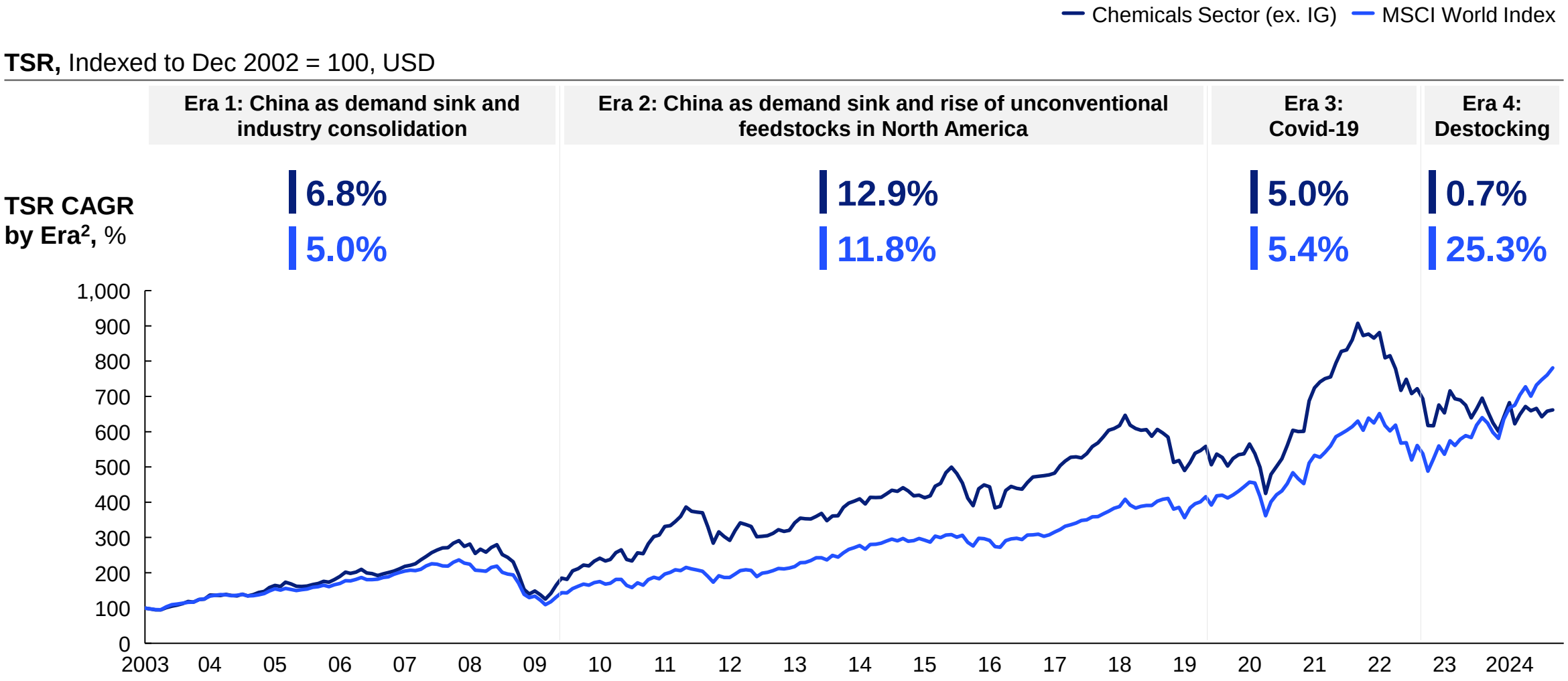
McKinsey & Company

Embracing Uncertainty: Unleashing Value in the Evolving Industry Landscape

TNChE Asia Conference

20 May 2025

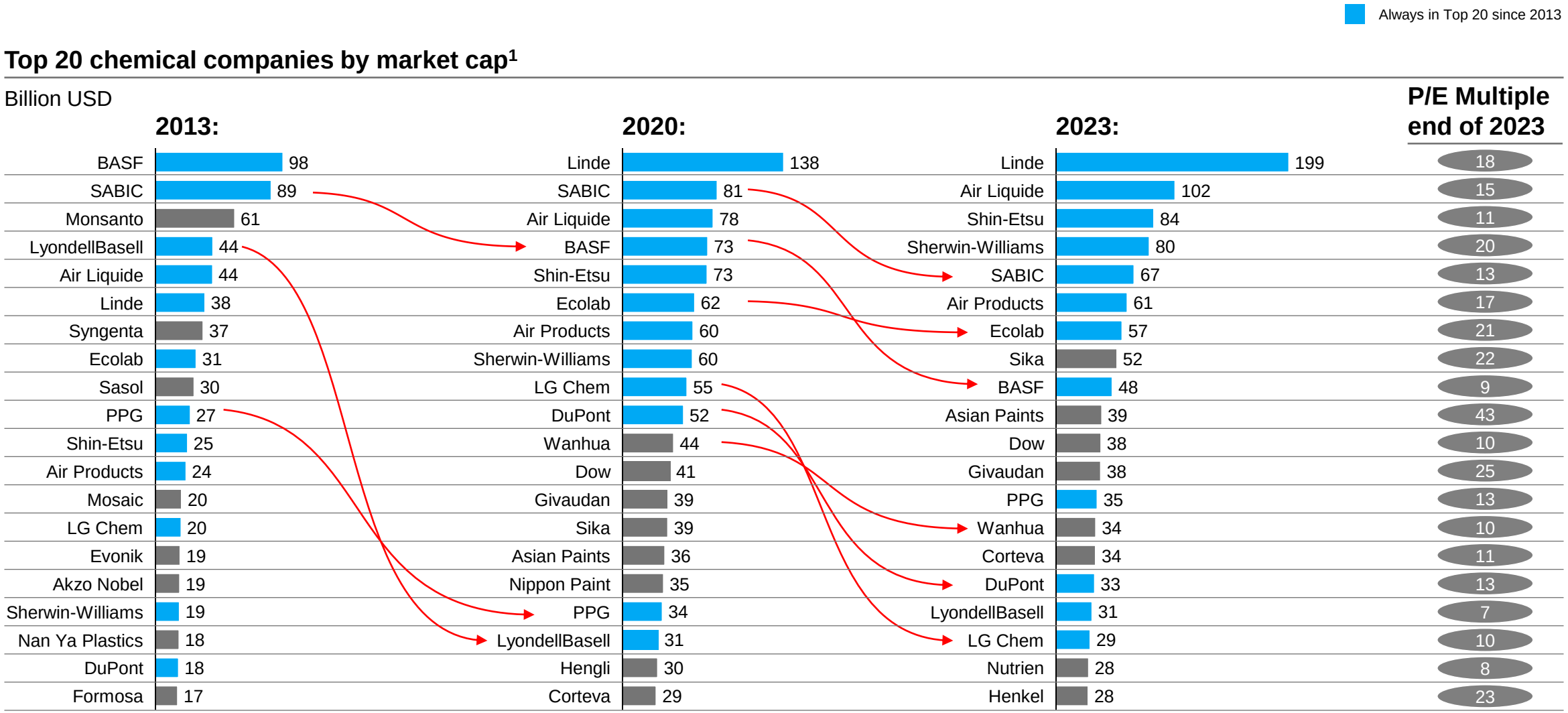
Chemicals sector is no longer outperforming the market in recent period reflecting the challenging industry conditions



1. Weighted Mean of Total Shareholder Return (TSR), yoy, Indexed to 100%. in USD. Chemicals Sample size 658 companies (excludes industrial gases)
2. Era 1: Dec 2002 to Dec 2008, Era 2: Dec 2008 to Dec 2019, Era 3: Dec 2019 to Dec 2022, Era 4, Dec 2022 to Aug 2024

Source: McKinsey Corporate Performance Analytics, S&P Global Market Intelligence

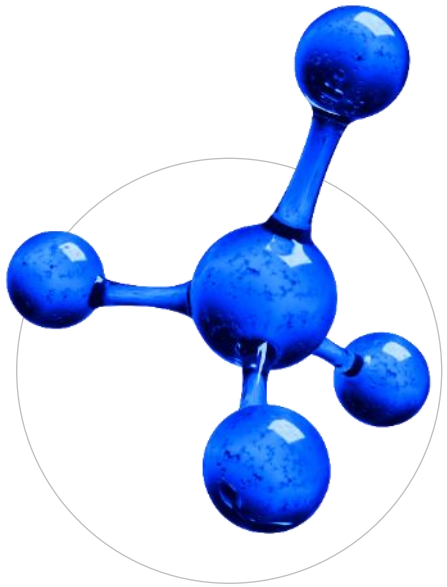
Landscape of top chemicals changed significantly over the last 10 years



1. Based on financial data on the end of the fiscal year

Source: Team analysis

Global chemical market is facing significant uncertainties



Longer term of down-cycle with unbalanced regional growth

- **The down-cycle will last longer than before**, given by the over-capacity (with new capacity plans in pipeline) and weak demand (aligned with GDP growth, lower than before)
- **Asia (especially China) has become the largest market**, will drive the major share of global growth
- Market share of USDope has dropped from 25% to 15%, and will shrink further given the high energy cost

Global supply chain is one the way of regionalization

- **Geopolitical tensions and uncertainty of tariff policy** increase the risk of global supply chain interruption
- Political and economical divers are both impacting the **shift supply chain from global to regional**

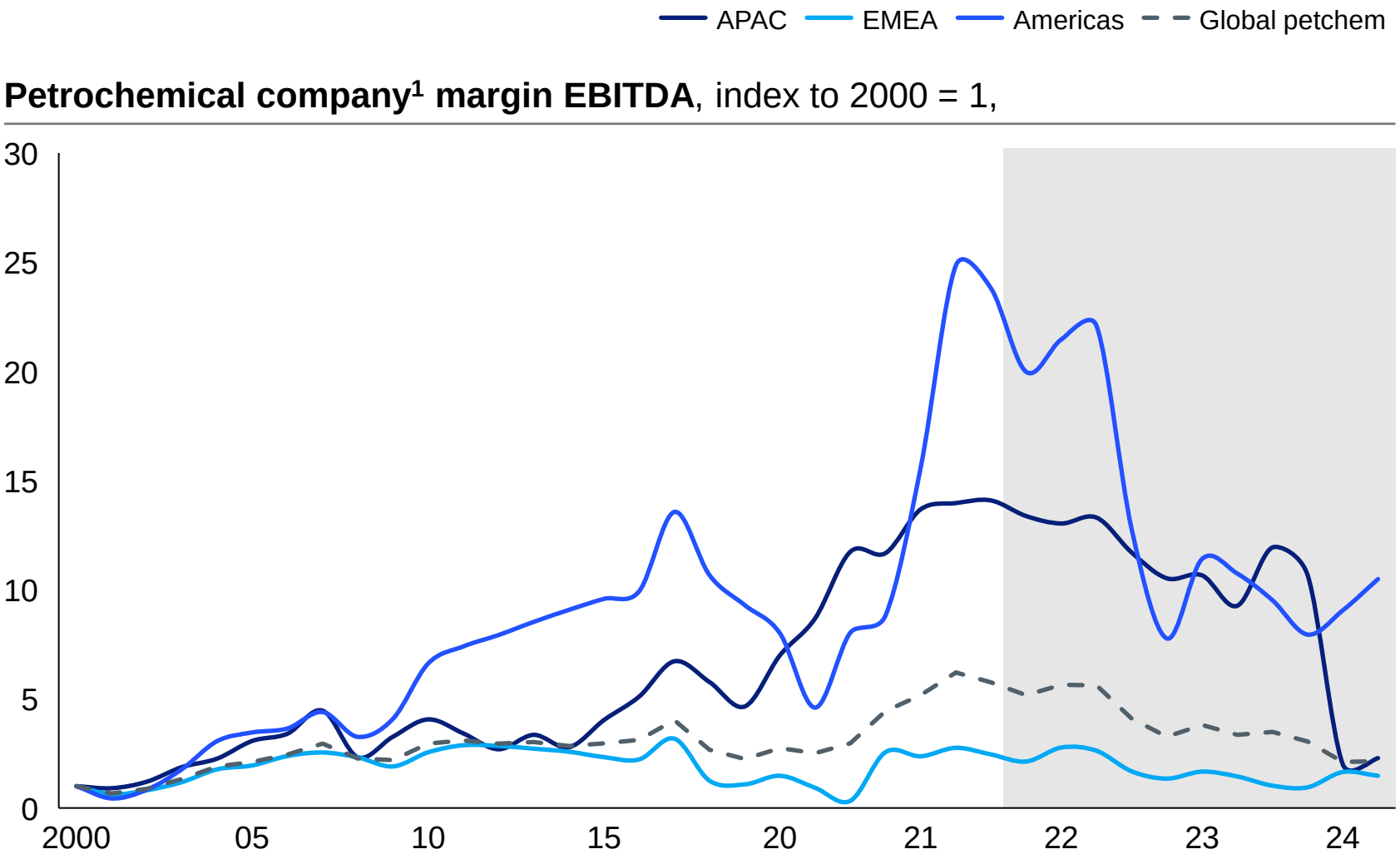
ESG is reforming the industry

- **Regulatory-driven ESG** is quickly shaping the chemical industry, especially through carbon emissions
- **Regulatory frameworks vary by region and are constantly changing**. it is critical for chemical companies to keep flexibility and resilience
- Not only bring extra cost to traditional players, ESG regulations also generate large scale of **opportunities to the players who can quickly transform to adapt new circumstance**

Evolution of digitalization and Gen AI

- **The AI revolution will significantly improve productivity** with huge potential. In addition to improving cost competitiveness, successful cases of using AI/Gen AI to disrupt innovative breakthroughs have emerged.
- **Chemical companies will be able to leverage Gen AI** to resolve customer's requirements that have not been met through new solutions (energy transformation, safer chemicals, etc.)

Following the peak in 2021, petrochemical margins continue to experience downward pressure

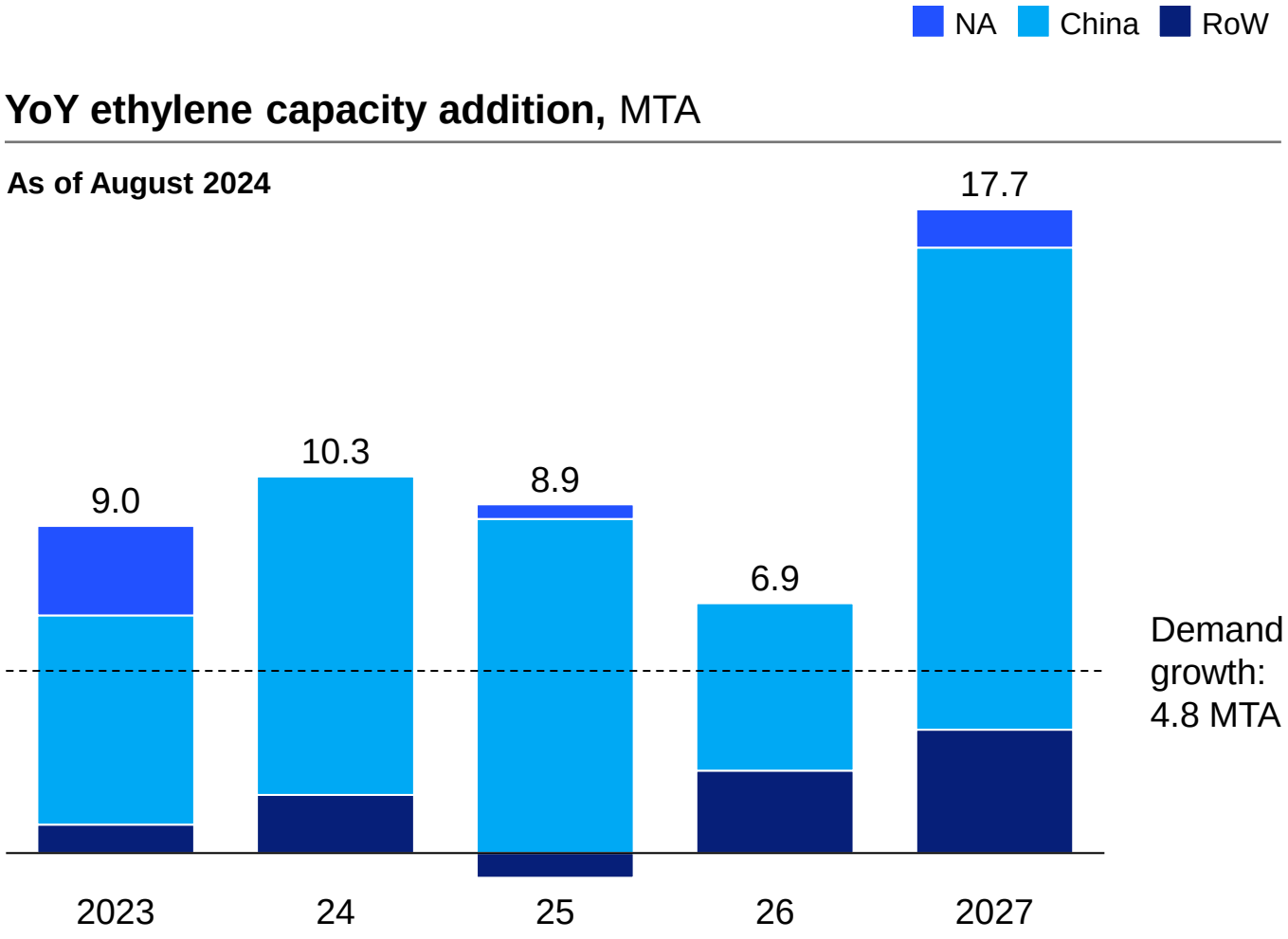


- Petrochemical companies earned record-high profits in 2021 through the first half of 2022, driven by strong demand recovery from COVID-19, and production/supply chain disruptions
- In the second half of 2022-2023, the market softened given high energy costs, prolonged lockdowns in China and significant capacity coming online

1. Average of 5-10 representative petrochemical companies in each region; quarterly results have been annualized

Source: CPAnalytics

Recent increase in ethylene capacity announcements are material



As of August 2024, ~66 MTA of capacity additions have been announced in China

Potential drivers for strong increase since March include:

- **Chinese capex advantage stimulating new builds**
- **Chinese policy requires investments in integrated refinery-steam cracking** complexes
- Desire of producers to receive permits **before 2030 peak carbon** limits kick in

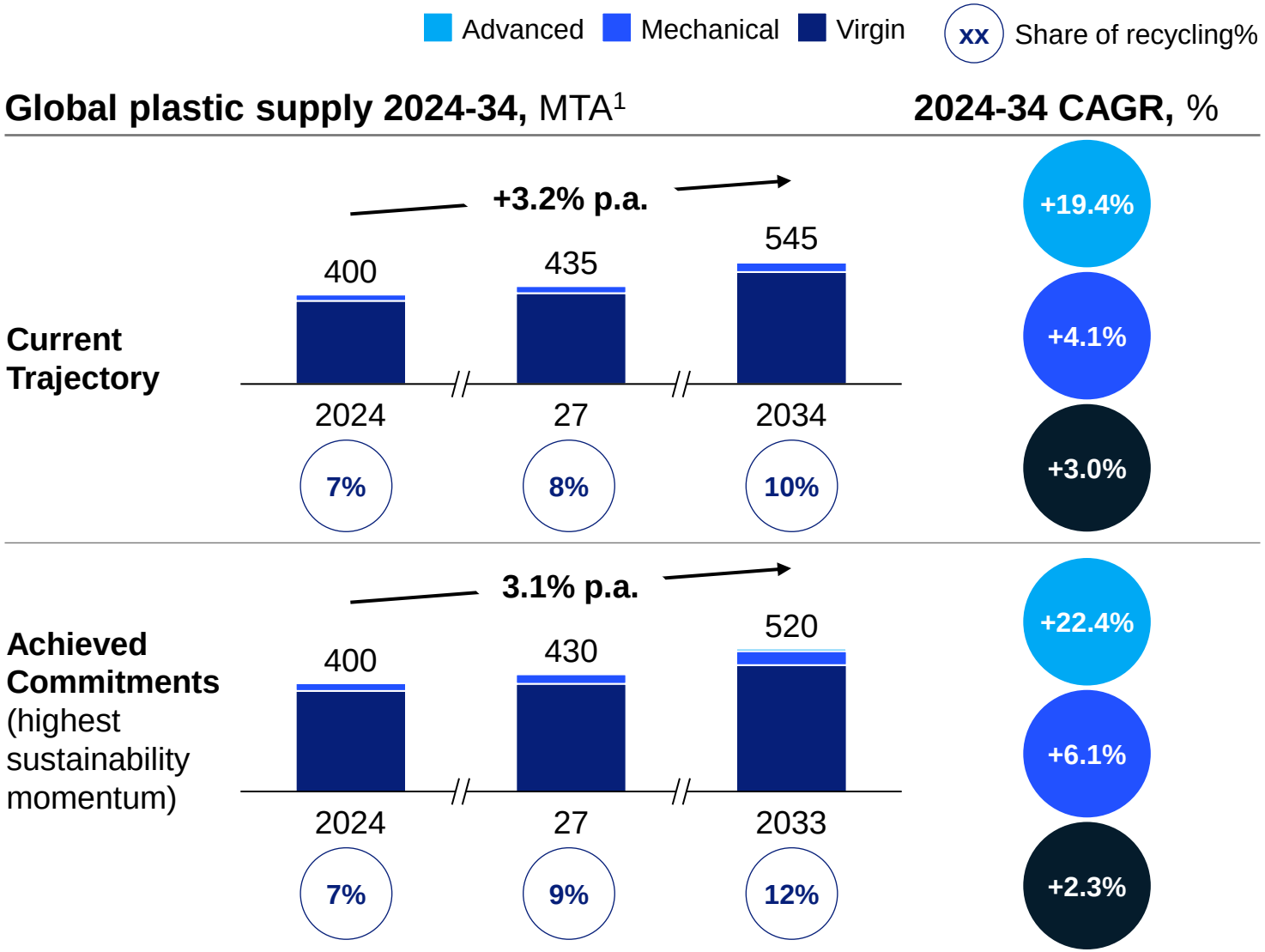
However, historical ethylene capacity expansions have been strongly linked to margins, creating **uncertainty how much of announced capacity will be built**

Drivers of current expansion would not be expected to continue past 2030, with peak carbon policy and less need for refining capacity post peak gasoline

1. Includes assumptions for the likelihood of each plant being built

Source: OPIS, McKinsey Chemical Insights

Even in an optimistic scenario, recycling is unlikely to significantly affect the growth of virgin demand



Observations

Recycling technologies growing fast, but from small base

Mechanical recycling potential of PE, PP, and PVC limited to ~10% of total volumes due to sorting and cleaning requirements

PET resin easier to mechanically recycle, but normally downcycled to polyester fiber, while fiber not recycled

Advanced recycling expected to start ramping by 2030 – very limited impact this decade

Advanced recycling does not negatively impact petrochemical utilization – need crackers to process pyrolysis oil

1. Includes fibers (polyester and polyamide), excludes rubbers and intermediates

Source: CI circular, CI demand

Opportunities

Maximize value from AI
Proven use cases deliver significant impact with low capex, e.g. furnace optimization in crackers, predictive maintenance, etc

Focus on growth markets
Structural demand growth exists in regions, end use markets and product groups

Focus on Innovation
New multi billion dollar value pools expected in new low-carbon products and/or chemicals enabling the energy transition

Feedstock diversification and optimization
Under Trump administration, additional supply of US crude oil, natural gas.

Inorganic moves to shift portfolio to align with strengths and strategy (e.g. trading capabilities, M&A)

Digital / AI in Chemicals – what has changed in the last 5-10 years

	Digital / AI in refining 5-10 years ago	Digital / AI in Chemcials today
	**Limited computational capabilities & high processing costs** Slow analytics and high costs for processing large data volumes due to outdated computing infra	**Enhanced computational power & cost efficiency** >90% improvement in computational abilities, at lower costs leveraging cloud and edge computing, alongside AI algorithms
	**Legacy infrastructure & integration** Older systems and proprietary equipment difficult to integrate with new digital tools	**Smart integration** AI-enabled middleware and IoT solutions now bridge legacy systems with modern platforms
	**Cybersecurity vulnerabilities** Older digital infrastructures were more susceptible to cyber threats and lacked robust security measures	**Enhanced cybersecurity** Modern systems continuously monitor and defend critical infra, ensuring operational continuity and protecting sensitive data
	**Legacy optimization limited** Legacy optimization tailored to specific physical systems, providing detailed, asset-level insights	**AI optimization maximizes Value** AI-powered optimization scalable across domains, integrating diverse data sources to optimize processes

AI in refining: using **large data sets** and **advanced prediction algorithms** to **solve difficult and impactful problems** in new ways at a new pace

Delivered >0.5$/bbl across domains in refining and petrochemicals

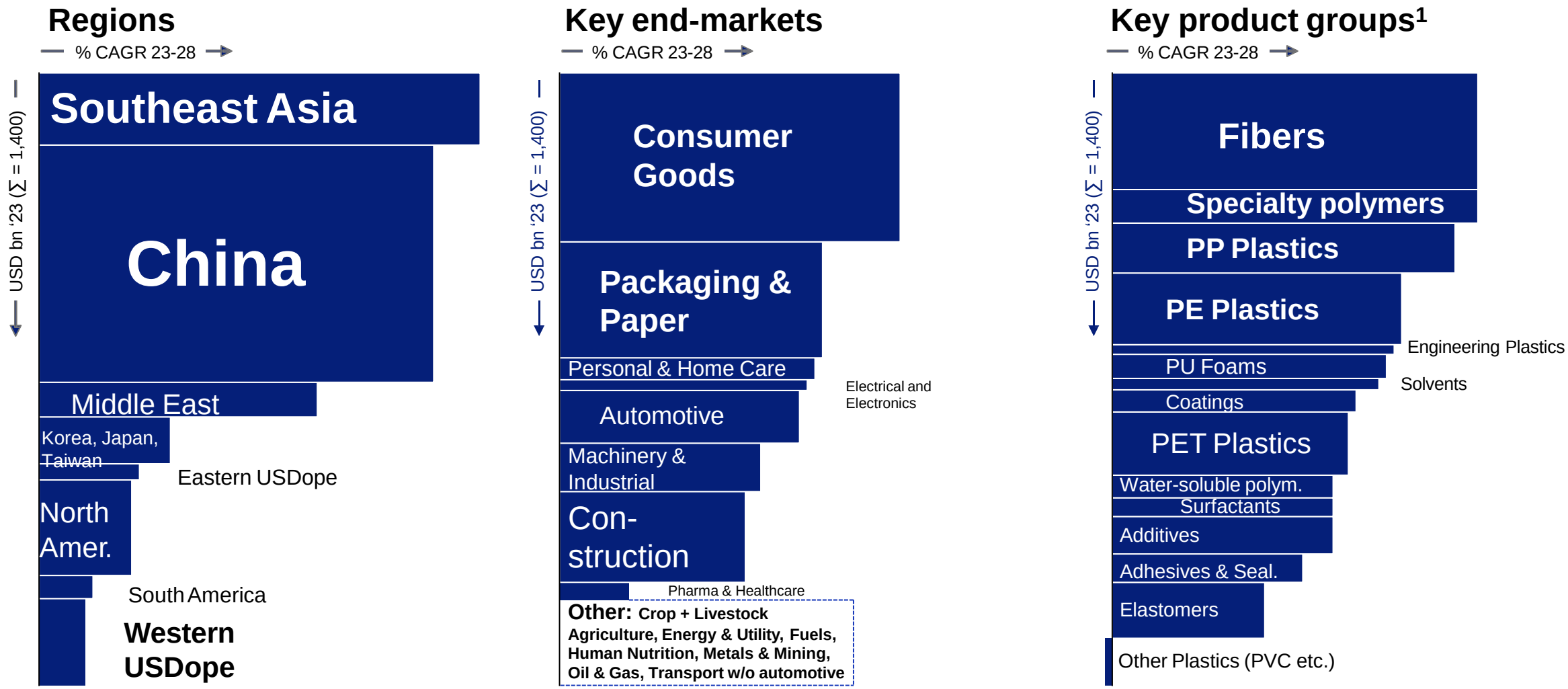
11 areas of highest business impact area for refining and chemicals

Based on our experience of 400+ digital projects with refinery and petchem players

Operations	Maintenance				Supply chain	Proc.	Commercial			
Yield, Energy, Throughput	**Predictive Maintenance**	**Digital Workflow Management**	**Integrated planning, on field SOPs** (Routine maintenance)	**Integrated planning, on field SOPs** (Turnarounds)	**Digital Supply chain**	**Digital Procurement**	**Sales growth optimization**	**Pricing and margin management**	**Customer experience design**	**Business model innovation**
Optimization from crude to finished product tankage that immediately responds to market and operating constraints – gross margin and volume expansion	Improved approach to conducting planned/preventative maintenance through analysis of various sources of equipment data – mostly uptime improvement	Field worker productivity increases through better access to information for Operations, Maintenance, Inspections and Engineering – tool time improvement	Dynamically adjusted and optimized maintenance execution through analytics of past work orders, warehouse digitization, and automation of job scheduling – tool time improvement	Real-time tracking of turnaround execution to enable monitoring/management of 'earned' schedule hours and 'burned' costs and reallocation of workforce – opex and uptime improvement	End to end digitization from feedstock, shipping to planning and scheduling, outbound logistics and trading	Leverage digital and analytics to increase spend visibility, advance sourcing, improve procure to pay and performance management of procurement organization	Granular insights on opportunities and offerings to increase pipeline and conversion Dynamic allocation of sales resources based on algorithmic deal scoring	Tailor pricing based on deep customer insights and past purchases Develop full transparency of SKU margins and act on underperformers	Optimize integrated sales & supply chain margin/ mix based on CX analytics and insights Unlock new services revenue streams centered around CX	Rapidly develop MVPs and shorten time-to-market Install iteration based continuous improvement setup
0.30 – 0.50 $/bbl in refining & ptechem	**Up to 20% - 30% reduction in unplanned downtime**	**Up to 10% maintenance tool-time increase**	**Up to 10% maintenance tool-time increase**	**Up to 10% schedule and cost improvement**	**0.30 – 0.50 $/bbl in refining & petchem**	**3~20% savings across categories**	**+1-2% Sales** **+1-3% Margin**	**5-10% product margin**	**20% → 80% Digital Interactions** **+1-5%-pts Market Share**	**Business Creation @Scale** **Business Model Reinvention**

Growth comes from Asia, consumer goods and their packaging

The 1,400 bn USD chemicals market broken down by different dimensions



1. Only showing product groups above 10 bnUSD sales. Thus excludes composites, high-performance polymers, other resins

Source: IHS Markit; CMA by OPIS; McKinsey Chemical Insights

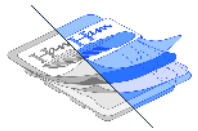
Innovation needed to meet market demand worth 100s of € bn

Key novel requirements and associated value pools by 2030

Deep dive to follow

Applications

Packaging



Recyclability via functionalized mono-materials

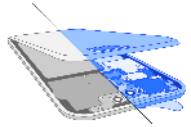
350-550 USD bn

Apparel & footwear

Sustainability via low-emission, recyclable mono-material

200-250 USD bn

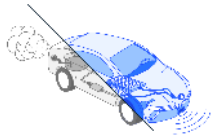
Consumer electronics



Recyclable materials and repairability via modular design

70-100 USD bn

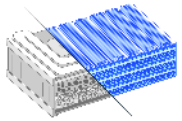
Electric vehicles



Recyclability via debondability and sustainable mono-materials

50-100 USD bn[2]

Batteries

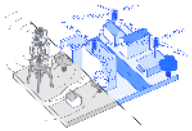


Longevity via heat transfer and repairability via stack design

150-200 USD bn active materials

50-70 USD bn other

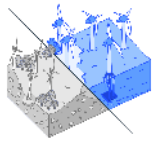
Networked equipment



Increase of low loss, high frequency transparent materials

20-30 USD bn

Wind power



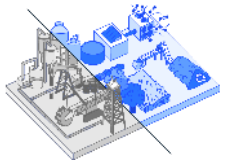
Total cost reduction via automated processes and durable materials

30-40 USD bn

Replacement of hazardous substances, e.g., PFAS certain solvents etc.

Technologies[1]

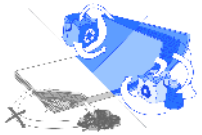
Feedstock



Sustainability via non-fossil and recycled input material

15-400 USD bn

Composite materials



Recyclability via mono-material and process solutions

40-50 USD bn[3]

1. Across all applications
2. Without battery materials
3. Without transportation (esp. automotive) and energy (esp. wind) applications

Source: McKinsey analysis

Apparel and footwear example

Today

Cost-driven fast fashion.
Functional clothing for athleisure

+ Future requirements

Sustainability-driven recycled, refurbished and regenerative fashion with traceable materials. Low energy curing during assembly

Cotton, synthetic fibers (polyester, nylon, spandex), wool

Leather

Polymer foams, e.g., PU, EVA

Adhesive

Multi-material, abrasion-resistant sole, e.g., synthetic rubbers, PU foam

Renewable performance fibers, e.g, recycled polyesters and cottons, wool-like biotech fibers

Low-carbon leather replacements (e.g., recycled, synthetic or bio-based)

Recycled or green polymer foams

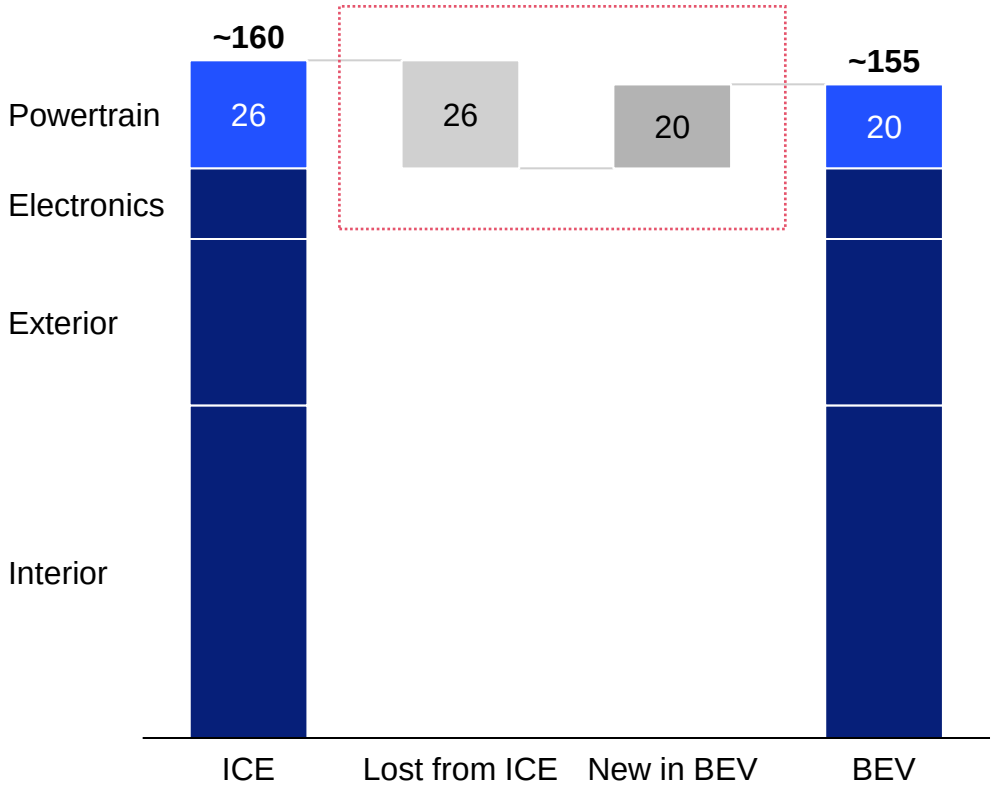
Selectively debondable, low energy curing adhesive

Recyclable mono-material sole

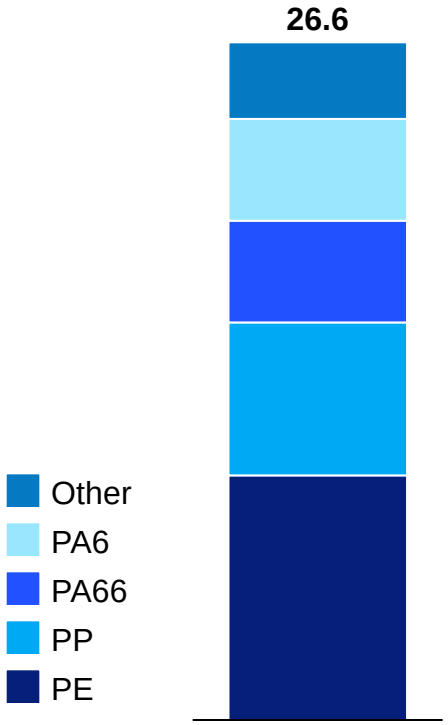
Source: McKinsey analysis, Statista, USDomonitor

Electrification will change the mix of plastic demand for the auto industry

Evolution of plastic content from ICE to BEV
kg/vehicle

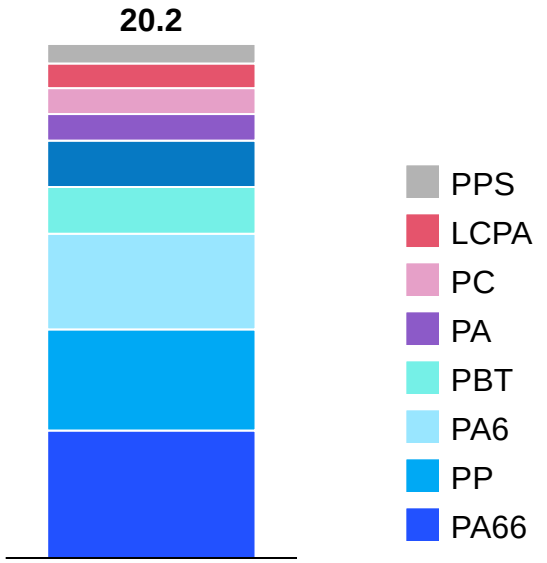


Threat
Lost volumes in ICE powertrain



Opportunity - estimated
New volumes in BEV powertrain

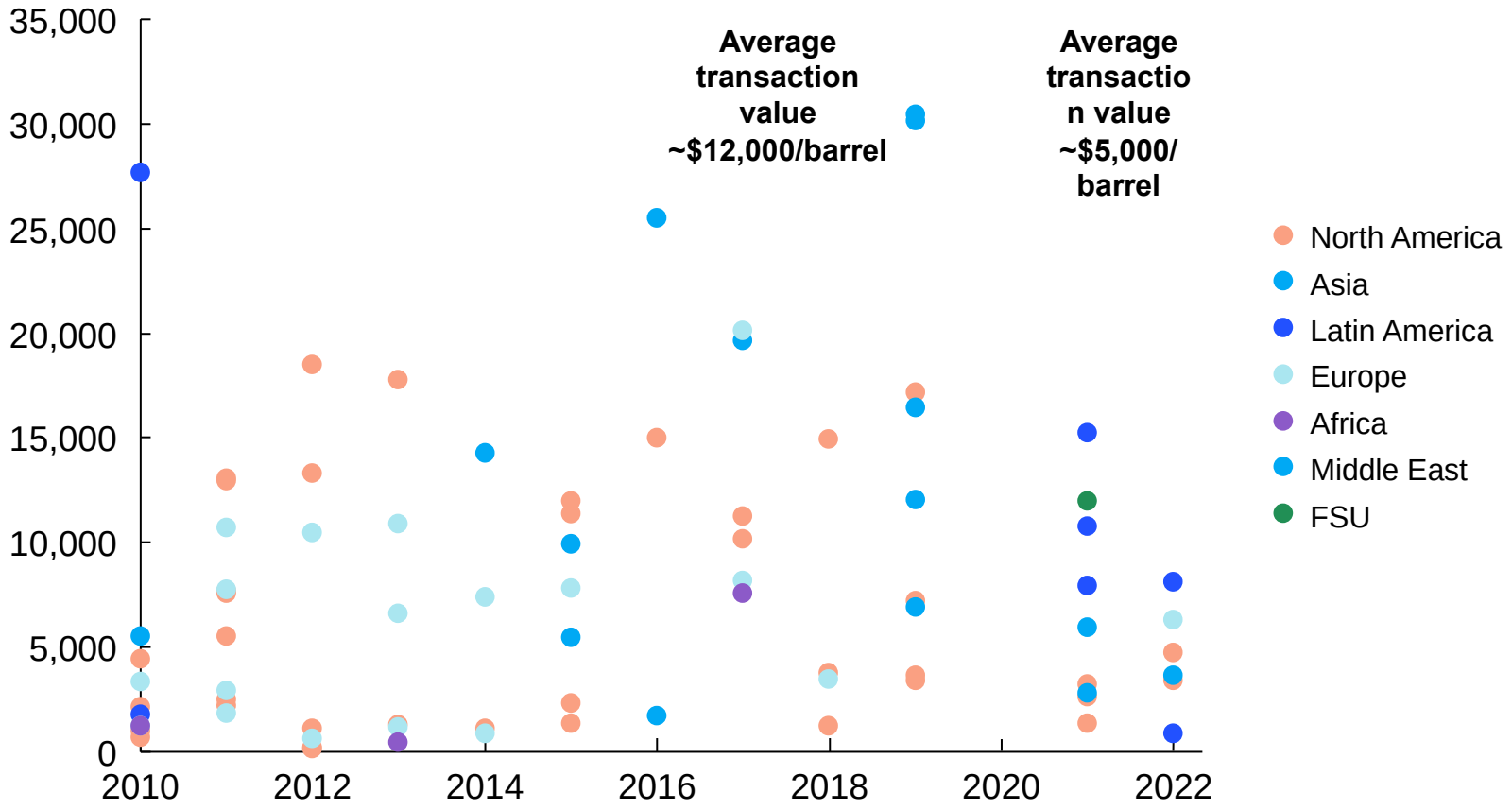
Evidence of shift to higher value polymers



Source: McKinsey analysis

Refining M&A transactions continue, at attractive values for buyers

Transaction value[1]
$/barrel capacity - normalized to Nelson Complexity of 10



1. Deal value excludes inventories and non-refining assets

Source: McKinsey M&A Investment Tracker

Refinery asset transactions have continued post pandemic recovery, but at reduced values

This is driven by the restructuring of refiner portfolios as they adapt to an energy transition world

This is creating inorganic growth opportunities for refiners able to define a successful strategy for legacy assets

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