McKinsey & Company

MATERIAL ECONOMICS

From Ambition to Action

EPCA 2023 Opening Leadership Forum

Vienna, 26 September 2023

The EU chemicals sector historically has done well – despite structural disadvantages

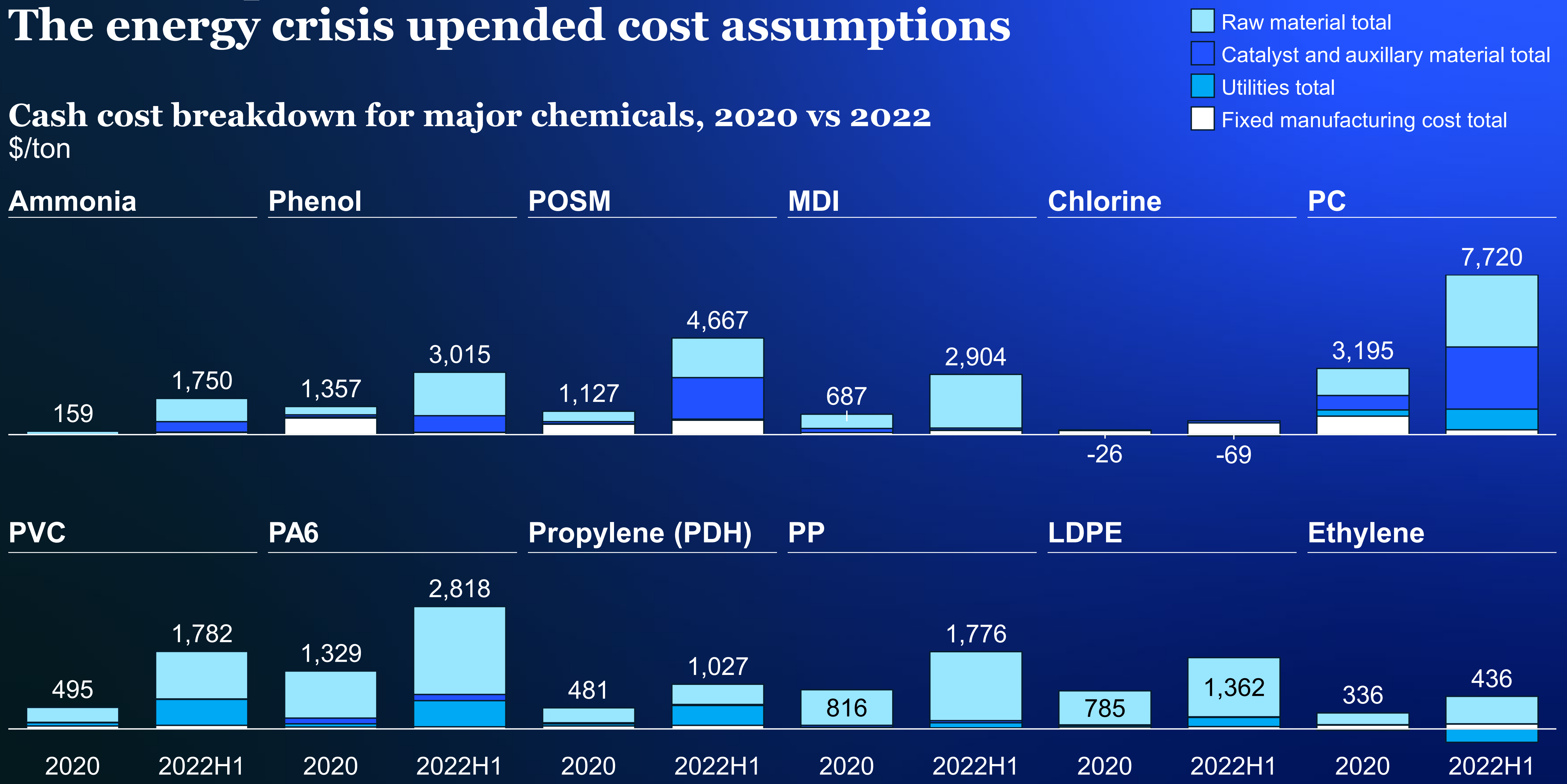
Chemicals total return to shareholders

$ (index Jan 2000 = 100)

Source: Capital IQ; MSCI; S&P;Datastream & Corporate Performance AnalyticsTM, McKinsey

Inflection point 1:
The energy crisis upended cost assumptions

Cash cost breakdown for major chemicals, 2020 vs 2022
$/ton



Note: Note: Oil price 2020 $/bbl 42, 2022H1 107; Natural gas 2020 $/mm BTU 3, 2022H1 32; Caustic $/ton 2020 230, 2022H1 811

Source: McKinsey Chemical Insights analysis

Inflection point 2: A "hockey stick" in sustainability ambitions

The scientific view: close to net-zero emission by 2040

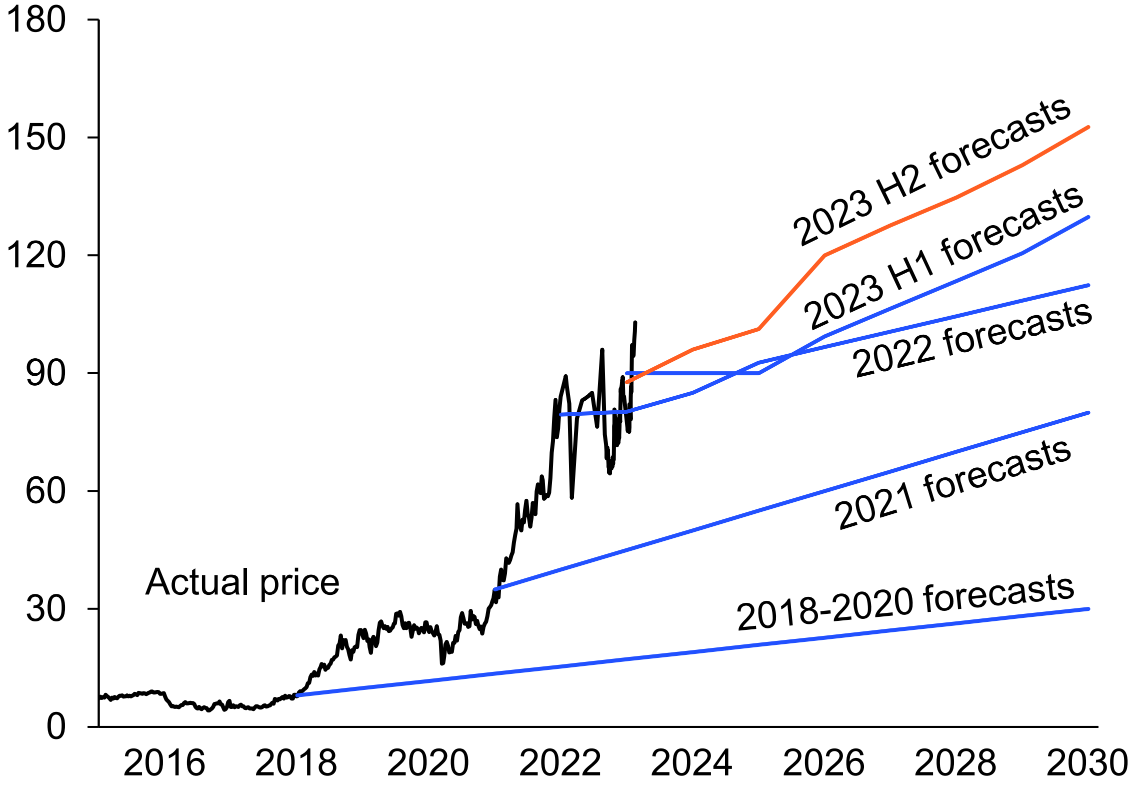
"The Advisory Board recommends keeping the EU's greenhouse gas emissions budget within a limit of 11 to 14 Gt CO_2e between 2030 and 2050. Staying within this budget requires emission reductions of 90–95% by 2040, relative to 1990."

Source: European Scientific Advisory Board on Climate Change, 'Scientific advice for the determination of an EU -wide 2040 climate target and a greenhouse gas budget for 2030–2050', June 2023

The business implication: *'CO_2 unaffordable by the late 2030s'*

EU carbon price and forecasts

USD per t CO_2



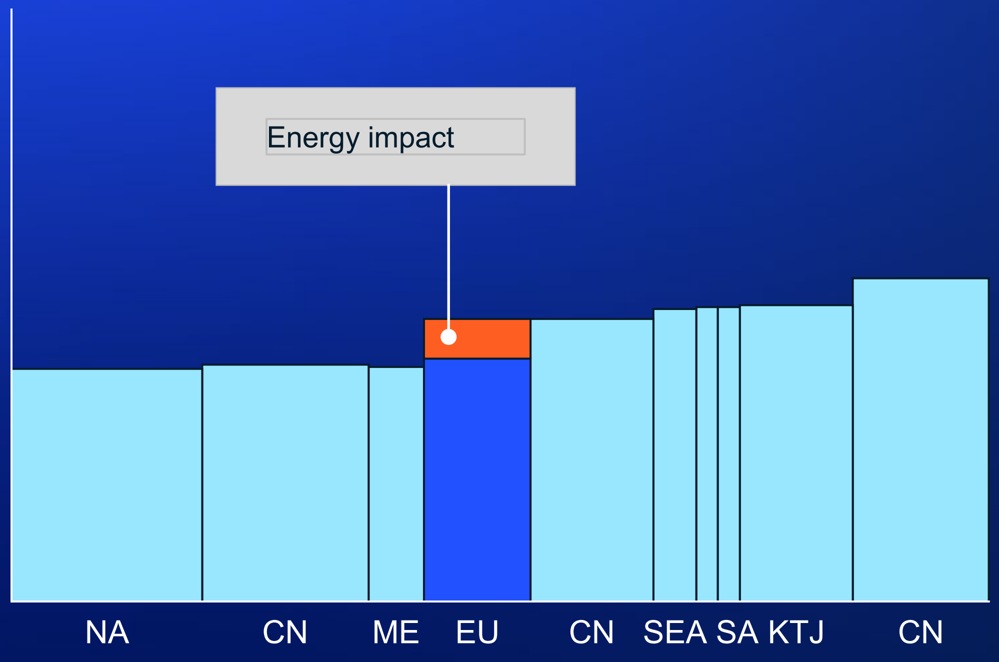
Source: EEX and ICE data; Material Economics analysis based on various analyst reports

Cost of energy, carbon, and CBAM impacts differ by chain

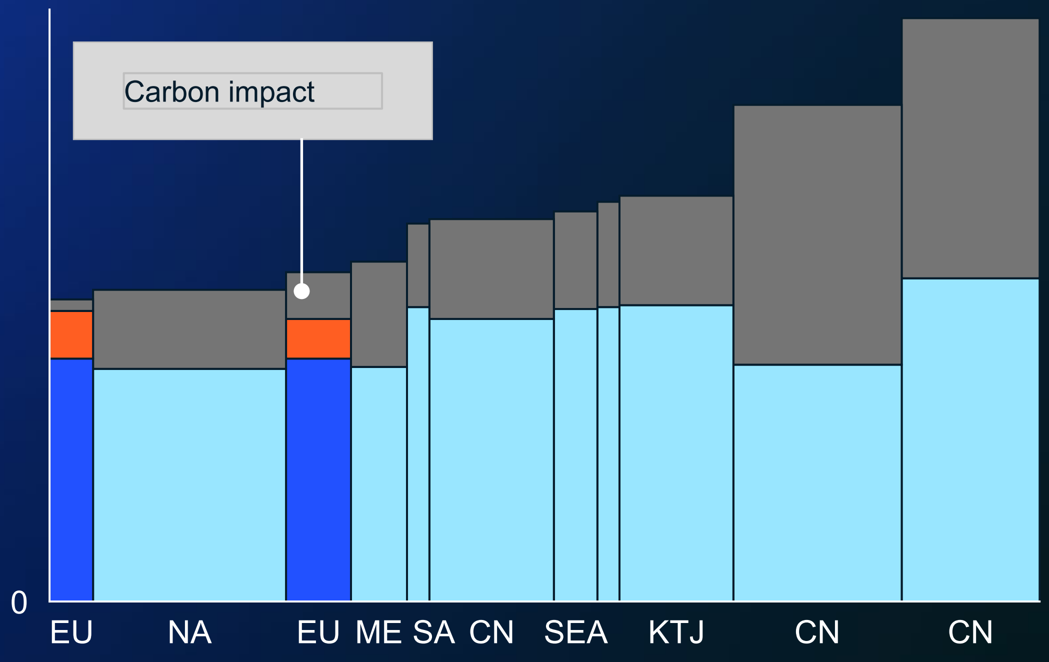
PVC example

PVC global cost curve FOB in 2030
$/ton and Mt capacity

Energy cost could strike against exports…



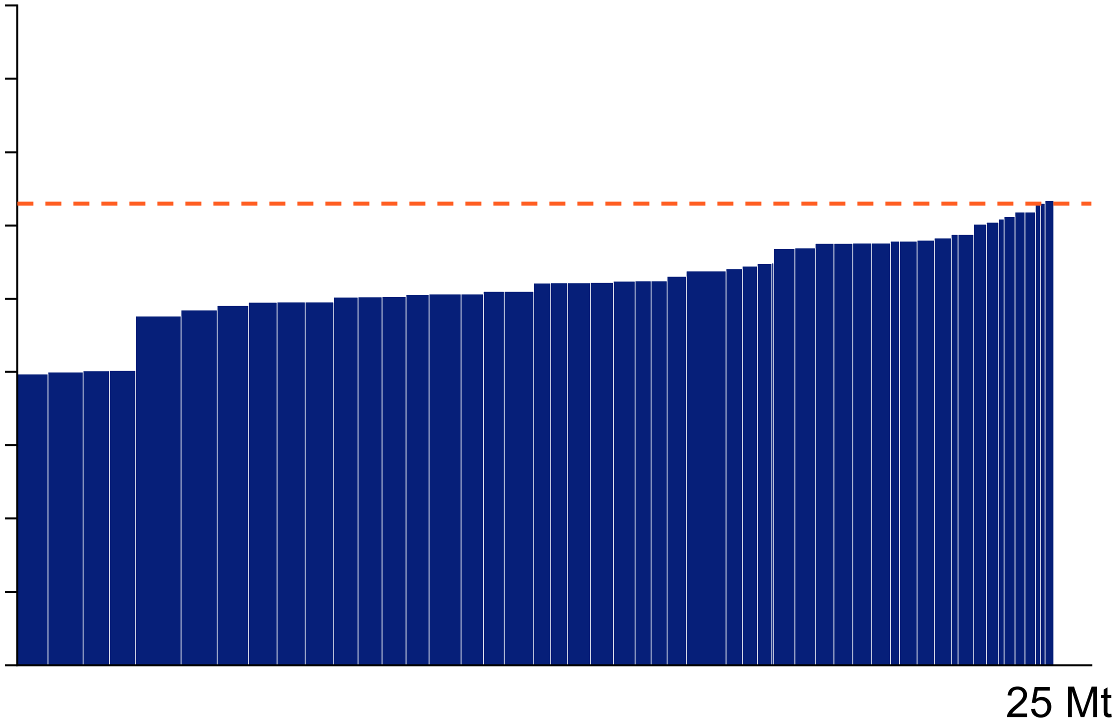
…but CBAM could protect against imports?



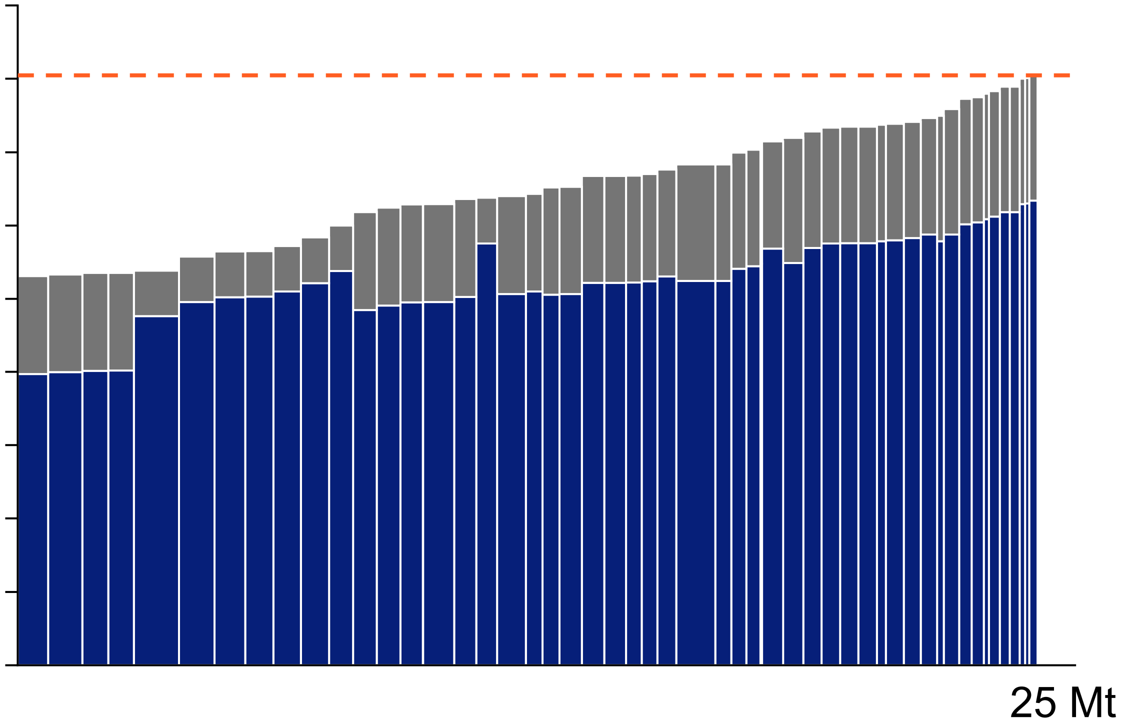
Source: CMA OPIS; McKinsey Chemical Insights

Fundamental impact on industry dynamics – and a clear first-mover advantage

Western Europe ethylene cost curve
65 USD/bbl
USD / t ethylene



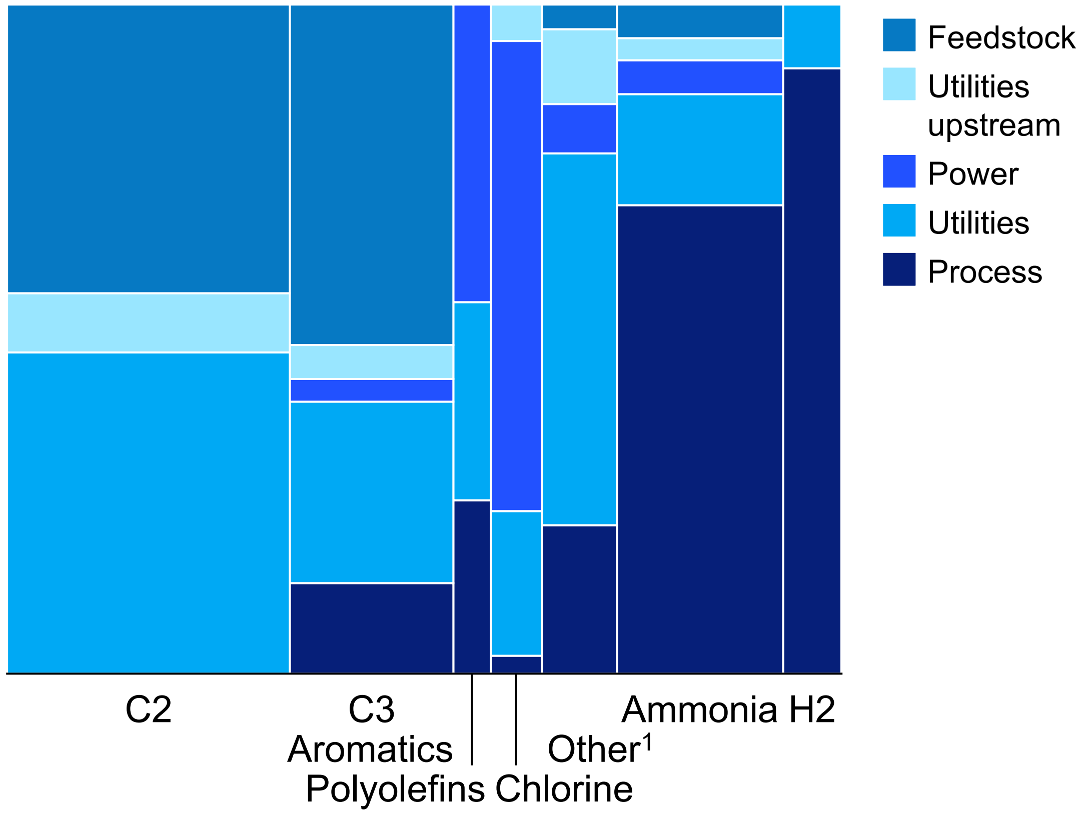
Western Europe ethylene cost curve
at 65 USD/bbl and 150 EUR/t CO_2
USD / t ethylene



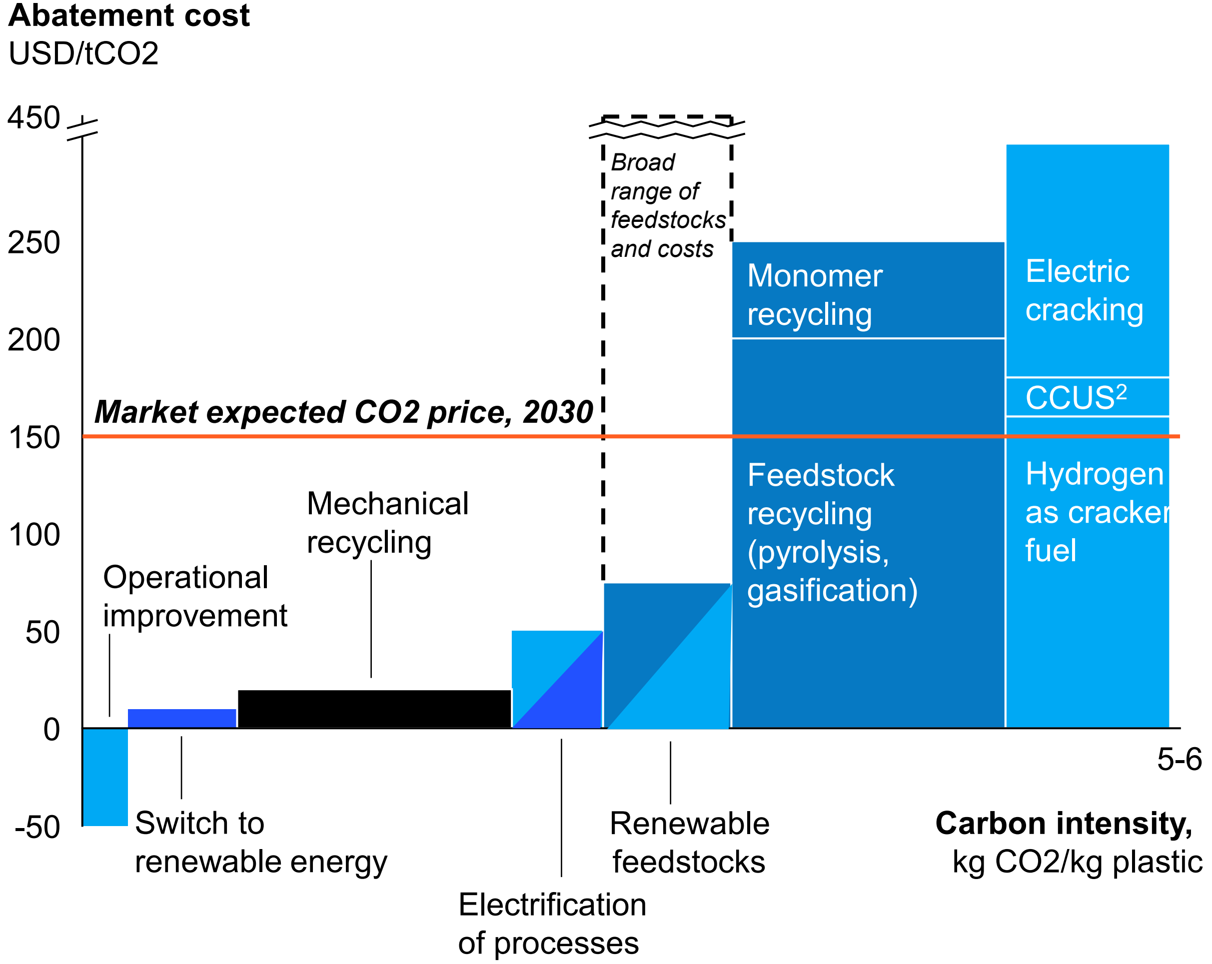
Source: McKinsey Chemicals Insights; Material Economics Sustainable Chemicals Model

A competitive carbon cost position requires sophisticated management of multiple strategies

163 Mt CO_2 in direct emissions and inputs



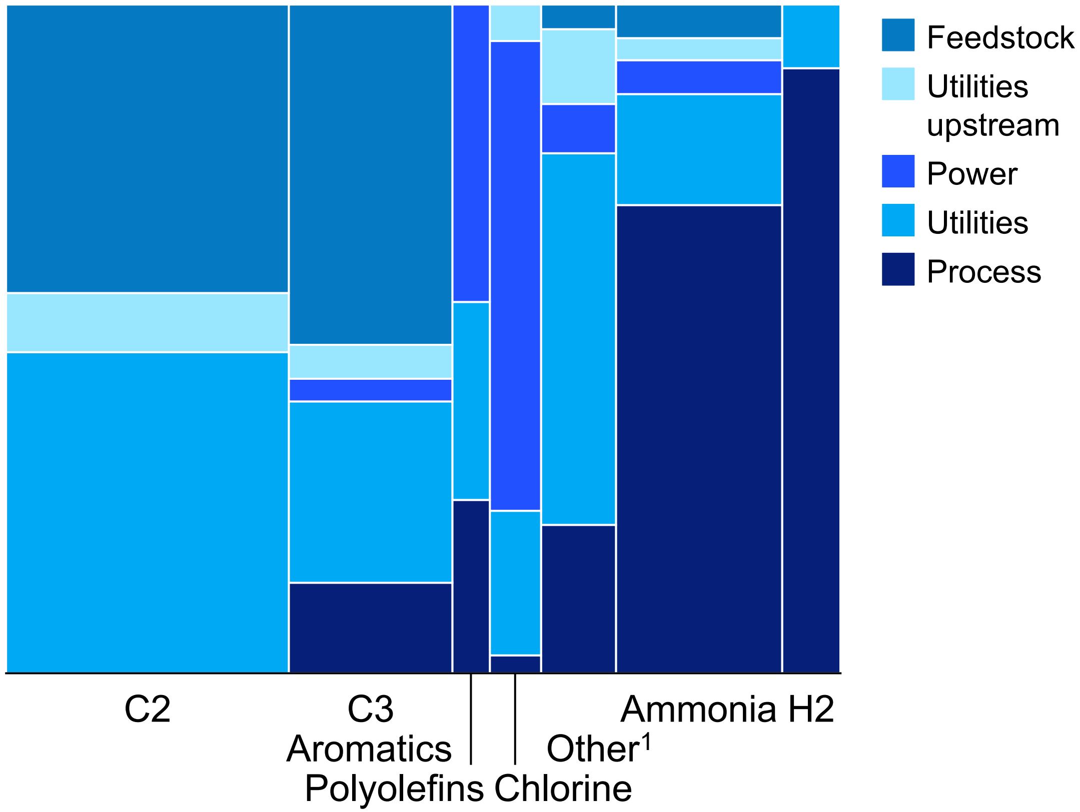
Example: Plastics CO_2 abatement



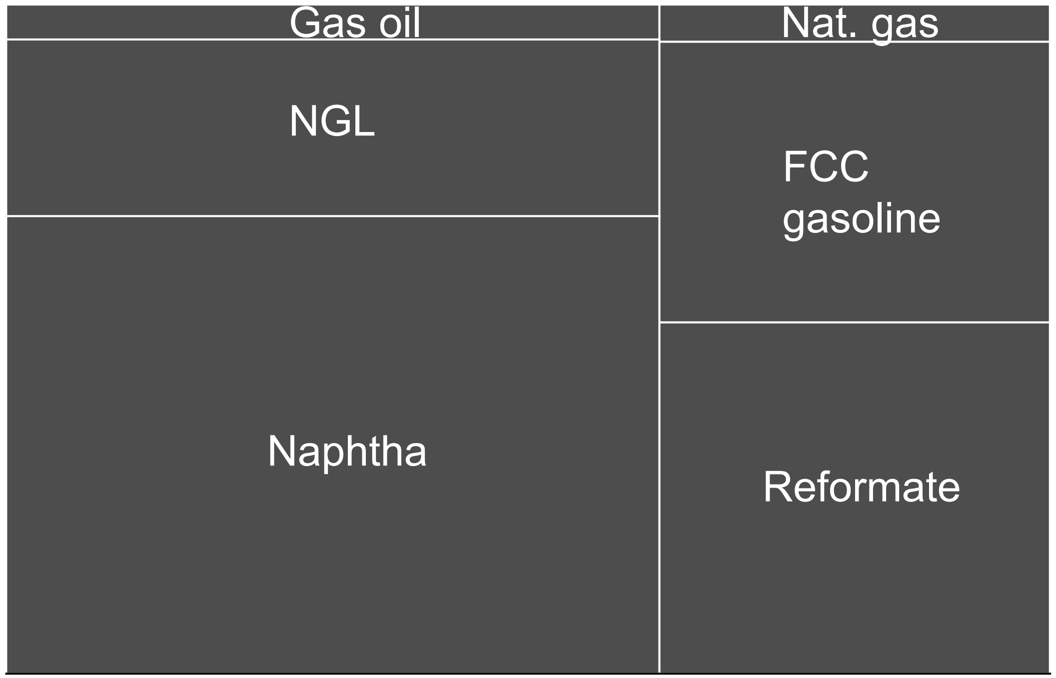
Note: Ethyleye Oxide, MEG, Methanol, PET, PTA, PVC, Styrene

Feedstock: time to take a complete view of carbon

163 Mt CO_2 in direct emissions and inputs



220 Mt CO_2 equivalent in feedstock carbon

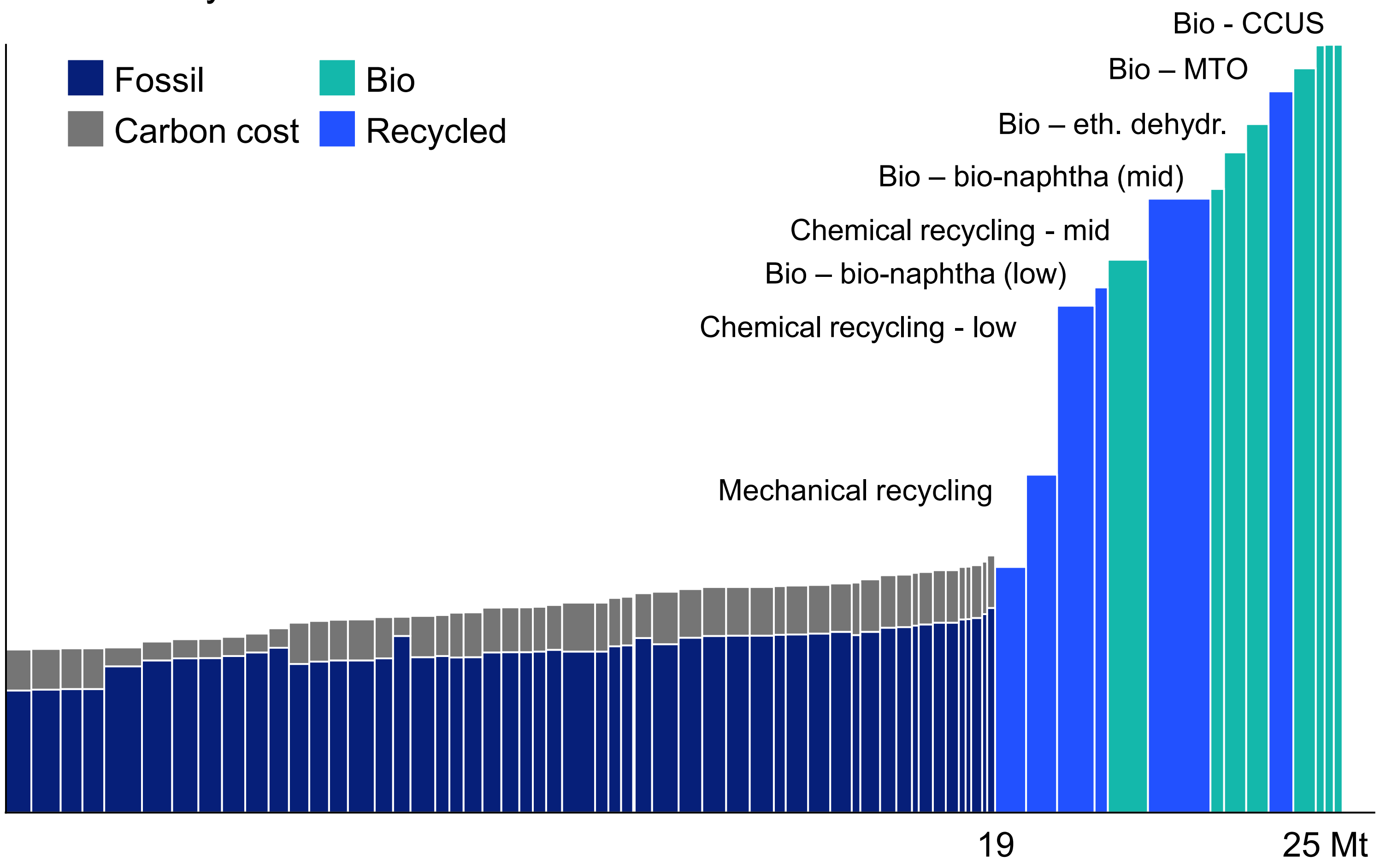


1. Ethyleye Oxide, MEG, Methanol, PET, PTA, PVC, Styrene

Mandates for non-fossil carbon fundamentally shift available value pools

Illustrative 2035 view - if current regulatory proposals are implemented

Western Europe ethylene cost curve at 65 USD/bbl
USD / t ethylene



Source: McKinsey Chemicals Insights; Material Economics Sustainable Chemicals Model

"By 2030, at least 20% of carbon used in products should come from sustainable non-fossil sources"

-- 2021 Communication on Sustainable Carbon Cycles

"packaging shall contain the following minimum percentage of recycled content…" – 10-30% in 2030, 50-65% in 2040

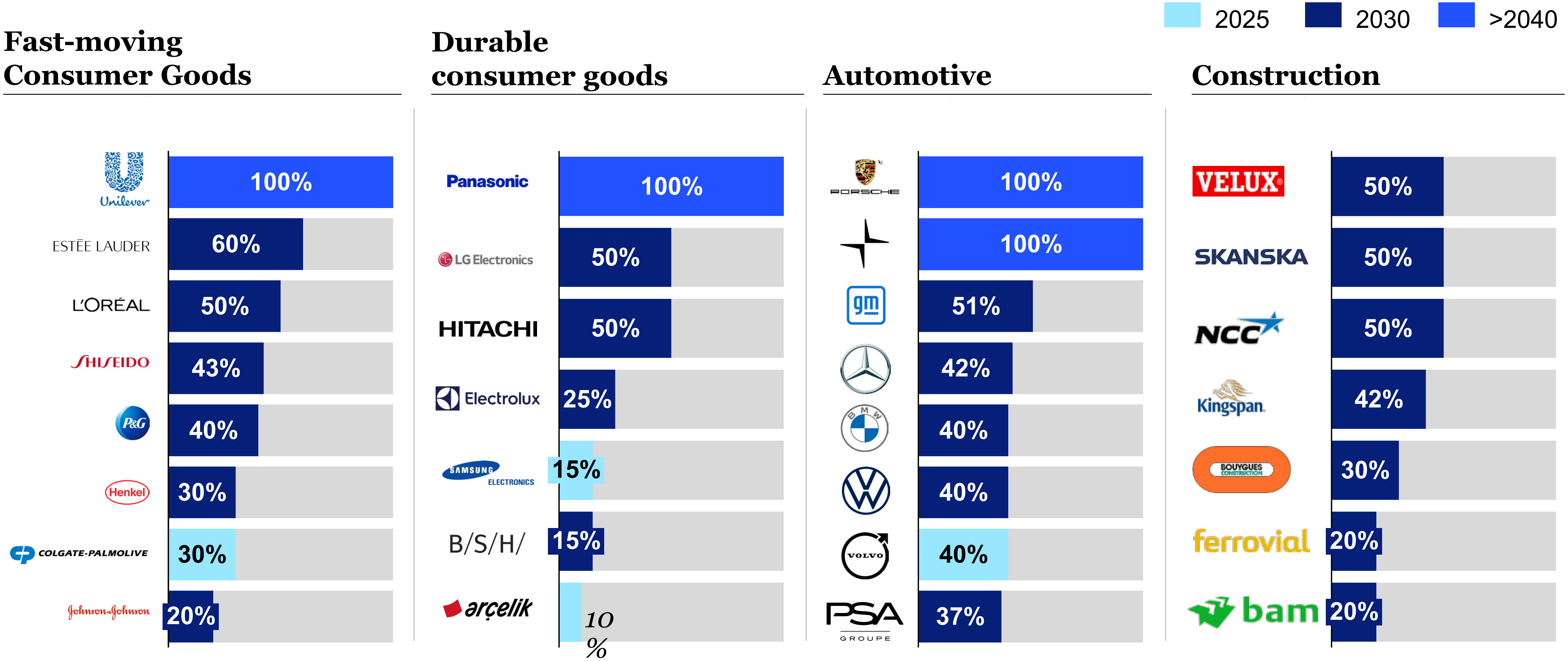
-- 2022 Packaging and Packaging Waste Regulation (draft)

"each vehicle type contains at least 25% of plastic recycled from postconsumer plastic waste, "

-- 2023 End of Life Vehicle Directive (draft)

Customers seek 30–40% value chain CO_2 cuts by 2030

Scope 3 emission reduction targets as of 2022



Source: Company announcements

Green premia emerging but still nascent

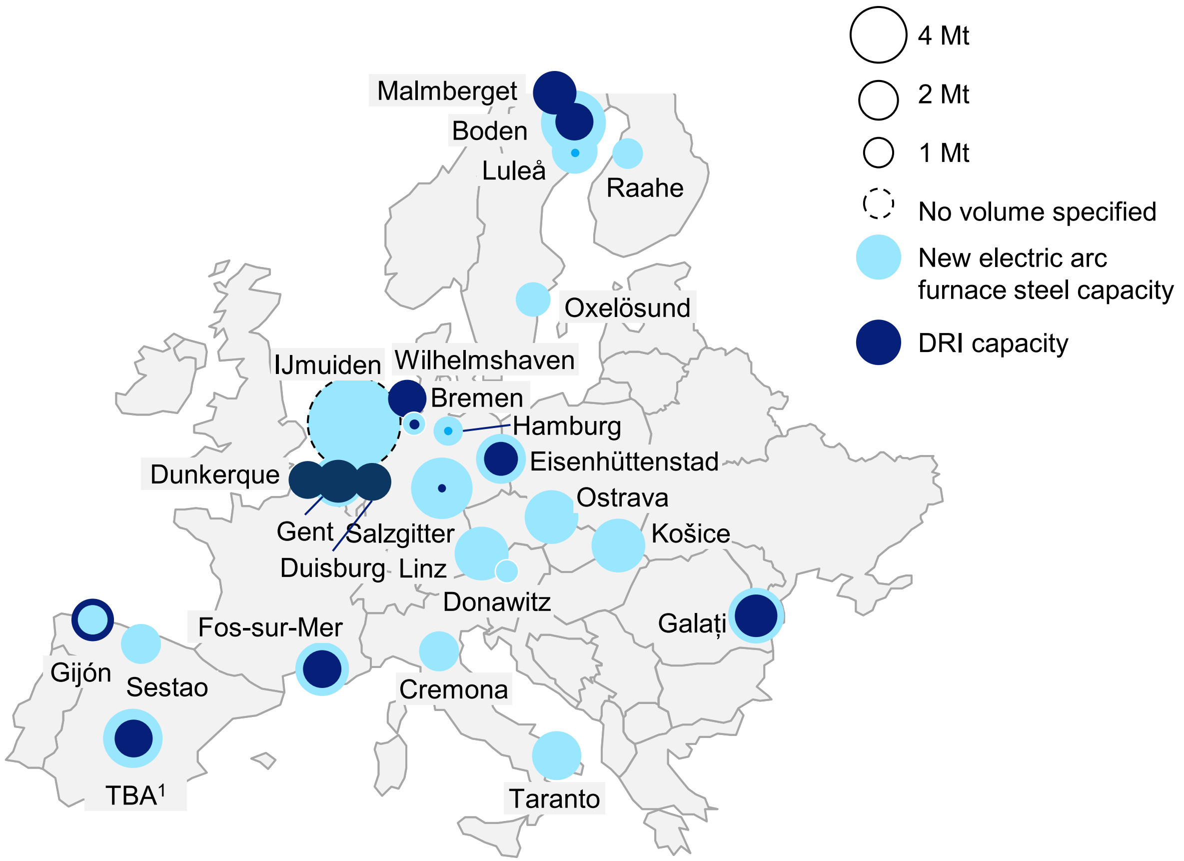
Examples

Green Premia vs. standard products		**Bio-alcohol ethoxylate**	**rPET**	**Bio-PE**	**PLA**	**MGDA/ GLDA**	**Natural rHDPE**
		0%	0-10%	25-50%	100-150%	50-100%	100%+
Economic drivers	**Common markers**						
Demand for more sustainable products with incremental value	Consumer/packaging applications Brand-owner commitments Regulation		✓	✓	✓	✓	✓
Approximate volume (2022)[1,2], kta		~2000[3]	~800	~200	~450	~75	~400
Higher cost compared to conventional polymer production routes	Structurally higher feedstock cost More complex production route Smaller scale (to date)			✓	✓		
Supply constraint for sustainable products	Feedstock constraint Capacity limitations	(✓) Temporary		(✓) Temporary	(✓) Temporary	✓ Consolidated industry structure	✓
Price setting Mechanism		Fossil parity	Fossil parity	Cost recovery	Cost recovery	Value-based	Fly-up

1. Recycled based on US market only
2. Bio-PE volume reflects only sales from Braskem
3. Estimated from split of natural vs. crude-based detergent alcohol production, applied to overall alcohol ethoxylate volume.

Lessons from steel and from sustainable fuels

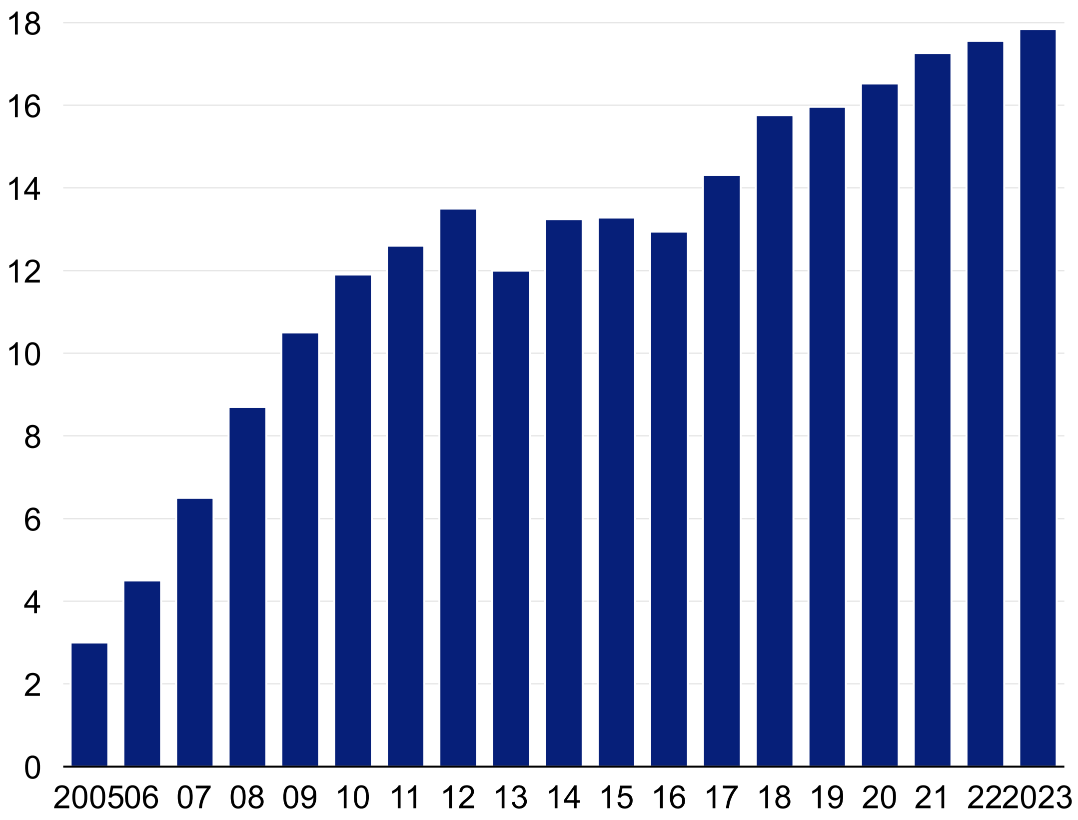
Steel: Sudden new equilibrium as 60 million tonnes of new H2 and scrap capacity announced



Source: Company announcements

Fuels: steady growth for 20 years

EU biofuels, million tonnes of oil equivalent per year



Source: Eurostat; USDA

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To succeed in this new landscape, companies need to embed energy and carbon in all aspects of strategy

01 Operations

02 Cost position

03 Portfolio

04 Feedstock

05 Commercial

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Thank you

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