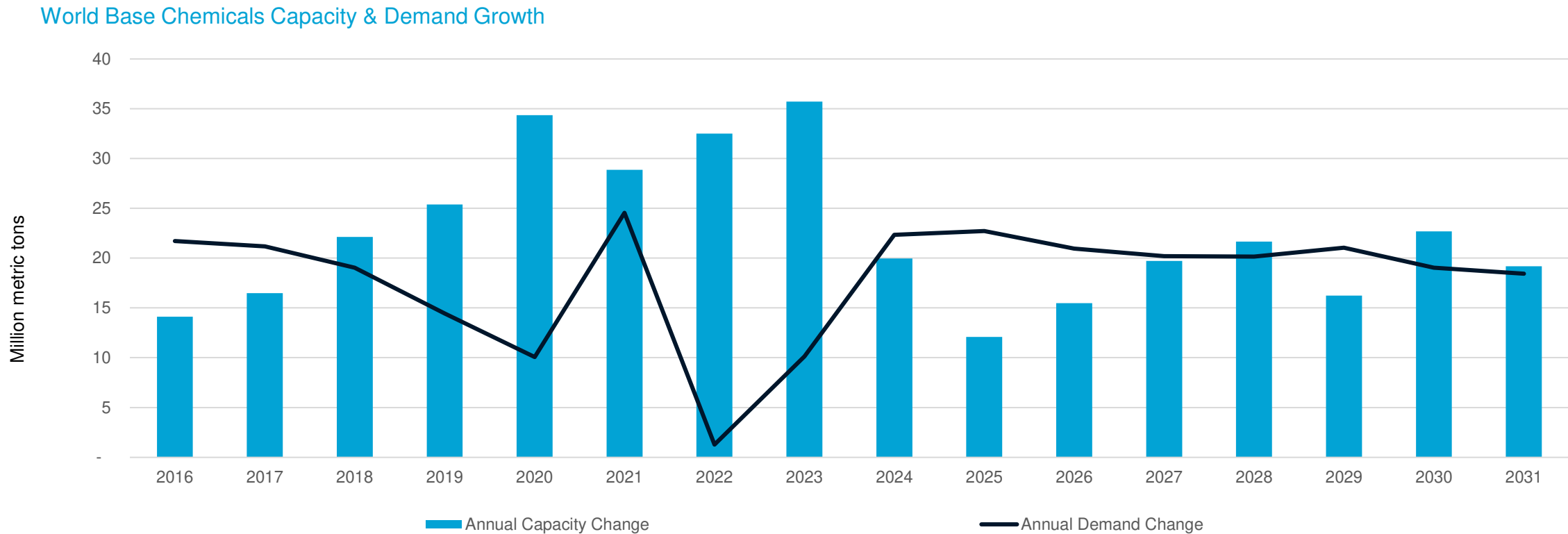
Source: Chemical Market Analytics by OPIS

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# Petchem: Absorbing the overbuild in a Weaker Economy

# Imbalance between new capacity and demand growth

*This would suggest a decline in margins, demand growth ups and downs driven by logistics and stocking/destocking*



Source: Chemical Market Analytics by OPIS

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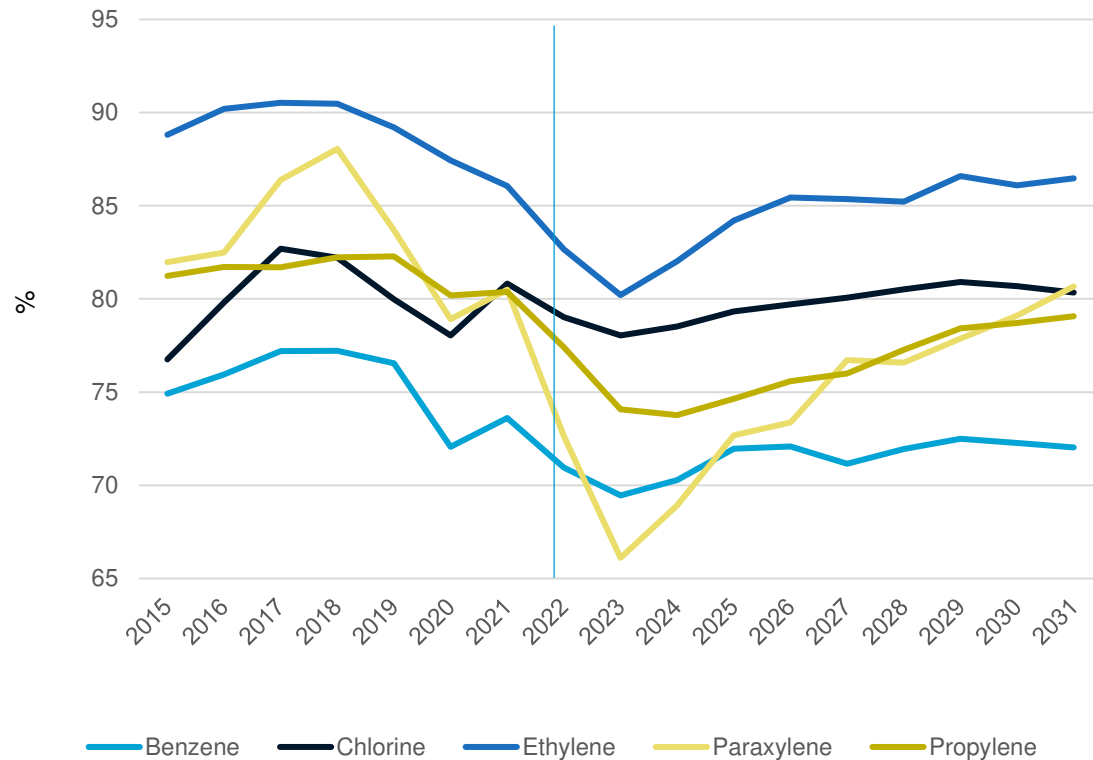
**Base chemicals = ethylene, propylene, methanol, benzene, chlorine, paraxylene**



# Demand continues to grow after 2022 “pause”.

*Operating rates remain depressed for most building blocks, does not bode well for margin recovery.*

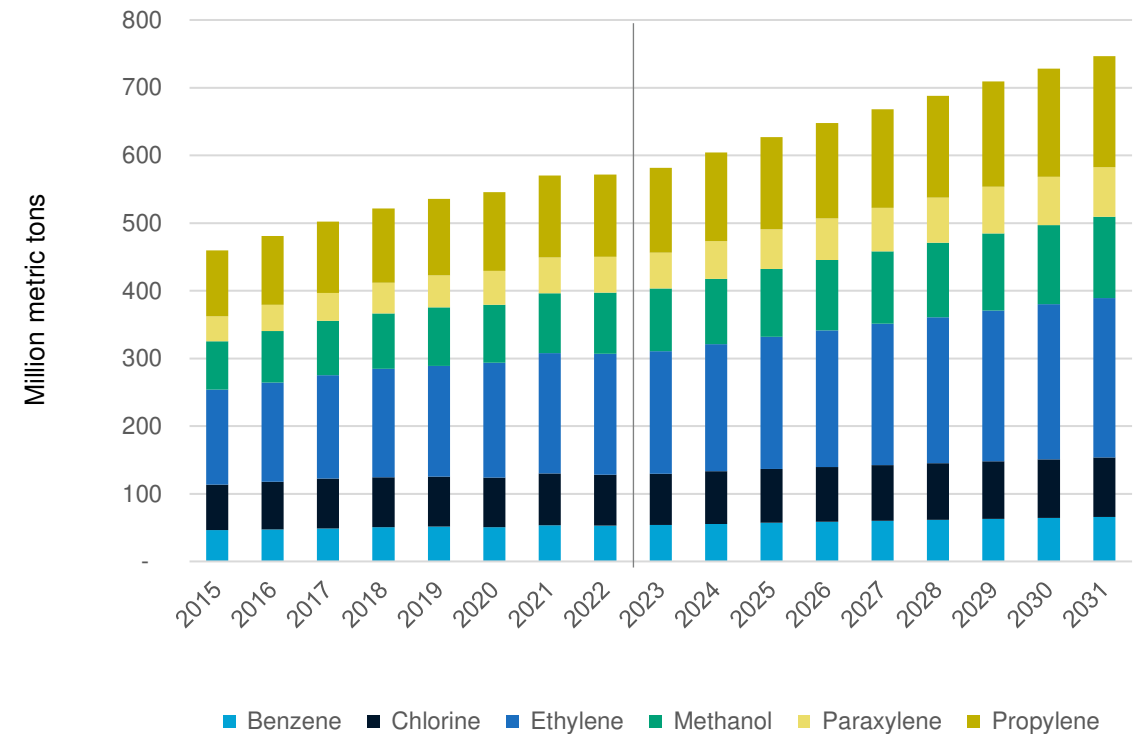
World Nameplate Capacity Utilization (Select Markets)



Source: Chemical Market Analytics by OPIS

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Total Base Chemical Demand by Market



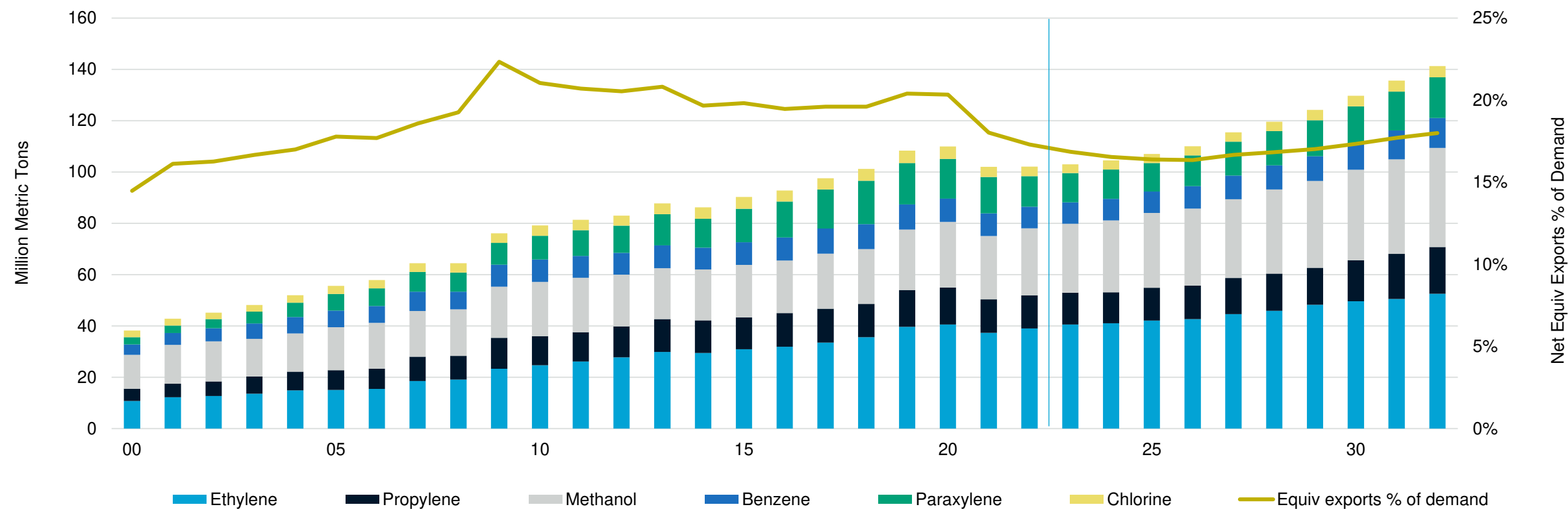
Source: Chemical Market Analytics by OPIS

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# Equivalent exports for major base chemicals are increasing

*Globalization continues, but self sufficiency increases in most regions*

World Base Chemicals Net Equiv. Exports



Source: Chemical Market Analytics by OPIS

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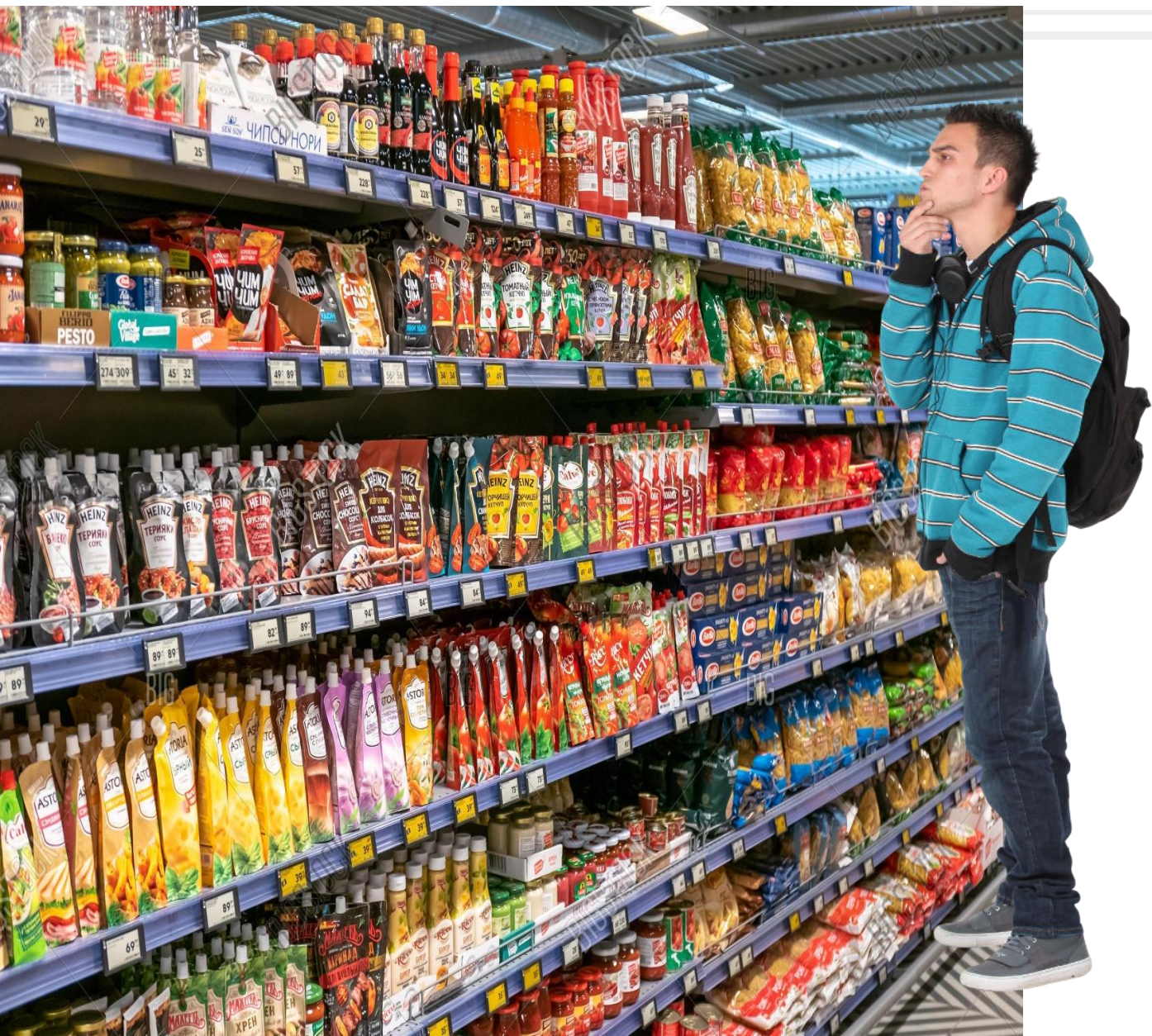


# Sustainability – Looking further out

## The future - balancing “TONS” versus Ideas

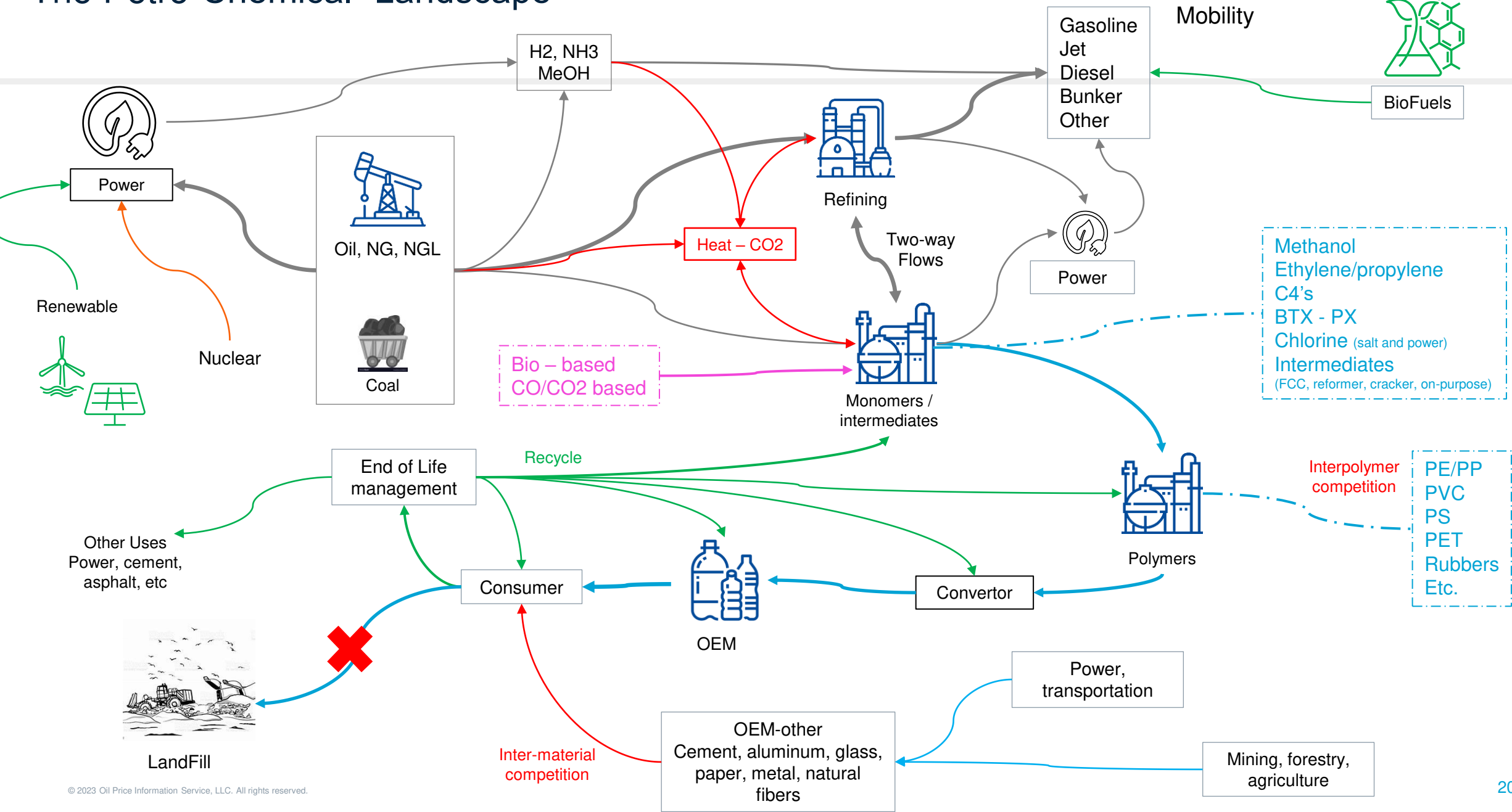
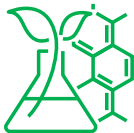


# What is the objective – how do we weigh the outlook?



Packaging	Price	Recyclability	Carbon footprint
Plastic	Pick from cost per unit of volume	med/low	med
Glass		high	high
Metal		high	high
Pouch		low	low

# The Petro-Chemical “Landscape”





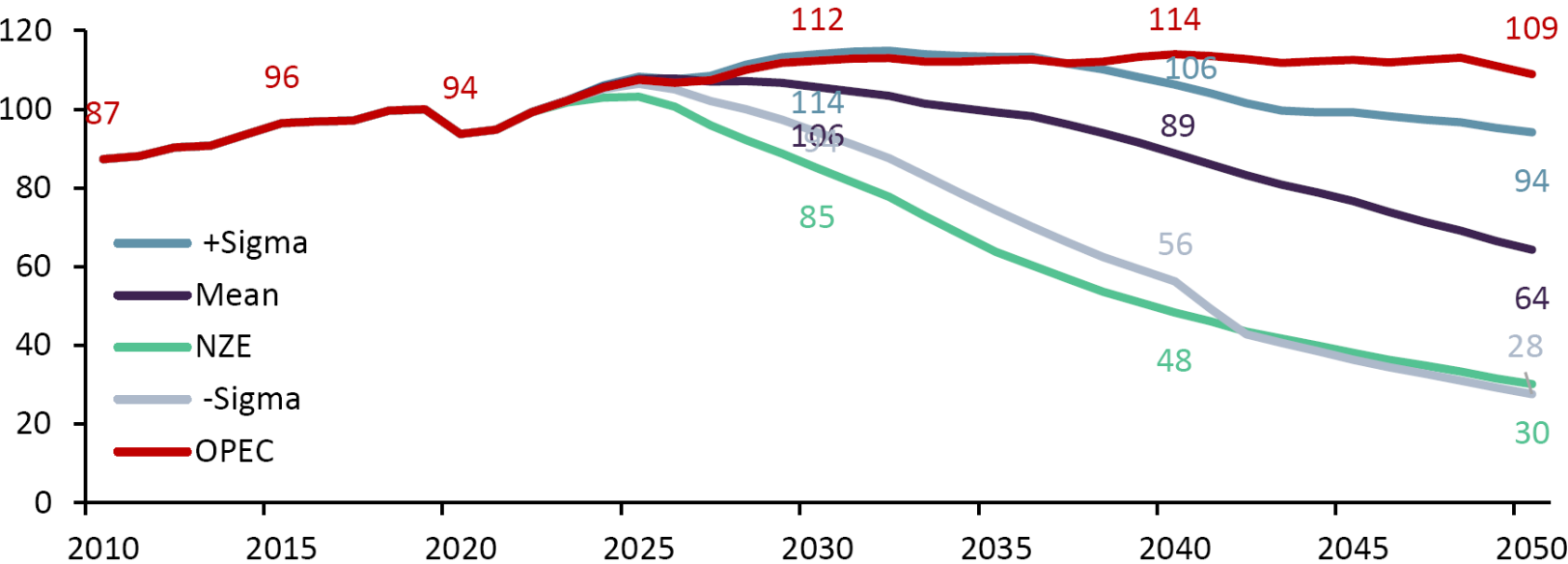
# Total Global Liquids Supply Towards 2050 Varies Significantly Depending on the Trajectory of Decarbonization

**OPEC scenario** sees bullish liquids demand with a gradual increase in demand up until 2045. The aviation, road transportation, and petrochemical sectors will each see oil demand grow by around 4 million bpd between 2021 and 2045. The electric vehicle (EV) fleet approaches 540 million vehicles by 2045, representing more than 22% of the global fleet.

**NZE scenarios** from the IEA sets a narrow pathway for global energy to achieve net zero CO<sub>2</sub> emissions by 2050. Oil demand peaks in 2021 and falls sharply to 30 million bpd in 2050. NZE is a backward-calculated scenario with the main goal being to cap global warming to 1.5°C. The NZE scenario sees major changes in the composition of product demand, requiring refiners to adapt refinery configurations and business models and to invest more heavily in emission reductions, hydrogen, and biofuels.

**Mean scenario (1.9°C)** assumes that the oil peaks at 106 million bpd in 2026 and declines progressively. EV adoption develops according to reasonably risked-down current EV manufacturers' targets. Oil substitution in other sectors develops pursuant to current decarbonization policies.

Global liquids supply (MMb/d)



**+Sigma scenario (2.2°C)** is an upside probabilistic range from the Mean scenario. Oil demand peaks in 2031 at 111 million bpd and declines to 93 million bpd in 2050.

**-Sigma scenario (1.6°C)** is a reasonable downside probabilistic range from the mean scenario. Oil demand peaks at 105 million bpd in 2025 and falls sharply to 22 million bpd in 2050.

Source: Rystad Energy research and analysis

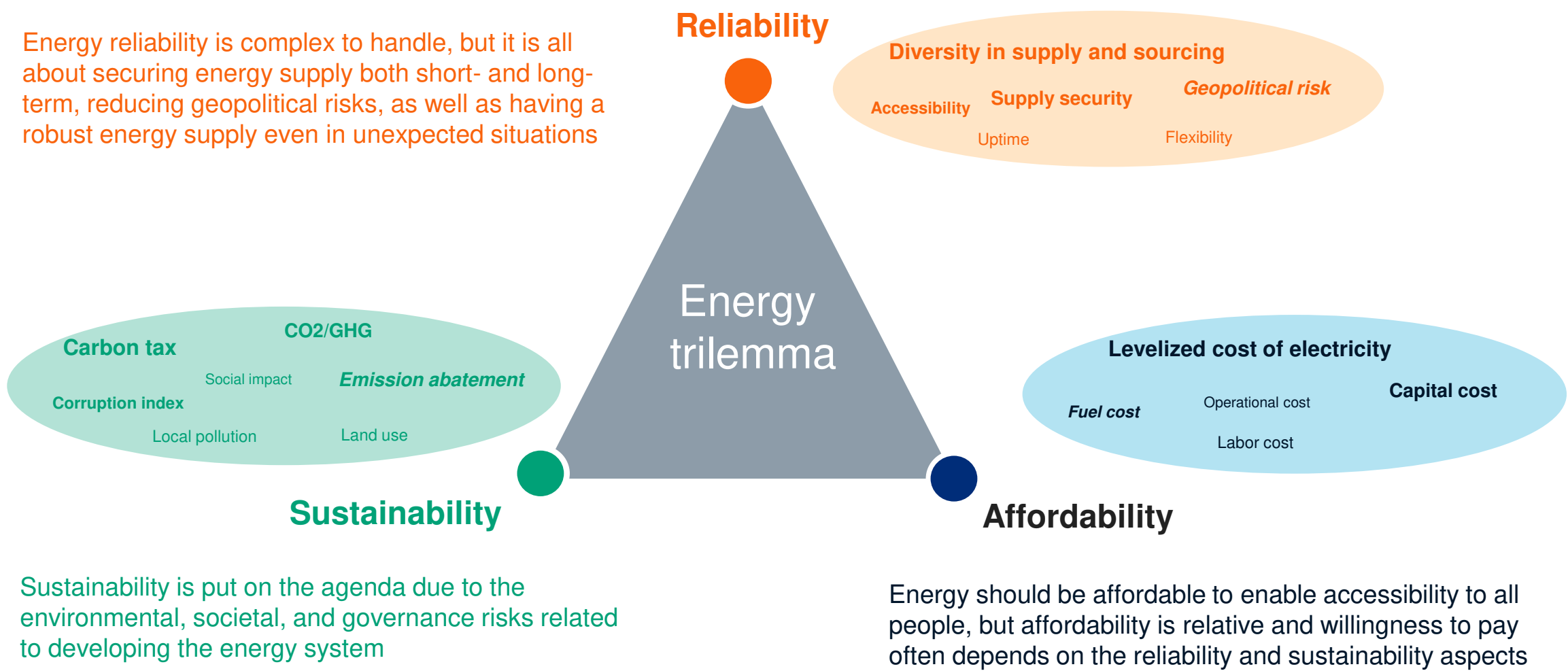
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# Mobility and Refining

## What it means for crude oil to chemicals



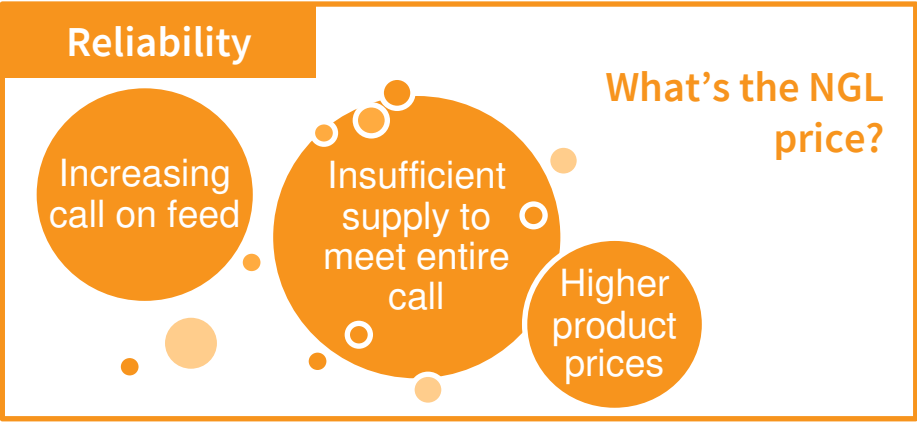
# The World is Facing an Energy Trilemma



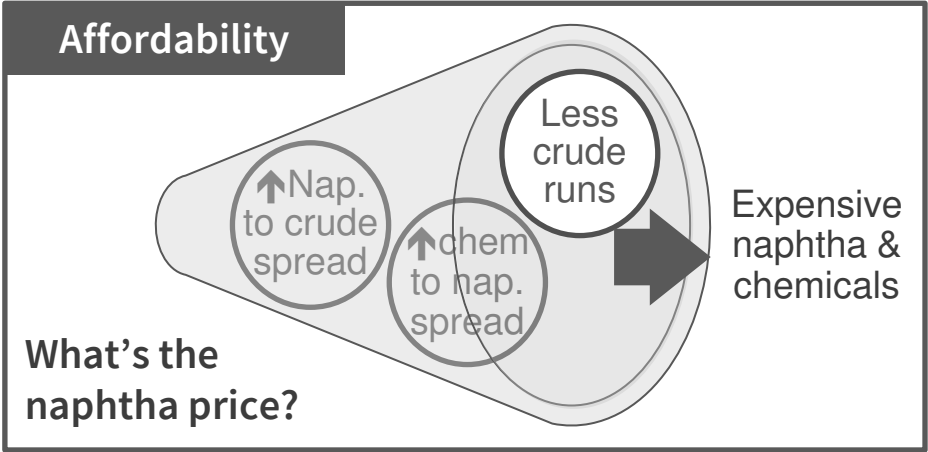
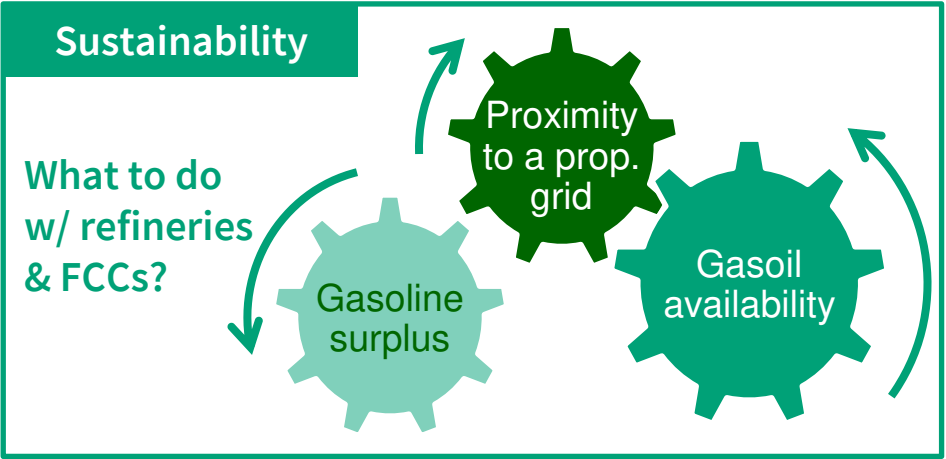
# Petrochemical Industry Faces a similar Trilemma

Industry is stuck between conflicting dynamics within the trilemma:

- 1) demand growth
- 2) feedstock uncertainty

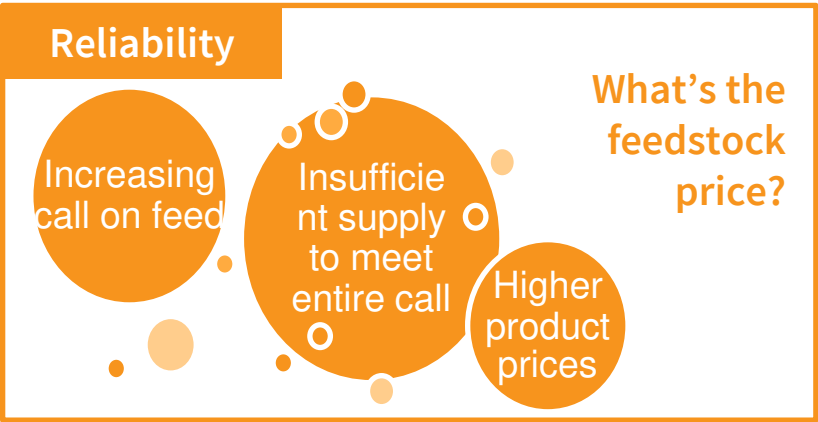


Regardless of the outcome, expect higher prices throughout the chain

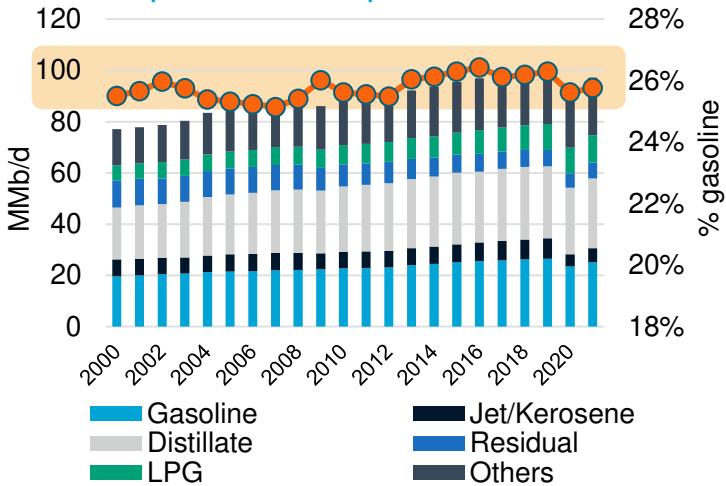


# Accelerated Growth of Hydrocarbons in the Chemical Pool

*Still small relative to fuel, but an important driver of prices*

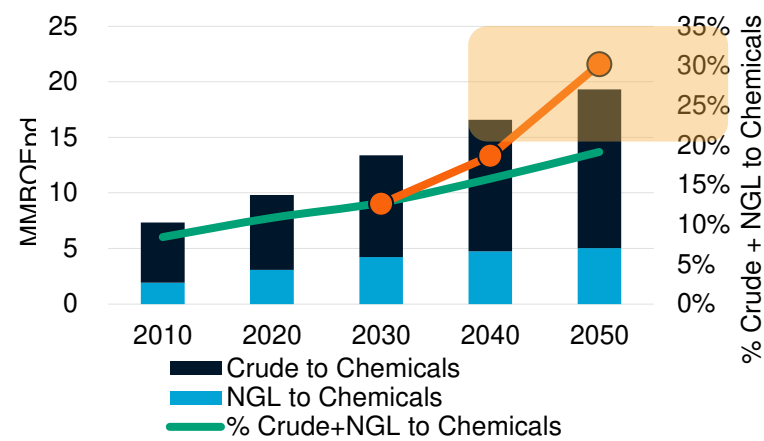


Global liquids consumption

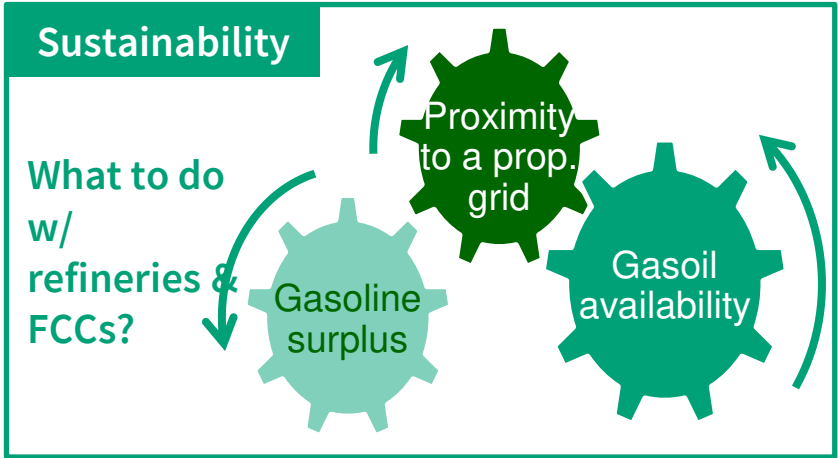


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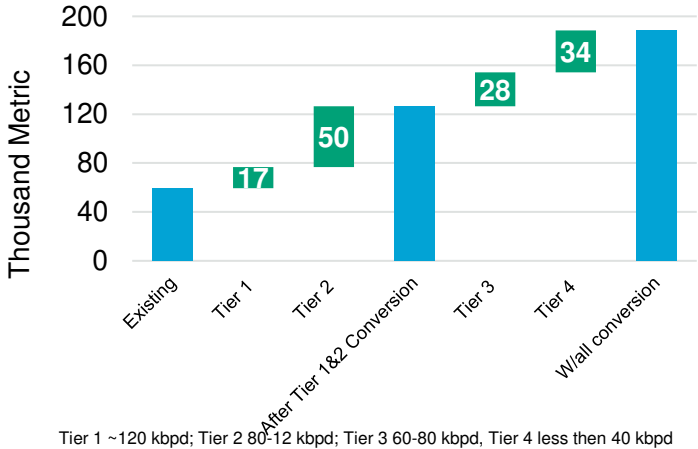
Crude and NGL to chemical use



Source: Chemical Market Analytics by OPIS © 2023 Oil Price Information Service, LLC.

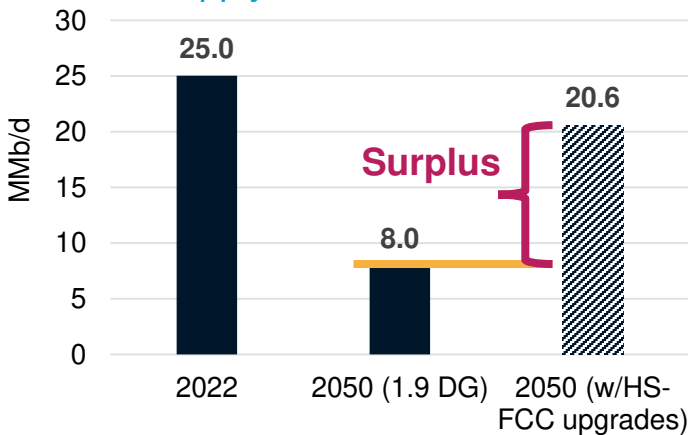


Refinery based propylene capacity creep by FCC



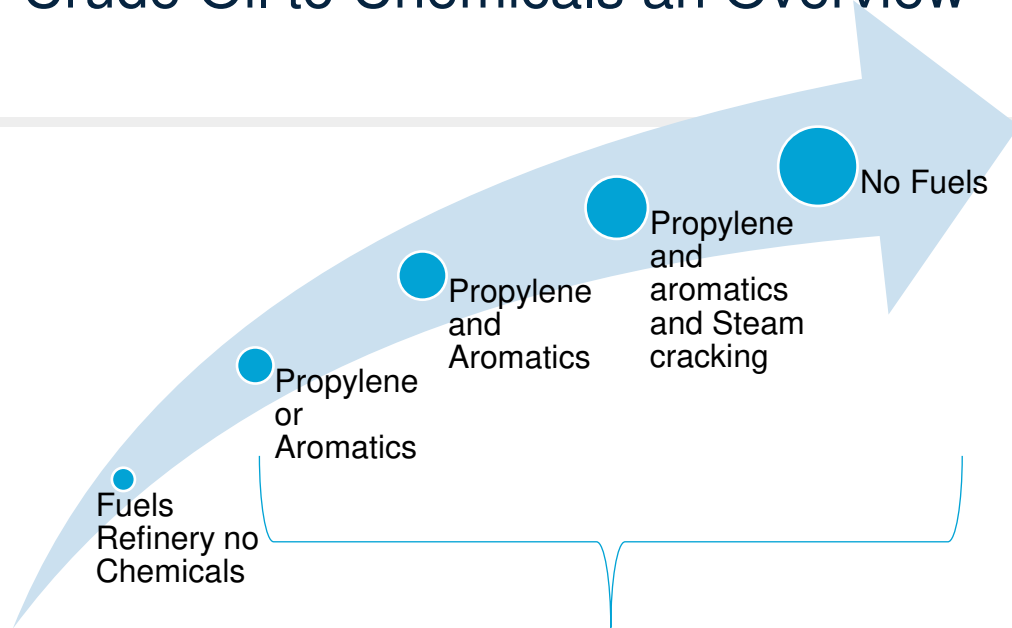
Tier 1 ~120 kbpd; Tier 2 80-12 kbpd; Tier 3 60-80 kbpd, Tier 4 less than 40 kbpd  
Source: Chemical Market Analytics by OPIS © 2023 Oil Price Information

Gasoline supply scenarios

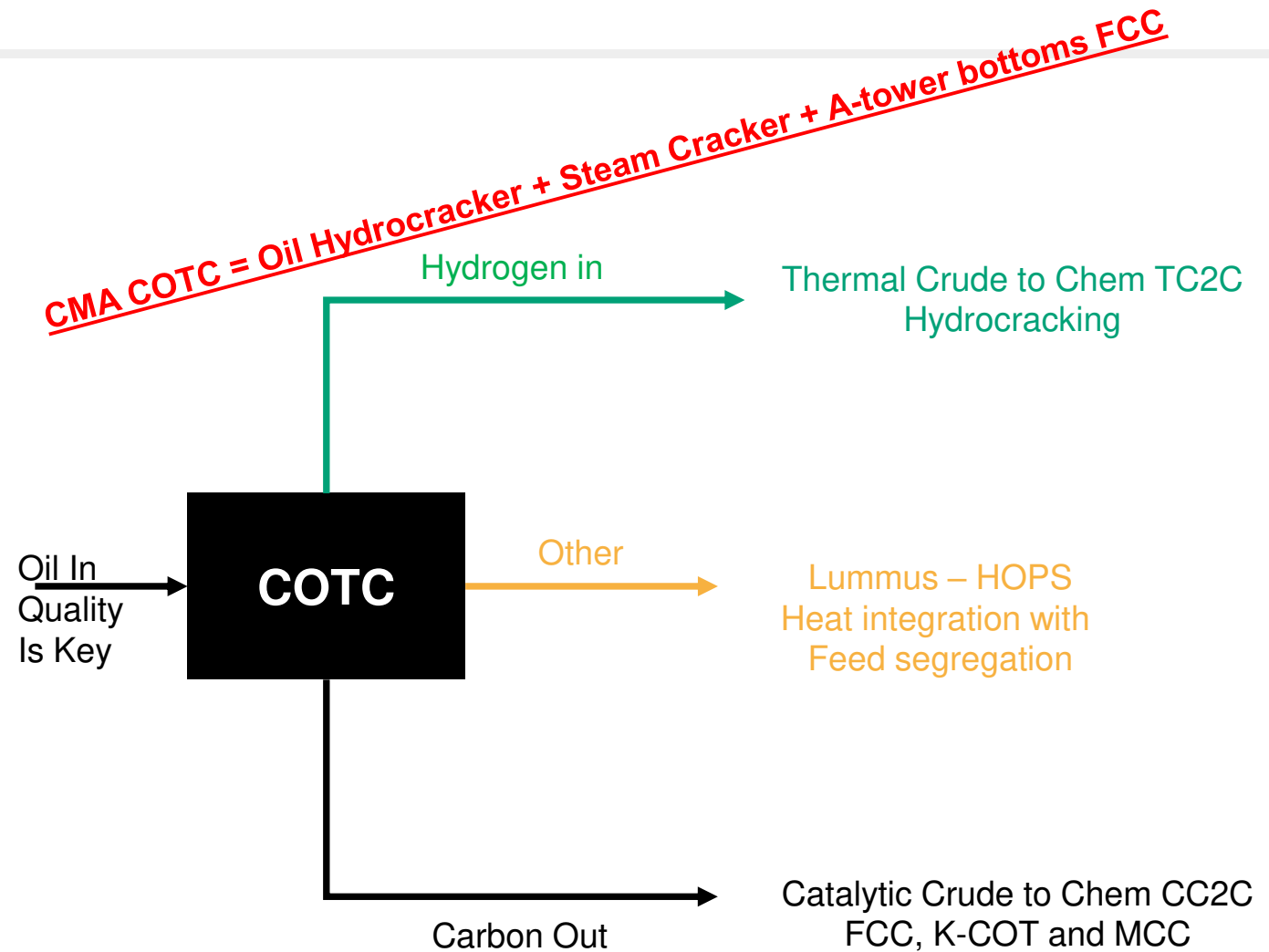
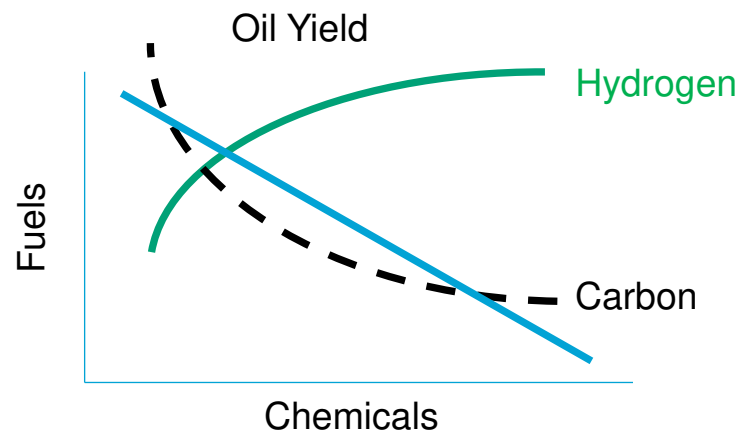


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# Crude Oil to Chemicals an Overview



COTC a matter of Degree  
Chems/bbl of oil input



# COTC – Hypothetical driven by Demand – 23”t” balance

*Installed near population growth centers – high demand growth regions*

World, kta	COTC
20-50	63,600

★	China, kta	COTC
	20-50	28,000

★	SAR, kta	COTC
	20-50	7,300

Indonesia, kta	COTC
20-50	2,500

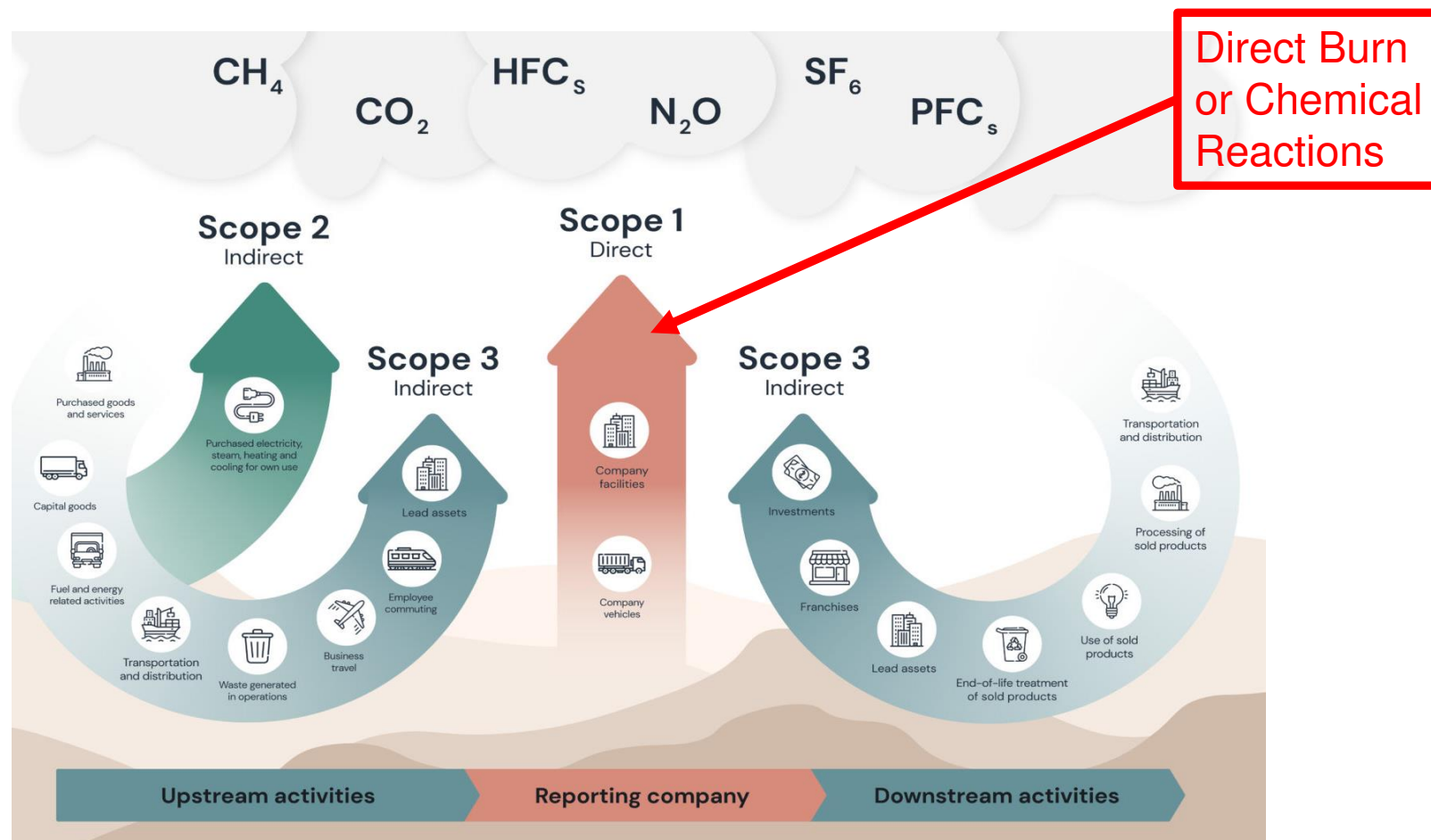
★	India, kta	COTC
	20-50	20,500

Viet Nam, kta	COTC
20-50	3,700

Thailand, kta	COTC
20-50	1,600

# Carbon – Cost competitiveness, what solutions win?

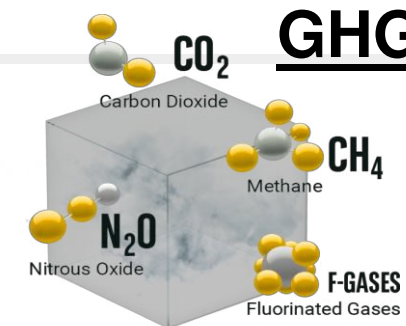
- Scope 1 – Reporting Company manage direct energy burn and to some extent chemical reaction related CO2 (chemistry improvements)
- Scope 2 – Reporting Company to manage CO2 with electricity provider to address CO2 from power generation (or own co-gen to be managed → scope 1).
- Scope 3 upstream – Reporting Company has limited control, some level of influence, but get what comes from those providers.
- **Likely impact from CO2 management will be incorporated in price of those inputs from third parties (scope 2 & 3).**





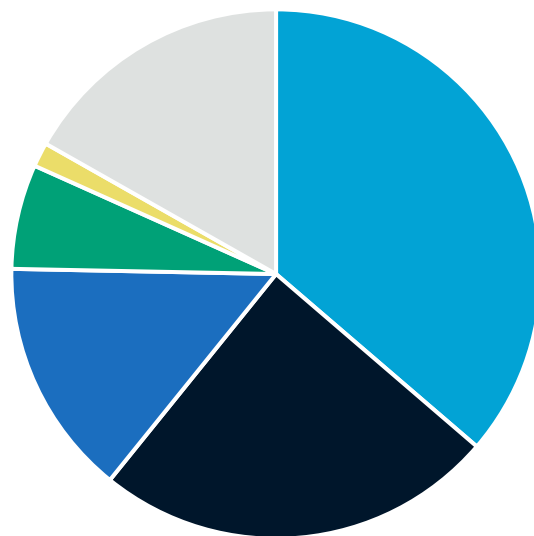
# CO<sub>2</sub> by source – eliminating fossil fuels a challenge

Transportation/Industry/residential/refining to electric.....then electric to renewable??



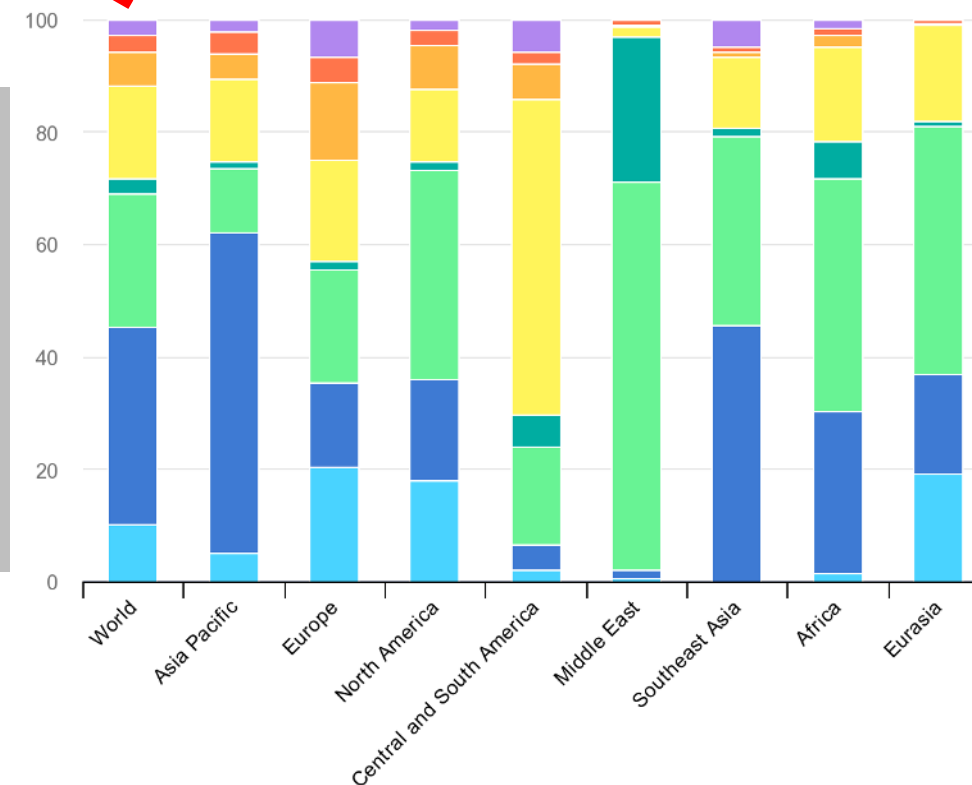
**60% of Base Electricity is Fossil Fuel Based!**

CO<sub>2</sub> Global Emission Breakdown



■ Power ■ Transportation ■ Industry ■ Residential ■ refining ■ other

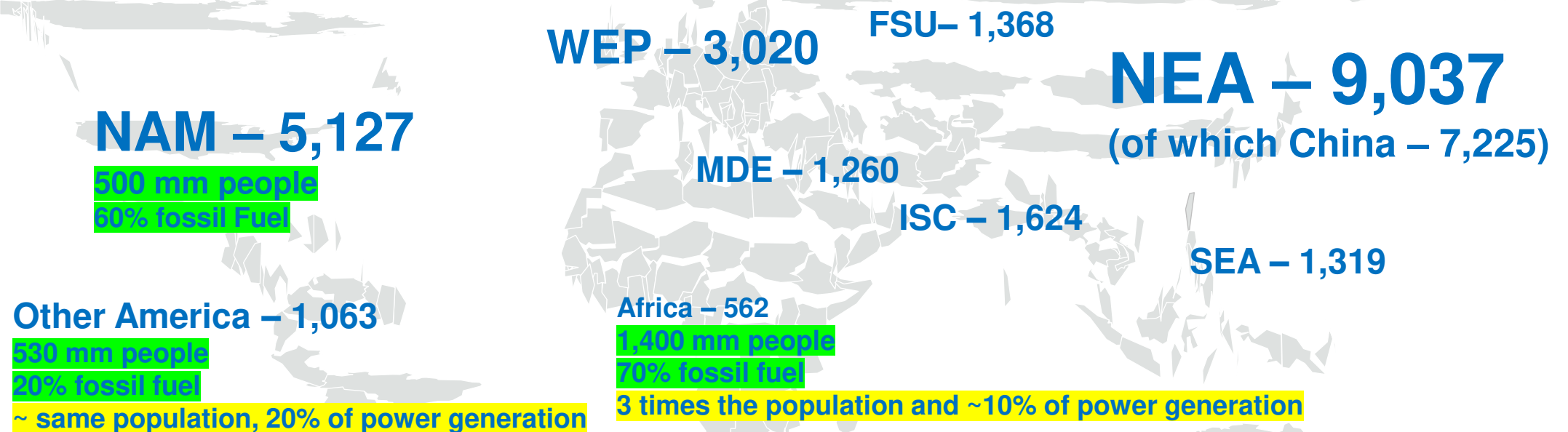
•Other Renewables  
•Solar PV  
•Wind  
•Hydro  
•Other non-renewables  
•Gas  
•Coal  
•Nuclear



# EIA – 2019 power Generation (B kWh) all Sources

25% of Countries make up 94% of Power generation

**Long Journey to convert Base load to non-fossil Fuel – in backdrop of population and consumption per capita changes**



**Then converting other CO2 sources to electric brings another set of challenges**

# CO<sub>2</sub> From Steam Cracking: Small Subset of Global Emissions

Where best to focus efforts on CO<sub>2</sub>? Petchem first mover but competes with other CO<sub>2</sub> sources for solutions.

## 2021 Estimated CO<sub>2</sub> Emissions Steam Cracking

■ Global ■ Industry ■ Chemical ■ Steam Cracking



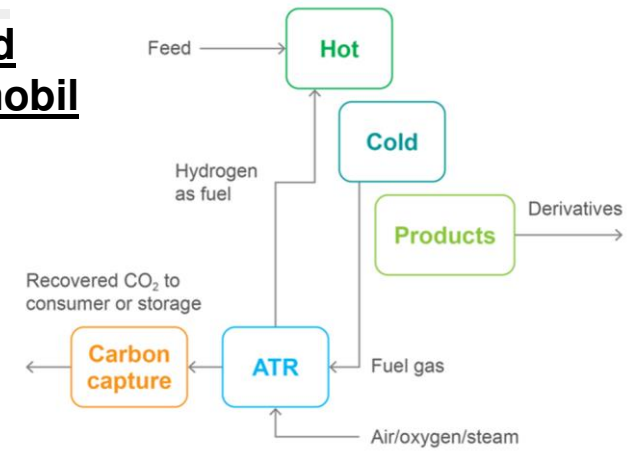
Industry = Iron/steel, Chemical, Construction, mining, non-ferrous metals, mineral non-metal, other



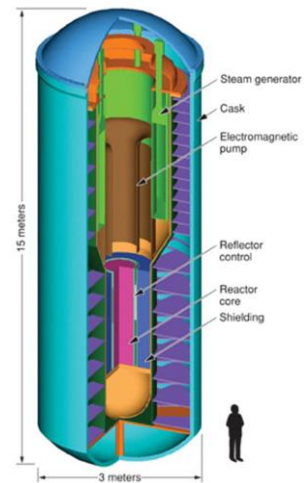
### Retrofit CC/CCUS

**Ineos ARA cracker**  
**30% more energy efficient.**

### **Dow and Exxonmobil**

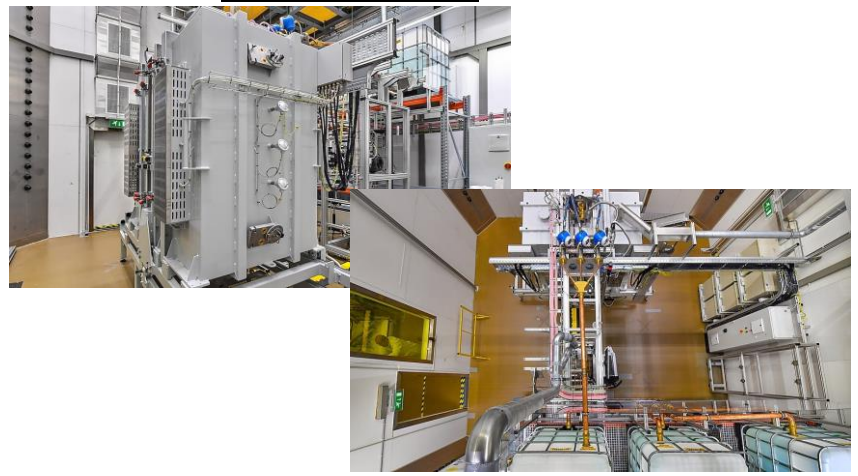


### Rotary Cracking Super Sonic Cracking



### **Modular nuclear plant** **Dow - XEnergy**

### **Electric furnaces (green power?)** **Dow-Shell/BASF-Sabir-Linde /** **TechnipEnergies**



# Net zero journey

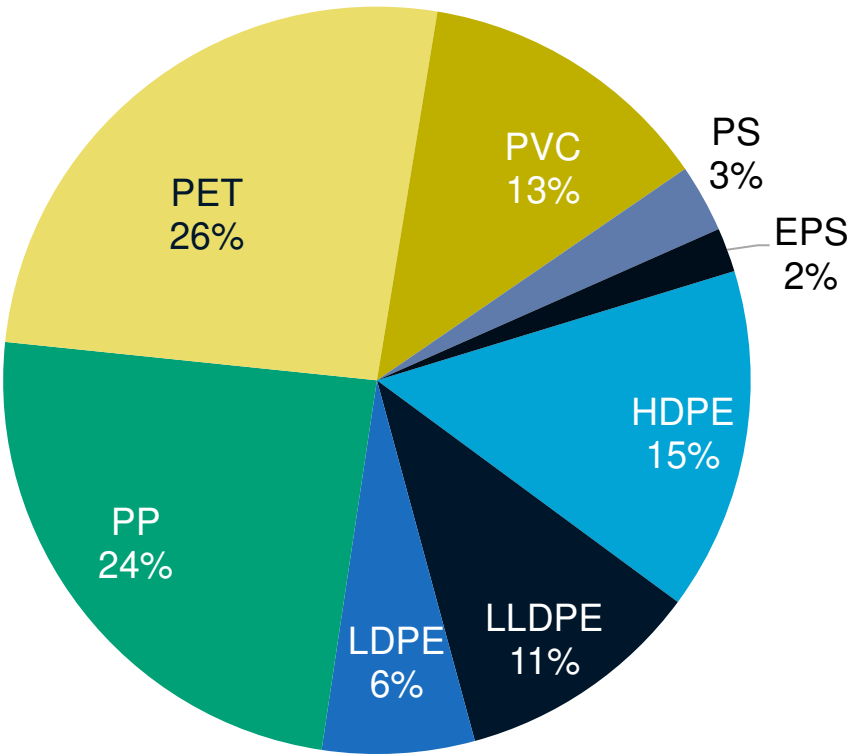


- Policy – ambitions are high, reality is small percentage of global GHG is in countries with laws enacted ~10-12%
- Process emissions – varies by technology, vintage, application of best available technologies
- Price: Many ways to set:
  - Energy Trading systems
  - Taxes
  - Investments
  - Offsets
- Pathways is key both for interpolymer and inter-material

# Transition to Circular Plastics

# Large Proportion of Plastics Consumed in Packaging but Limited Volume in Single Use Food Service & Retail Bags

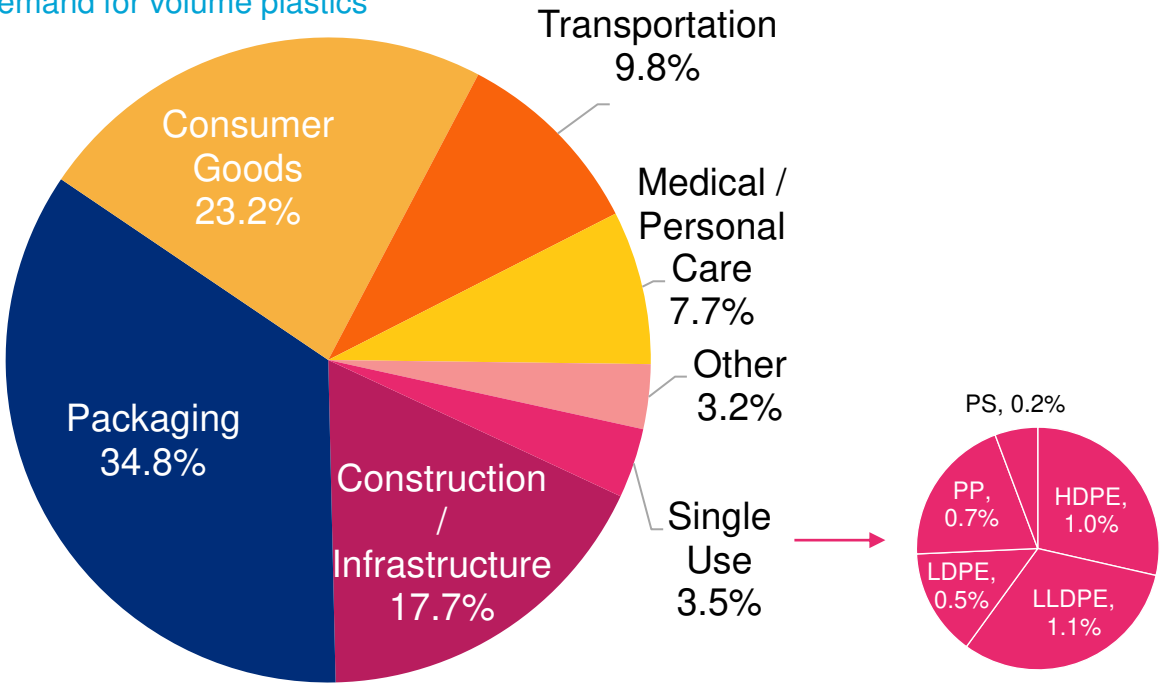
Global demand for volume plastics



Source: Chemical Market Analytics by OPIS

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Global demand for volume plastics

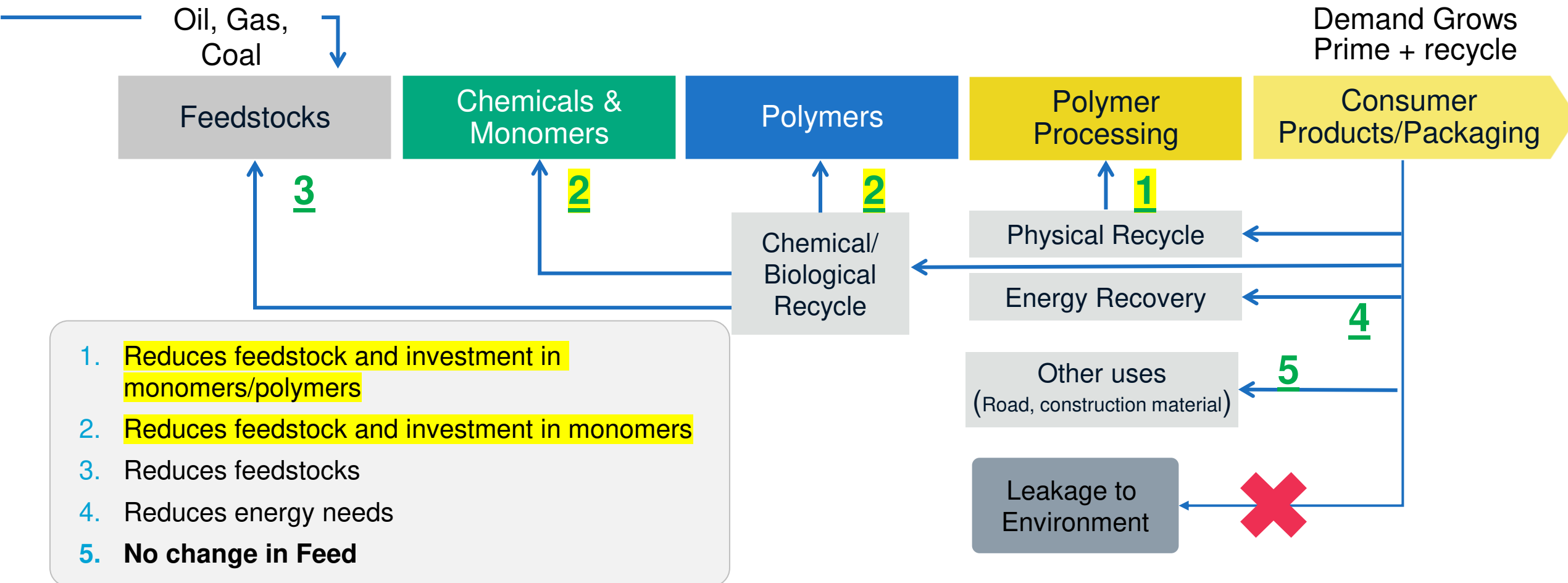


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• Other includes wide range of durable and non-durable industrial applications

# Plastics Circularity – Investment Perspective

Key point, where is the loop closed for chain segment demand growth impacts?

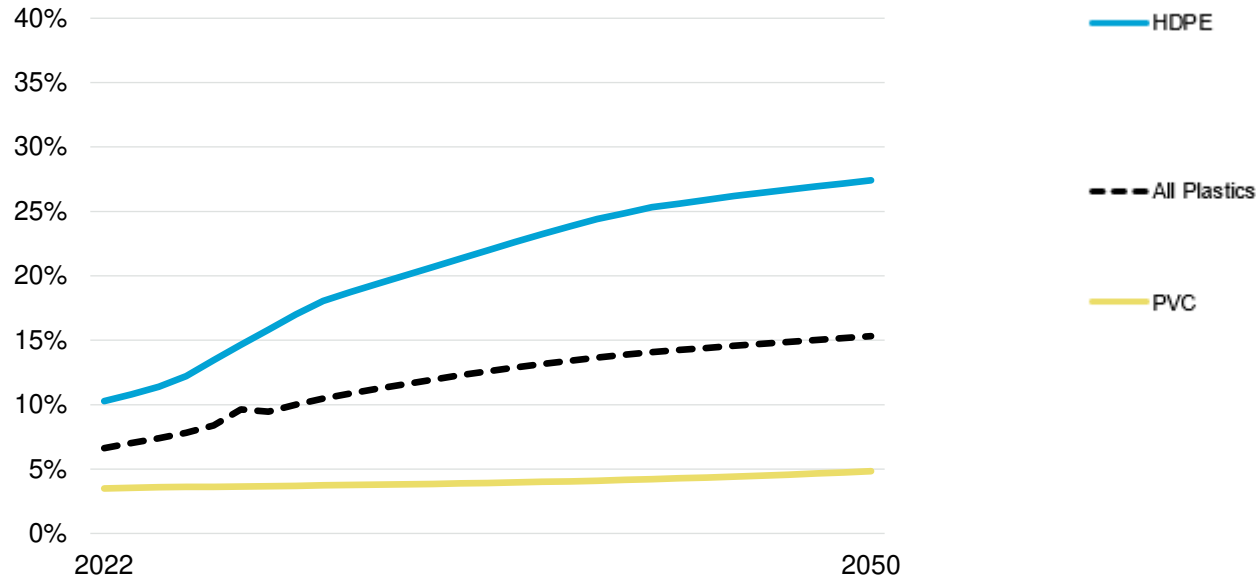




# PCR as Percent of Total Demand for Volume Polymers

*Has been part of the polymer supply picture and will likely grow.*

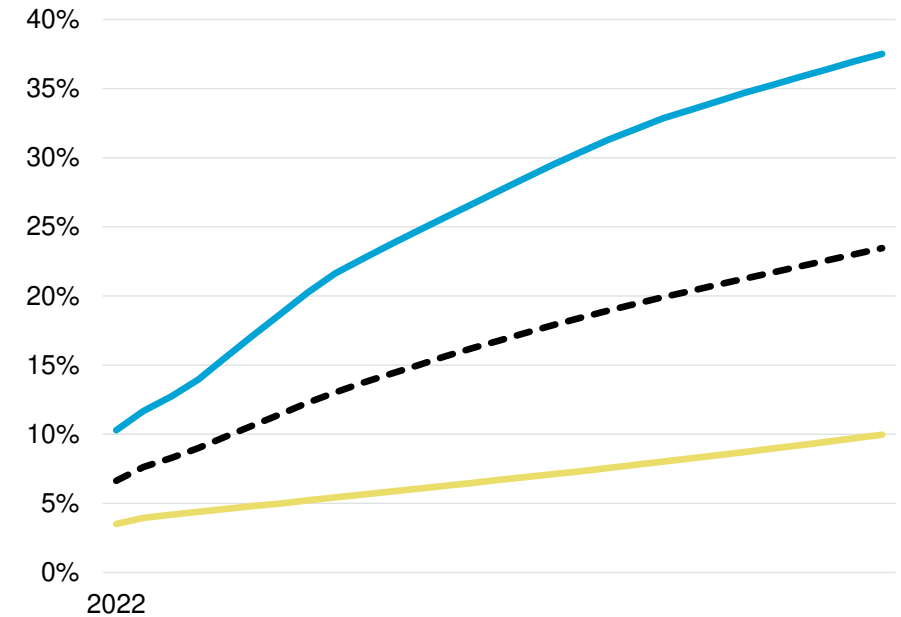
PCR as % of Total Demand - Global - Incremental Progressive Base Case



Source: Chemical Market Analytics by OPIS

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PCR as % of Total Demand - Global - Green



Source: Chemical Market Analytics by OPIS

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All other polymers are “bounded” by HDPE and PVC

Still a challenge to recycle all that is produced

# Alberta

# Different Regional Dynamics Drive Opportunities and Threats

## *Six key investment metrics*



	United States	West Europe	Middle East	Asia	Western Canada
Secure Energy Position	Advantaged	Disadvantaged	Advantaged	Importer / China coal as feed	Advantaged
Integration	Feed to Intermediates	Challenged	Feed to Intermediates	Intermediates to end use	Feed to intermediates
Demand	Build to Export	Moderate	Build to Export	High	Build to Export
Investment Drivers	Feedstock Advantage	Sustainable / Specialization	Feedstock Advantage	Proximity to Demand and low cost labor	Feedstock Advantage
Sustainable Policies	Accelerating (IRA)	Lead	Energy / Derivative planning	Mixed	Lead, CO2 pipe hub
Trade Challenges	Sanctions	CBAM / EPR/ Net Zero	Exporter	China Import Restrictions	Over the Mountains or into the US



CHEMICAL MARKET ANALYTICS

BY OPIS, A DOW JONES COMPANY

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