

# Global Chlor-Alkali Market

Changing dynamics, challenges and opportunities

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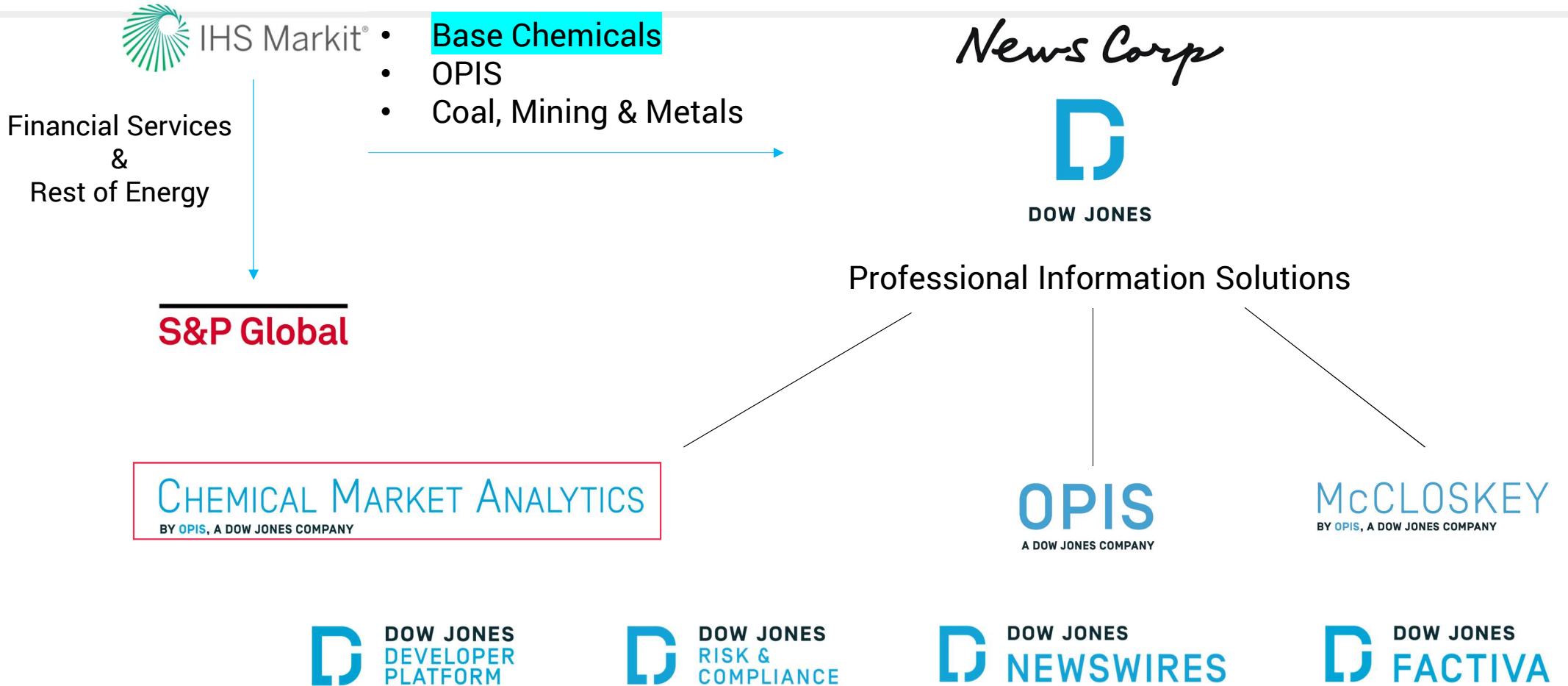
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Market Fundamentals

Changing Dynamics

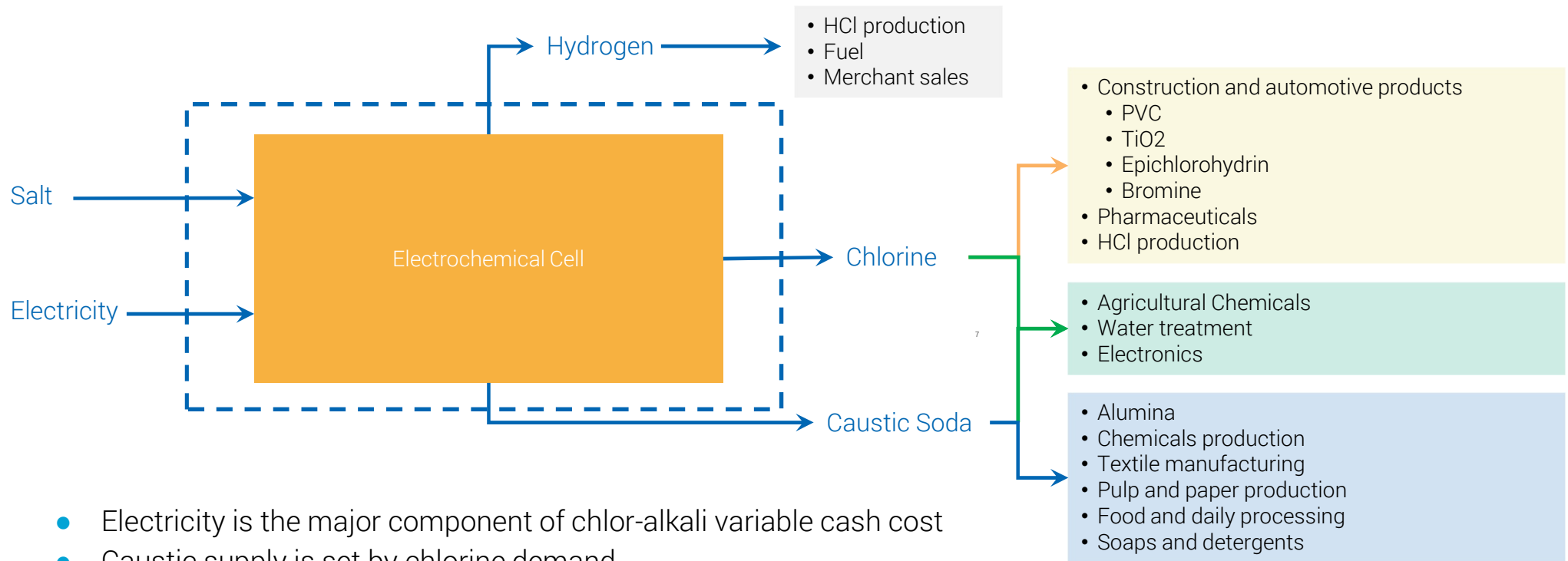
Looking ahead: Challenges and Opportunities



# Market Fundamentals

# Introducing the ECU

1.0 ton chlorine + 1.1 ton caustic = 1.0 ECU



- Electricity is the major component of chlor-alkali variable cash cost
- Caustic supply is set by chlorine demand

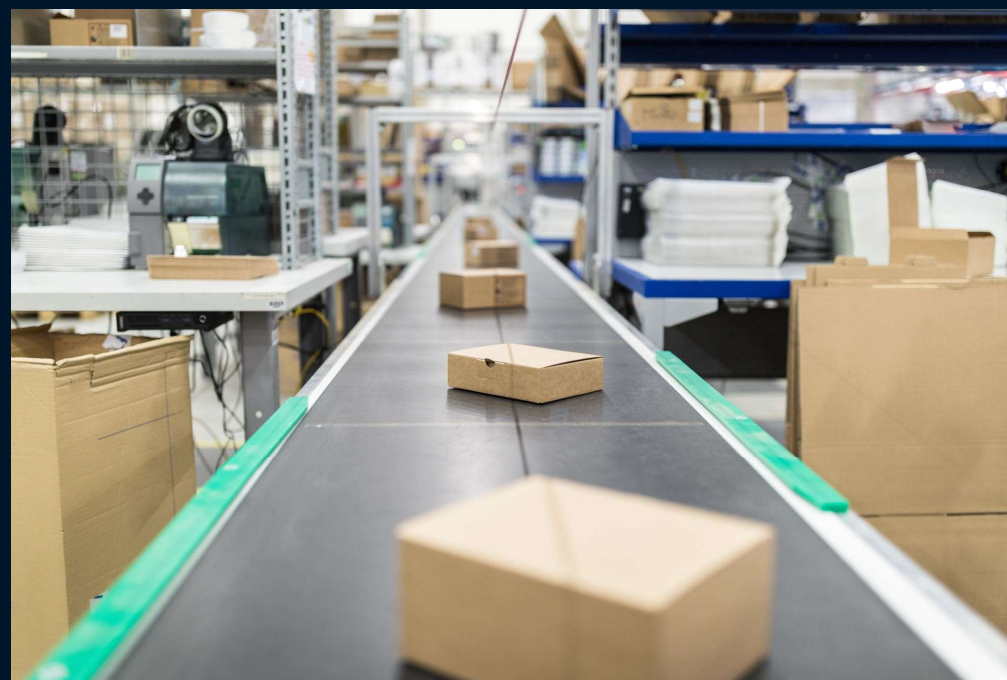


# Chlor-alkali market balance relies on two different drivers

## Chlorine correlates with construction



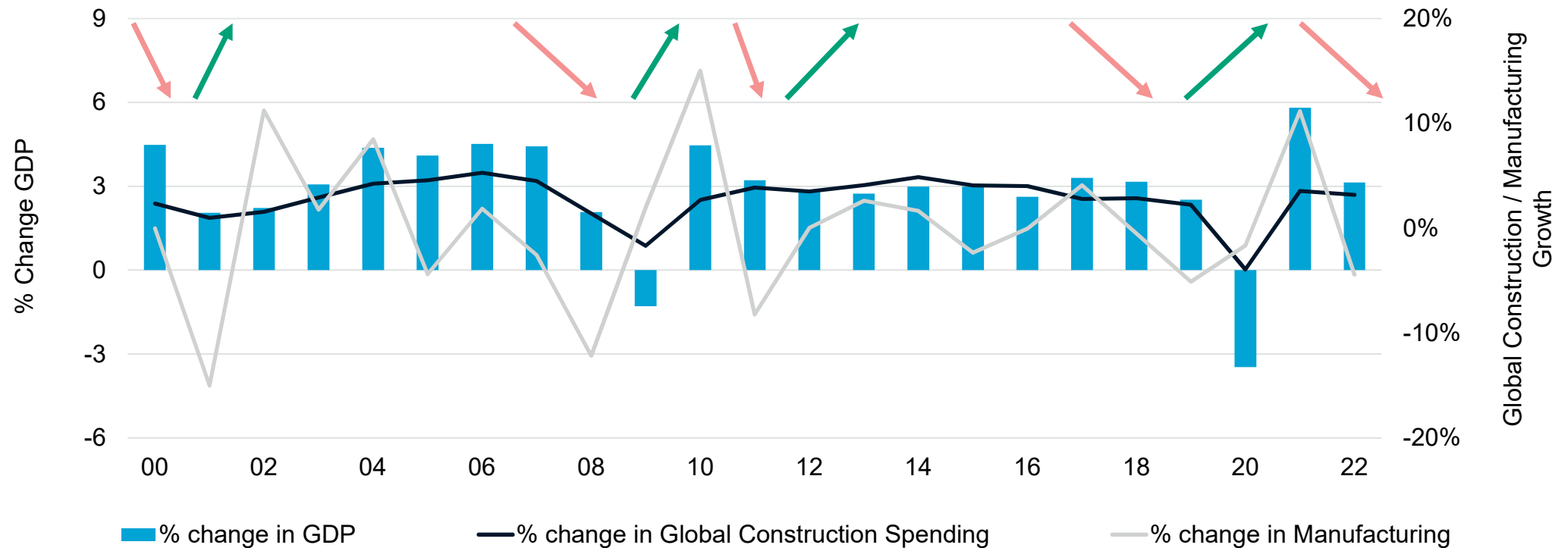
## Caustic soda correlates with manufacturing





# Economic Cycle vs. Chlorine/Caustic Demand

Correlation, Global GDP and Construction / Manufacturing Activity

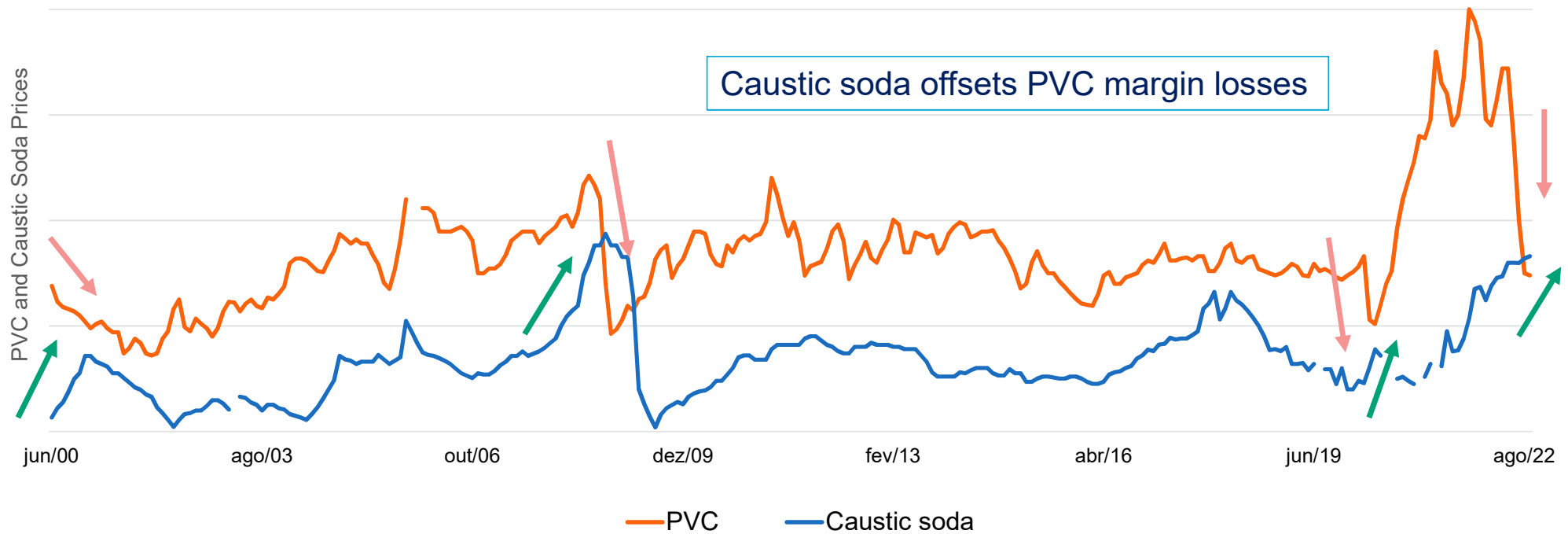


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# PVC and caustic soda prices reflect market imbalances

## US spot export prices



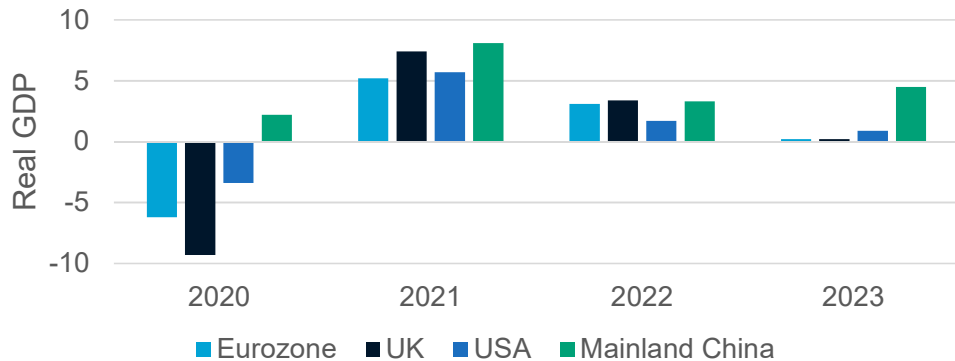
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# Changing Dynamics

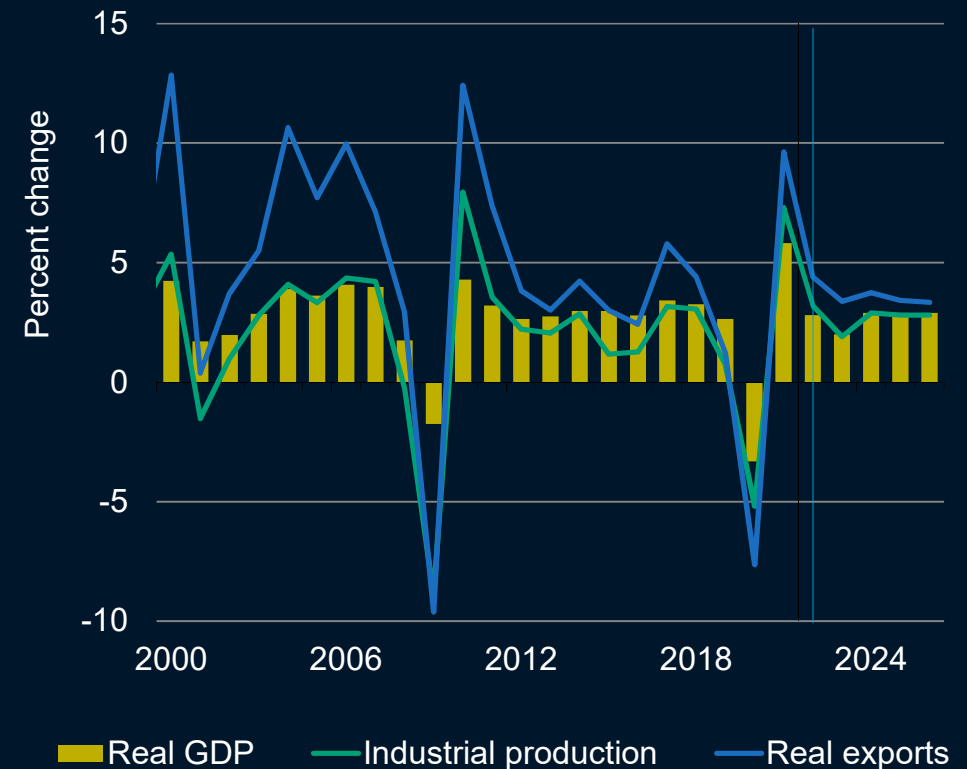
# Global growth is slowing as policies tighten to cool inflation

- Global consumer inflation likely to increase to 7.3% in 2022 from 3.9% in 2021
- Pivoting fiscal policies from stimulus to restraint slow global real GDP growth from 5.8% in 2021 to 2.8% in 2022 and 2.0% in 2023
- Near-term growth will be led by Asia Pacific; Europe and parts of Latin America likely to experience recessions



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## Global real GDP, industrial production, and real exports of goods and services



# West Europe chlor-alkali: structural shift amid an existential crisis

- Shifting trade patterns
- Supply and demand impact

## UKRAINE CONFLICT



- Energy price surge
- Uncertainty / volatility

## ELECTRICITY COSTS

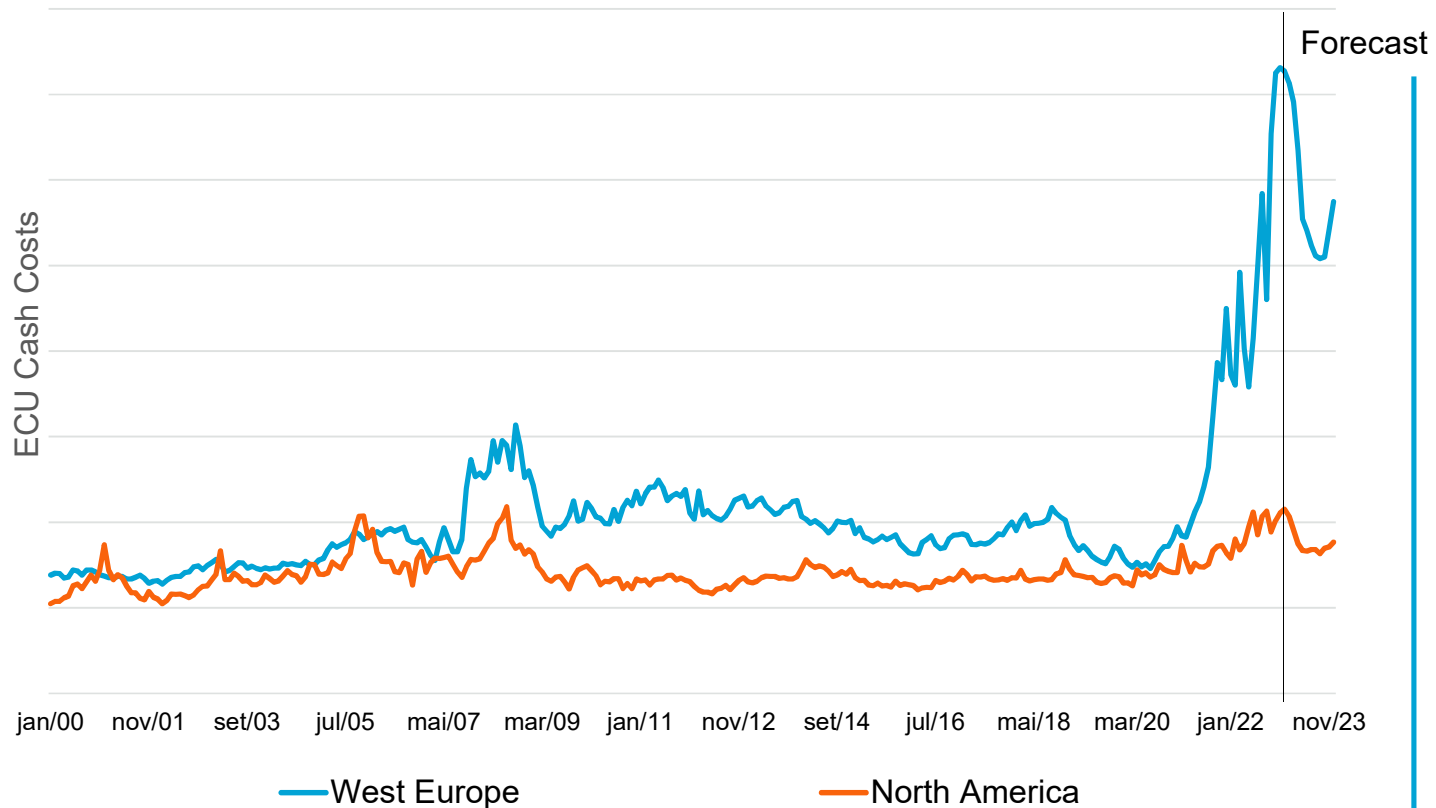


- Unplanned outages
- Logistical challenges

## SUPPLY LIMITATIONS



# ECU cash costs in Europe reached unprecedented levels



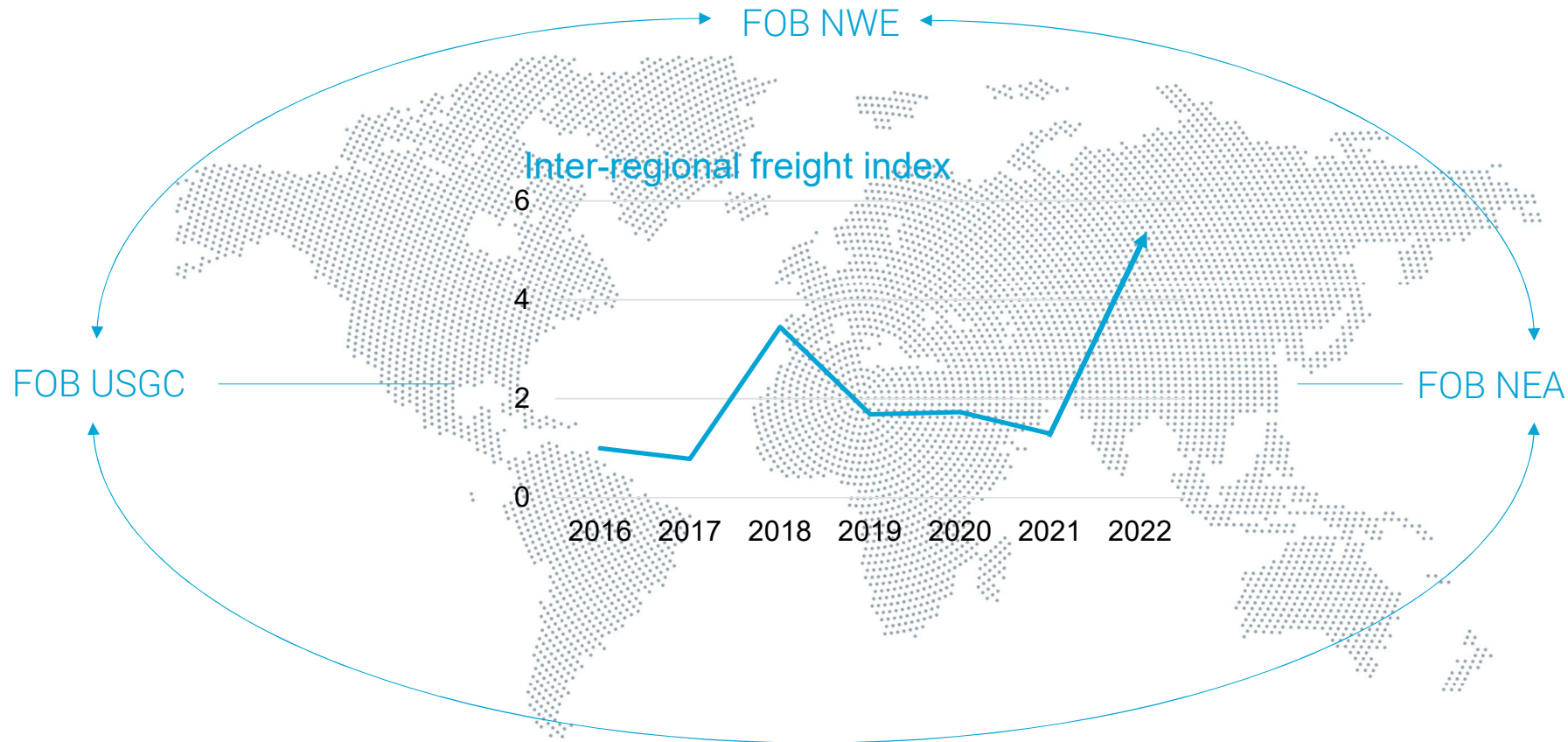
- European energy prices forecast to remain elevated
- European cash costs are defining global caustic soda price trends
- Energy costs expectations set a new base line for ECU margins

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# Record high freight rates further impacting import costs





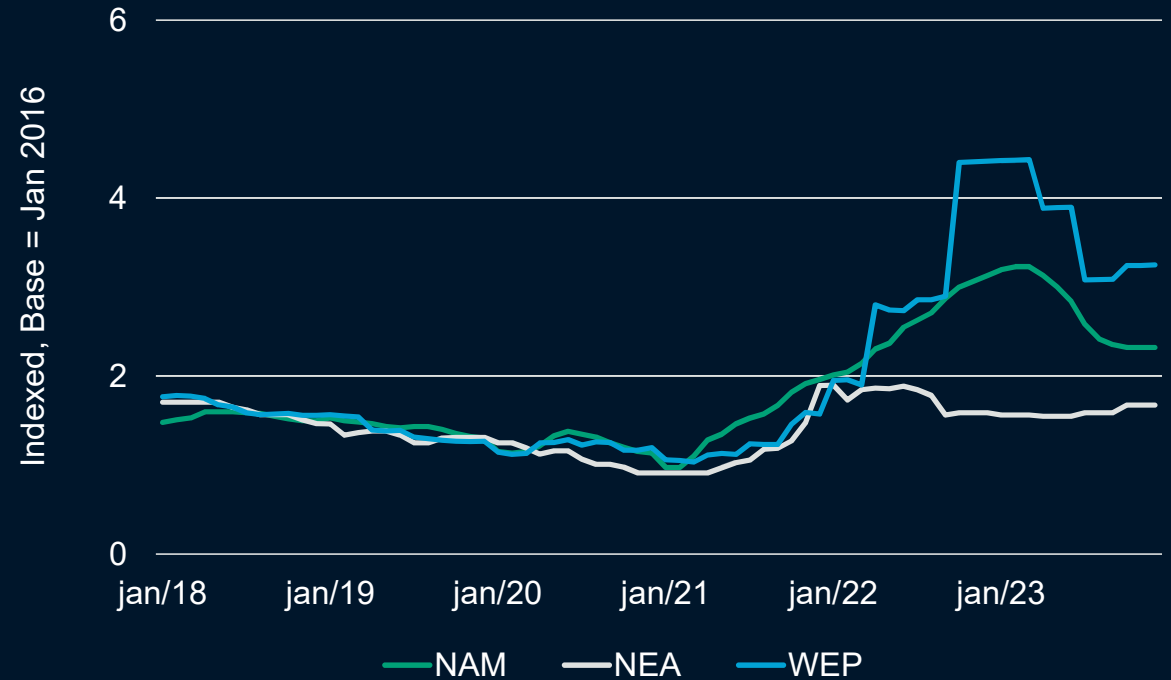
# Regional contract prices have followed spot market trend

- Record high freight rates have increased the price spread between regions
- Arbitrage windows are open but longer supply chains create time-risk
- Result is apprehension to commit to long-lead imports with potential recession looming



Source: Freightos Baltic Index Global Container Index

## Regional caustic soda price comparison



Source: Chemical Market Analytics by OPIS

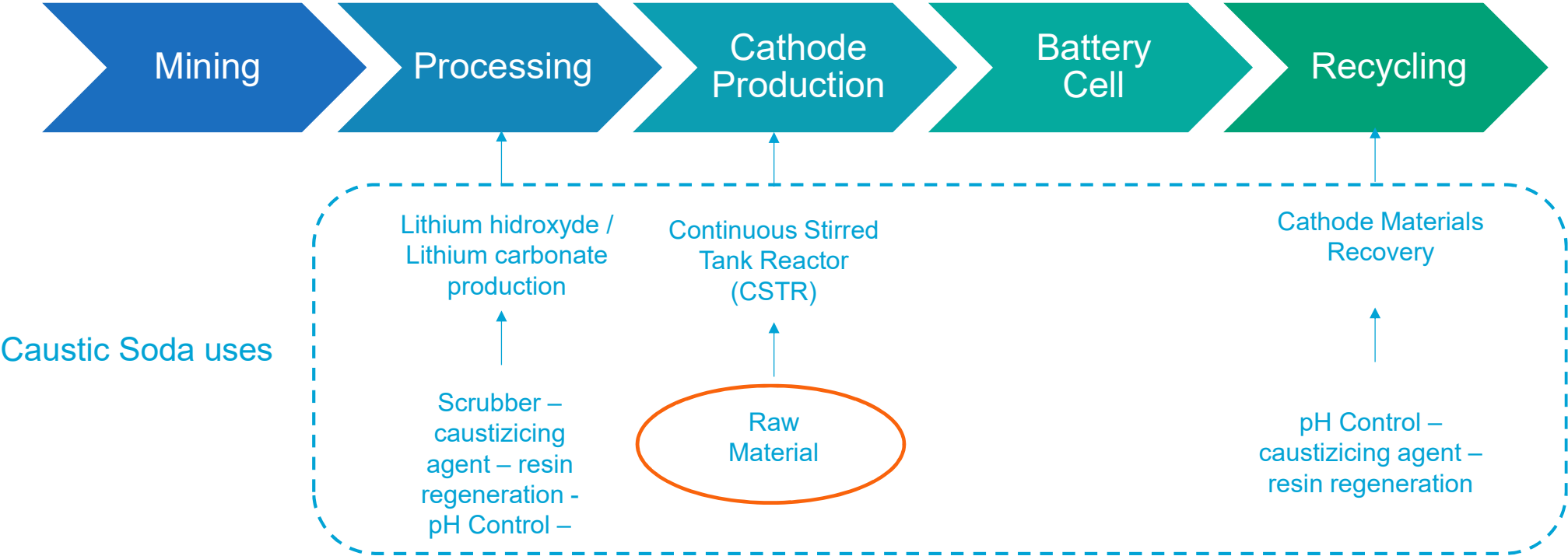
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# Looking ahead: Opportunities and Challenges



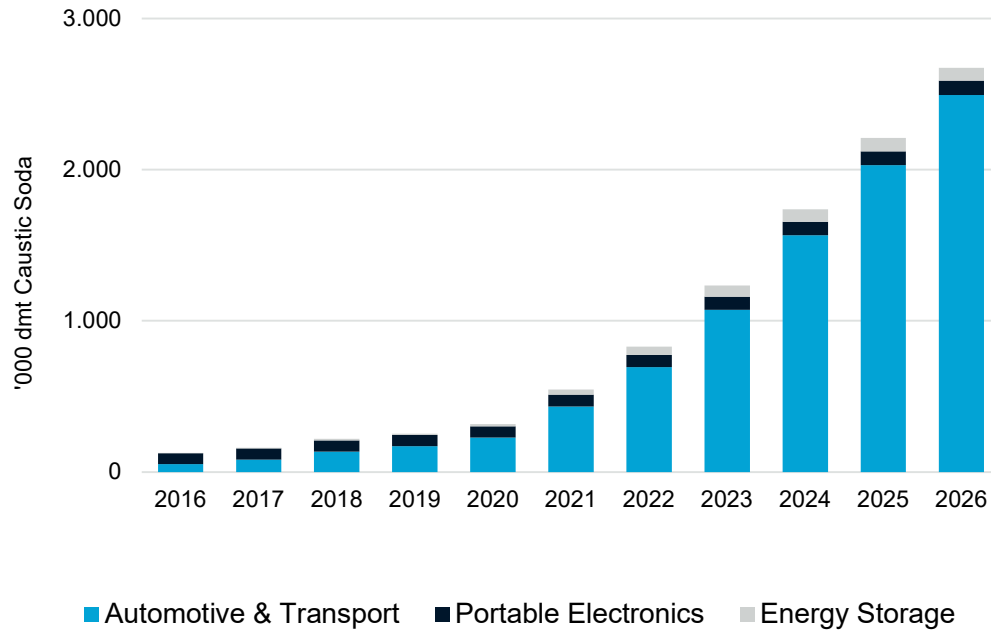
Electrification will be a main driver for caustic soda demand growth

# From mining to recycling: Caustic soda has different applications through the Li-ion batteries supply chain

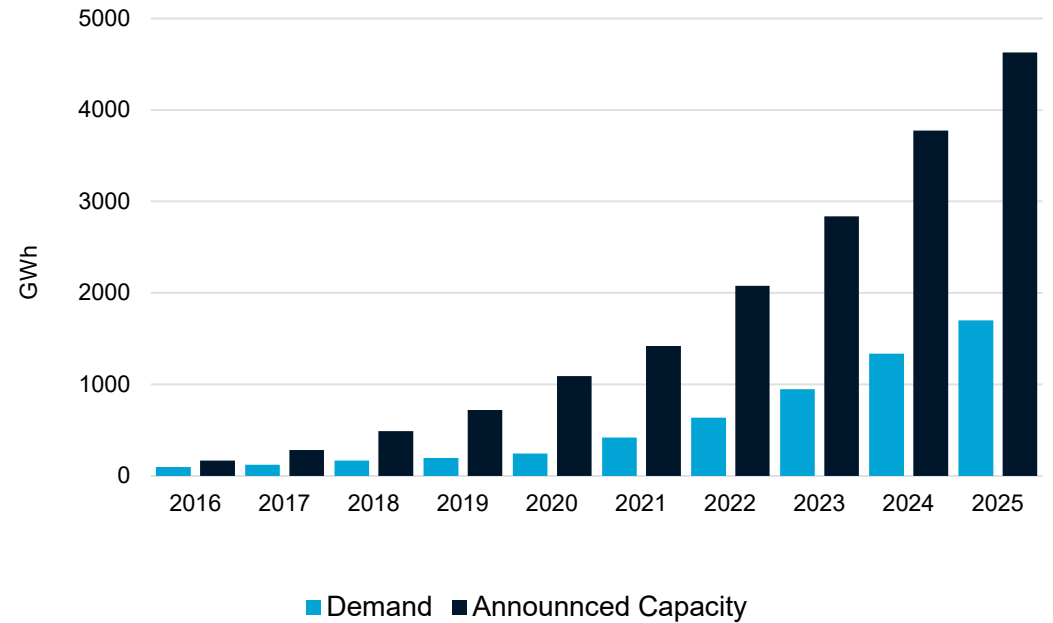


# Cathode manufacturing is most caustic intensive step in lithium battery value chain

### Global caustic soda demand from cathode manufacturing



### Cell manufacturing capacity and demand (GWh)



Source: S&P Global, Chemical Market Analytics by OPIS

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Source: S&P Global

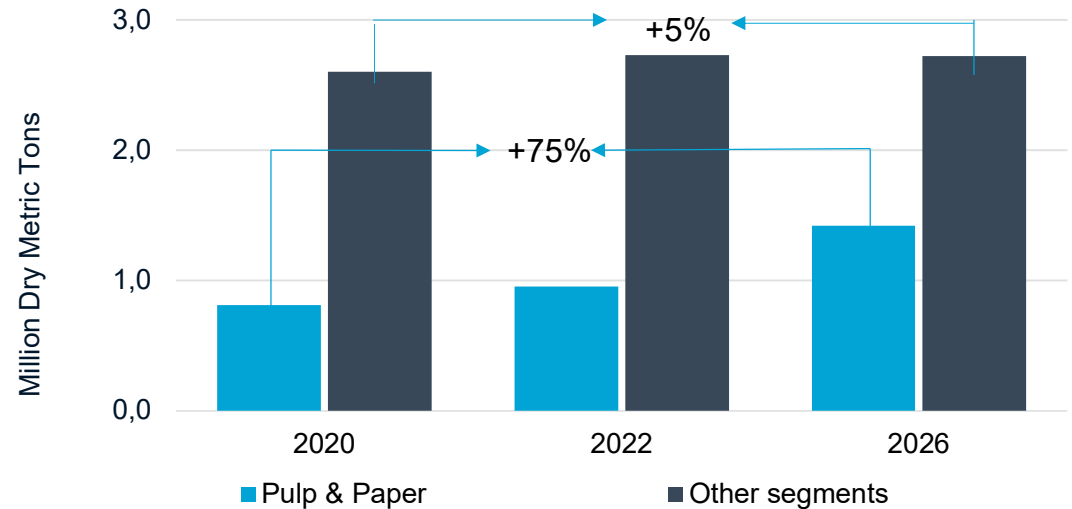
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# Relative-low cash costs and favorable environmental conditions attracted new pulp and paper projects

## Largest South America pulp mills projects

ARAUCO	UPM	SUZANO
MAPA Chile 2022 - 2023 1.5M TON BKP	Taurus Project Uruguay 2023 – 2024 2.1M TON BKP	Cerrado Project Brazil 2025 2.5M ton BKP
BRACELL	PARACEL	
Project Star Brazil 2022 2.8M TON BKP/DP	2024 Paraguay 1.5M TON BKP	

## South America caustic demand growth will be driven by P&P



Source: Chemical Market Analytics by OPIS

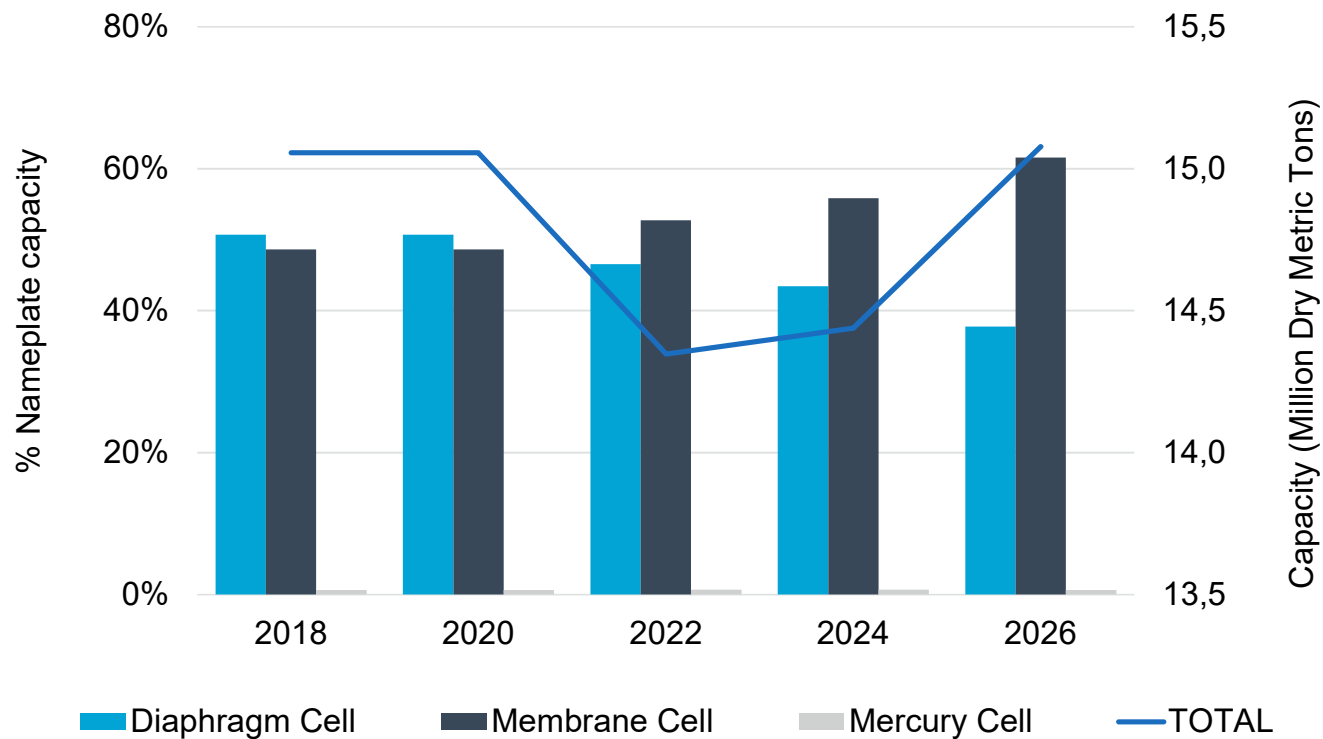
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# US chlor-alkali technology is still in transition

## US caustic soda capacity by technology



Source: Chemical Market Analytics by OPIS

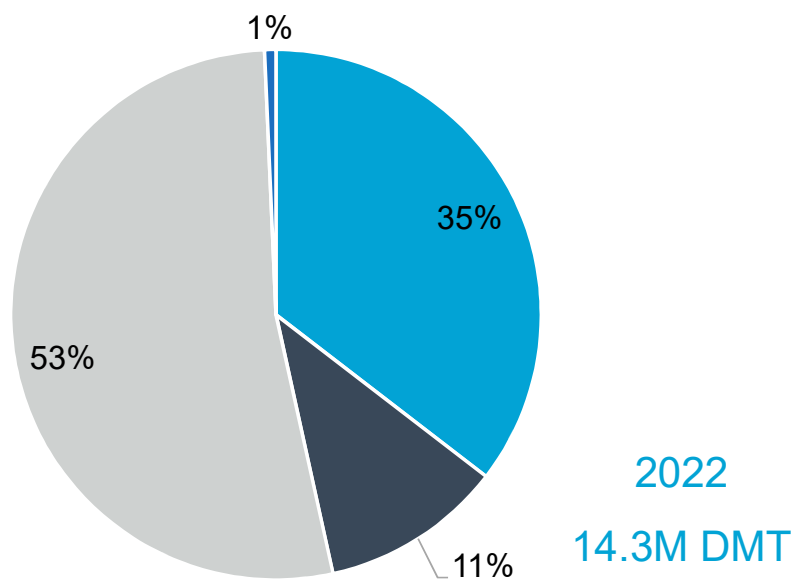
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- Technological changes:
  - Higher efficiencies
  - Lower carbon footprint
  - Environmental regulations
- NAM: 70% of global D-grade capacity (2022)
- 2010 – 2020 :
  - 1.5 MM DMT incremental capacity
  - D-grade: From 66% to 51%
  - Mercury-grade: From 3% to 1%



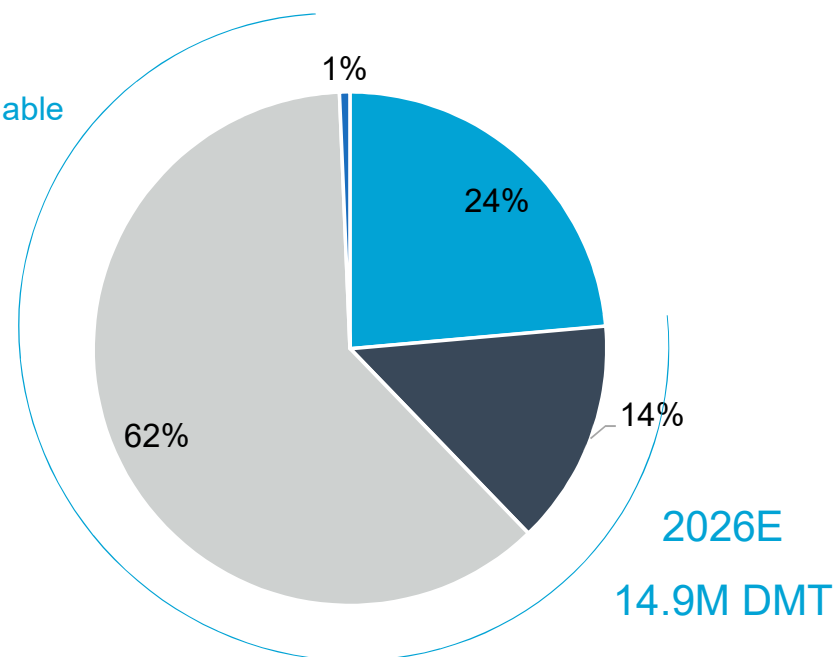
# EPA proposed ruling might accelerate technology change

## US Caustic Soda Capacity by Technology



- Diaphragm cell - AB
- Membrane cell

75.5% - Best Available Technology



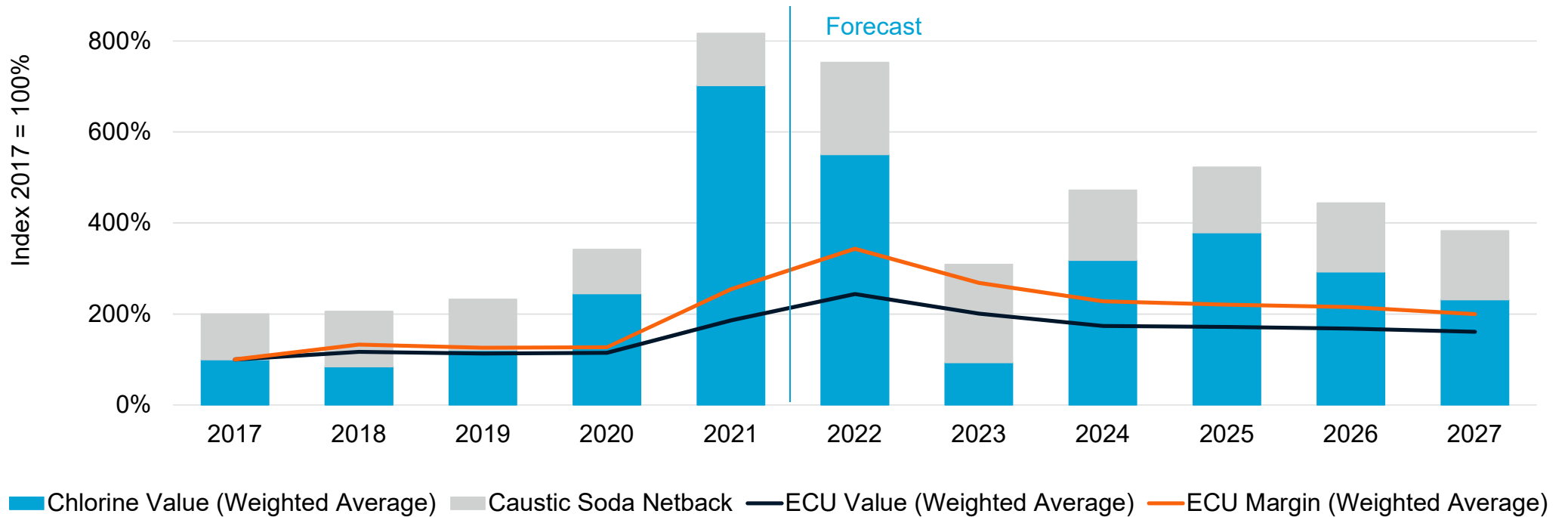
- Diaphragm cell - Non AB
- Mercury cell

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# Increasing caustic soda value offsets decreasing chlorine value after 2022

## Indexed US chlor-alkali economics

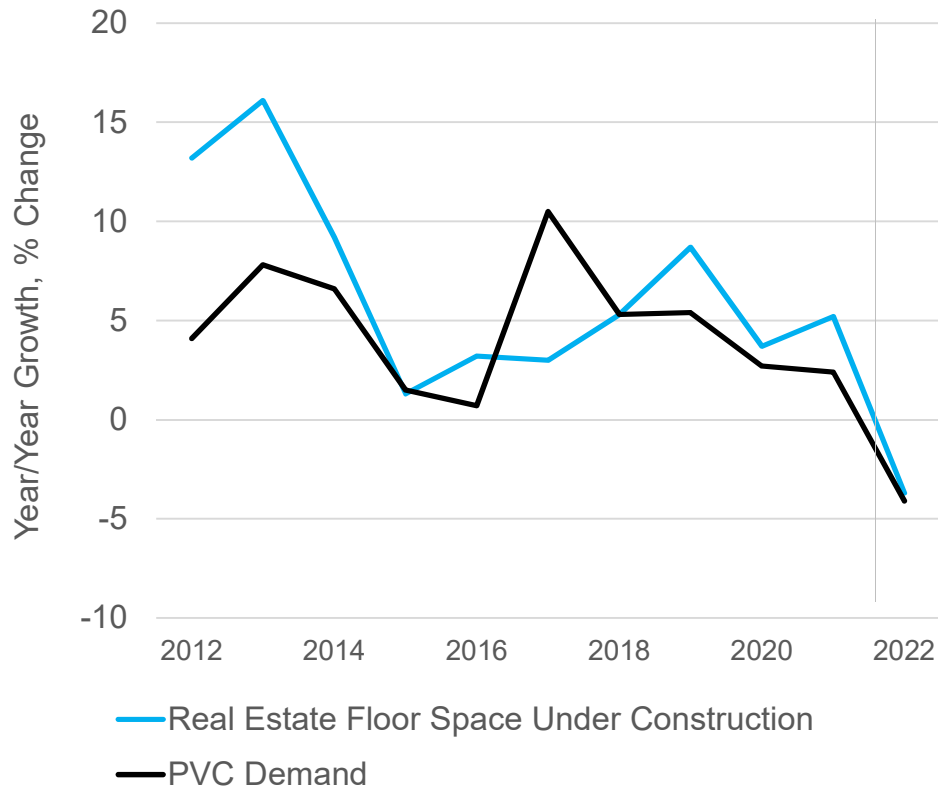


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# Mainland China construction activity is tempering near-term demand

Demand Growth: Mainland China  
Real Estate Construction Spending & PVC Demand

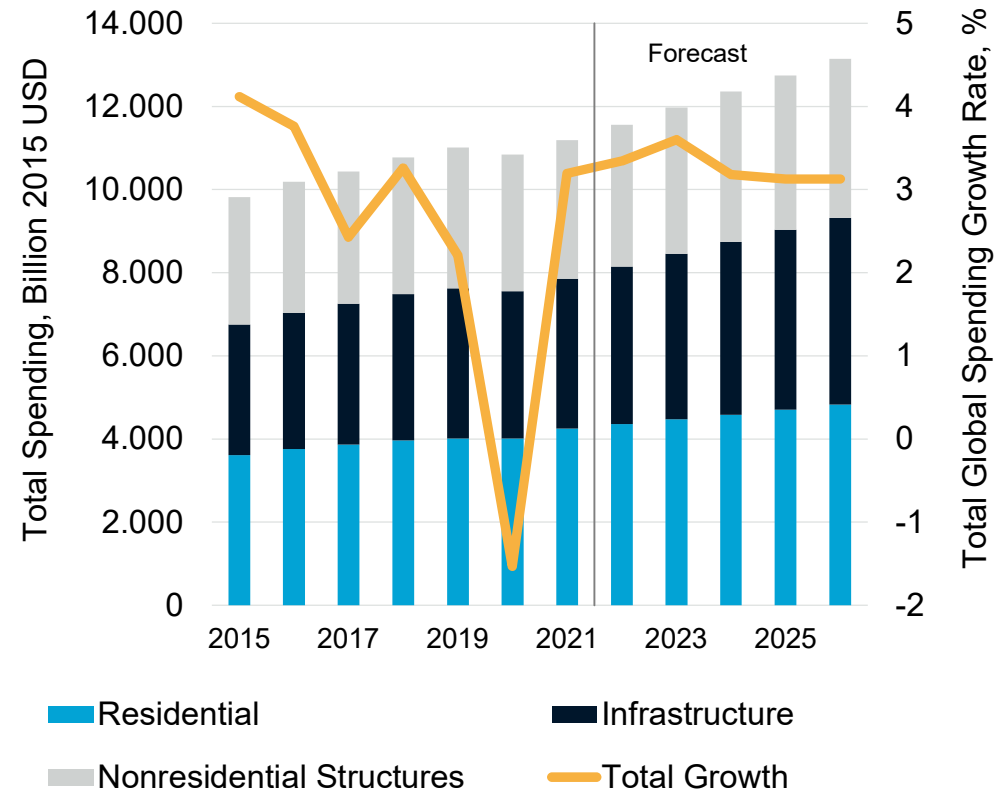


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Global Construction Spending by Segment;  
Year/Year Total Spending Growth Rate



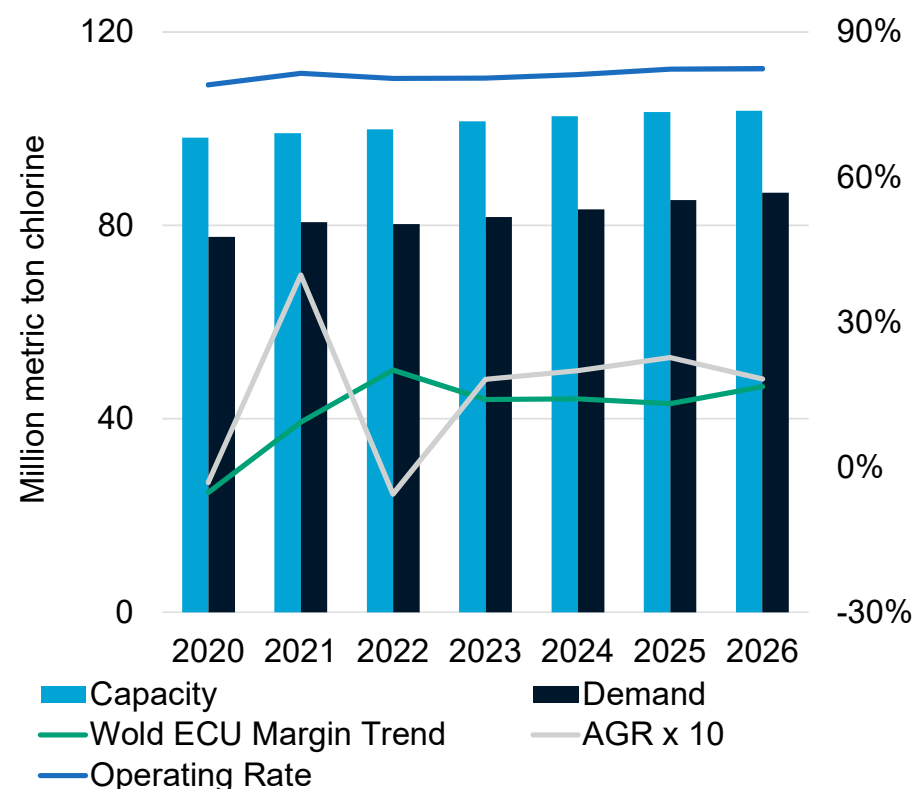
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# Energy outlook for Europe lifting global caustic soda prices

- Near-term economic slowdown in Americas and Europe
  - Asia remains the growth engine albeit at a moderated pace
- Ukraine conflict has disjointed trade flows
  - Freight rates expected to decline but not to historical levels in 2023 without a more significant slowdown
- Europe as high cost producing region becomes the price setter
  - Caustic imports expected to increase as infrastructure allows
    - Chlorine/vinyls demand falling, limits caustic supply
    - Some high-cost capacity could be at risk.

Global chlor-alkali market outlook



Note: Operating rate based on chlorine  
Source: Chemical Market Analytics by OPIS

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