Market outlook - refining in unprecedented times

Back to the Future – how to avoid a 1980s rerun?

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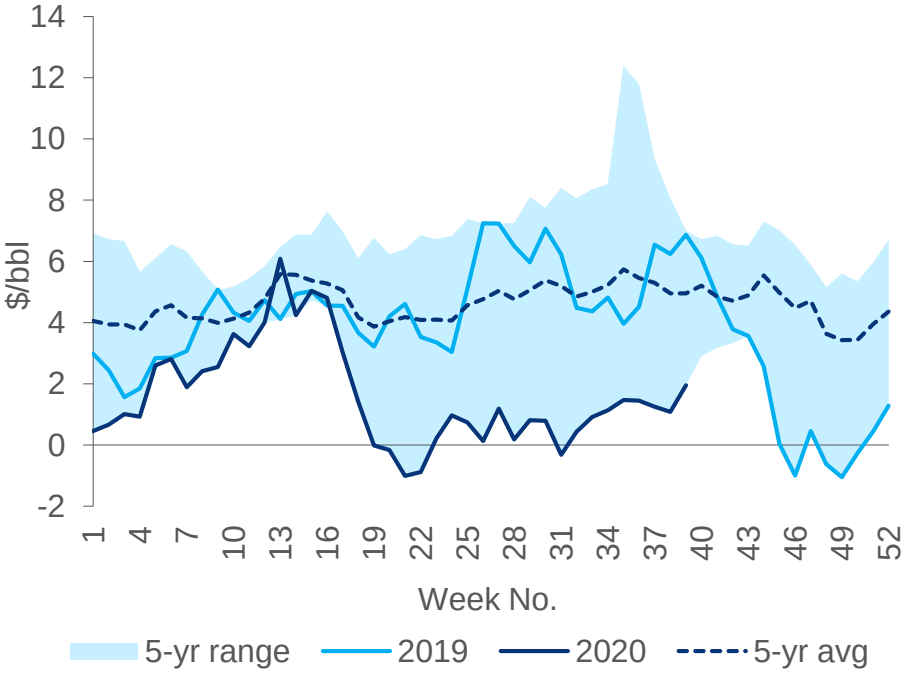
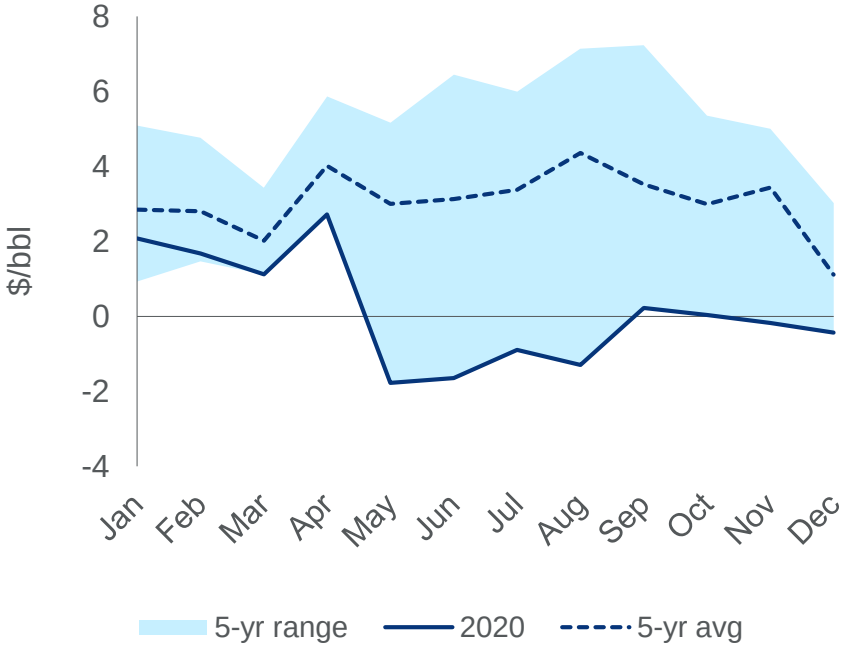
The global pandemic has hit the global refining industry very hard, with margins reduced to variable cost breakeven economics

For Europe, Brent FCC reference gross margin has set “new lows” for summer time margins as personal mobility was restricted to slow the pace of the virus

Global Composite Gross Refinery Margin
Weekly Historical



Northwest Europe Gross Refinery Margin
Brent FCC

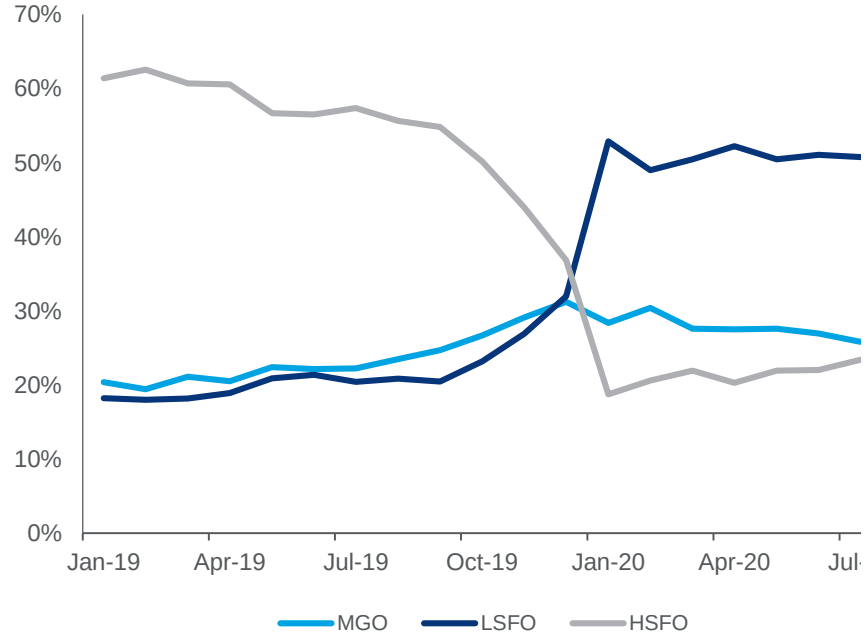


Source: Wood Mackenzie Product Markets Service Short Term

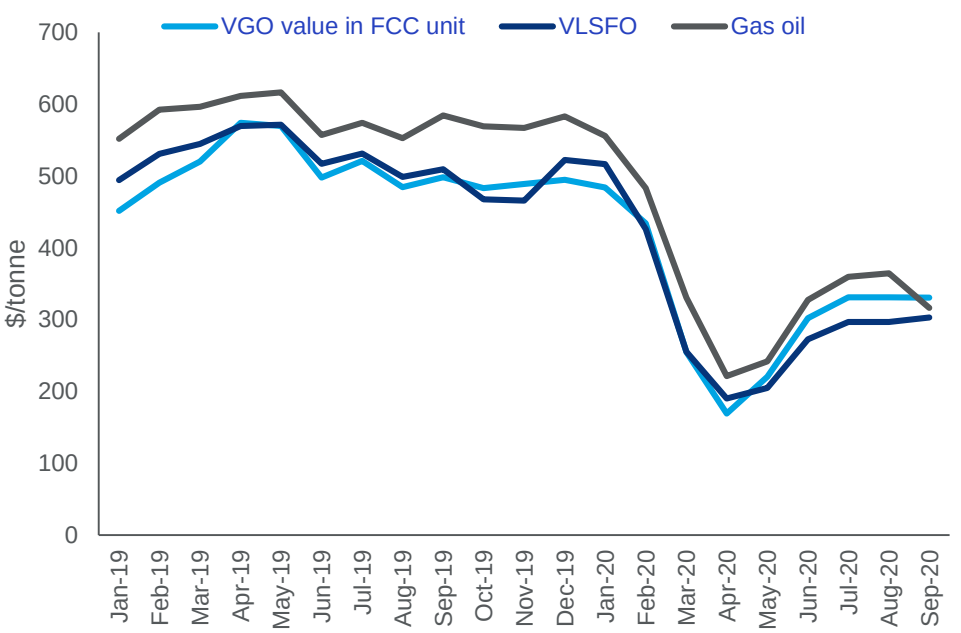
IMO 2020 was to provide a lift to global refining earnings. Ample VLSFO supply and a weaker economy have overwhelmed its impact

HSFO prices did not collapse and diversion of VGO into VLSFO pool provides a new linkage in pricing between bunker fuels and gasoline. Scrubbers continue to be deployed

% share of marine bunker sales in Europe*



European compliant S bunker prices(US$/ton)

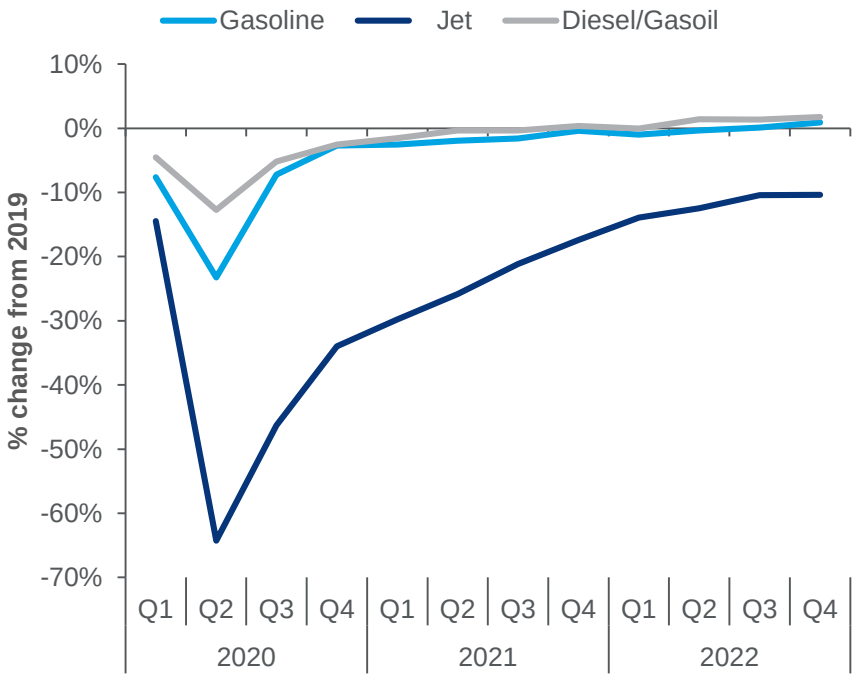


Source: Wood Mackenzie Product Markets Service, Eurostat
* LSFO includes all fuel oil with 1% sulphur or less, but is primarily VLSFO (0.5% sulphur) from the end of 2019

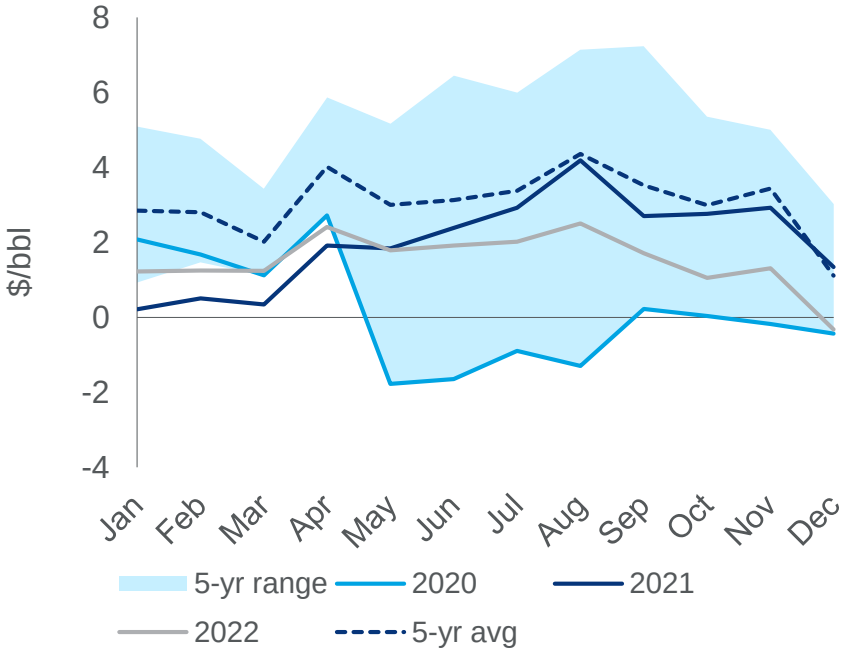
Despite a vaccine expected to emerge end Q1 2021, jet fuel demand takes many years to recover

Margin recovery is forecast for Q2 2021 in Europe, but stalls into 2022

Transport fuel demand, 2021-2022 vs. 2019



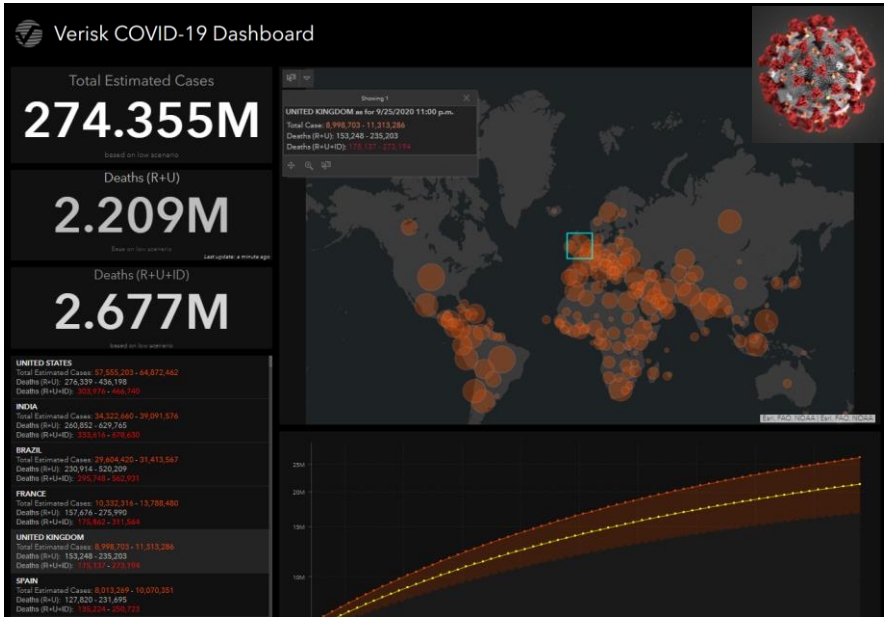
NWE refining margin outlook – Brent FCC



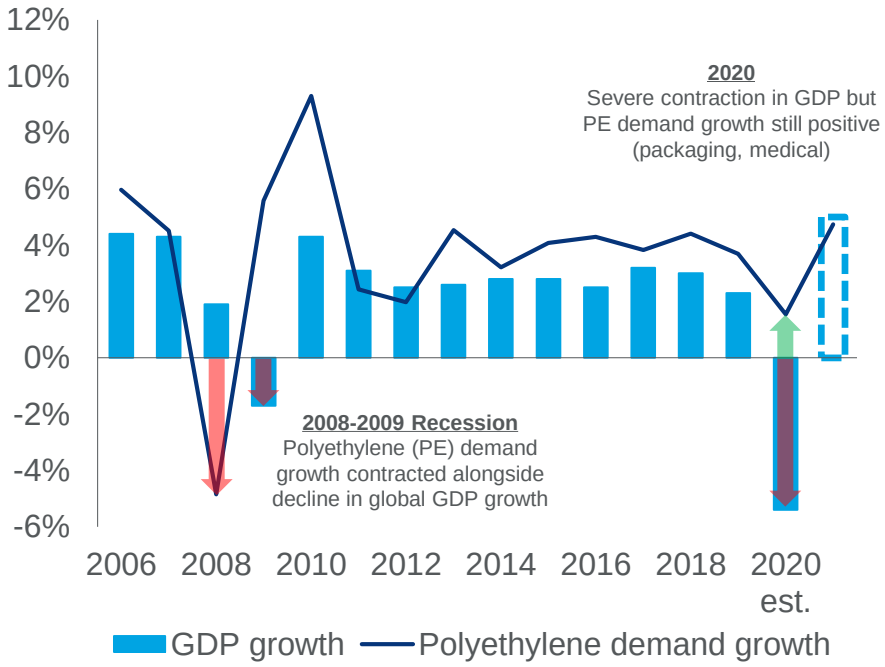
Source: Wood Mackenzie Product Markets Service Short Term

Petrochemicals has provided a relative bright spot in 2020, with LPG and naphtha prices held up as transport fuel demand was hit harder

Response to the global pandemic has supported demand growth for certain chemical derivatives – especially those used in packaging and medical applications



Polyethylene demand and GDP growth

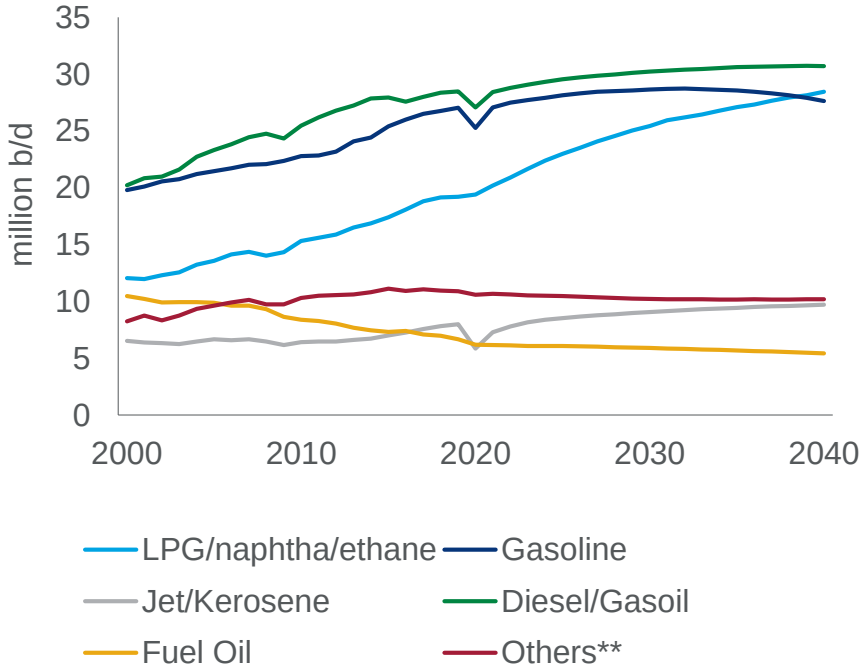


Source: Verisk COVID-19 Dashboard (via AIR Worldwide); Wood Mackenzie Polyethylene Global Supply Demand Analytics Service – September 2020 (preliminary)

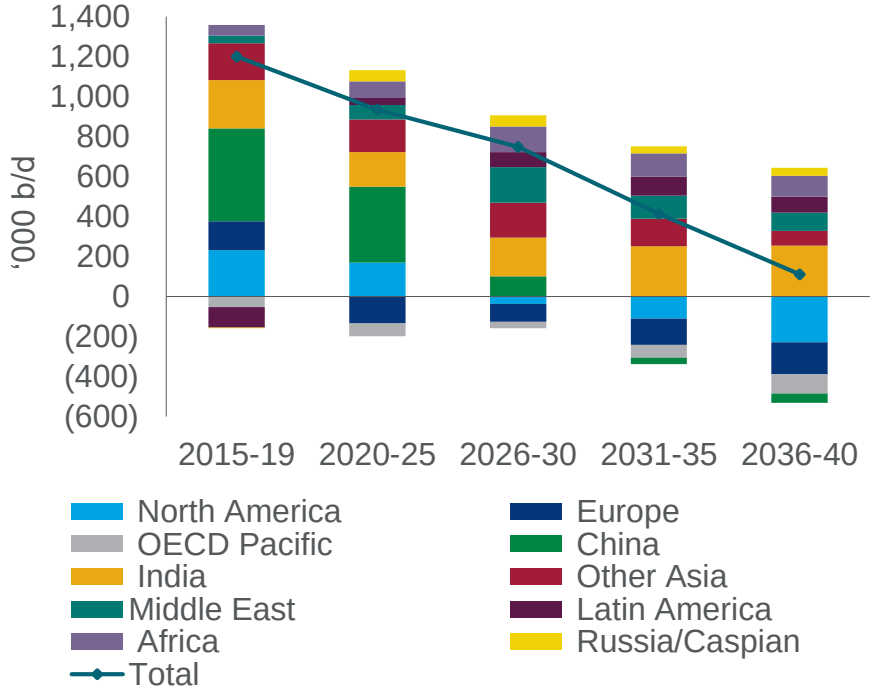
Medium term global demand growth profile shows there is light at the end of the tunnel, with 2040 demand 12 million b/d over 2019 levels

Post 2030, overall demand falls not only in OECD but also in China. Growth centers move to India and other emerging economies outside of China.

Global oil demand by product*



Annual average demand growth by region



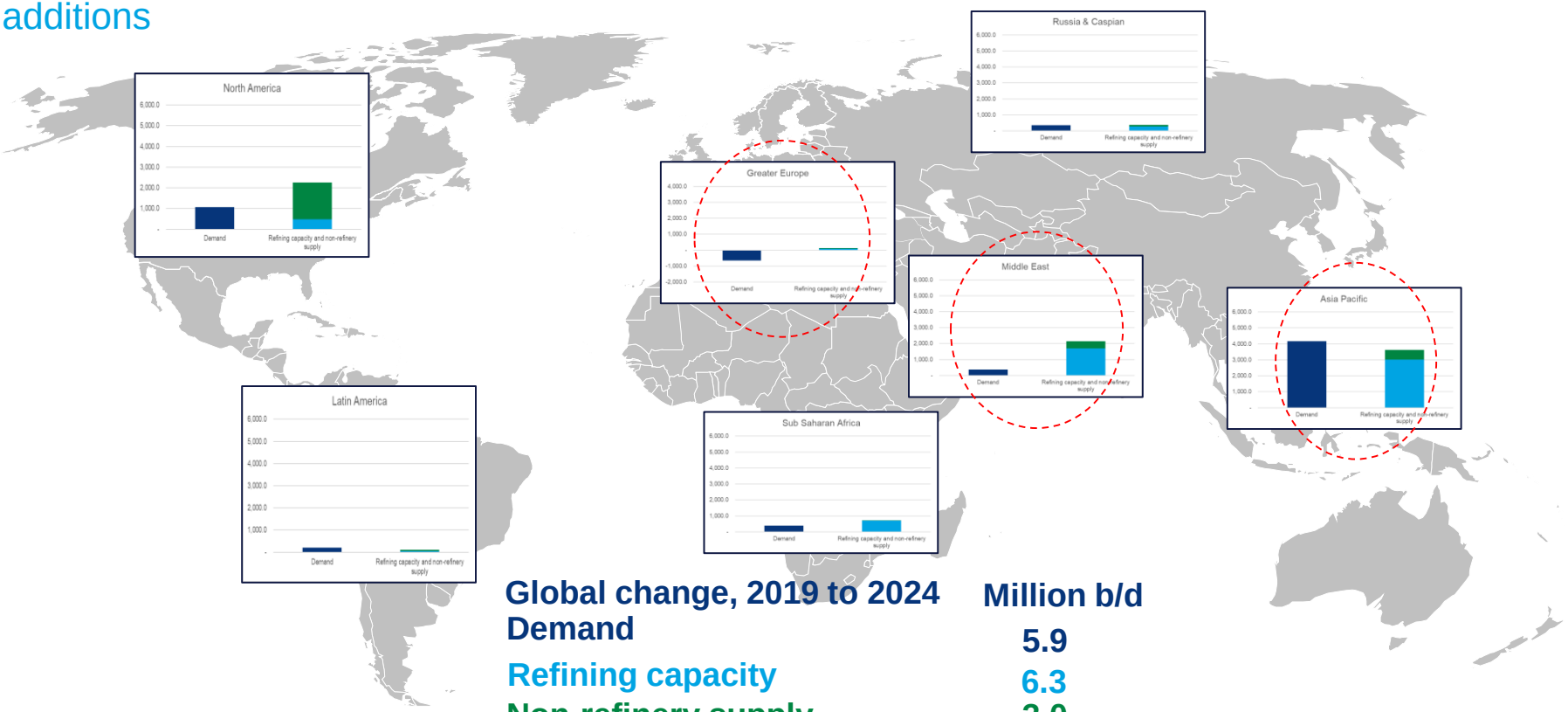
*Product-level demand is reported on a gross base including backflow.

**Includes multiple products such as refinery gas, petroleum coke, bitumen, crude oil, non-specified other products, and backflow (negative figure).

Source: IEA, Forecast – Wood Mackenzie Product Markets Service

The tunnel is however long, as industry is overbuilding refining capacity for the next 5 years

European demand is falling, with only demand in Asia outpacing capacity/non-refinery supply additions



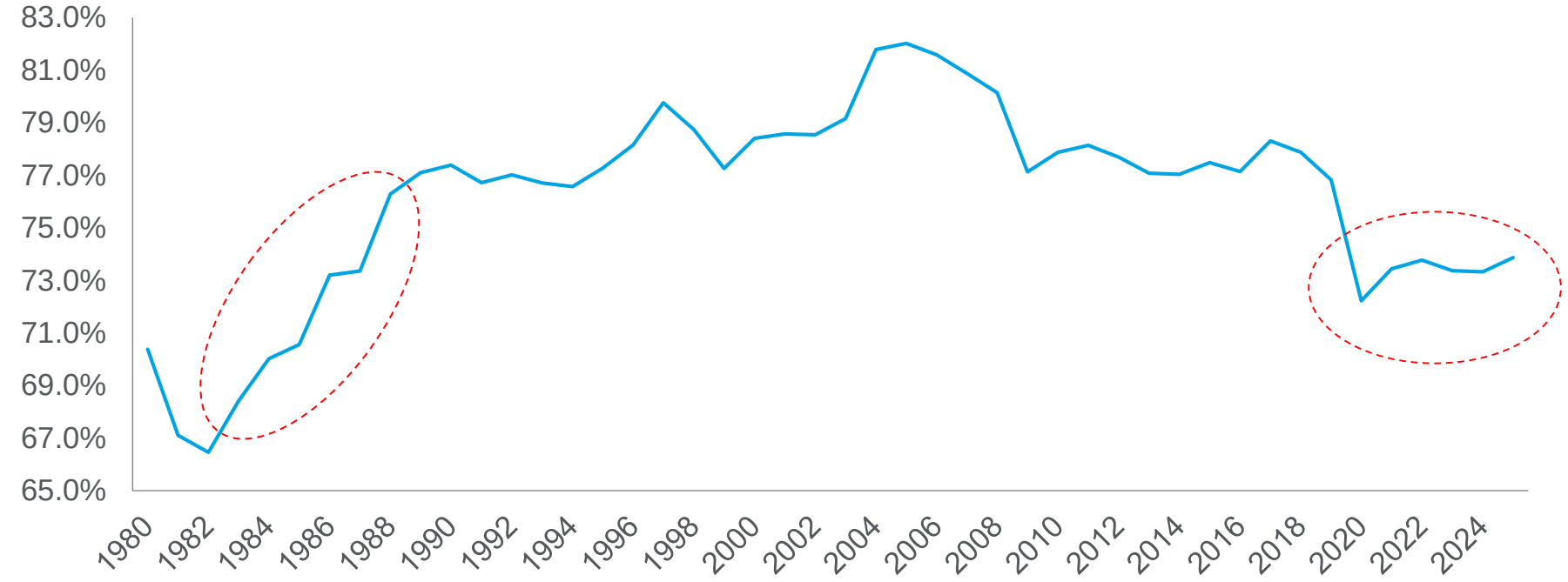
Global change, 2019 to 2024	Million b/d
Demand	5.9
Refining capacity	6.3
Non-refinery supply	3.0

Source: Wood Mackenzie Product Markets Service

Refinery utilisation is back to the 1980s, which inevitably weakens margins

1980's was a period of extensive refinery rationalisation, primarily by the integrated majors, as oil demand collapsed from high prices and the 1970s construction wave was ending

Global refinery utilisation (annual average)

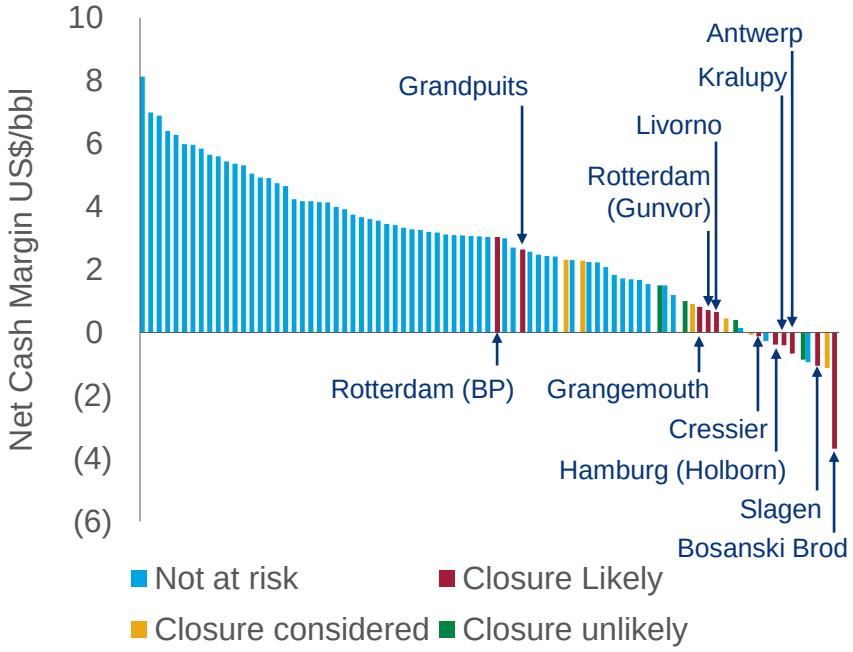


Source: bp stats, Wood Mackenzie analysis and Wood Mackenzie Product Markets Service

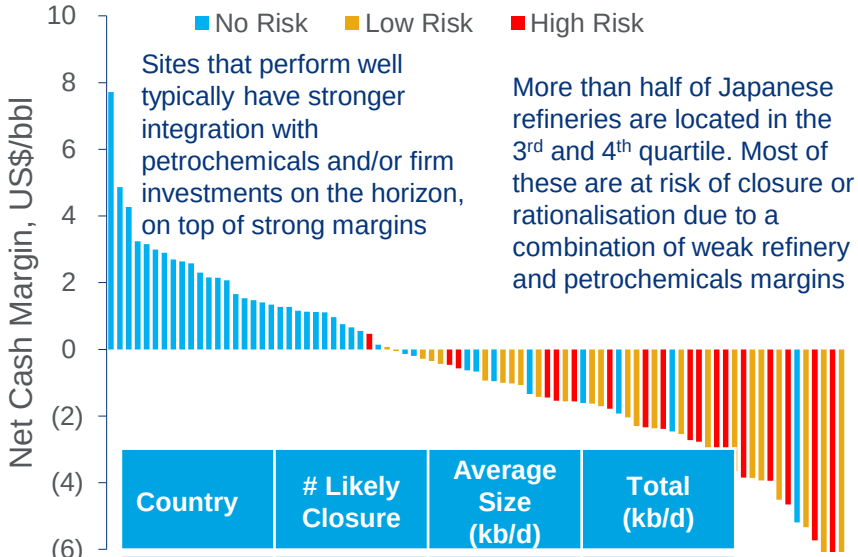
A number of assets are assessed at high risk of closure over the next few years, though few belong to the oil majors

Volumetrically, Europe and Japan are most at risk of extensive rationalisation. The US has almost 400 kbd at risk of closure in addition to the almost 400 kb/d converted to biodiesel.

2018 NCM chart – highlighting assets on the closure threat analysis



Asia ex China 2023 Net Cash Margin (NCM)



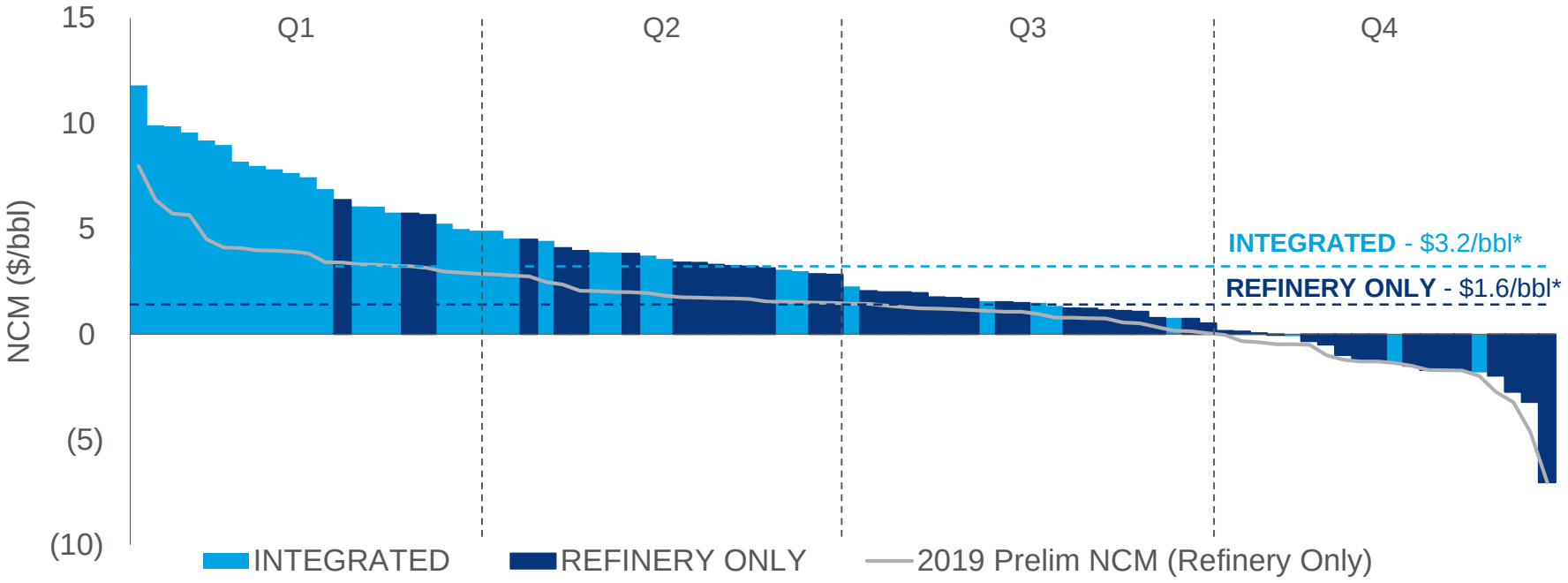
Country	# Likely Closure	Average Size (kb/d)	Total (kb/d)
Japan	12	125	1,248
Malaysia	3	124	247
Pakistan	2	89	177
Others			~610

Source: Wood Mackenzie Refinery Evaluation Model

Petrochemical integration adds material value to refining, so highlighting that stand-alone assets are vulnerable to the energy transition

Petrochemical integration adds value through greater flexibility in addition to operational synergies.

European 2019 Preliminary NCM incorporating petrochemical integration (US$/bbl)



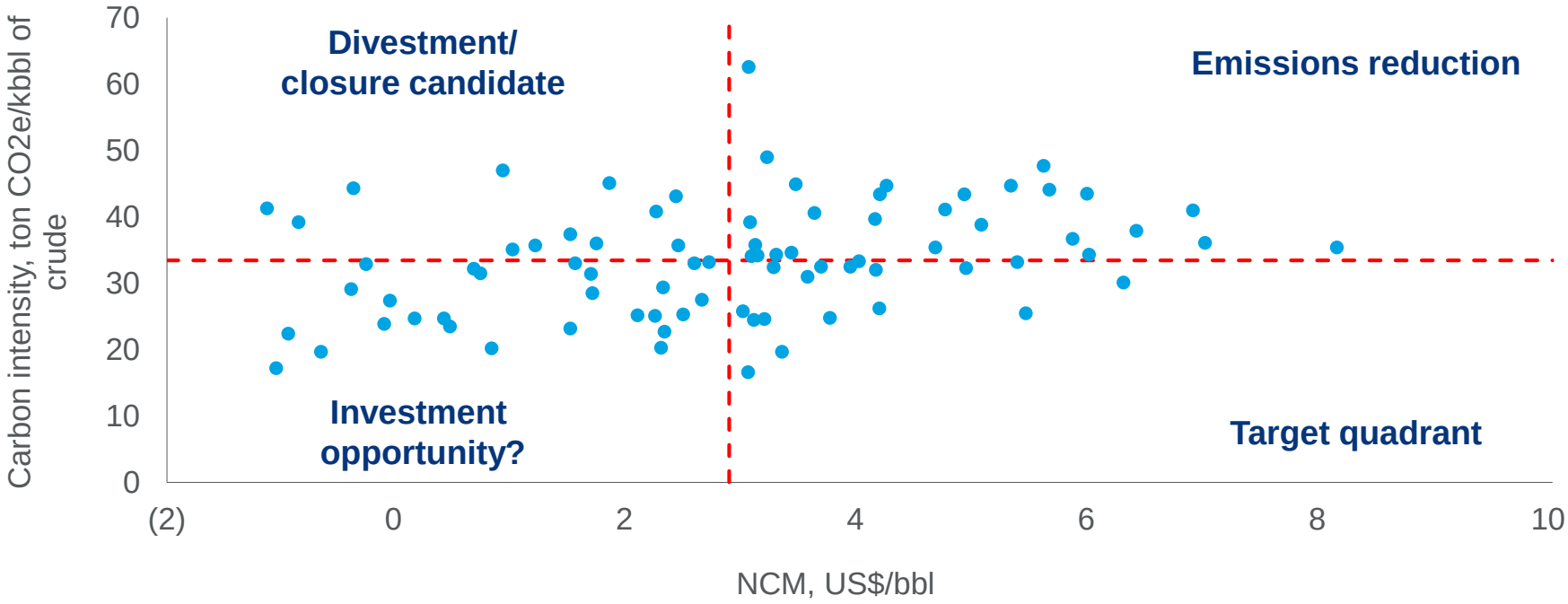
Source: Wood Mackenzie REM-Chemicals Service

Note: * Weighted Average

Given the rise of ESG considerations, carbon emissions are starting to provide a further dimension to portfolio management

The extension of this analysis to include olefins production and associated hydrogen production will likely further enhance the sustainability of integrated sites

European 2018 NCM v carbon emissions intensity

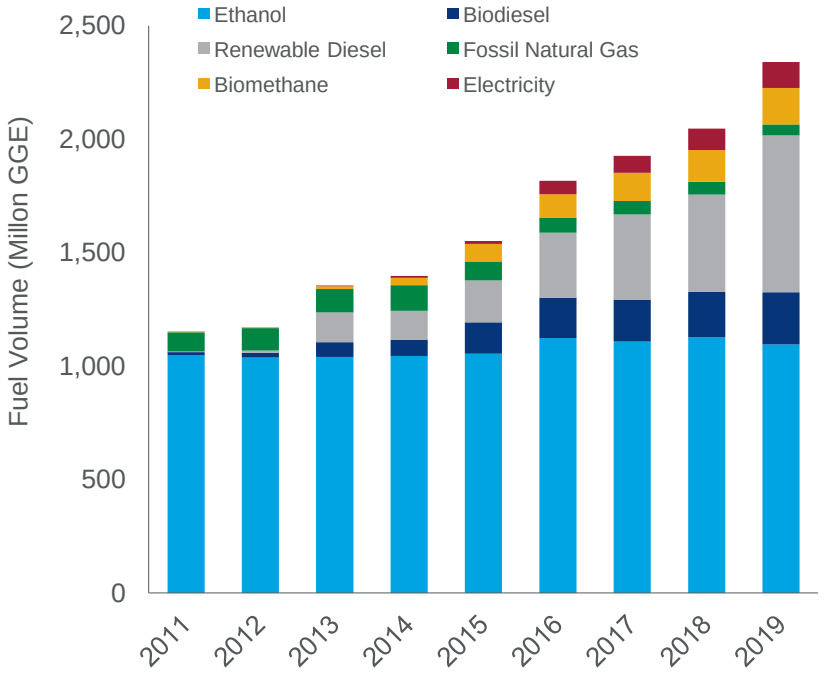


Source: Wood Mackenzie Refinery Evaluation Model and Emissions Benchmarking Tool

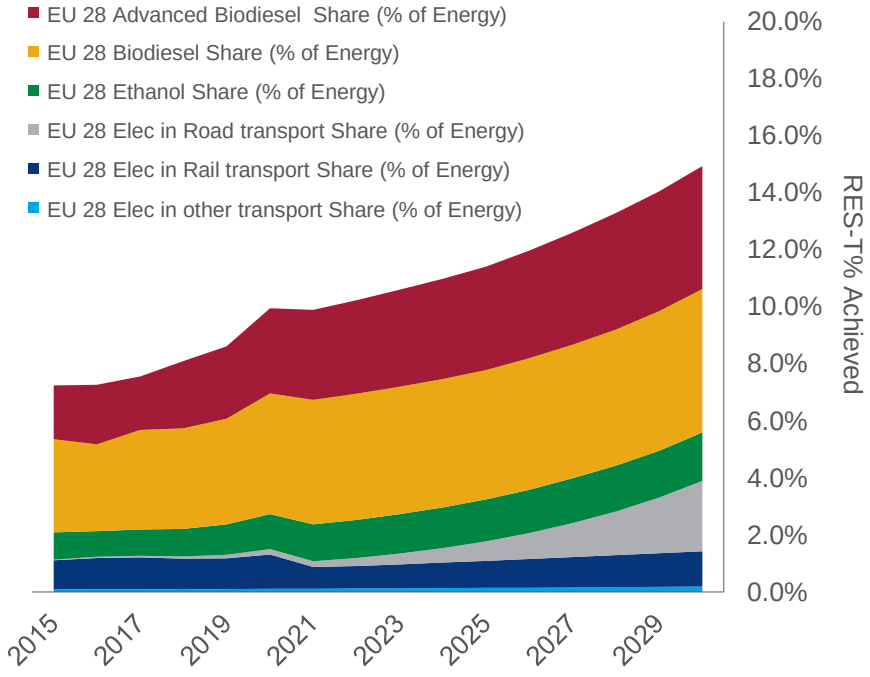
Where is the money now? Terminal conversion and/or liquid renewables can provide a near term pathway in the re-alignment of refining assets

US is showing the way, as Californian's have the greatest ability to pay for limited low carbon intensity feedstocks (used cooking oil/animal fats). EU regulation promotes vehicle electrification

LCFS credit generation by source



EU 28 RED II renewables in transport

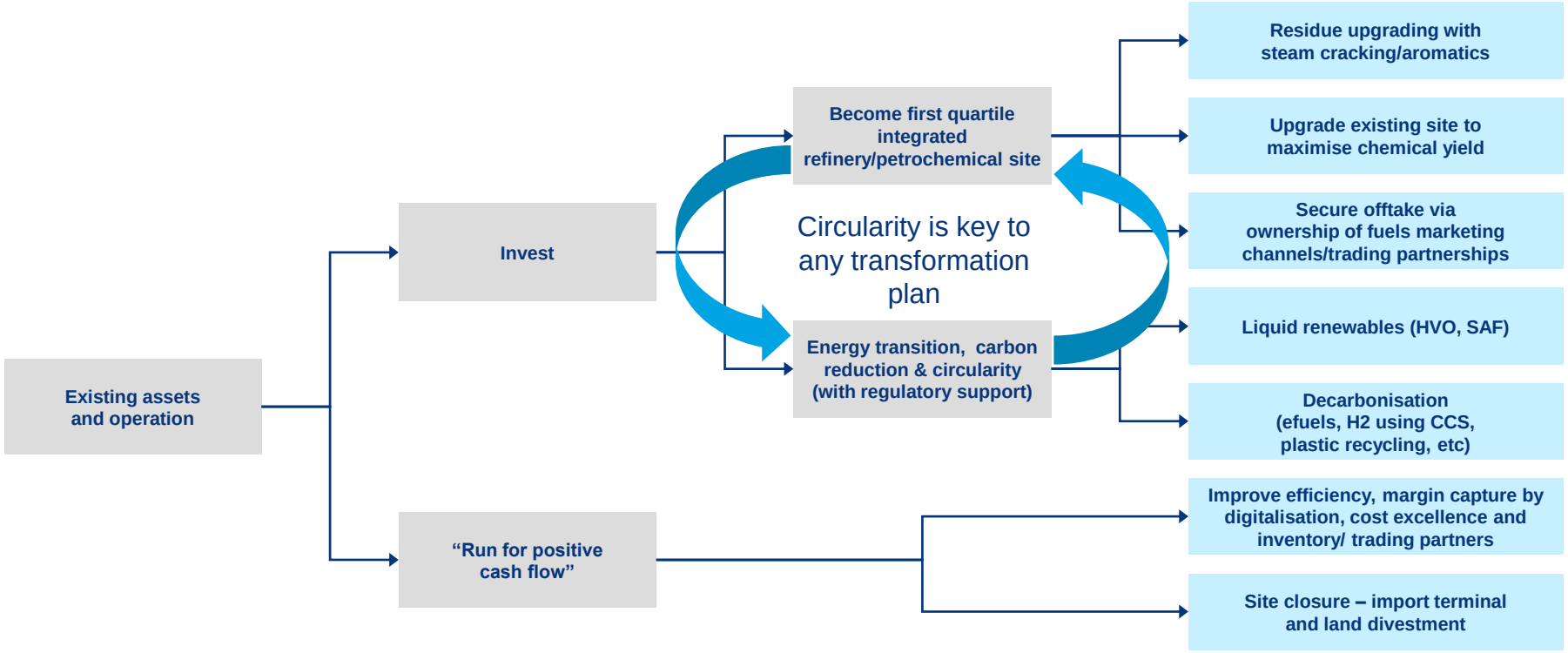


Source: Wood Mackenzie Product Markets Service

Difficult decisions are to be made and quickly if the sector is to be rescued from a re-run of the 1980s

Do near term options ensure survival of the “refining platform” that could be the base for future sustainability, which involves a greater role of petrochemicals?

Indicative Downstream decision tree



Source: Wood Mackenzie

REM-Chemicals provides a full view of integrated refinery-petrochemical site outputs

To provide the foundation of informed valuations and industry benchmarking

Multi-site benchmarking for integrated refinery-petrochemical assets

Evaluate global investment plans and their impact on competitive position

Inform valuations of integrated refinery-petrochemical assets

Conduct due diligence on new investments, screen target acquisitions

Understand the effect of changes to refinery configuration on earnings performance

Analyse refinery transactions

Assess competitive advantage

Understand themes and trends impacting refining & petrochemical markets and economics

Assess key elements influencing current & future margins

Evaluate whole industry supply/cost curves to support market understanding and forecasting

Q&A

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Alan Gelder

VP Refining, Chemicals and Oil Markets

Biography

Alan is VP Refining, Chemicals and Oil Markets. He is responsible for formulating Wood Mackenzie's research outlook and integrated cross-sector perspectives on this global sector.

Alan Gelder joined Wood Mackenzie's Downstream Consulting team in 2005 and became global head in 2009. He transitioned into research upon his return from Houston in 2011 and was Global Head of Refining and Chemicals.

Prior to joining Wood Mackenzie, Alan had 10 years of industry consulting after working for ExxonMobil in a variety of project planning and technical process design roles.

Alan has a first class Master Degree in Chemical Engineering from Imperial College, London, supplemented by an MBA from Henley Management College.

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