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# Recent Trends and Future Perspectives on Global Petrochemicals Market

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CPCIC



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- Leader of BCG's Chemicals practice in China; 12 yrs with BCG
- Focus on growth strategy, business performance improvement, organization and talents across the full chemicals value chain
- PhD chemistry, MS electrical engineering, Stanford Univ

Source: BCG

# Agenda for today

Outlook on global refinery market

Perspectives on global petrochemicals market

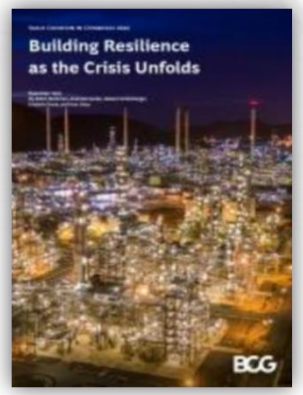


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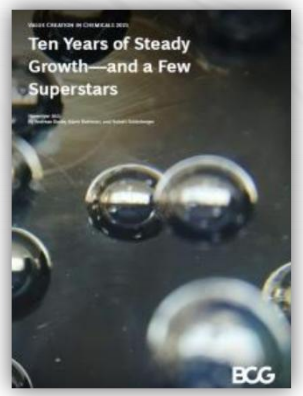
# BCG's Annual Value Creators Report in Chemicals is a roadmap to success in the business



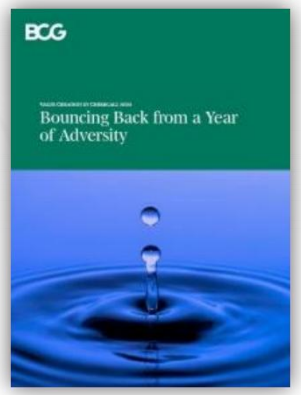

*Facing Unprecedented Pressures*



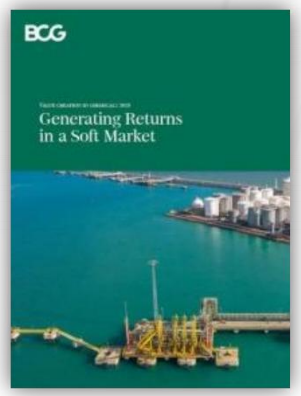

*Building Resilience as the Crisis Unfolds*



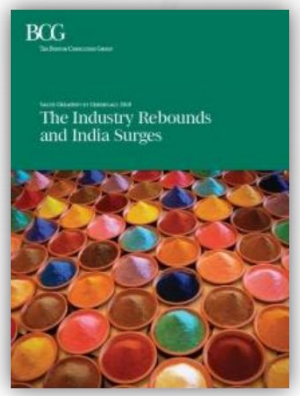

*Ten Years of Steady Growth — and a Few Superstars*



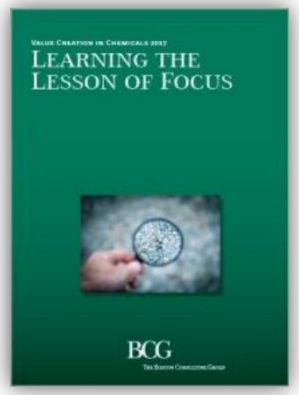

*Bouncing Back from a Year of Adversity*



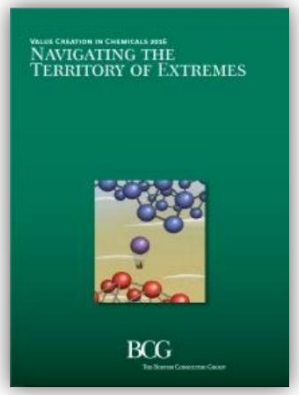

*Generating Returns in a Soft Market*



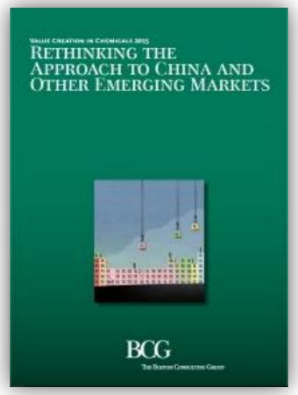

*The Industry Rebounds and India Surges*



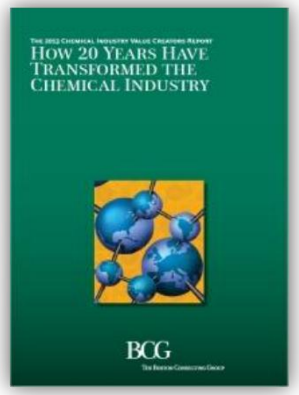

*Learning the Lesson of Focus*



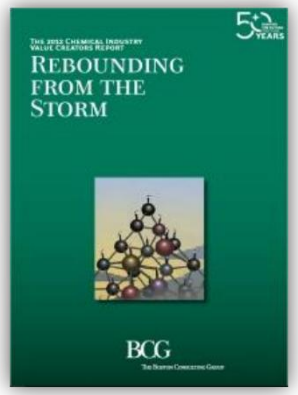

*Navigating the Territory of Extremes*




*Rethinking the Approach to China and Other Emerging Markets*




*How 20 Years Have Transformed the Chemical Industry*




*Rebounding from the Storm*

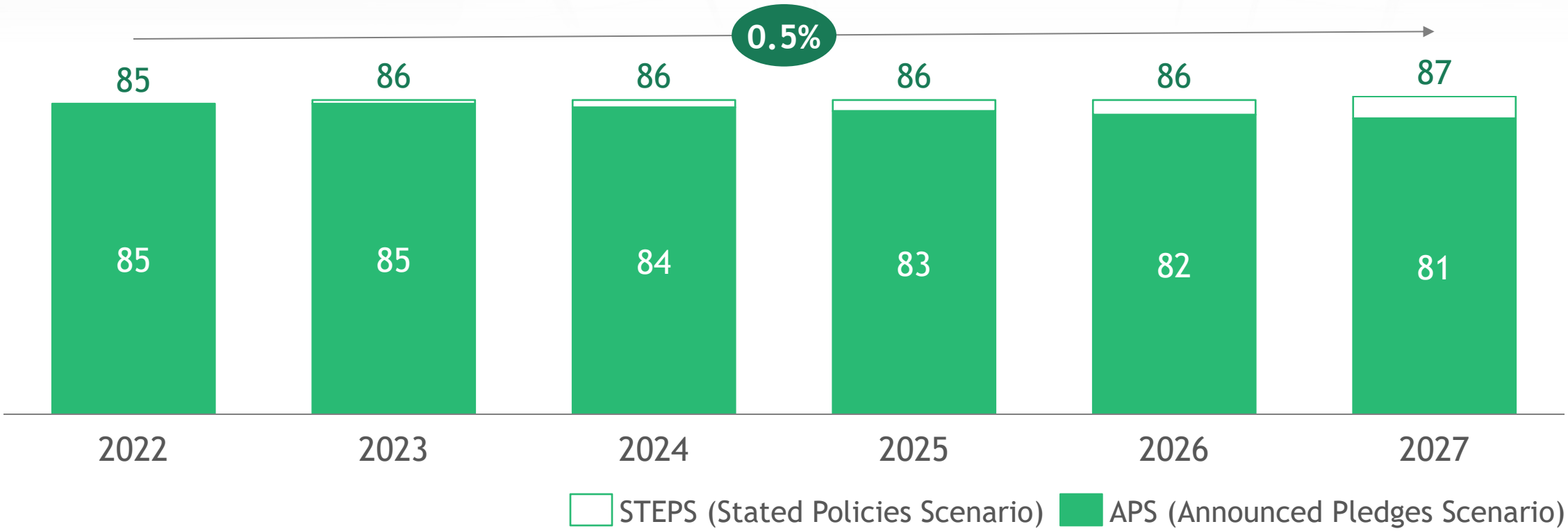


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# Outlook on global refinery market

# Medium term | Globally, flat to marginally increasing demand over the next 5 years…

## Global refinery products[1] demand scenarios *(MMbd – Million Barrels per Day)*




1. Refinery products include oil products, excluding fractionated products from Natural Gas Liquids
Source: World Energy Outlook 2022, IEA, BCG Analysis

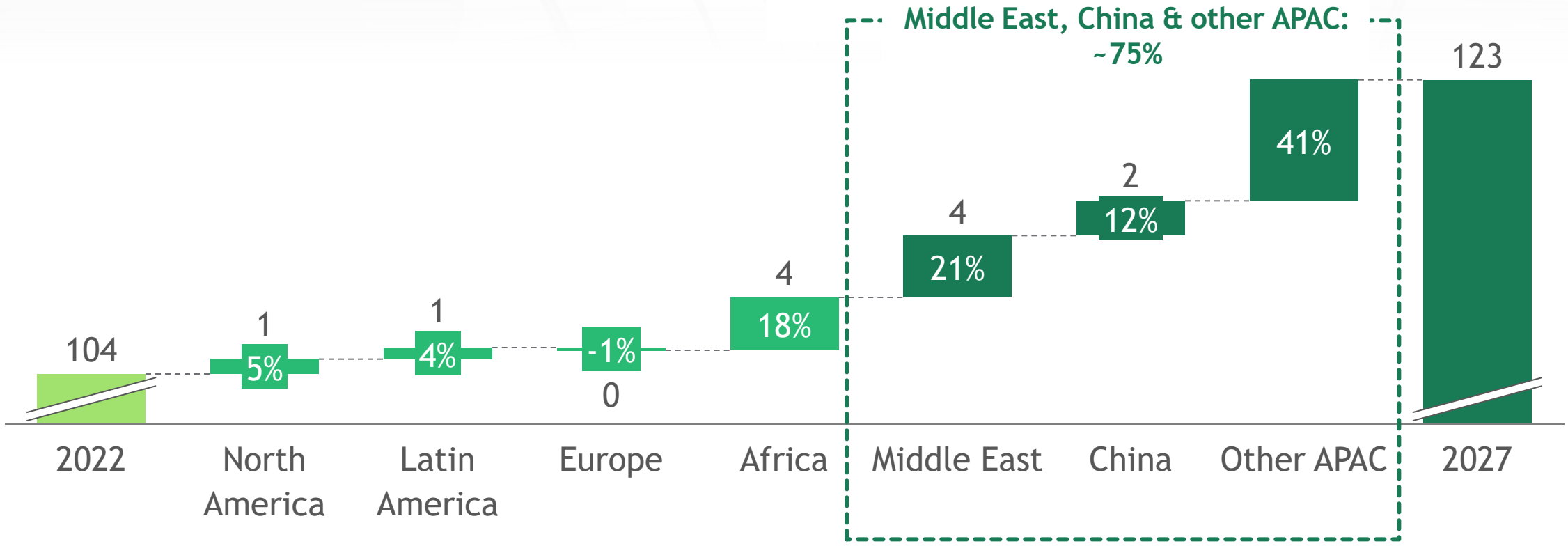


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# … more than offset by capacity additions, concentrated in ME, China, Africa, and other APAC

Announced projects

## Medium term refining capacity growth by region[1] *(MMbd – Million Barrels per Day)*



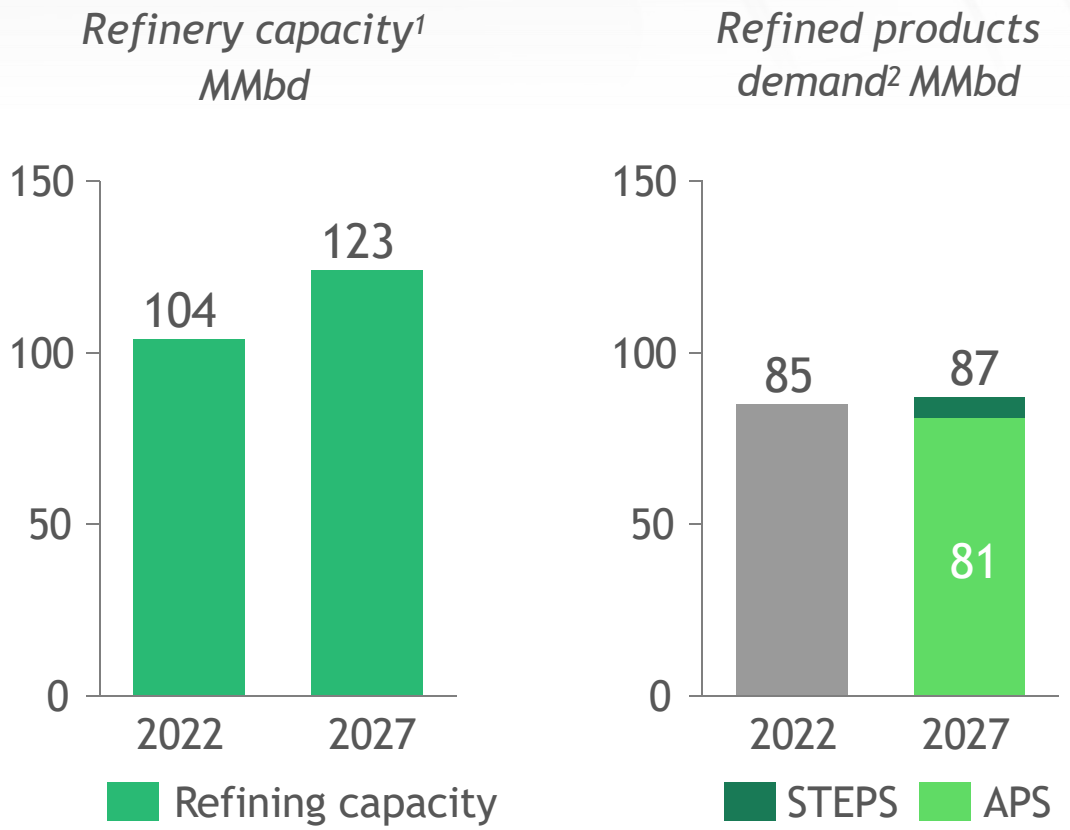

1. Not probability weighted
Note: Regional groupings in this table are geographical, with no reference to OECD affiliation Source: GlobalData 2022, BCG Analysis



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# Medium term | Announced refinery capacity increase exceeds projected refined products demand resulting in a more competitive landscape and lower margins

## Refining capacity vs. refined products demand




Medium term new builds and expansions are expected to increase global refining capacity encouraged by current tightness

Announced expansions would shift product demand to 70% of refining capacity significantly below normal level of ~80%[3]

Refinery rationalization is expected in higher cost regions which will bring market back to balance

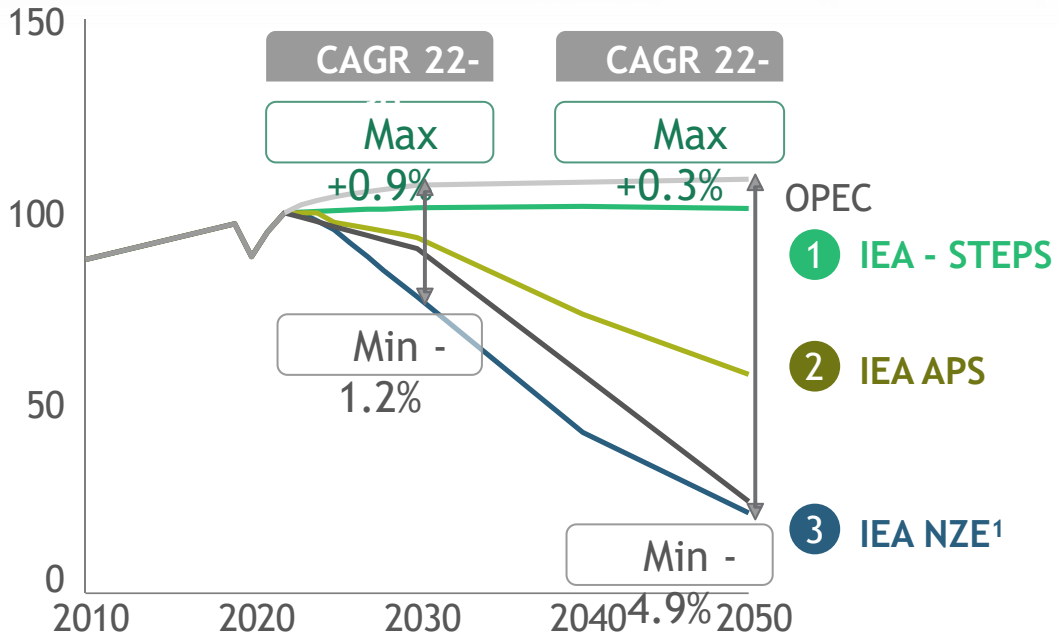
1. Global refining capacity based on crude distillation 2. Refined product demand, not including NGL and other sources of oil 3. Product demand divided by refining capacity based on 2019, 2021, and 2022 Source: GlobalData; IEA; BCG analysis



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# Long term | Oil demand expected to peak by 2030 or earlier, with downward pressure from energy transition

## Worldwide oil demand evolution 2010-2050




**1 IEA STEPS**
Higher reliance on oil

2.5 4.6

- Business as usual scenario
- Lower focus on sustainability
- Reduced impact of fuel efficiency gains

**2 IEA APS**
Lower reliance on oil and gas

2.2 2.4

- High EV and hybrids cars penetration
- High investment in fuel efficiency technologies

**3 IEA NZE**
Targeting to achieve net zero emissions

1.4 3.7

- Focus on complete decarbonization by 2050
- Higher incentivization in the clean tech and expansive alternatives to fossils
- Higher focus on the renewables

XX *Temperature rise in 2100 (degC)*

XX *Emission reduction[2] (Gt)*

**Actual demand will be defined by future regulation and how announced and future pledges translate into policies**

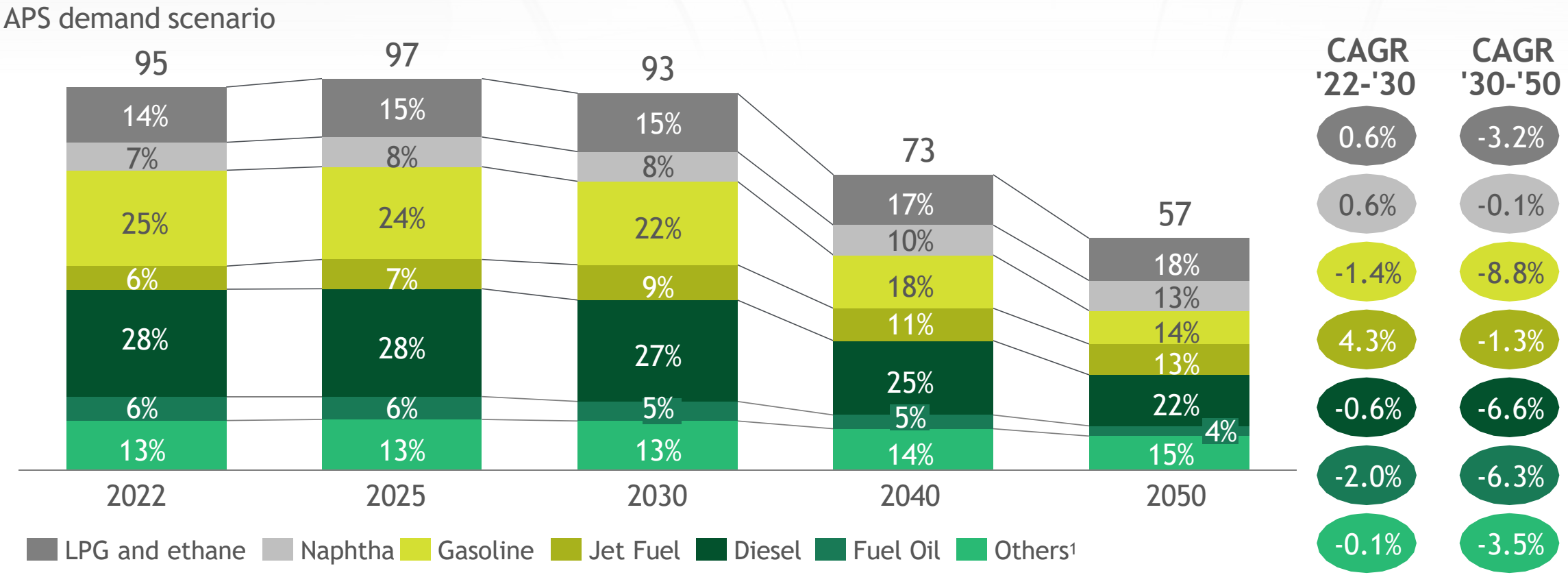
1. IEA STEP scenario, 2. IEA APS scenario, emission reduction is from 2021 to 2050 3. Scenario slope of IEA NZE has been adjusted in order to reflect a stronger emission reduction effort from 2030. Temperature rises and CO2 reduction for cases 2 and 3 are approximate and derived by linear interpolation from IEA STEPS and IEA APS scenarios, not bottom-up climate modelling
Source: IEA; BP; BCG analysis



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# Long term | Jet fuel and naphtha expected to be the most resilient oil products until 2050

## Oil demand by product *(MMbd)*

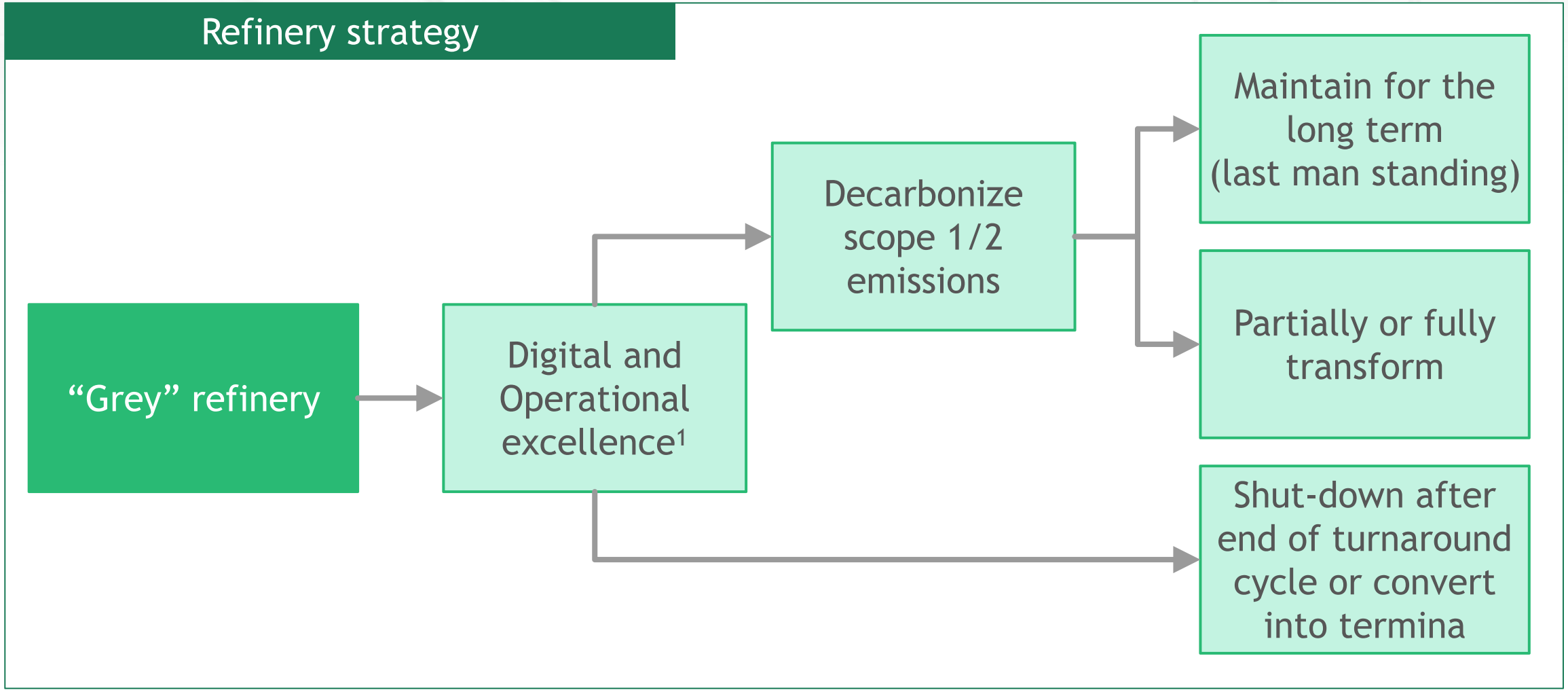



1. Includes agriculture, transformation, other non-energy use (mainly bitumen and lubricants)
Source: IEA WEO 2022, BCG analysis



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# Strategic options | Refiners with options for each asset




Note: Examples only, not exhaustive
1. Only short pay-back levers applicable if strategy is to shut down



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# Key questions for refiners



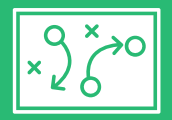
What is the long-term earnings potential of each refinery?



To what extent should operations be decarbonized operations, and what technologies will be used to meet targets?



How will operational excellence improve resilience?



How can the business be futureproofed by diversifying the product portfolio?



What competitive advantage does the existing asset base provide in high growth new energy businesses?



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# Perspectives on global petrochemicals market

# Eight key trends shaping the future of PetChem

## Demand shifts

1. India & SEA are emerging growth pockets; China to grow slower but remain a cornerstone market
2. Evolving customer needs (e.g., circularity) reshaping value pools & impacting purchasing criteria

## Supply shifts

3. Growing overcapacity & shift in capacities closer to demand reshaping investment strategies
4. Travelling US ethane impacting competitiveness and strategic choices in Europe, Asia & Africa
5. New feedstocks (e.g., recyclate) and technologies (e.g., CO2-to-X) to start disrupting supply curves

## Market balance

6. China's self-sufficiency and export increase reshaping global trade flows
7. Competitive pressure transforming European markets
8. Expansion of oil & gas majors' into petrochemicals intensifying competition



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# Demand shifts shaping the future of PetChem

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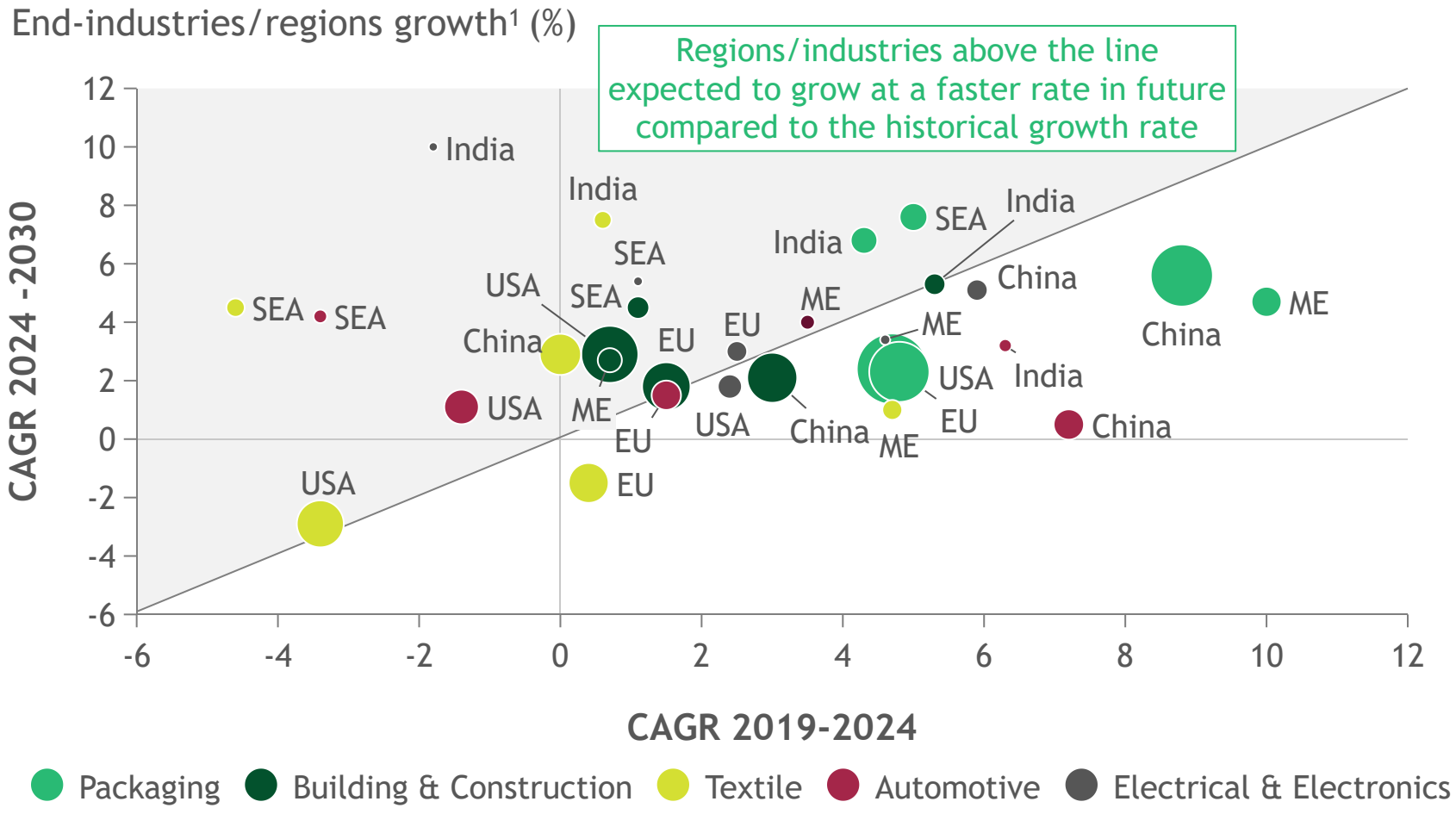
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# Demand | Expect slower growth across most end-industries, however with significant regional variations




1. Regional bubbles are directional/illustrative, and representative of market size based on GDP / industry contribution to GDP
Notes: Other smaller end-industries include appliances, toys & sports, aerospace, agriculture, etc.
Source: Nexant, Oxford Economics, Statista, BCG analysis

## Key highlights

- **Slower growth expected across most end-industries**, however with significant regional variations
- **Robust market growth is anticipated in India and SEA** in the textile, packaging, and electrical & electronics sectors
- **Negative growth rates are** expected in **sizeable US and EU textile markets**
- **Evolving customer needs** across end-industries will continue reshaping value pools

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# Demand | Evolving end-industry needs will reshape value pools & increase a need to collaborate across value chain

| | Sustainability/ circularity | Lightweighting | Other trends |
|---|---|---|---|
| Packaging | Focus on **sustainable materials** (e.g., recycled, biodegradable, design to support recyclability & reuse) | **By focusing** on new innovative **materials, design and technologies** | **Enhanced functionality** with advanced materials (e.g., higher $O_2$/moisture barriers for better shelf life, safety) |
| Automotive | **Pressure to reduce waste** from discarded cars, components and materials | Initially driven by **fuel requirements**, and now by **driving range needs for EVs** (e.g., via plastic composites) | |
| Building & Construction | **Lighter & greener building materials** (e.g., for pipes, doors, windows) | | **Modularisation** (e.g., 3D printing) and **building for urban environment** (e.g., noise insulation solutions) |
| Textile | **Rising consumer demand for sustainability** driving brands to invest and partner across the value chain | | **Brands diversifying supply base** e.g., from China to other regions (India, SEA, etc.) |

Source: BCG analysis

Deep-dive on the next pages

## Key highlights

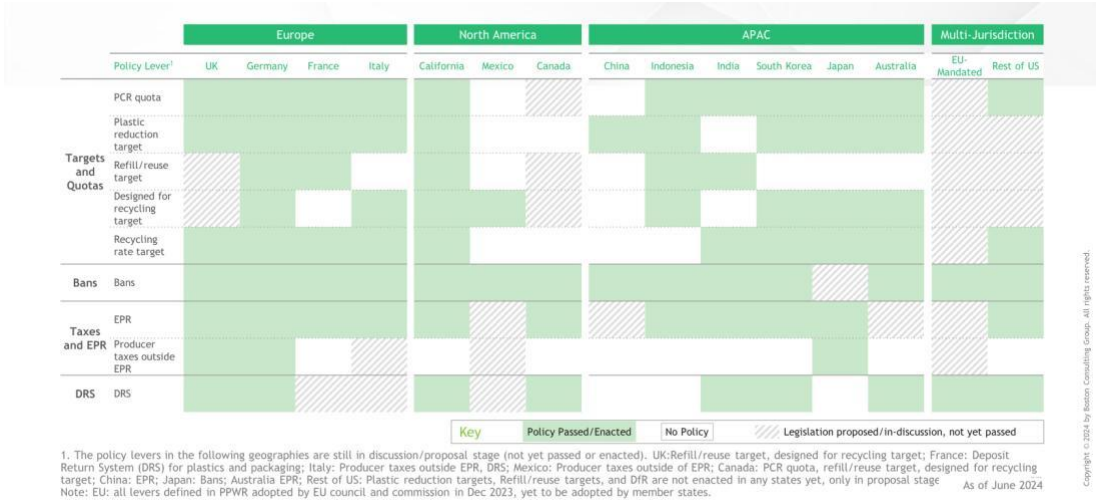
- **Increasing needs for circularity** across all end-industries - volume pressure on virgin chemicals, but also opportunities
- In some industries, the **supply base is shifting to different locations** (e.g., in textile from China)
- **Demand for new materials and formulations** in some end-industries, however this will have a higher impact for **specialty chemicals**



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# Demand | Circularity regulations are actively expanding across markets while becoming more nuanced – this will start influencing end-industries' needs

## Circularity regulations are being actively implemented across most markets to varying degree…




1. The policy levers in the following geographies are still in discussion/proposal stage (not yet passed or enacted). UK:Refill/reuse target, designed for recycling target; France: Deposit Return System (DRS) for plastics and packaging; Italy: Producer taxes outside EPR, DRS; Mexico: Producer taxes outside of EPR; Canada: PCR quota, refill/reuse target, designed for recycling target; China: EPR; Japan: Bans; Australia EPR; Rest of US: Plastic reduction targets, Refill/reuse targets, and DfR are not enacted in any states yet, only in proposal stage
Note: EU: all levers defined in PPWR adopted by EU council and commission in Dec 2023, yet to be adopted by member states.

As of June 2024

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***Target & Quotas along with bans have the most impact** on the petrochemical industry & players*

## …while becoming more nuanced and complex to navigate

*Selected examples from Packaging & Packaging Waste Reg. (PPWR)*

- **Designed for recyclability (DfR):** all packaging must meet DfR reqs. (e.g., likely shift to mono-material plastic packs)
- **Compliance:** Manufacturers would have to carry out a conformity assessment procedure
- **Harmonized labelling scheme:** Labelling scheme, including recycled content and disposal instructions
- **Biodegradable requirements:** Very lightweight plastic carrier bags would have to be compostable from 2028
- **Deposit return scheme (DRS):** Mandatory DRS systems for single-use plastics bottles with capacity up to 3L

Source: EU Commission, BCG analysis



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# Supply shifts shaping the future of PetChem

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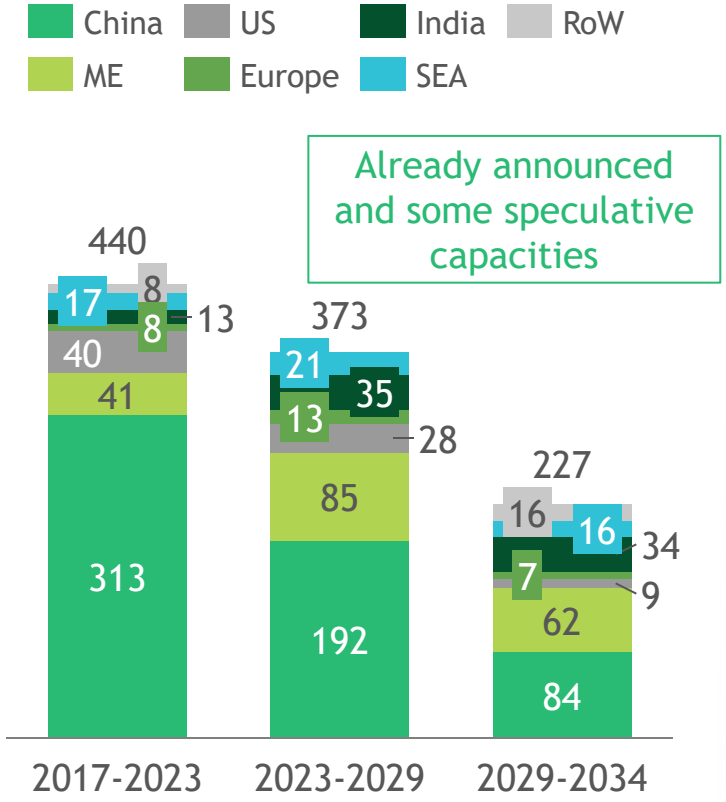
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# Supply | After a period of significant capacity extensions, expect slower growth, however closer to where demand is

**Net capacity[1] additions by region,** mtpa[2]




1. Including speculative capacity 2. Million tons per annum
Source: Nexant, ChemCom, BCG analysis

**China** is expected to continue adding new capacities (however slower) to achieve self-sufficiency, and even accelerate their export

**ME** capacity expansions slowed down till recently – now leading players trying to catch up; key players expanding also outside of ME

**NA** capacity expansions slowing post shale gas boom. However, significant investments continue mainly in new ethylene crackers

**EU** is expected to rationalise some assets, however, selected players to continue investments to boost their competitiveness

**India** is expected likely to follow China's self-sufficiency with a notable number of partnerships/JVs with O&G players from abroad

**SEA:** investments to continue in new projects due to increasing local consumption, primarily in Indonesia and Thailand

## Key highlights

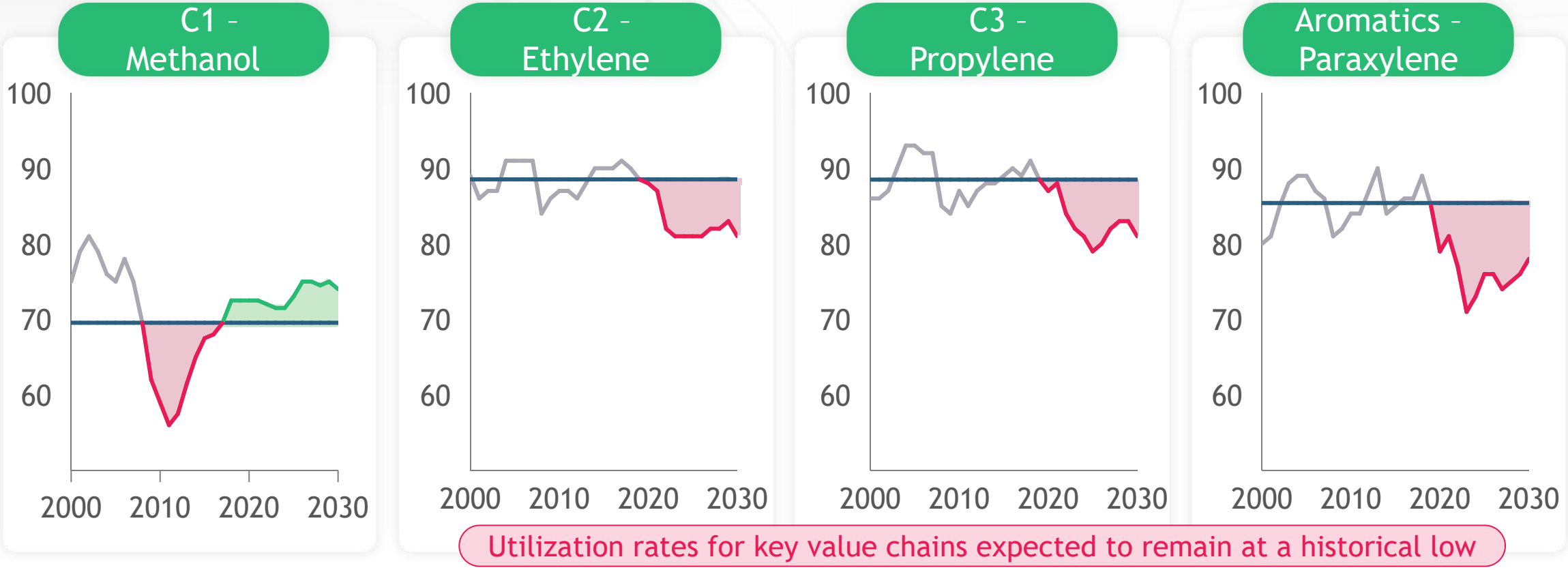
**Demand centers driving shift in capacity locations,** e.g.:

- India expected to build more capacity than NA
- ME is actively pursuing opportunities outside of the region (e.g., Aramco with COTC investments in China and South Korea)

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# Supply | Despite slower capacity growth, overcapacity will still push utilization below historical avg. and lead to margin pressure & intensified competition

## Historical and expected utilization rates (%)



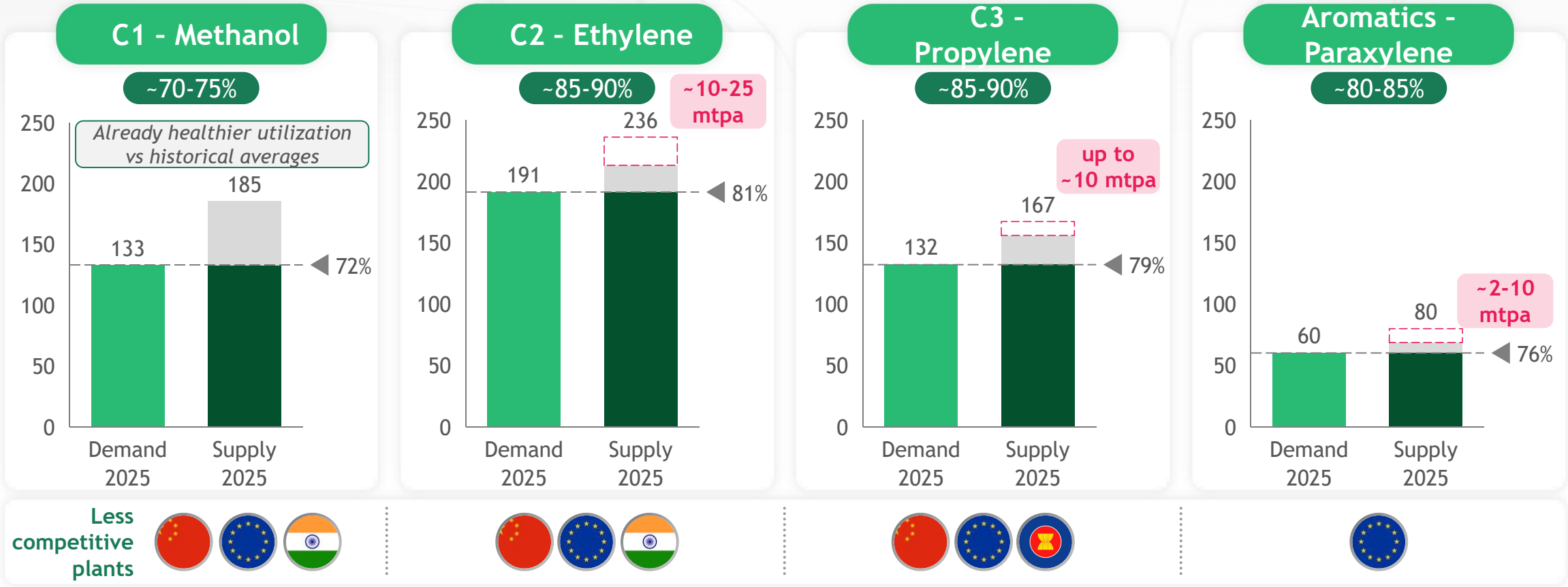

Source: Nexant, ChemCom, BCG analysis



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# Supply | For utilization rates to increase to the historical averages, up to ~20-45mtpa capacity of key building blocks will need to be rationalized

## Global petrochemicals supply & demand, mtpa




*Legend* *Demand* *Production* *Unused capacity* *Potential capacity to be rationalised* XX *Average utilization 2000-2019* XX mtpa *Excess capacity*

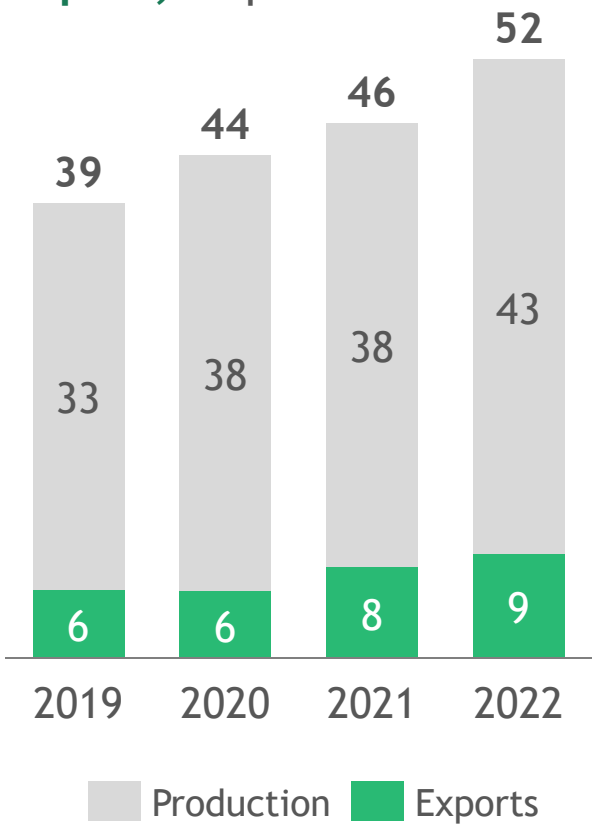
Note: Actual average historical utilisation rates (2000-2019) as follows, ~70% Methanol, ~90% Ethylene, ~90% Propylene, ~85% Paraxylene
Source: Nexant, ChemCom, BCG analysis



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# Supply | Travelling US ethane impacting competitiveness and strategic choices in Europe, Asia & now also in Africa

## US ethane production and export, mtpa




**Ship transport**




**Pipeline import**




1. Consortium comprising several major players in the Egyptian chemical, gas, and construction industries

Source: EIA, ICIS, Platts, Global S&P, press releases

## Key highlights

- Players **should evaluate benefits** from leveraging US feedstock and understand **prerequisites** (e.g., supply chain excellence, trading capabilities)
- **Trend expected to expand to ethylene** in light of large-scale announced or under construction capacities (e.g., Shell, Bayport Polymers)



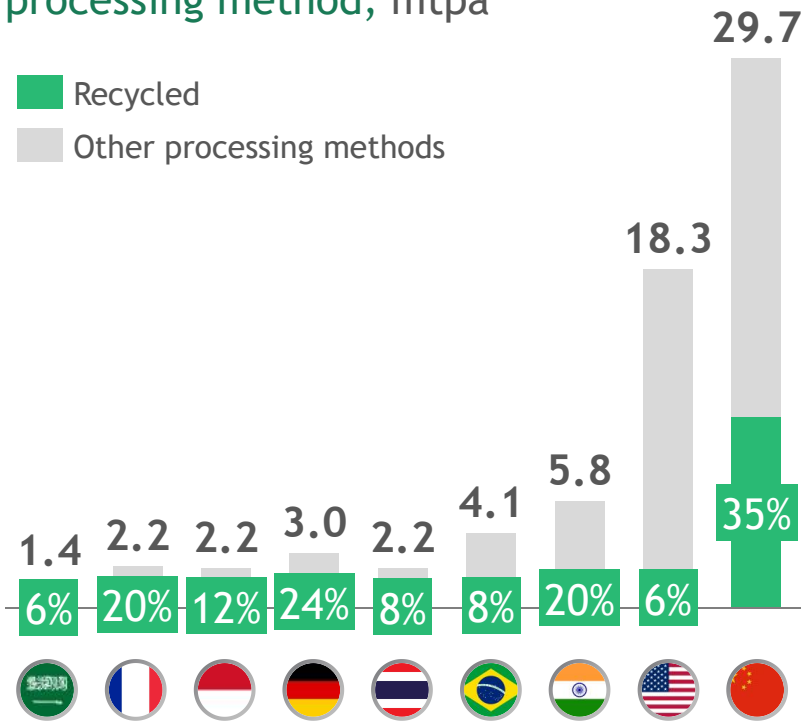
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# Supply | Different success factors and challenges in new feedstocks will define potential

Selected examples

## Wide ranges in feedstock availability

Total plastic waste available by processing method, mtpa




Source: Plastics Europe, EPA, BCG analysis

## Different pain points across value chain must be addressed to enable circularity

### Raw materials

Use of certain materials (e.g., multilayer plastics) that are not easily recyclable

### Design

Suboptimal design for handling and recycling (e.g., plastic products with dark colors or additives that can contaminate recycling streams)

### Produce

Production of products that are not 100% recyclable; low supply of recycled raw materials and/or high prices

### Collect

Lack of recycling culture coupled with deficient collection systems, incorrect sorting and leakage

## Several key factors that will define potential

- **Addressable volume of plastic waste**
- **Feedstock acquisition and treatment costs** (incl. future regulatory regimes)
- **Design capacity** (esp. in pyrolysis)

**Increasing importance of partnerships across value chain** and **proactive policymakers' engagement**

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# Supply | Emerging technologies to make platform choice even more nuanced & complex and disrupt supply curves

Selected examples

| | | |
|---|---|---|
| **Crude Oil-To-Chemicals (COTC)** | Converting crude oil into chemicals, bypassing traditional refining with two key variants:<br>• Paraxylene-focused (Chinese variant)<br>• Olefin-focused (Saudi Aramco) | أرامكو السعودية saudi aramco, 恒力石化 HENGLI PETROCHEMICAL, 盛虹石化 SHENGHONG PETROCHEMICAL, ZPC 浙江石油化工有限公司 Zhejiang Petroleum & Chemical Co.,Ltd. |
| **E-technologies** | Using 'green' power in chemical processes to replace fossil fuels, reducing emissions | BASF, سابك sabic |
| **CO2-to-X** | Converting $CO_2$ into useful products like synthetic fuels, chemicals & other materials | EVONIK Leading Beyond Chemistry, covestro, Braskem |
| **Chemical recycling** | Two different processes to produce 'virgin grade' – depolymerization and pyrolysis | سابك sabic, INDORAMA |

Source: BCG analysis

## Key challenges

- **Uncertainty of future demand** (e.g., for recycled polymers)
- **Increasing variety of technology platform** options available
- Future **cost uncertainty** (both CAPEX and OPEX)

**How to set investment priorities for your portfolio of the future** e.g., from sustainability, feedstock dependency, and market prioritization perspectives?

**How to design new** (integrated) **sites, incl. location for new ones?**

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# Market balance shifts shaping the future of PetChem

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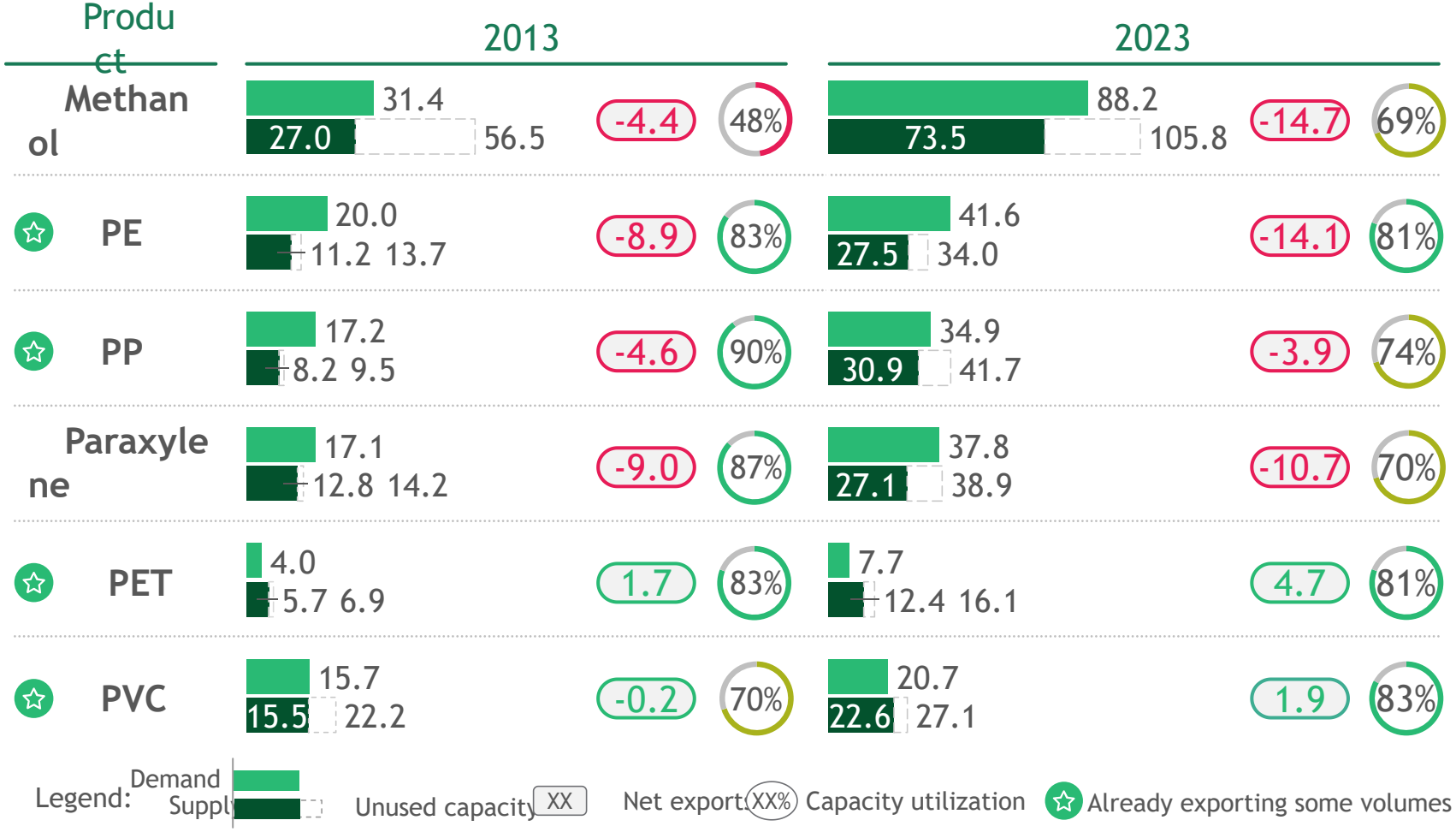
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# Market balance | China's capacity increase and export trend already started reshaping global trade flows

China's petrochemical supply & demand balance, mtpa




Note: Speculative capacity not included; Operating rate for PE calculated as weighted average for HDPE, LDPE and LLDPE
Source: ChemCom; BCG Analysis

## Key highlights

**China has already achieved self-sufficiency** in several products (e.g., PP, methanol, paraxylene)

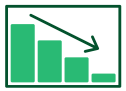
**Export pace is likely to accelerate** –
e.g., in PP on top of already established PVC and PET export

**Traditional importers** are being forced to explore other opportunities to **reroute their volumes**

Some global players are considering / **shifting some new investments to China** (e.g., BASF)

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# Market balance | Competitive pressure transforming European markets – European producers and key exporters should explore new opportunities to win



## Stagnation

E.g., ~1% GDP growth in 2023



## Supply chain risks & dependency

E.g., up to 50% from single suppliers for some feedstock and intermediates



## Energy crisis

E.g., up to 20-80% higher electricity price expected vs. China, US, ME in 2030



## Climate challenge

Ambitious emission reduction targets, however diverging regulations discouraging investments in Europe (e.g., IRA in the US)



## European producers should prioritise three key mid- and long-term levers

**Optimise margins:** e.g., drive cost reduction programs

**Rethink footprint:** e.g., import feedstock/intermediates from own and partners' assets, selectively relocate or rationalize not competitive plants, consider investments outside of Europe

**Push & prepare for 'green' markets:** e.g., drive regulatory advocacy to create green premium markets, accelerate in green solutions/tech, develop green offering and go-to-market strategies



## Key exporters (primarily US and ME)

**Position for competition and define competitive advantages of the future** under different market restructuring & reg. scenarios

Source: BCG analysis

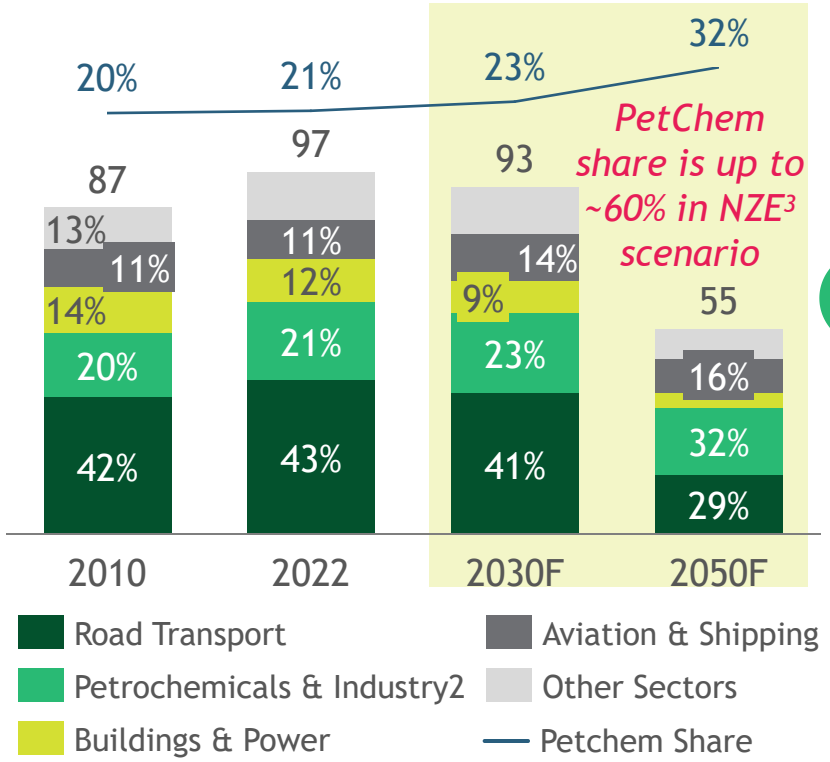


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# Market balance | Oil & gas majors' growing presence in petrochemicals will reshape the competitive landscape and intensify competition

## Share of PetChem in oil demand to increase by ~10-40% by 2050

*Oil demand by sector[1], mb/d*




Selected examples

- TotalEnergies is partnering with Aramco on the $11B Amiral project in KSA
- Shell Chemicals Park Moerdijk starting production in 2024 (a new pyrolysis oil upgrader unit boosting circular & low-carbon offerings)
- ExxonMobil plans to construct $10B ethylene plant in China (2.5mtpa)
- Saudi Aramco is betting on COTC projects now: 2 domestic (~18mtpa), 2 in China (~8mtpa) and 1 in South Korea (~2mtpa)
  Seeking partnerships to expand conventional cracking (e.g., Amiral project with TotalEnergies in KSA)
- Doubling the company's ethylene production capacity through $6B Ras Laffan petrochemicals project (a JV with CPChem)

1. Announced Pledges Scenario (APS) 2. Sector includes fuel used within the manufacturing and construction industries incl. iron, steel, aluminum, cement, pulp and paper. Excluding the use for the transformation of energy into another form or for the production of fuels 3. NZE – Net Zero Emissions by 2050 Scenario
Source: IEA WEO 2023, BCG analysis



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# Six strategic imperatives for petrochemical players

| | |
|---|---|
| 1 Seize India & SEA growth opportunities | • **Expand market presence, shape and develop** downstream markets<br>• **Build local footprint**, incl. by leveraging strategic partnerships/JVs |
| 2 Develop a robust China strategy given self-sufficiency | • **Challenge China's strategy:** traditional bulk export will no longer work – identify & make value-creative bets or consider other growth avenues<br>• **Safeguard from emerging export** by leveraging customer relationships, product/service differentiation, and improving competitiveness |
| 3 Reimagine serving European market in the long-term | • **European producers** to explore new ways to increase competitiveness and proactively develop 'green' markets with policymakers<br>• **Exporters,** primarily ME & US, **to identify future competitive advantages** beyond e.g., price in different regulatory scenarios |
| 4 Reinvigorate sales & marketing muscle and approach | • **Strengthen sales skills** to navigate intensified competition, growing product complexity & experienced workers retiring |
| 5 Examine talent & knowledge retention strategy readiness | • Proactively assess **op model & org readiness for e.g., new growth pockets, revised footprint, new technologies**<br>• **Prepare to manage workforce generation transition** e.g., value proposition for younger |
| 6 Forge ahead with creative partnerships | • Strategically evaluate and secure opportunities **especially in circularity**, be it with **customers**, to **secure access to (new) feedstock,** with **technology leaders**, and others |

## When acting on the six strategic considerations, players should…

### Build an "Uncertainty Advantage"

Proactively use scenario-based thinking (e.g., potential shifts in regulations, geopolitics) to be ready to radically shift the course if needed

### Craft own "Petchem Company of the Future" vision

E.g., with digital/AI operations central to all functions, differentiated technology portfolio, next level in supply chain mgmt. capabilities


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