The Quest for PVC Sustainability Amid Profound Trade Shifts

Asia Petrochemical Industry Conference 2026

Fukuoka, Japan

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29 May 2026

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PVC’s Next Chapter: Responding to regulatory change and shifting trade flows

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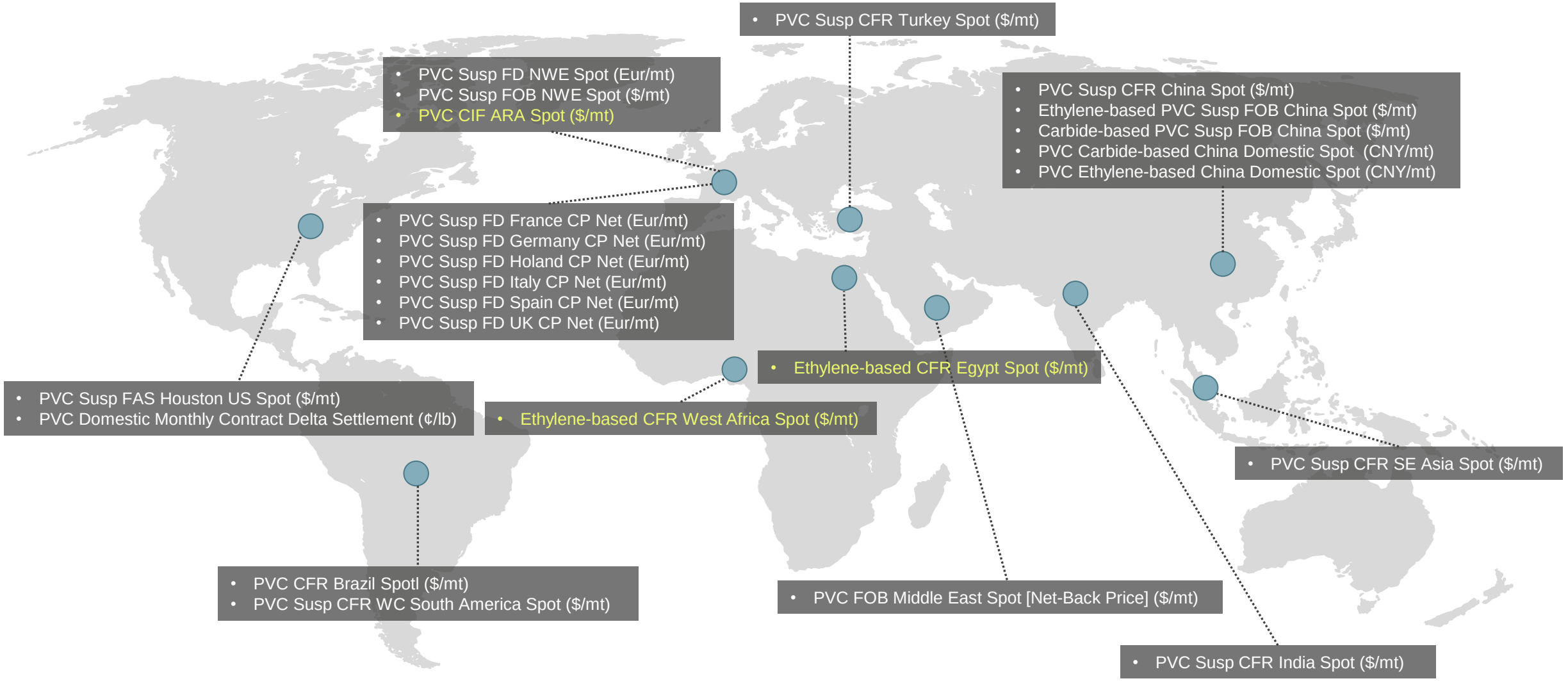
29/05/2026

Agenda

- Key Shifts in Global Regulations
- The PVC Value Chain
- Price Shocks 2025/2026
- Feedstock Challenges
- USA and EU PVC Dynamics
- Key Takeaways

Platts Assesses Polyvinyl Chloride Globally



Source: S&P Global Energy

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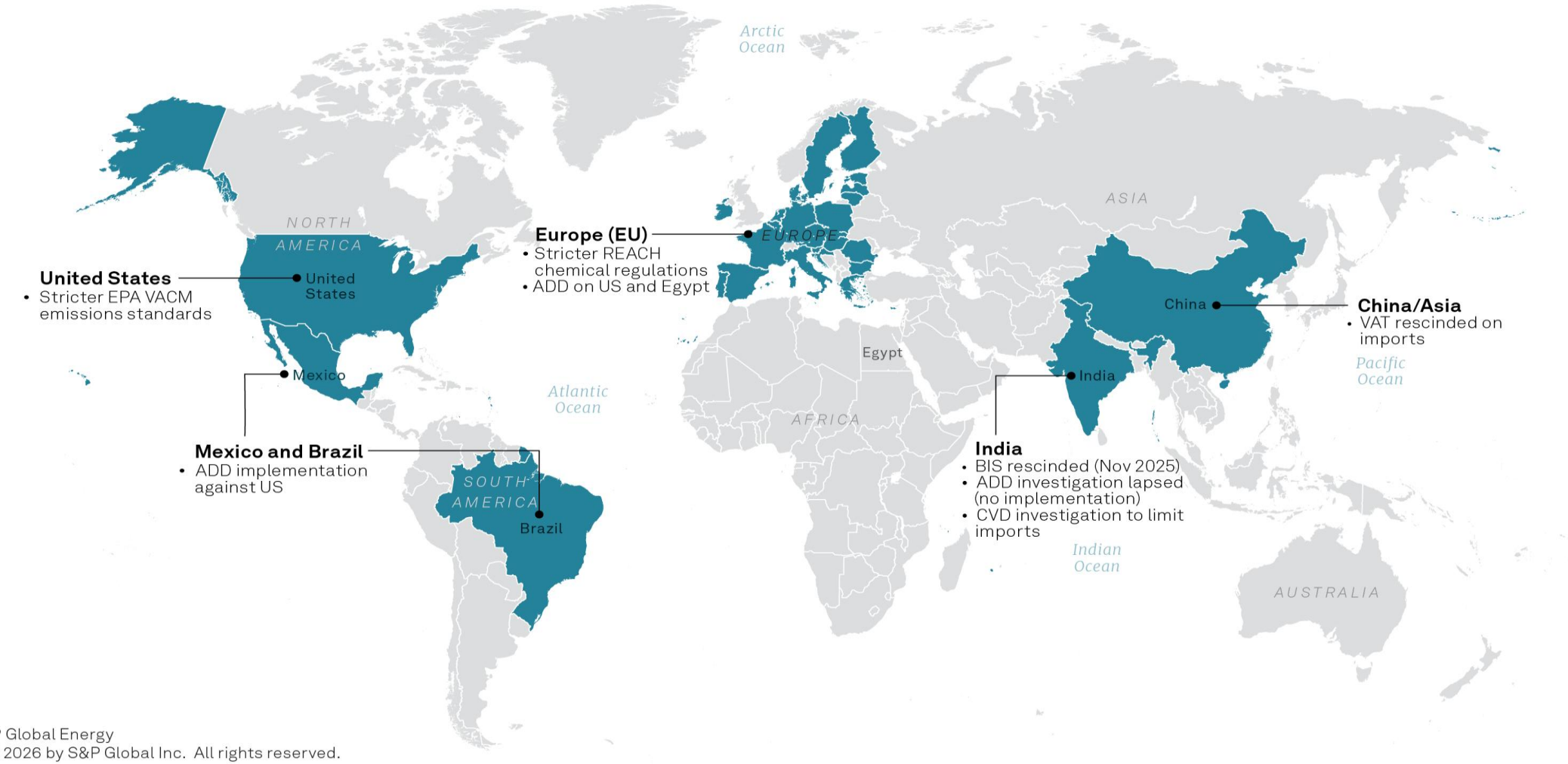
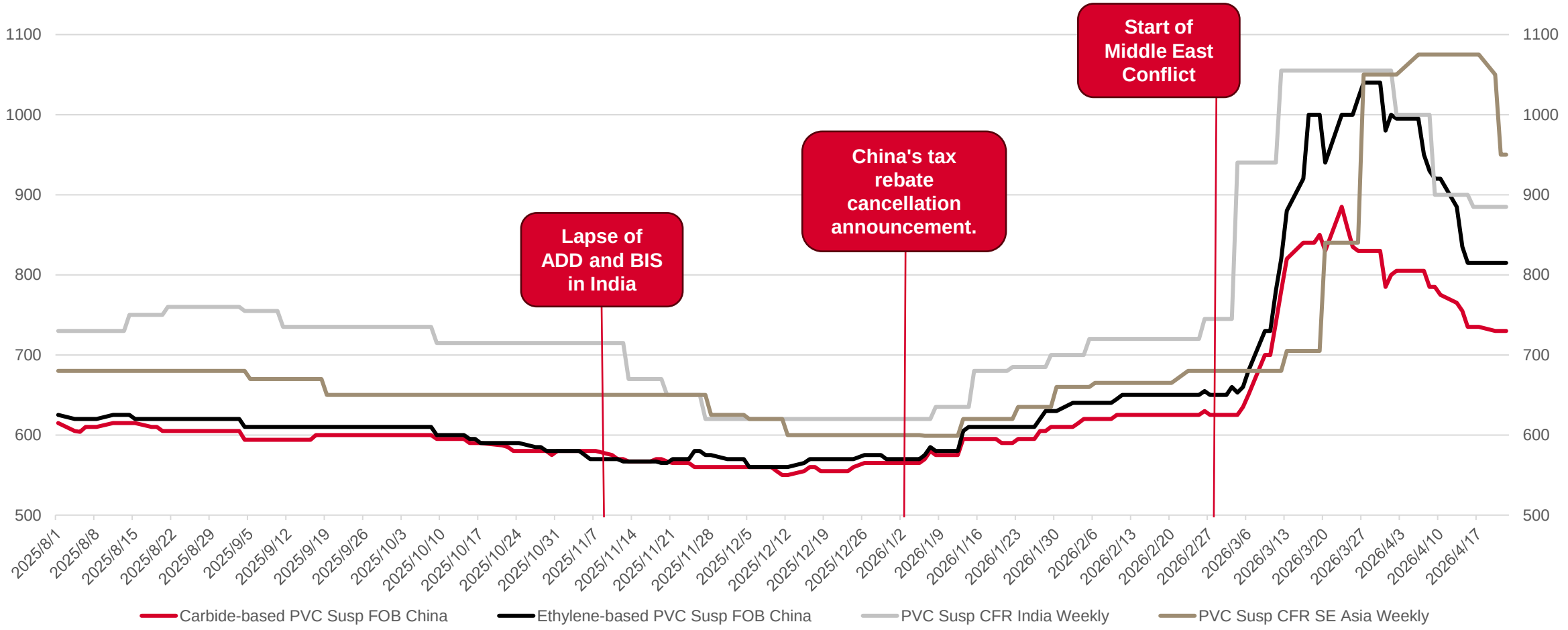
Shifting winds: 2025 PVC regulatory overhaul



Source: S&P Global Energy

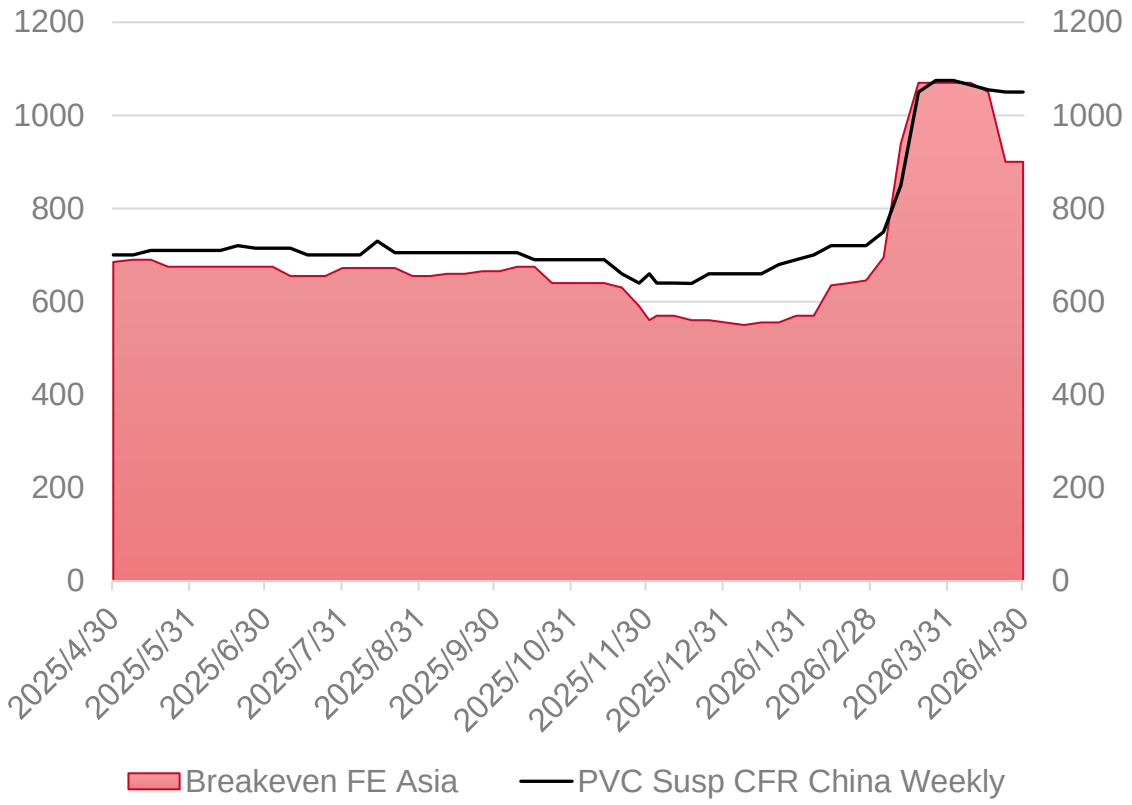
Unprecedented Price Shocks Shaping the PVC Market 2025-2026



Source: S&P Global Energy

Margin Meltdown: The PVC Feedstock Fight

EDC VCM rapid volatility post war putting pressure on margins



Supply and Demand Imbalance - EDC and Naphtha shortage, poor end user demand

Price Pressures – current Geopolitcs, Margin squeeze, trade barriers

Market Pressures – Inflation, Higher freights

Source: S&P Global Energy

The US PVC Landscape in 2026: Supply Tight, Margins Thin

Key drivers and challenges in shifting landscapes

1

Americas Overview

- **Sharp price increase following Middle East conflict**
- **Price surge was not sustained**

2

USA Overview

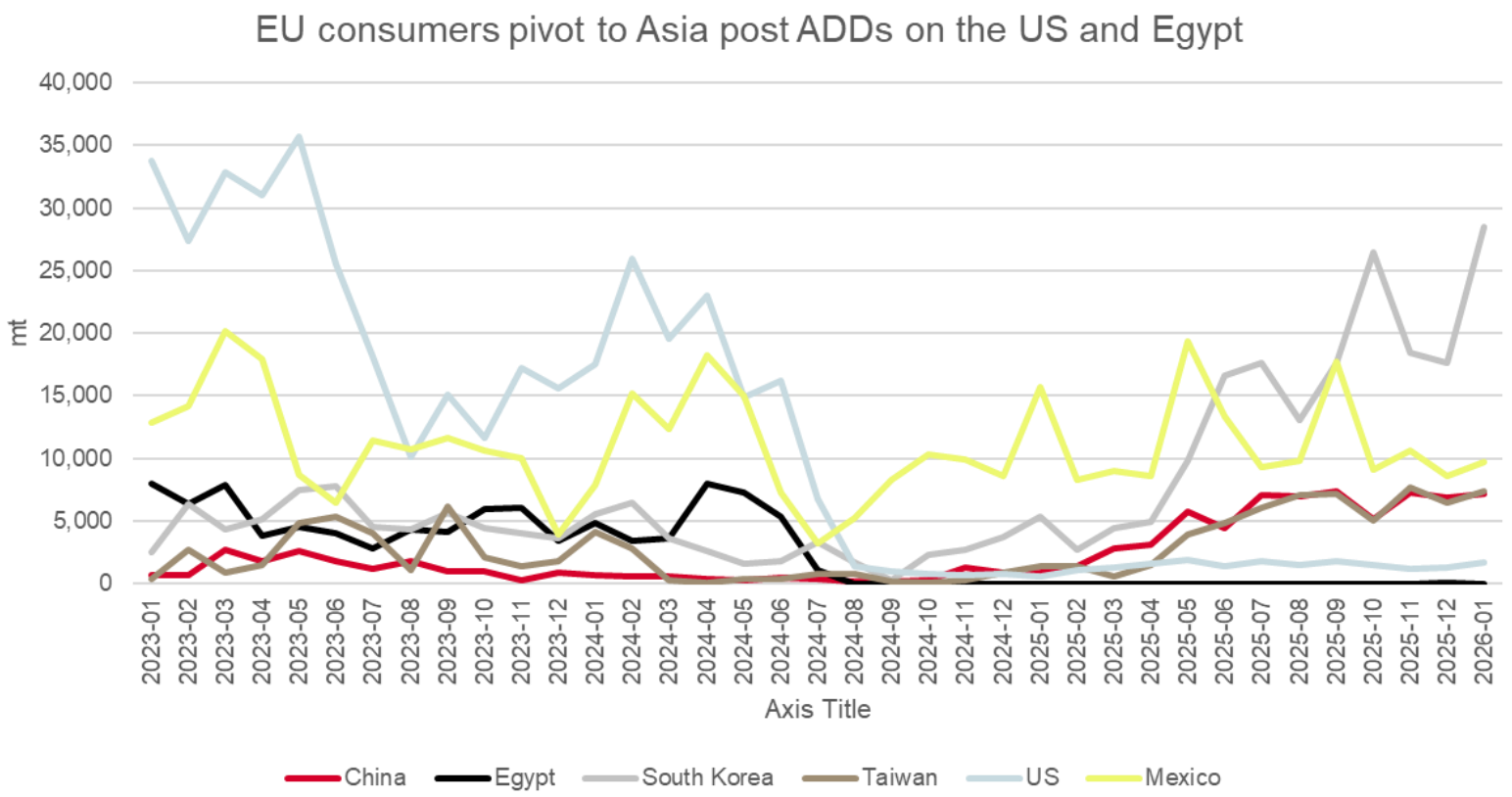
- **Concerns over limited export markets**
- **Anti-dumping duties against USA in Brazil, Mexico, and Europe.**
- **India remains essential for the USA export volumes**
- **USA volumes still face competition from China in African markets**

3

Latin America overview

- **WCSA and Central America prefer USA PVC**
- **Cheaper Chinese offer pressure remains**
- **Brazil's anti-dumping duties remain in place against China and the USA**
- **Relies on imports from Colombia and Egypt**

Import Threats & Ethylene Spikes: The Perfect Storm for EU Margins



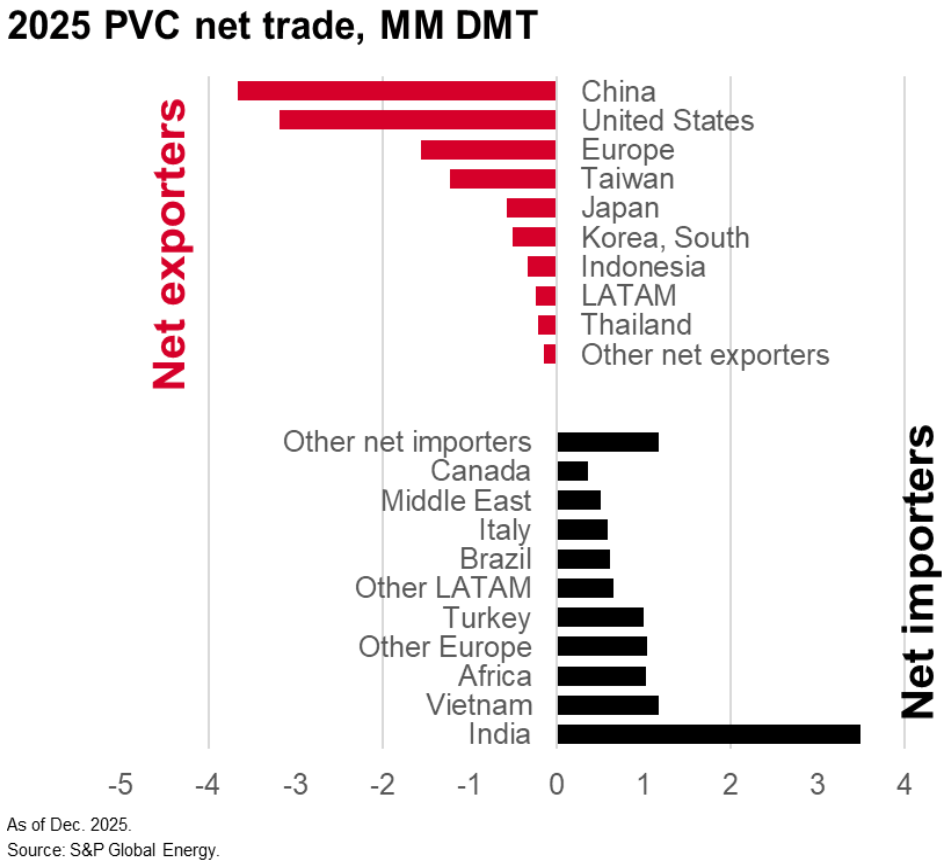
Definitive anti-dumping duties on US and Egypt

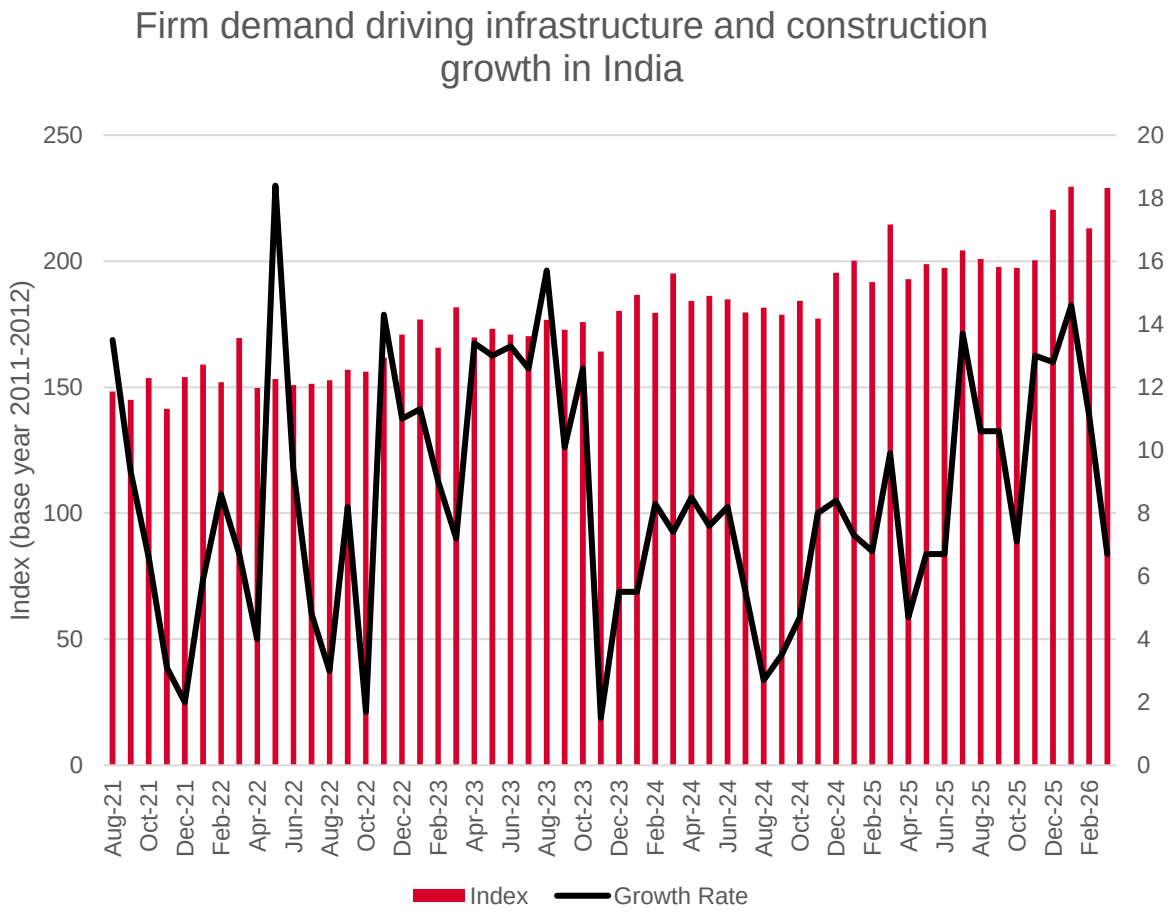
Alternative supply options: South Korea, China, and Taiwan

Middle East conflict resulted in higher ethylene prices in Europe

Source: S&P Global Energy

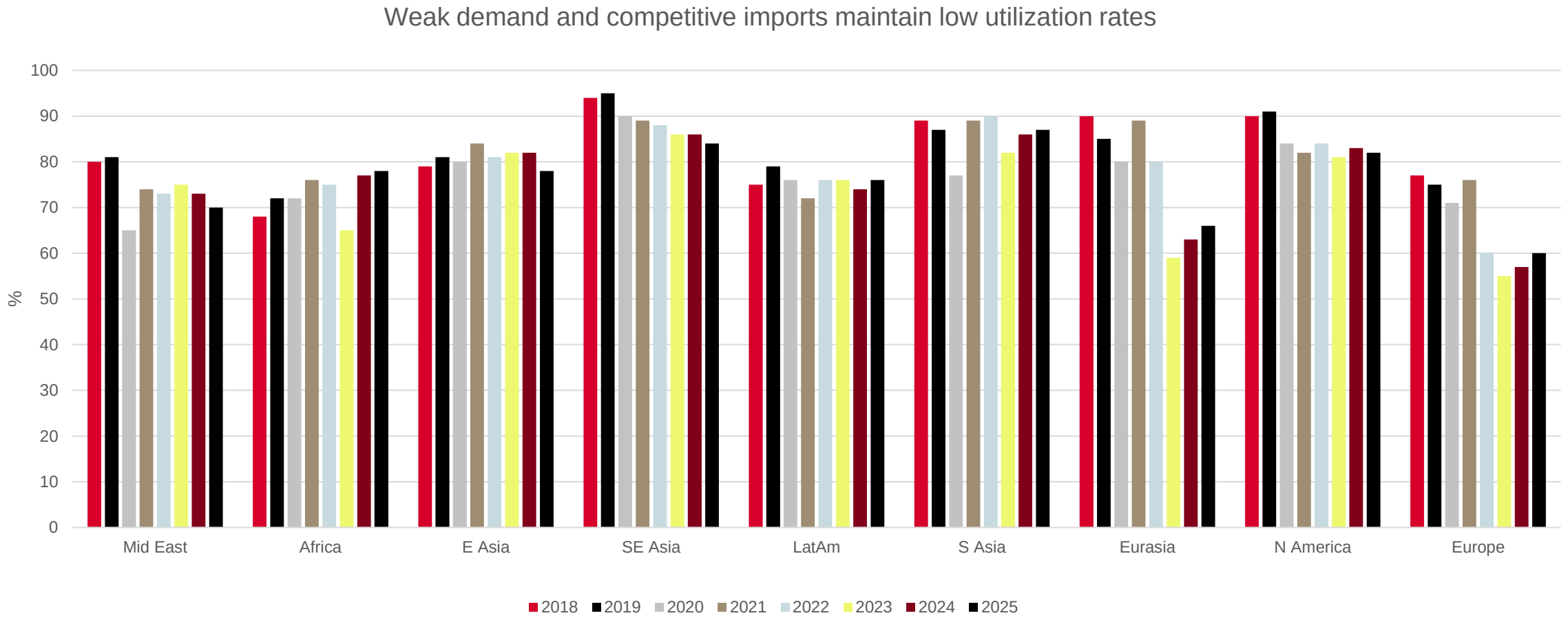
China and US Dominate 2025 Global Net Export Volumes





Source: Source: S&P Global Energy

Global Trade Disruptions Keep a Check on Capacity Utilization Rates



Source: S&P Global Energy

Charting the Course: The Way Forward

- Sluggish demand expected to persist
- Capacity Rationalization
- Manouvering trade barriers
- Sustainability

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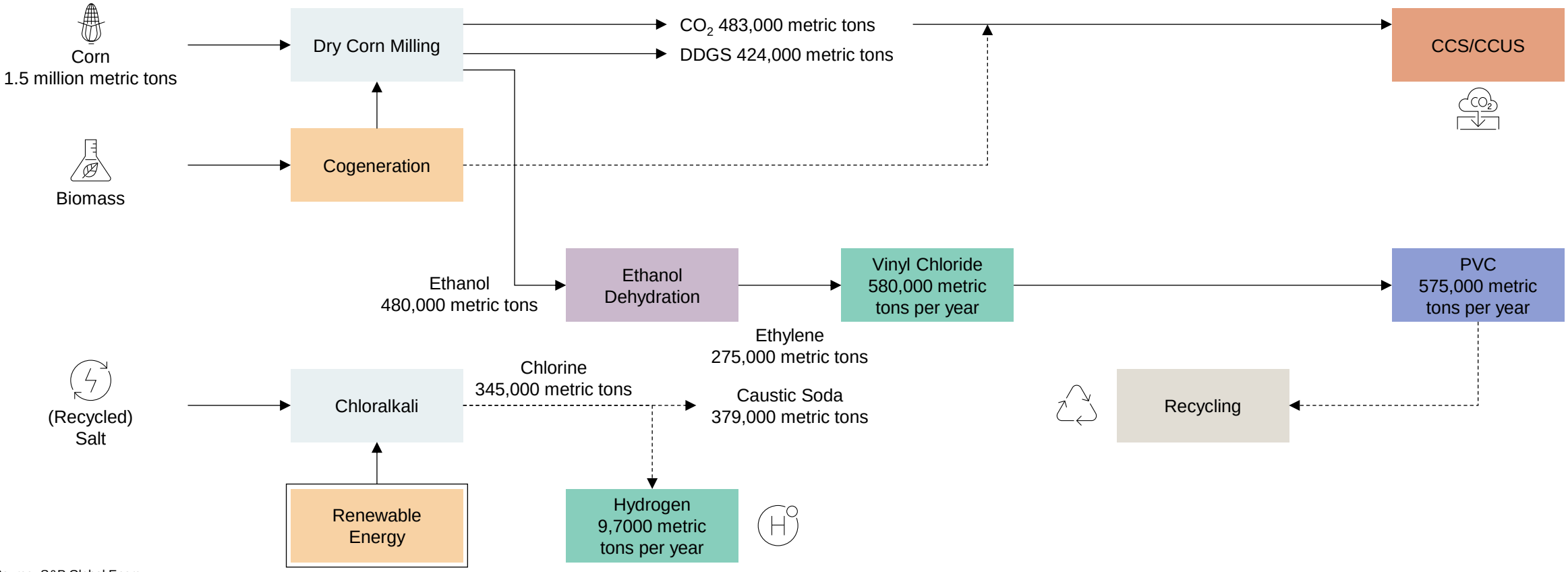
1. Sustainable chlor-alkali to PVC production
2. Advanced plastic recycling toolbox
3. Eco-friendly stabilizers boosting affinity for PVC
4. Competitiveness framework for non-phthalate plasticizer production

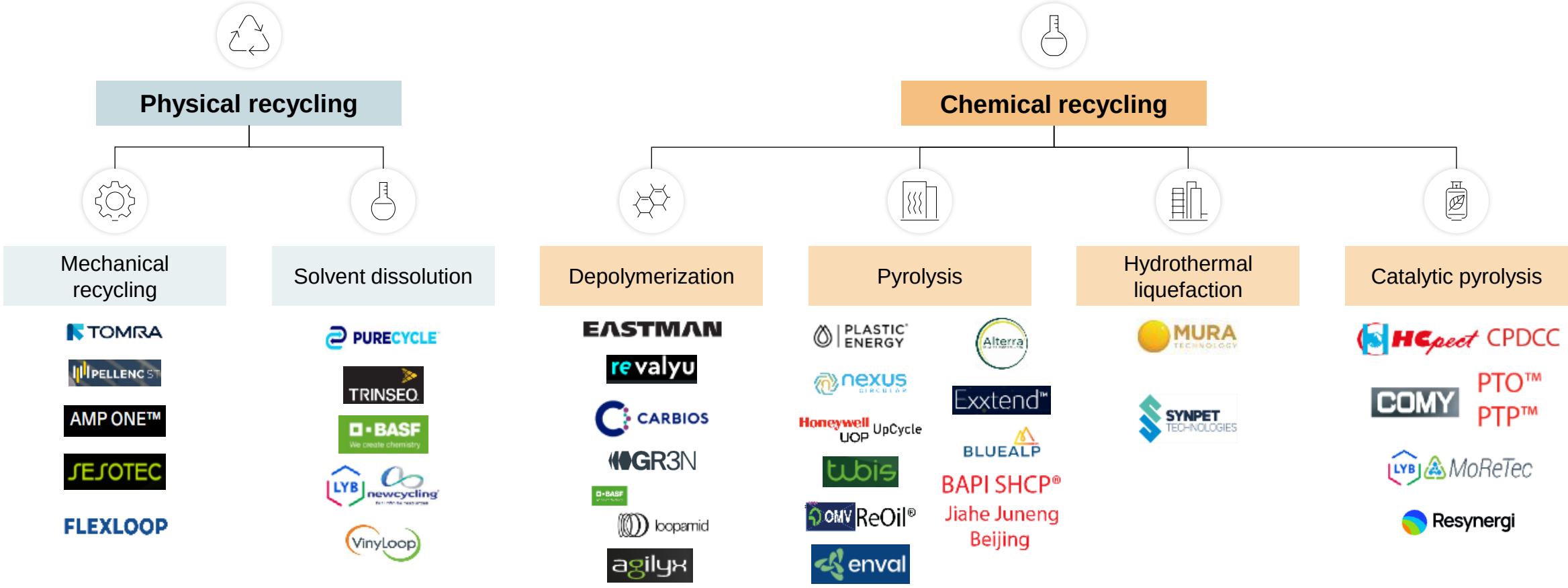
Sustainable Chlor-alkali to PVC production involves numerous components

Implementing parts or in phases help support sustainability and positive receptivity towards the value chain



Source: S&P Global Energy.

Advanced plastic recycling toolbox transforms waste to value



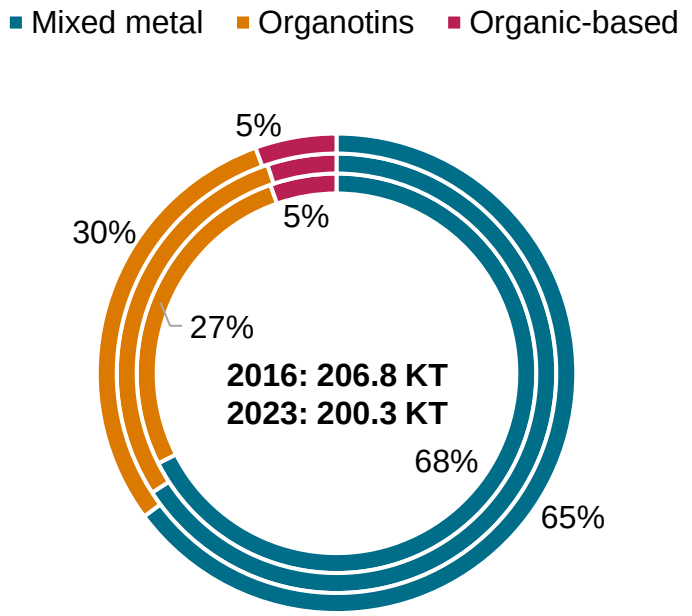
Technology isn't the barrier → Economics and policy are

Source: S&P Global Energy.

Global shift towards eco-friendly stabilizers boost affinity for PVC

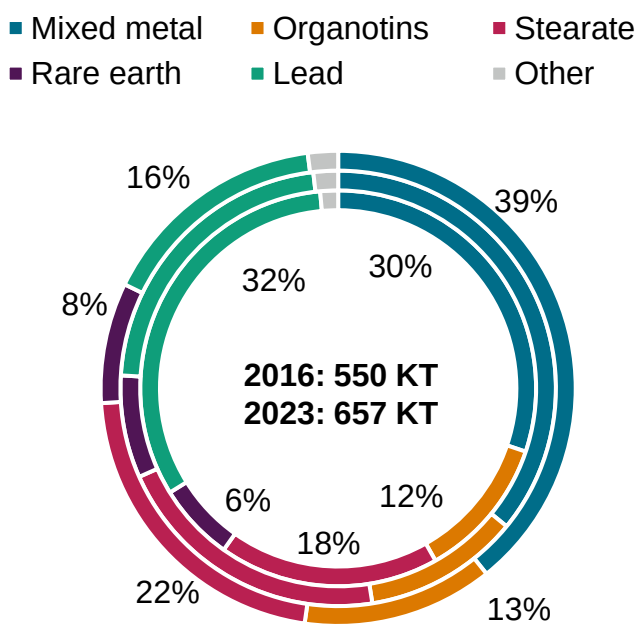
Lead remains significant in China and Japan but is fast declining

N. America and W. Europe



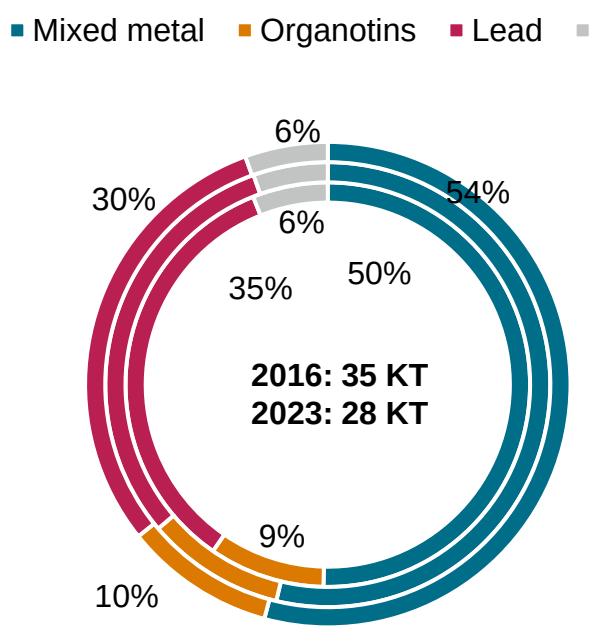
2028: 224.4 KT

Mainland China



2028: 731 KT

Japan



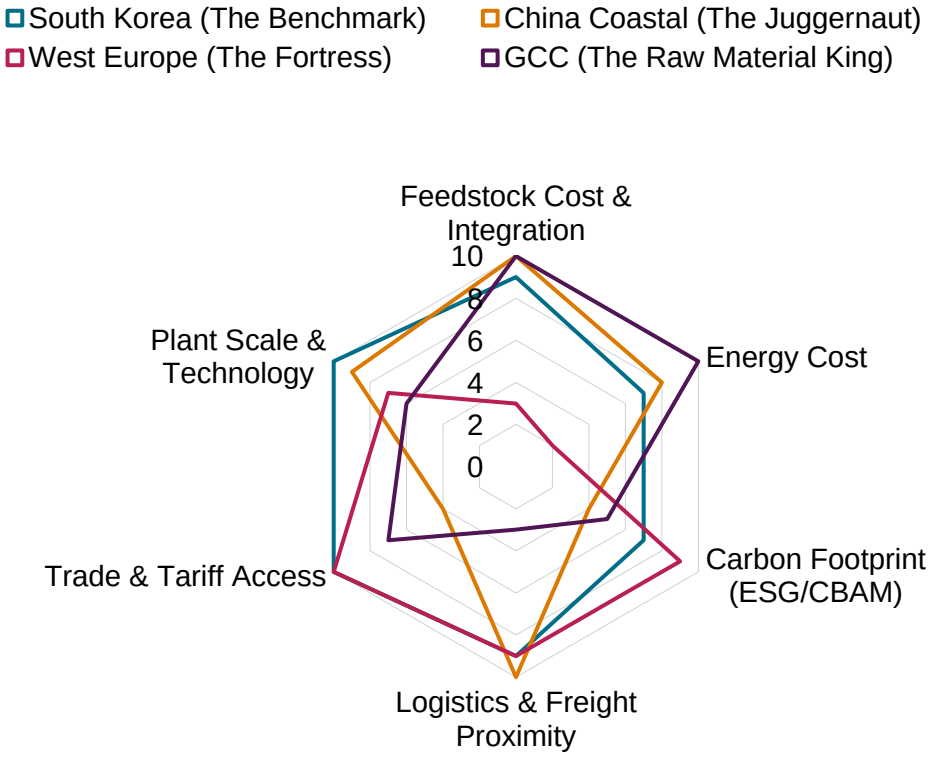
2028: 29 KT

Source: S&P Global Energy.

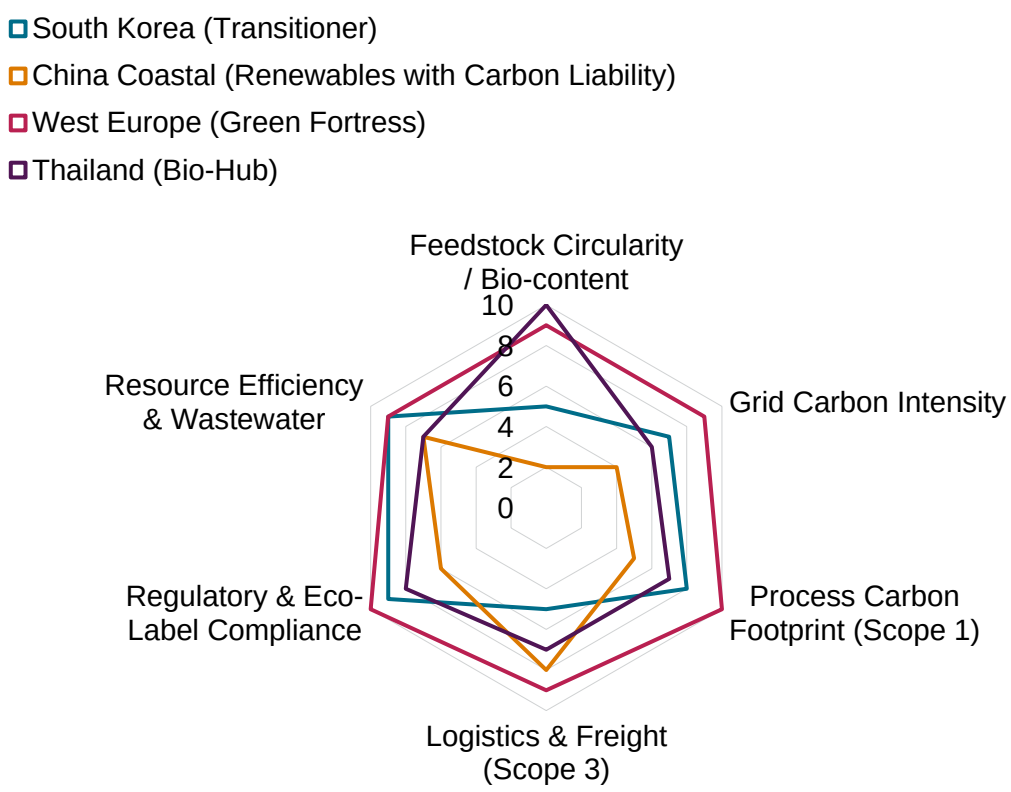
Non-phthalate plasticizer production – most ideal “hexagon” in South Korea

West Europe leads "Green Hexagon" focused on sustainability, circularity, and carbon economics

Economics comparison of non-phthalate plasticizer production



Competitiveness of non-phthalate plasticizer production (eco-indicators)



Source: S&P Global Energy.

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Key takeaways

- Implementing sustainable chlor-alkali to PVC production in parts or in phases supports positive receptivity towards the value chain
- A comprehensive advanced plastic recycling toolbox tackles myriad waste and creates value
- Rising eco-friendliness of additives boost affinity for PVC and facilitates recycling
- No country with the “Perfect Hexagon”; South Korea leads on economics and West Europe thrives in an eco-focused world

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From growth to influence: Asia’s central role in the global PVC market

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29 May, 2026

From growth to influence: Asia’s central role in the global PVC market

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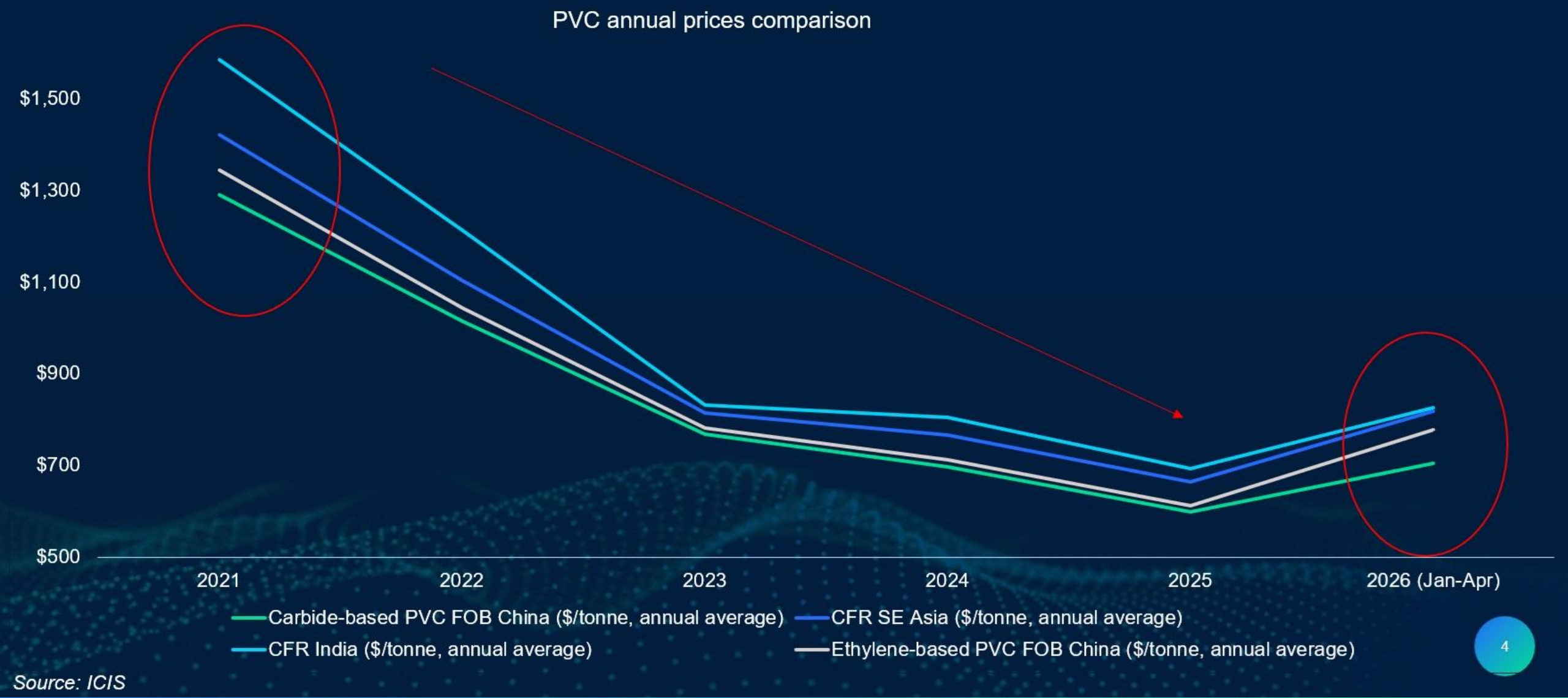
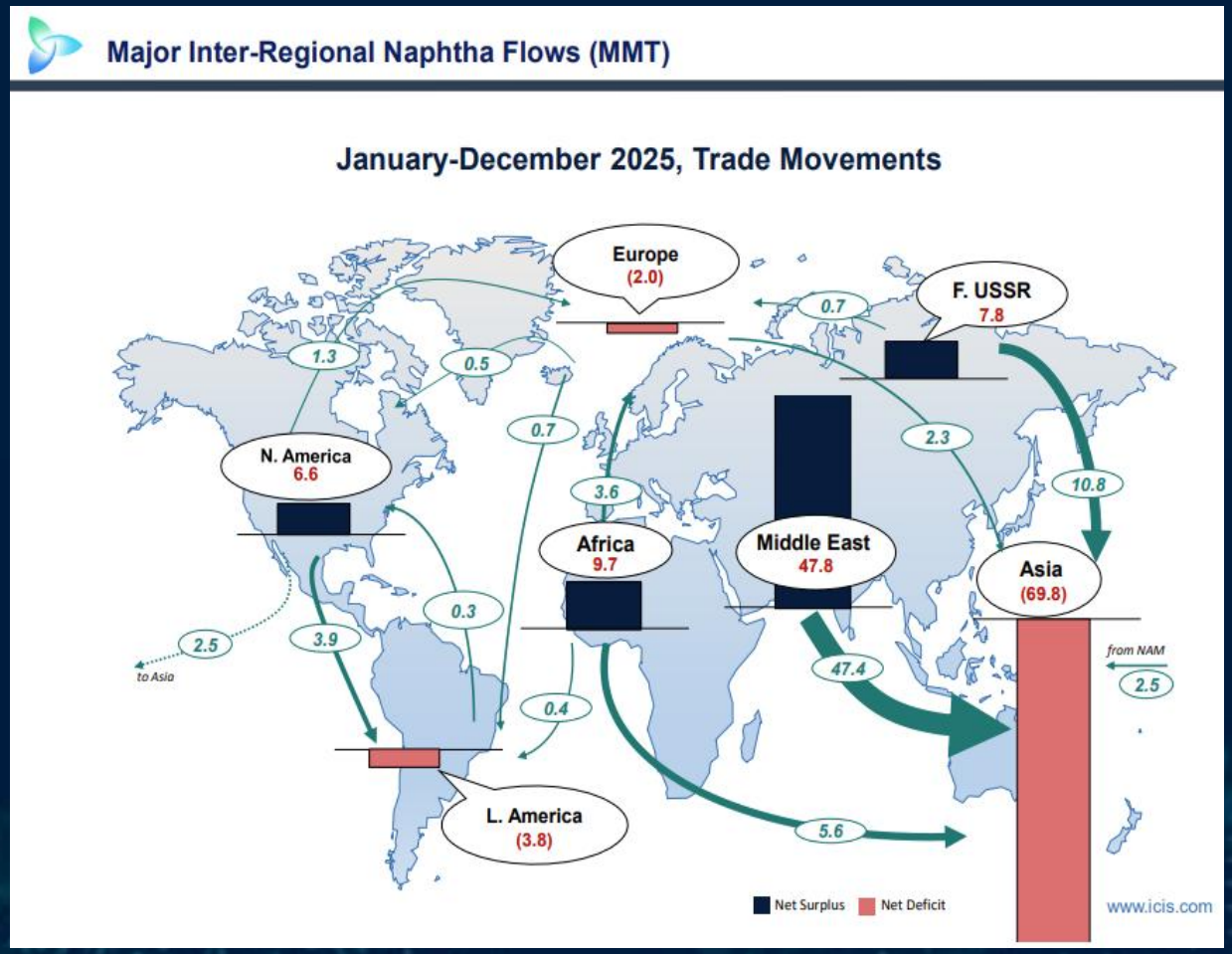
A look at events shaping Asia PVC price trends

PVC prices finally rebound after languishing for past 4 years



Source: ICIS

Strait of Hormuz: a critical feedstock corridor for Asia



- Asia gets ~70% of its naphtha from the Middle East
  - Enormous implications on ethylene
- Other suppliers may try to supply Asia, but it is a market with limited swing supply
- No alternative supplier can fully replace the Middle East

Source: ICIS

Feedstocks see biggest impact from Iran conflict

Commodity	Price change (27 Feb to 27 Mar)	Price change (27 Feb to 24 Apr)
Brent Crude Oil	74.7%	64.3%
Naphtha CFR Japan	79.6%	61.5%
Ethylene CFR NE Asia	98.6%	83.7%
EDC CFR Asia	114.6%	75.6%
VCM CFR NE Asia	100.0%	59.6%
Caustic soda FOB NE Asa	47.1%	25.0%

- Initial supply shock in March causes prices to surge
- Feedstock prices settle down in April, but remain elevated compared to pre-Iran conflict levels
- Naphtha, ethylene shortages in Asia to persist
- Co-product caustic soda prices see prices nearing pre-conflict levels

Source: ICIS

PVC prices see general increase but carbide caps upside

PVC	Price change (27 Feb to 27 Mar)	Price change (27 Feb to 24 Apr)
CFR SE Asia	62.9%	33.1%
CFR India	52.1%	23.2%
CFR Chile	48.3%	34.9%
CFR Turkey	43.8%	53.1%
CFR GCC	85.2%	81.0%*
FOB NE Asia	67.2%	48.1%
FOB NWE	46.4%	56.3%
FOB USG	53.8%	53.8%
FOB China C2	58.0%	48.1%
FOB China Carbide	34.7%	17.1%

- Most prices in April are softer when compared to March
- Exceptions: Europe/Turkey, US
- Special case: Middle East
- Converters still able to restock despite disruptions, as supply options remain
- Carbide PVC prices cap Asia (and global) price uptrend
- India, SE Asia buyers increase acceptance of carbide PVC

**CFR GCC 03 Apr due to Eid holiday on 27 Mar*
Source: ICIS

Iran conflict timeline: PVC perspective

US-Israel-Iran conflict timeline

Pre-conflict, Q1 2026

PVC prices already on slow uptrend after news of China's VAT rebates discontinuation

28 Feb 2026

Conflict begins, PVC prices hold steady, but players worry about feedstock disruptions

Week ended 6 Mar

India import prices up as feedstock and logistics costs surge

Week ended 13 Mar

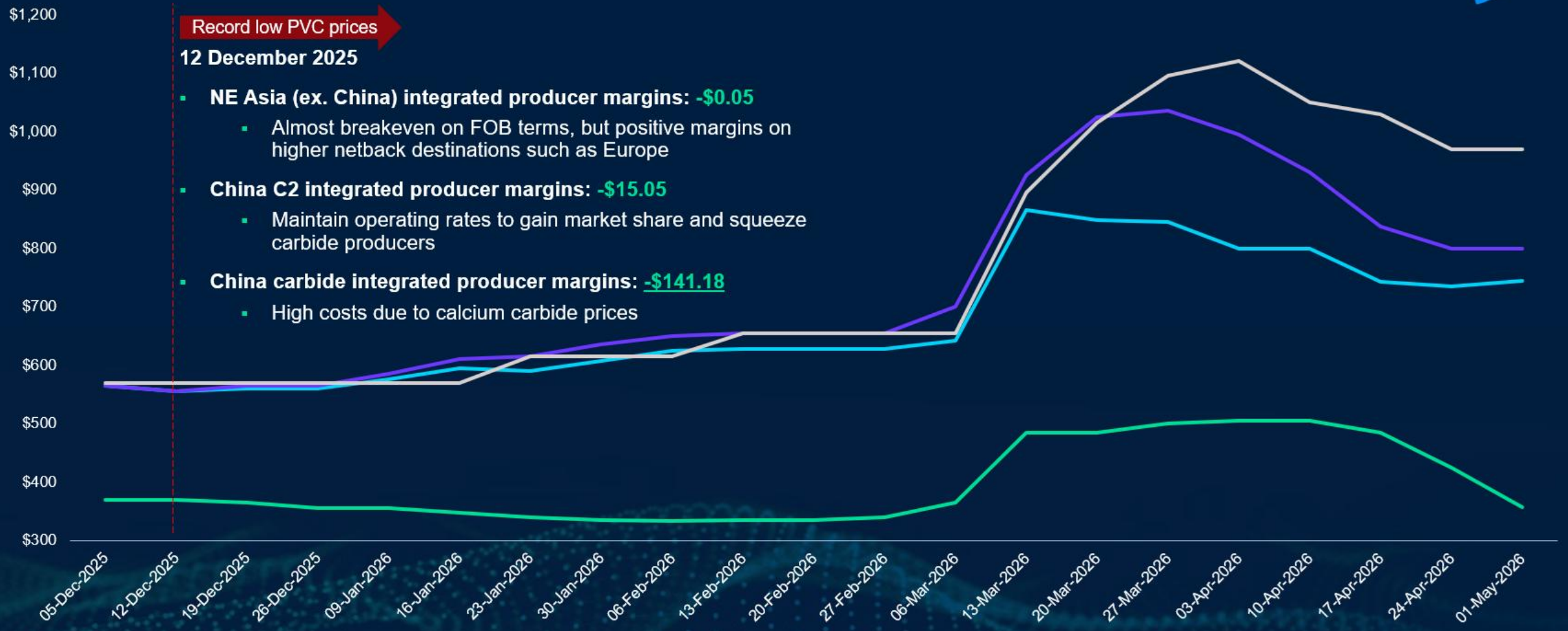
Prices in Asia surge as severity of naphtha, ethylene feedstocks are felt, some FMs declared

As we head into the present

Buyer apprehension on ethylene-carbide PVC price gap, but ethylene PVC costs remain high

- Conflict roils markets, no clear sign of de-escalation
- Crude prices fluctuate almost daily on current events
- Naphtha, ethylene shortages in Asia to remain for months

C2 vs carbide tussle: who is ahead?



Addendum: integrated producer margins = margins from 1 tonne of PVC and 1 dmt of caustic soda produced
Sources: Market sources, ICIS

C2 vs carbide tussle: who is ahead?

27 February 2026

- **NE Asia (ex. China) integrated producer margins: $74.55**
  - ↓↓C2, ↑PVC = higher margins
- **China C2 integrated producer margins: $74.55**
  - ↓↓C2, ↑PVC = higher margins
- **China carbide integrated producer margins: -$121.16**
  - Margins remain negative
  - But prices see slow uptrend as VAT refund discontinuation approaches

Addendum: integrated producer margins = margins from 1 tonne of PVC and 1 dmt of caustic soda produced
Sources: Market sources, ICIS

C2 vs carbide tussle: who is ahead?

27 March 2026

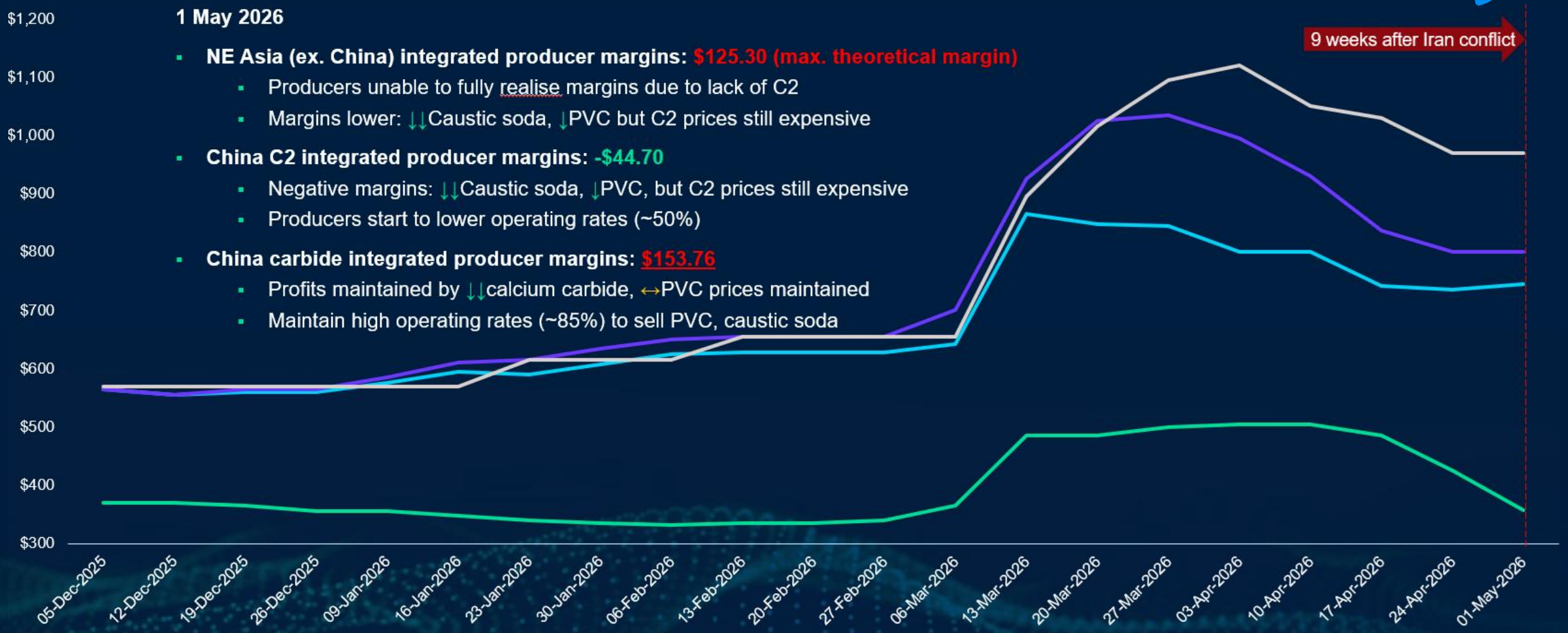
- **NE Asia (ex. China) integrated producer margins: $334.00**
  - Margins high due to ↑↑PVC, ↑↑caustic soda
  - Producers start to worry about costs due to ↑↑↑C2
- **China C2 integrated producer margins: $274.00**
  - Margins high due to ↑↑PVC, ↑↑caustic soda
  - Producers start to worry about costs due to ↑↑↑C2
- **China carbide integrated producer margins: $153.60**
  - Export prices peaked and softened
  - But Producers not affected by ↑↑↑C2
  - margins high due to ↑PVC, ↑↑caustic soda

Addendum: integrated producer margins = margins from 1 tonne of PVC and 1 dmt of caustic soda produced
Sources: Market sources, ICIS

C2 vs carbide tussle: who is ahead?

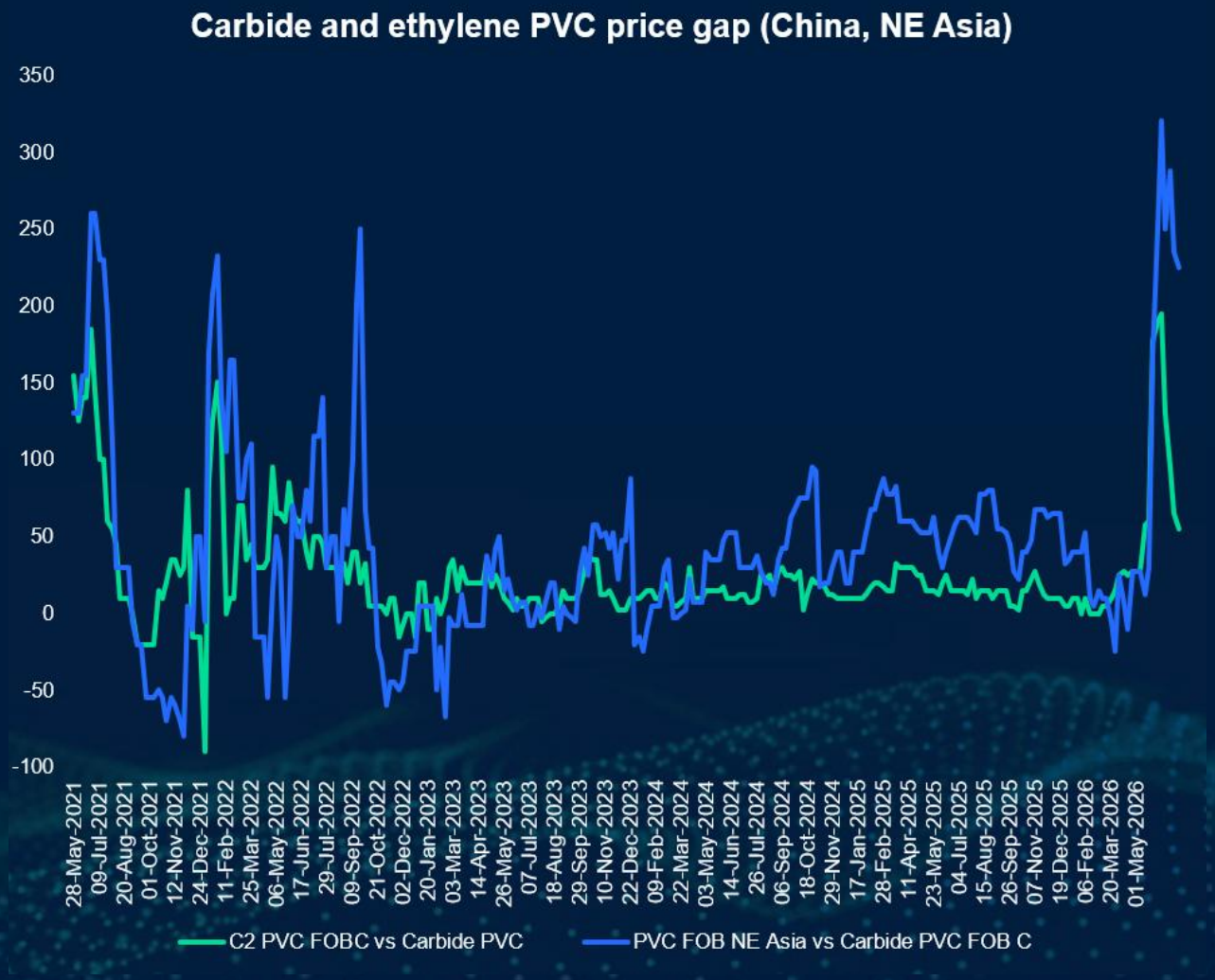
1 May 2026

- **NE Asia (ex. China) integrated producer margins: $125.30 (max. theoretical margin)**
  - Producers unable to fully realise margins due to lack of C2
  - Margins lower: ↓↓Caustic soda, ↓PVC but C2 prices still expensive
- **China C2 integrated producer margins: -$44.70**
  - Negative margins: ↓↓Caustic soda, ↓PVC, but C2 prices still expensive
  - Producers start to lower operating rates (~50%)
- **China carbide integrated producer margins: $153.76**
  - Profits maintained by ↓↓calcium carbide, ↔PVC prices maintained
  - Maintain high operating rates (~85%) to sell PVC, caustic soda



Addendum: integrated producer margins = margins from 1 tonne of PVC and 1 dmt of caustic soda produced
Sources: Market sources, ICIS

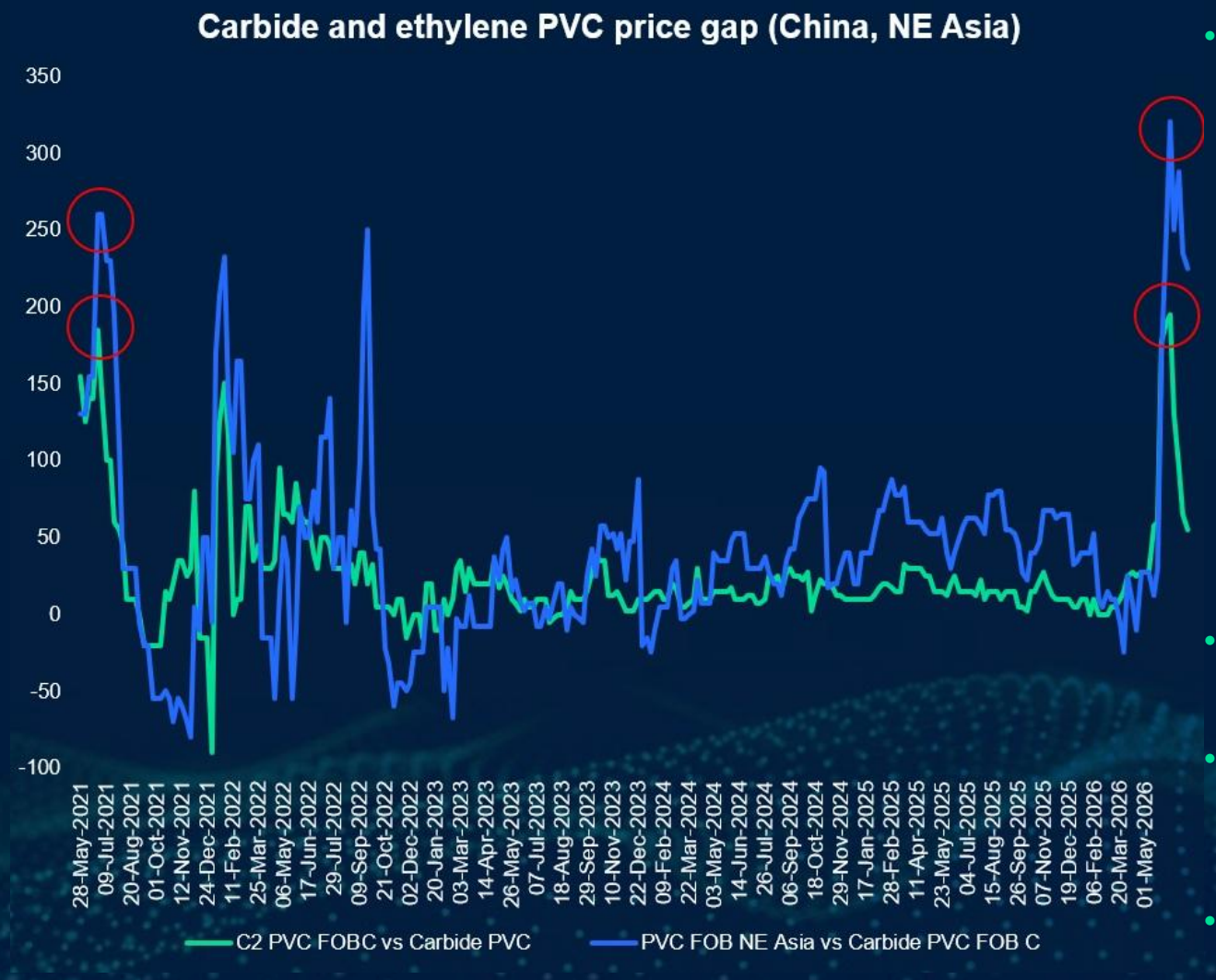
Widest carbide, ethylene PVC price gap seen in years



Source: ICIS

- **Post conflict:**
  Outbreak of Iran conflict leads to huge price gap
  - Skyrocketing feedstock costs caps C2 PVC run rates
  - Carbide producers now reaping good margins
  - End result: Regional supply shifts from very oversupplied to slightly oversupplied position
- **Pre conflict:**
  C2 PVC widely accepted globally, carbide PVC uptake tapering
  - FOB NE Asia priced higher, due to established markets
  - FOB China middle-priced, to grow market share
- Carbide PVC makers priced themselves lowest to keep market share

Widest carbide, ethylene PVC price gap seen in years



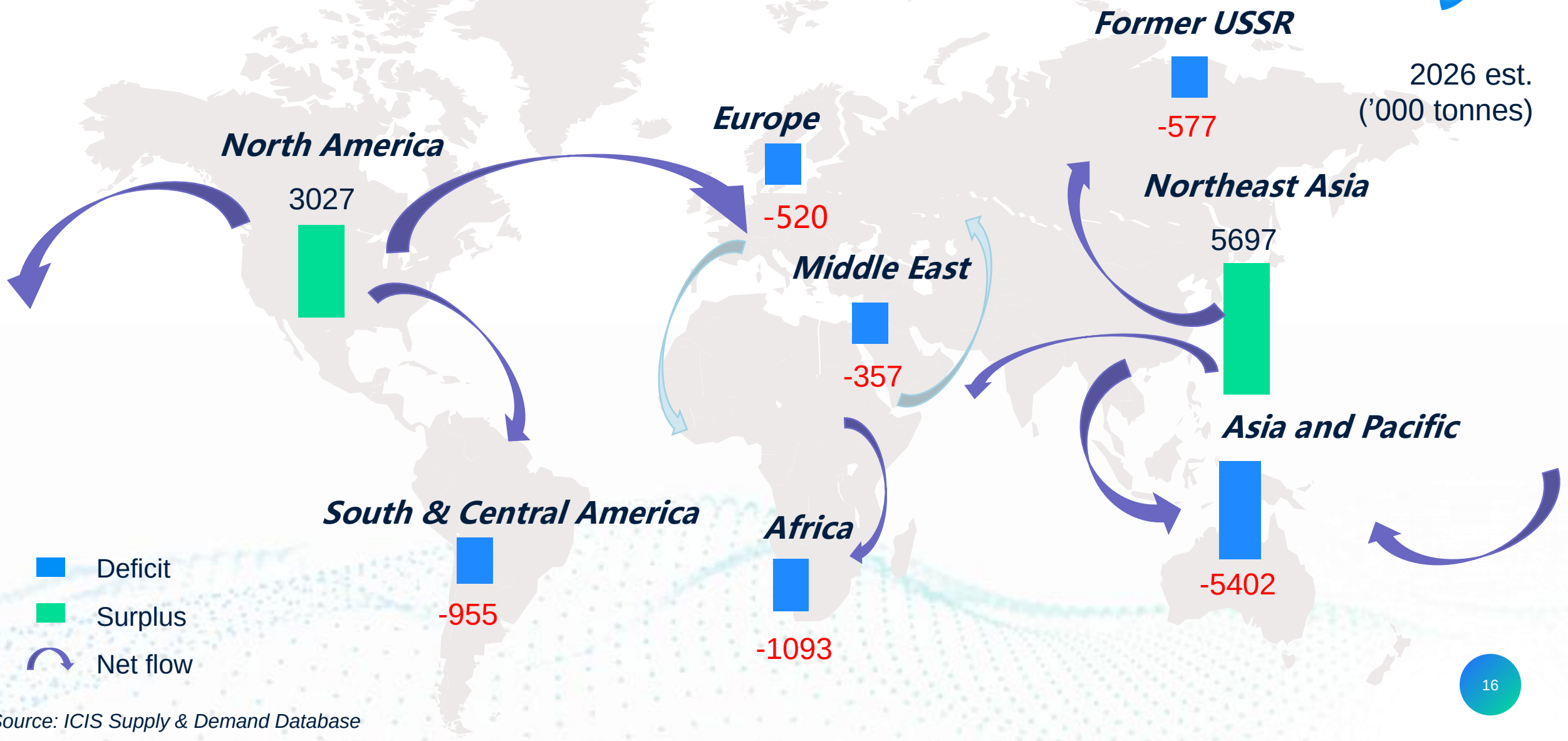
- **3 April 2026 sees record price gaps** (PVC prices were $800-$1,120/tonne)
  - $320/tonne (PVC FOB NE Asia vs Carbide PVC FOB C)
  - $195/tonne (C2 PVC FOB C vs Carbide PVC FOB C)
  - Asia's C2 PVC producers not able to see margins due to feedstock shortage
- Widest gap since assessments launched ~20 years ago
- **Last record: 16 April 2021 during US deep freeze** (PVC prices were $1,225-$1,485/tonne)
- No feedstock issues, Asia's C2 PVC producers see record margins

Source: ICIS

From growth to influence: Asia’s central role in the global PVC market

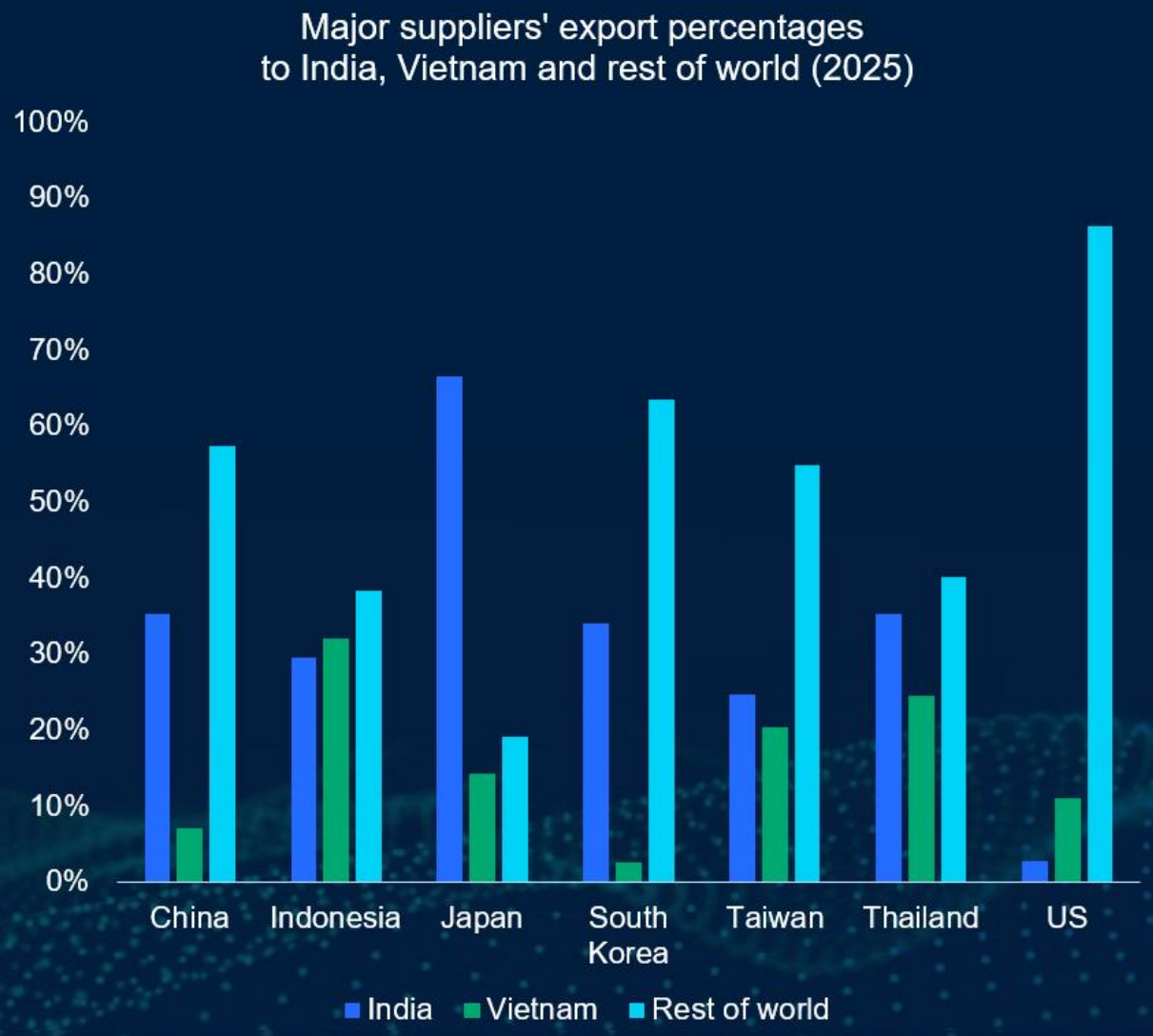
Asia remains a leading force of influence despite ongoing global uncertainties

Asia remains at forefront of PVC global demand/supply flows



Source: ICIS Supply & Demand Database

Major suppliers see India and Vietnam as important destinations



Source: ICIS Supply & Demand Database

- India and Vietnam important export destinations to major PVC suppliers
- Largest exporters China and US differ on export strategies
  - China (4.3m) leverages on India due to proximity and carbide end-use
  - US (3.6m) has very diverse customers, with large base in the Americas

From growth to influence: Asia’s central role in the global PVC market

Key forces that will balance global supply in the years ahead

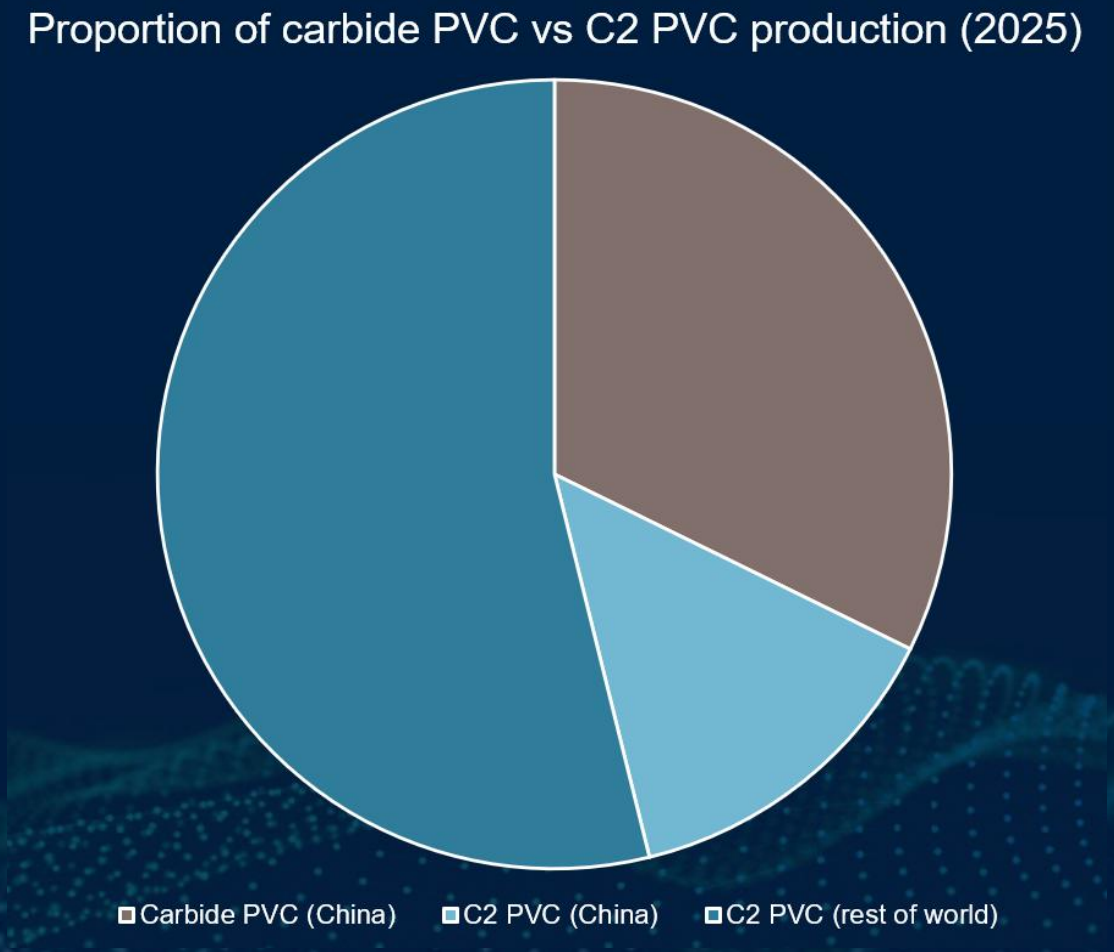
Short term factor for PVC Asia production disruptions

Company	Site	Capacity (kt/year)	Run rates	Date
Tosoh Chemical Industries	Guangzhou, China	220	0%	March-May
Tianjin Bohua Chemical Development	Tianjin, China	1,250	50%	March-May
Formosa Plastics Corporation	Taiwan	1,325	~60% (April) 50% (May)	March-May
Tianjin LG Bohai	Tianjin, China	400	0%	March-May
Sulfindo Adiusaha	Bojonegara, Indonesia	110	50%	March-May
Ningbo Zhenyang	Ningbo, China	300	0%	April-May
Formosa Plastics Corporation	Ningbo, China	400	50%	April-May
SP Chemicals	Taixing, China	500	50% (April) 0% (May)	April-May
China General Plastics Corporation	Taiwan	450	~20%	April-May
Ocean Plastics	Taoyuan, Taiwan	120	~50%	April-May
Hanwha Solutions	Ningbo, China	400	50% (April) 75% (May)	April-May
Qingdao Haiwan	Qingdao, China	1,200	70%	May
Wanhua Chemicals	Yantai, China	400	70%	May
Guangxi Huayi	Qinzhou, China	400	70%	May
Total capacity affected*		**7,475**		

- Asian C2 PVC capacity totaling ~7.5m tonnes/year* (or over 10% of global production) disrupted due to lack of raw materials
  - 3.3m tonnes/year on force majeure for material delivery
- Naphtha, ethylene to grow increasingly scarce if the US-Iran conflict continues

**Not an exhaustive list*
Source: ICIS

Carbide PVC investments in China face higher hurdles



- China's carbide PVC nameplate capacities are ~20 million tonnes/year
  - Forms 32% of of global PVC capacity
- This sector is now at risk of consolidation due to stricter regulations

Source: ICIS

Carbide PVC investments in China face higher hurdles

- China prohibits investments in:
  - Calcium carbide furnaces (except replacement with advanced equipment)
    - Open type
    - Internal combustion type
    - Single furnace capacity <12,500kVA (kilovolt-ampere)
  - Carbide PVC production <200,000 kt/year
  - Carbide PVC production using high-mercury catalysts (>6.5%)

Consolidation on the cards in China as 2032 approaches

- China will ban by 16 August 2032:
  - Primary mercury mining
  - Catalysts containing mercury
  - Using mercury compounds as catalysts

- Carbide PVC producers totalling 20 million tonnes/year consider their options:
  - Mercury-free (gold-based) catalyst
    - ❖ High production upgrade and catalyst costs
    - ❖ <5% of carbide PVC currently using gold-based catalysts
  - Switch to ethylene process
    - ❖ Hefty upfront investment costs
  - Exit the market
    - ❖ Smaller producers may have fewer choices available to them

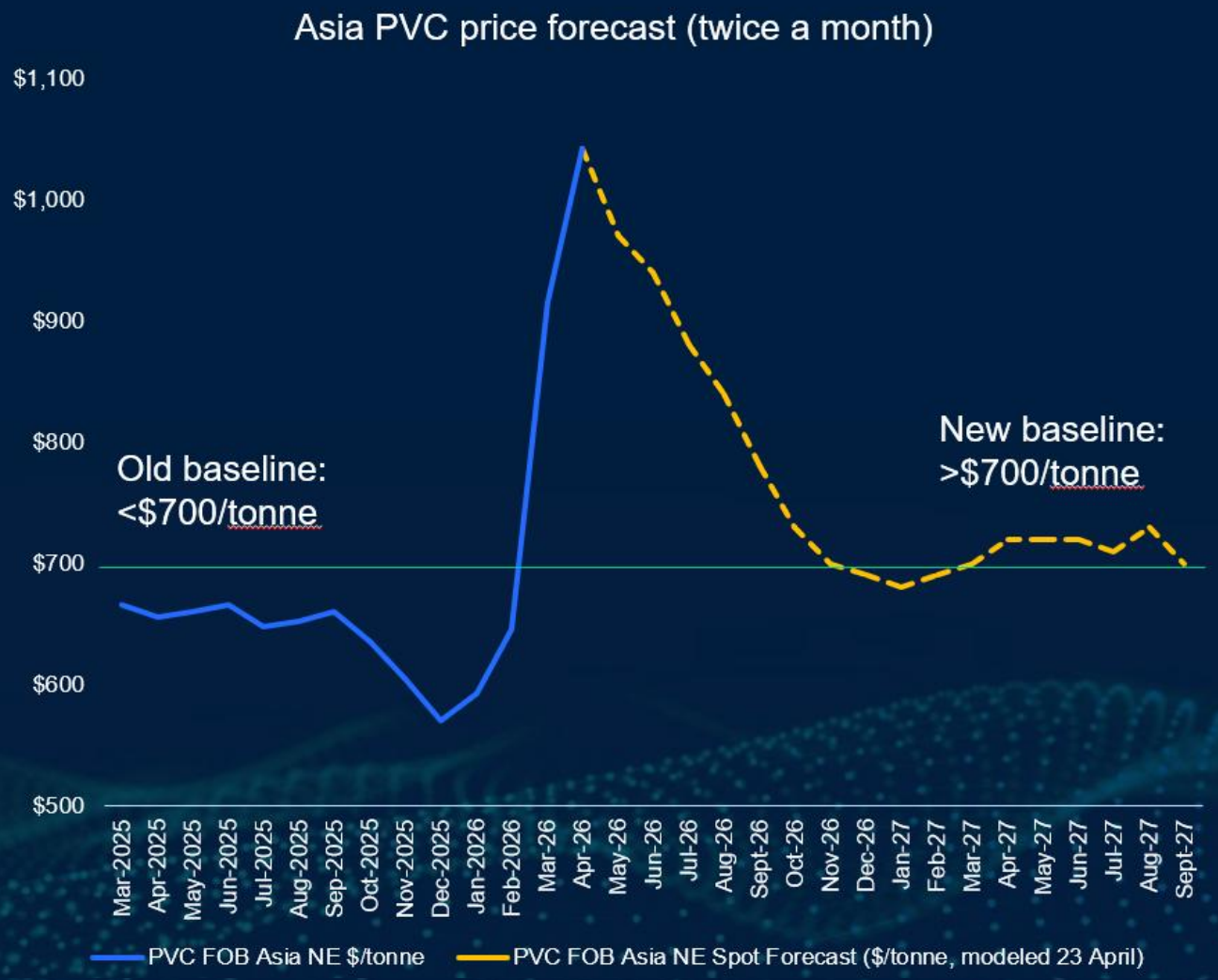
Policies are key drivers to global trade and supply trends

- **India**
  - Quality control order (lapsed)
  - Anti-dumping duties (ADDs) from 7 origins (no enforcement)
  - **Temporary removal of BCD (April to June)**
  - **Minimum import price (MIP) on suspension-grade PVC imports (ongoing)**
  - **Countervailing duty (CVD) investigation on China origin imports (ongoing)**
- **China**
  - **VAT rebates discontinuation (1 April)**
  - Carbide, mercury prohibitions
  - Other anti-involution measures
- **Pakistan**
  - **ADD investigation on PVC imports from Indonesia, the US (17 April)**
  - ADDs already in place on China, South Korea, Thailand, Taiwan origins
- **ADDs on US PVC**
  - UK/EU/Brazil/Mexico/Egypt/Pakistan
  - US producers look to other regions like Asia

Is the needle shifting toward a balanced global PVC market?

Conclusion: Why 2026 will be different from previous years

Effects of Iran conflict on feedstocks to have lasting issues for PVC



Source: ICIS Analytics

- Q2 2026: PVC forecasts elevated prices
  - Feedstock disruptions even if Iran conflict ends
  - Underlying high demand season
- Q3 2026: Gradual softening as players account for feedstock disruptions; India monsoon starts
  - China's new "bottom line" expected
- Q4 2026: Seasonal availability from China's winter lull
- Q1 2027: India's major expansions come online fully
- Q2 2027: India, SE Asia high demand season
- Q3 2027: NE Asia producer's TA balanced by India's monsoon season

Further capacity rationalization remains a possibility

Company	Site	Products (kt/year)	Status
Westlake	Lake Charles, Louisiana	Caustic Soda (415), Chlorine (376), VCM (415), Suspension PVC (454)	Closed (end 2025)
Orbia	Pedricktown, New Jersey	Emulsion PVC (60)	Closed (end 2024)
Fortischem	Novaky, Slovakia	PVC (90)	Closed (early 2025)
Vencorex	Pont-de-Claix, France	Caustic Soda (133), Chlorine (119)	Closed (H1 2025)
Vynova	Beek, Netherlands	PVC (225)	Closed (late 2025)
Spolana	Neratovice, Czech Republic	PVC (135)	Closed (H1 2025)
Toagosei	Kawasaki, Japan	PVC (120)	Closed (Dec 2025)
LG Chem	Yeosu, South Korea	PVC (150)	Gradual reduction from 200 to 50kt in 2024-2025
Various	China	PVC (~850)	Closed (2024-2025)

- Consolidations on the cards, just a matter of time
- Economics-driven scaling down of operations likely
- Fundamentally oversupplied market to squeeze out non-integrated players
- Aging capacities likely to be most at risk across regions
- The higher the level of integration, the better chances of weathering the storm

PVC sees strong demand outlook and future supply curtailments

Certainties

- India, Vietnam remain key PVC importers driving global trade
    - But carbide PVC acceptance growing
- China, US remain key suppliers
- 2026 exhibits more bullishness compared to previous years
    - Upside capped as C2-Carbide PVC to continue tussle for dominance
    - But C2 PVC production costs to remain affected by SoH

Uncertainties

- When will feedstock flows resume back to normal in Asia?
- Middle East net balance to remain tight for foreseeable future
- Heightened geopolitical uncertainties may throw unexpected wrenches into the mix
- **Consolidations likely in China and beyond** as we head into 2030 and beyond, but actual pace remains uncertain

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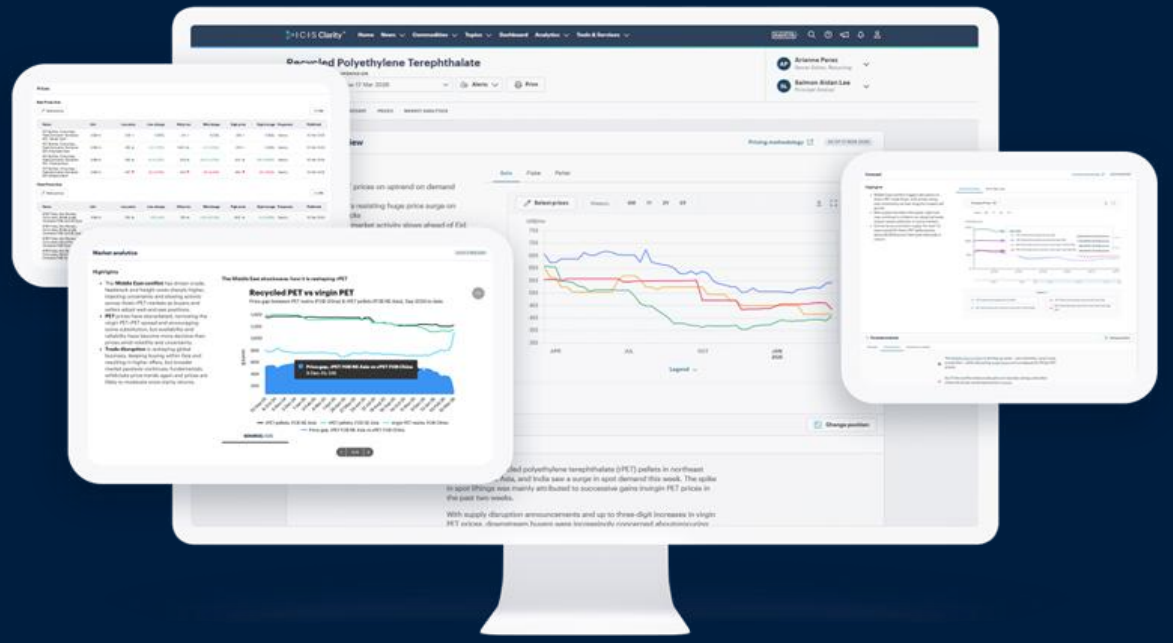

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APIC 2026
Asia Petrochemical Industry Conference
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The Geopolitical Pivot:

Vertical Integration as the Unavoidable Response to Global Trade Barriers in PVC

Gordon Kuo
Director, APAC Vinyls & India Chlor-Alkali
Gordon.Kuo@checmialmarketanalytics.com

Feedstock / Integration Matters

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Ethylene – Naphtha reliance triggers economic shocks in NEA

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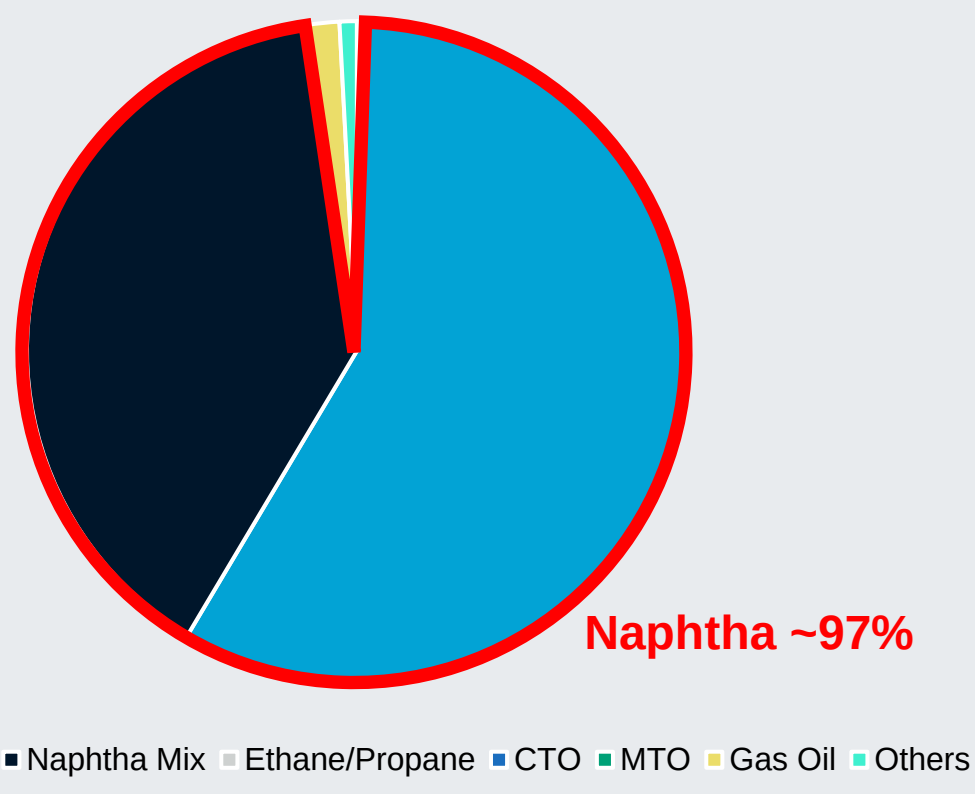
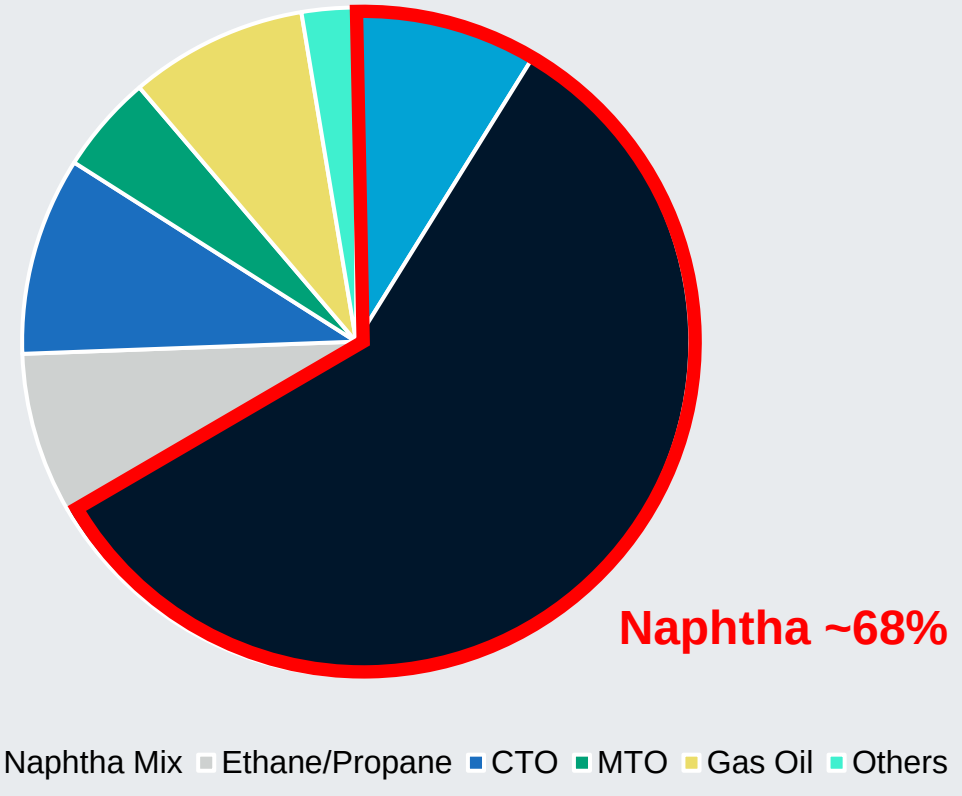
2025 Ethylene production by feedstock (**NEA-ex China**)



2025 Ethylene production by feedstock (**China**)



Source: Chemical Market Analytics by OPIS

Ethylene - SEA better with lighter feedstock, India's problem on EDC/VCM

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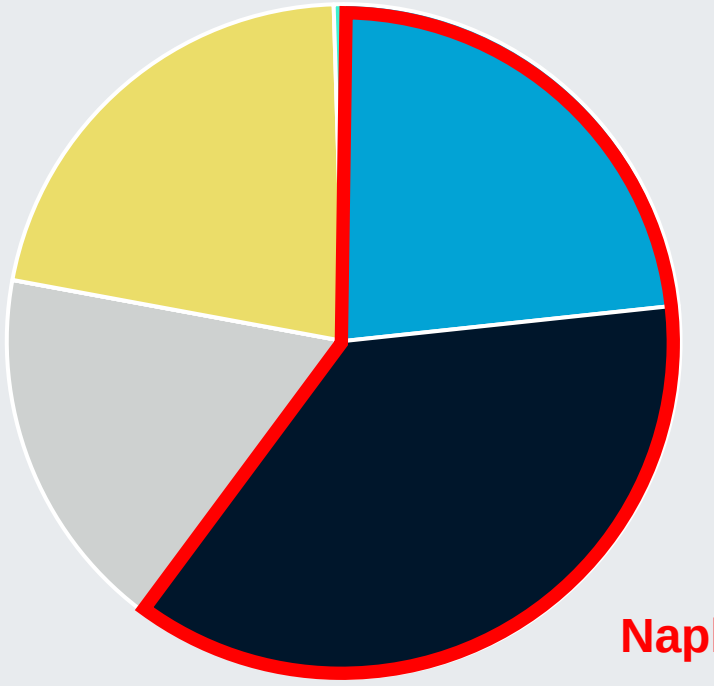
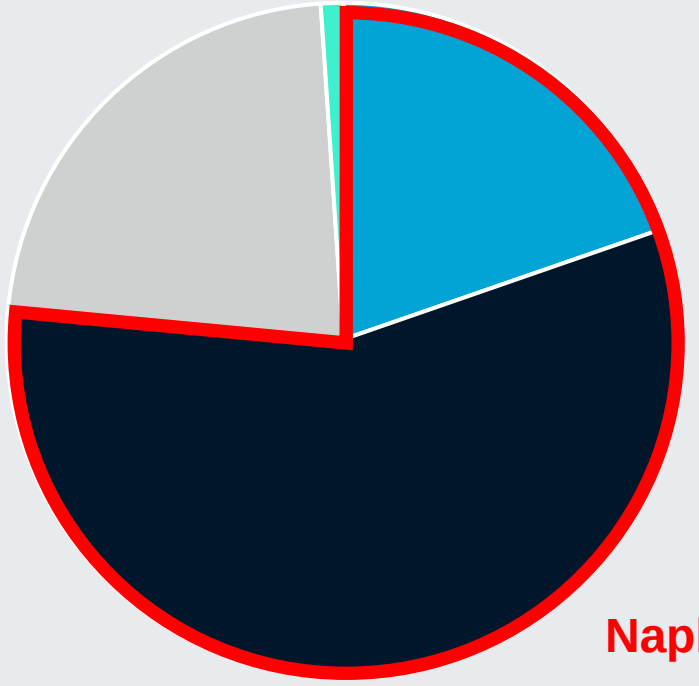
2025 Ethylene production by feedstock (**SEA**)



Naphtha ~60%

Naphtha | Naphtha Mix | Ethane/Propane | CTO | MTO | Gas Oil | Others

2025 Ethylene production by feedstock (**ISC**)



Naphtha ~77%

Naphtha | Naphtha Mix | Ethane/Propane | CTO | MTO | Gas Oil | Others

Source: Chemical Market Analytics by OPIS

EDC – NEA / SEA both to enhance integration to cover shortage

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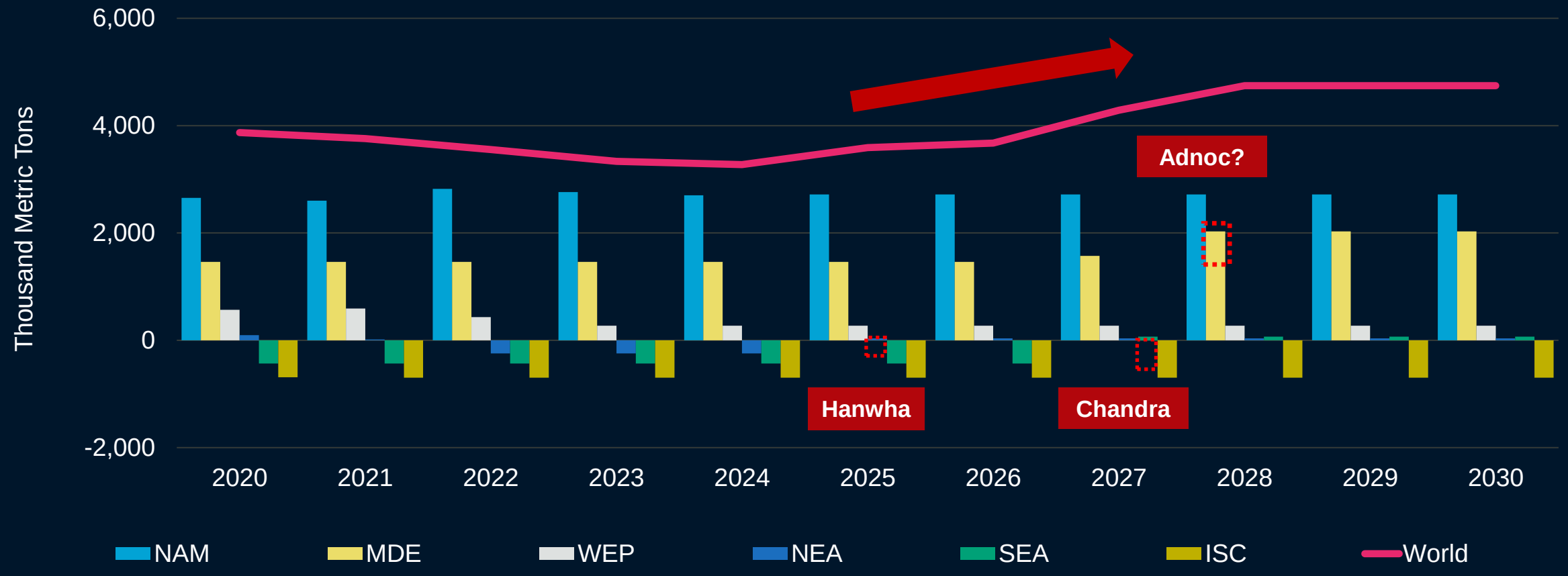
Global EDC Integration - Net surplus/Deficit



Source: Chemical Market Analytics by OPIS

VCM – Tighter across APAC region, especially crucial for India

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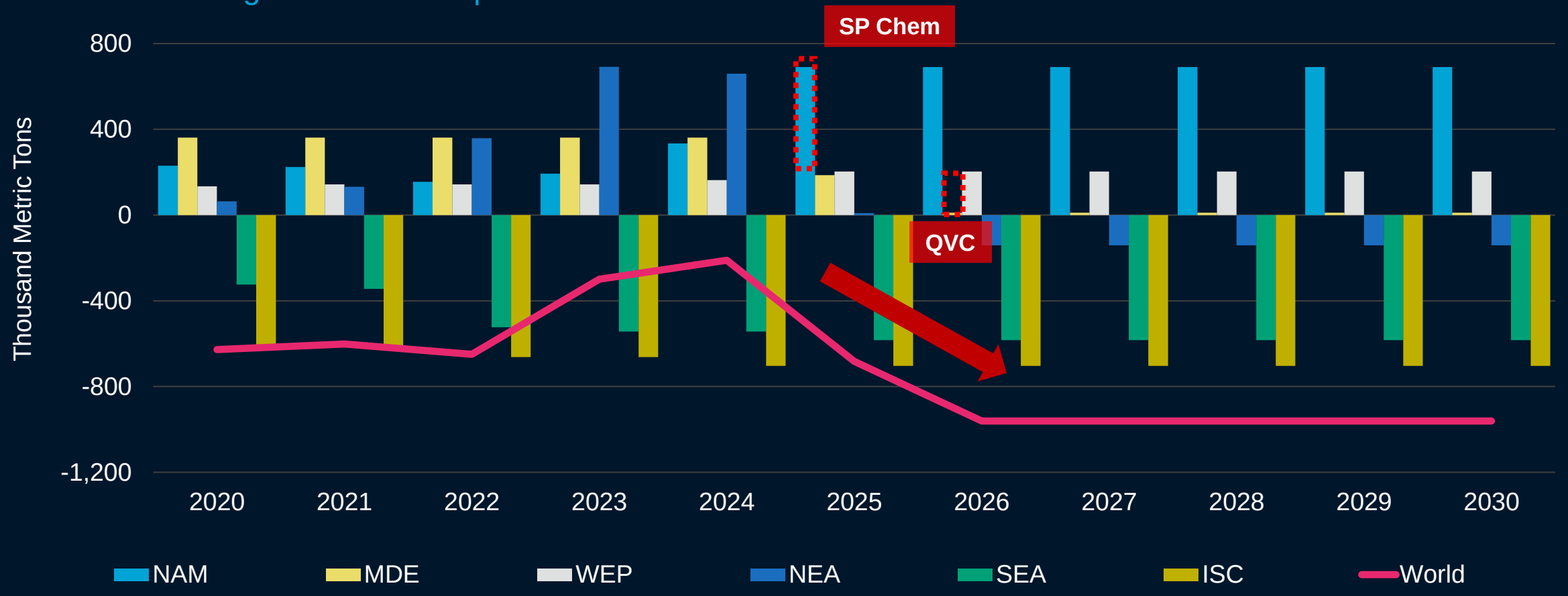
Global VCM Integration - Net surplus/Deficit



Source: Chemical Market Analytics by OPIS

Navigating through Recovery

Current market trough, for how long?

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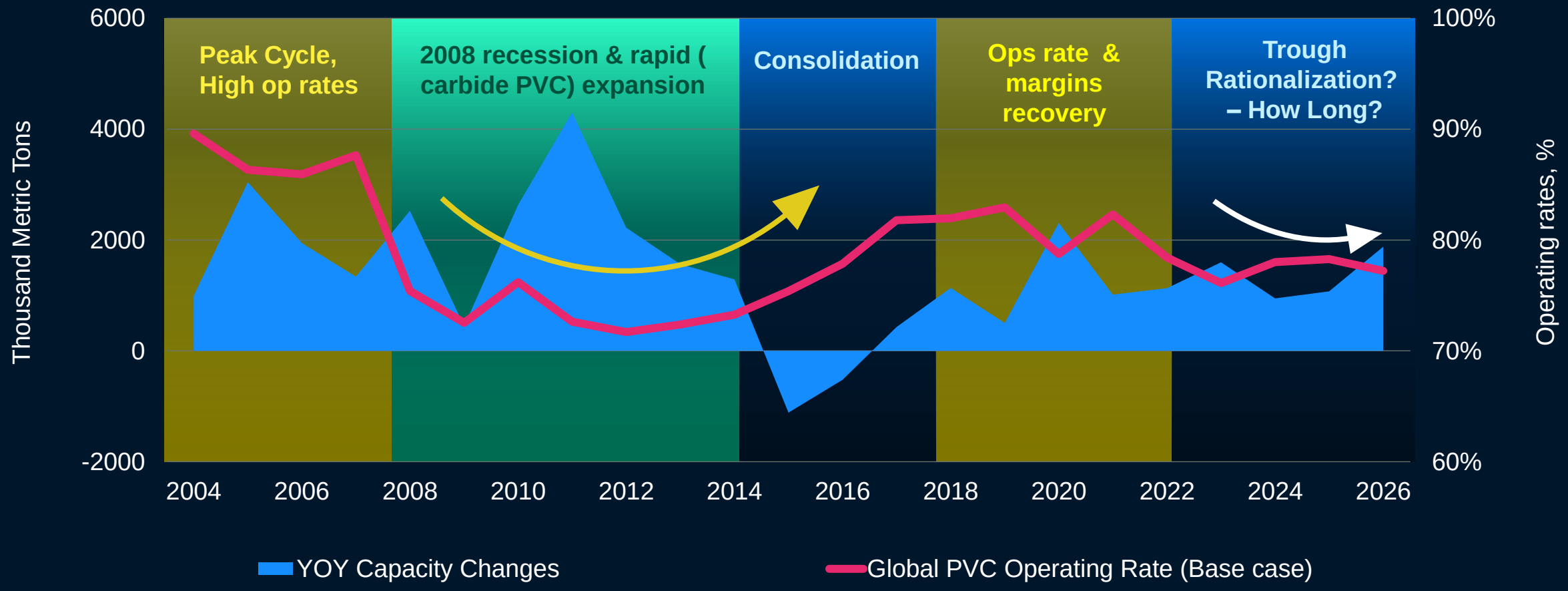
Global PVC YOY capacity changes versus operating rate



Source: Chemical Market Analytics by OPIS

Supply and demand shifting from China to SEA / ISC continues

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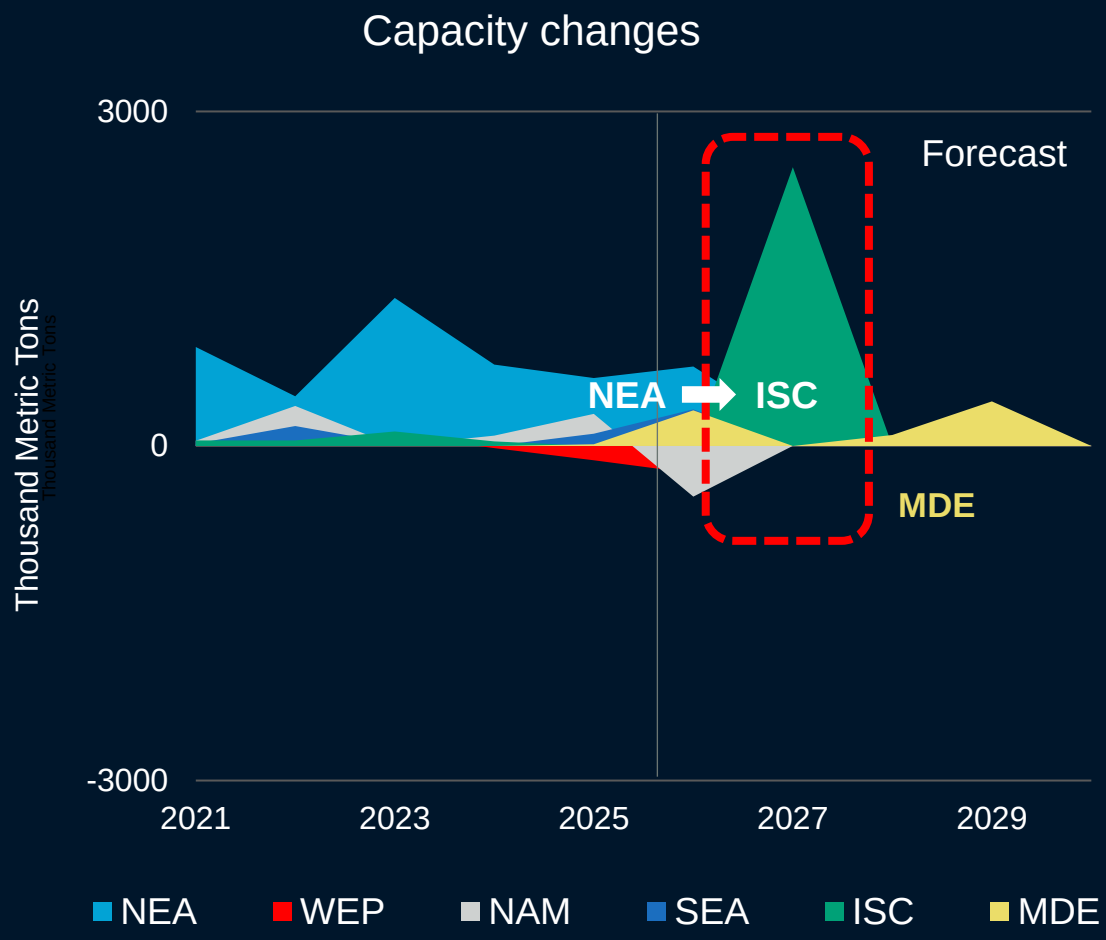
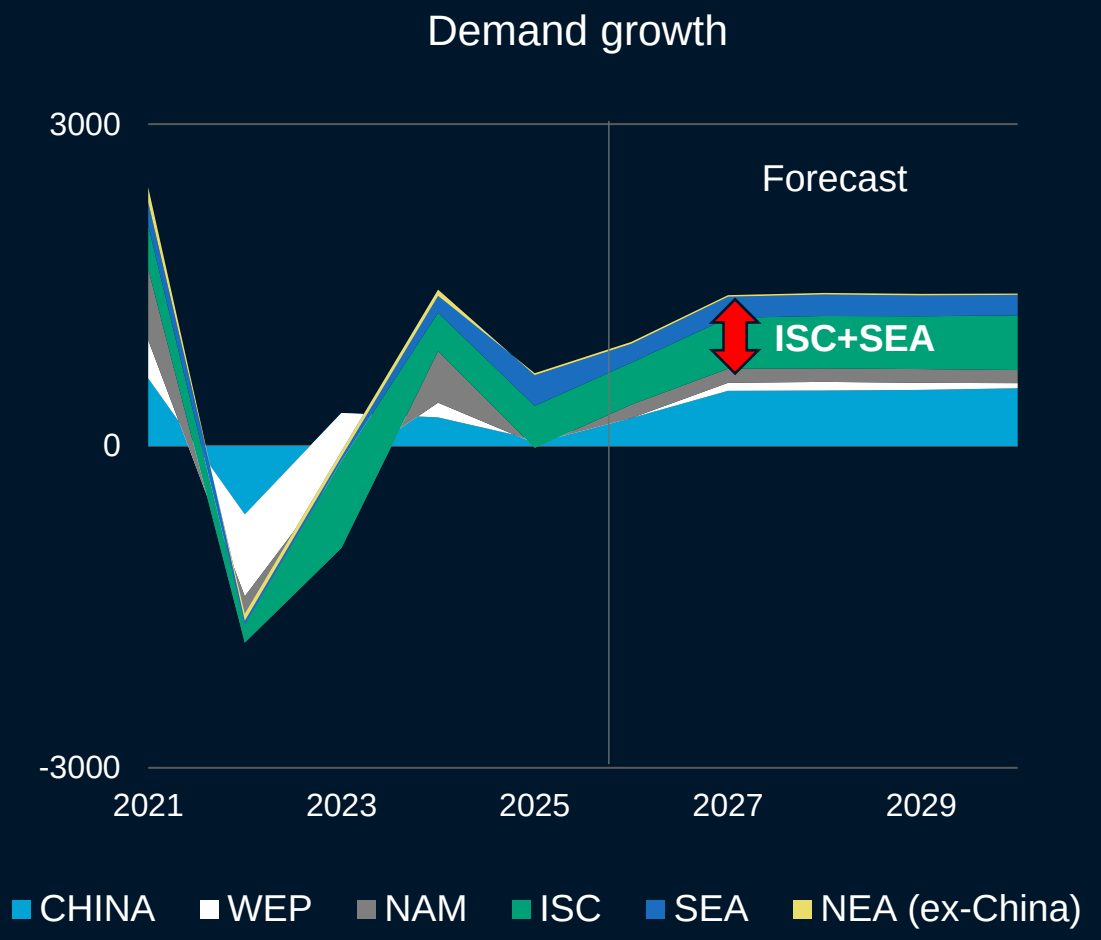
Global PVC capacity changes and demand growth by region





Source: Chemical Market Analytics by OPIS

Tighter control in China vs. Rising barrier intention in India

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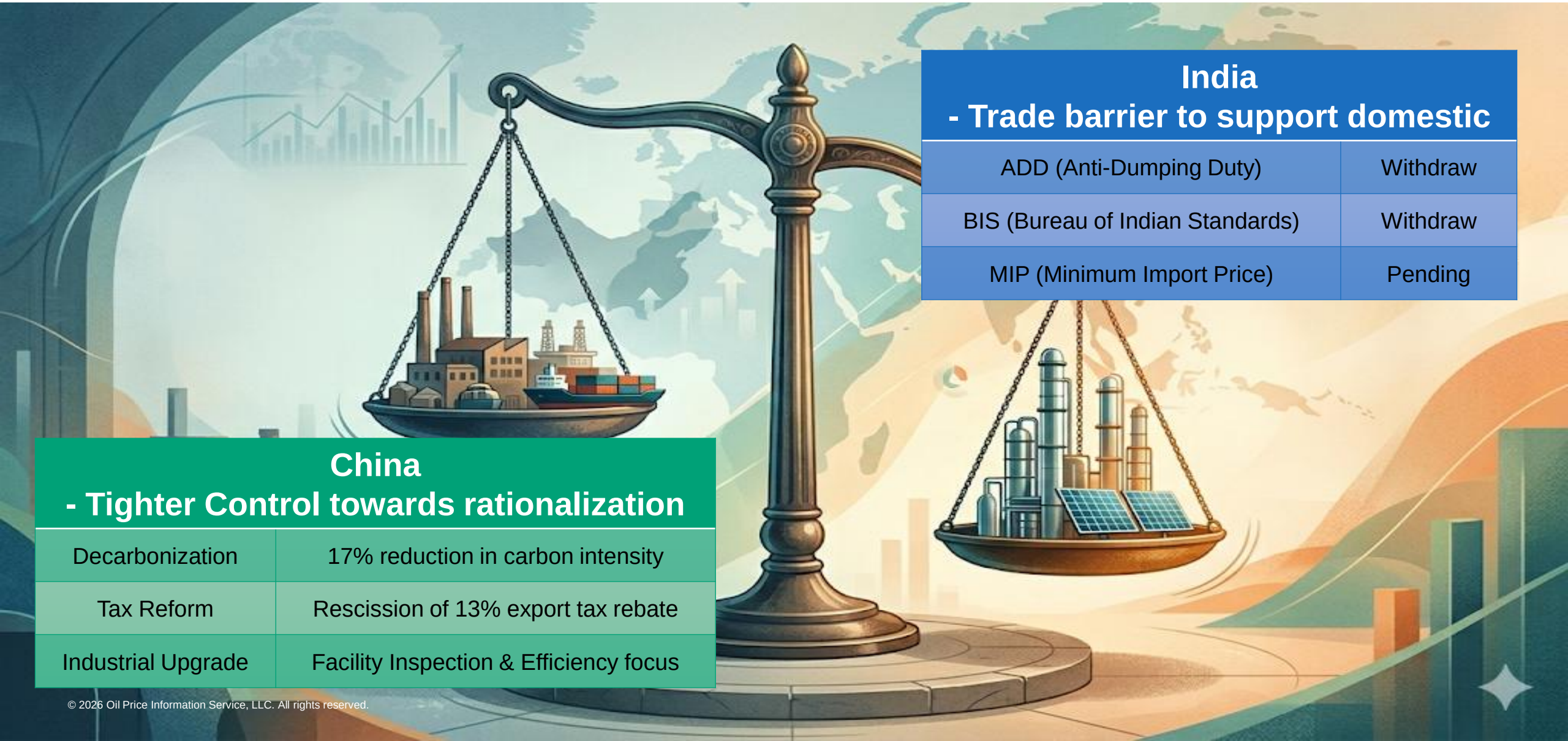

India - Trade barrier to support domestic	
ADD (Anti-Dumping Duty)	Withdraw
BIS (Bureau of Indian Standards)	Withdraw
MIP (Minimum Import Price)	Pending

China - Tighter Control towards rationalization	
Decarbonization	17% reduction in carbon intensity
Tax Reform	Rescission of 13% export tax rebate
Industrial Upgrade	Facility Inspection & Efficiency focus

PVC rationalization in China vs. Two mega plants in India

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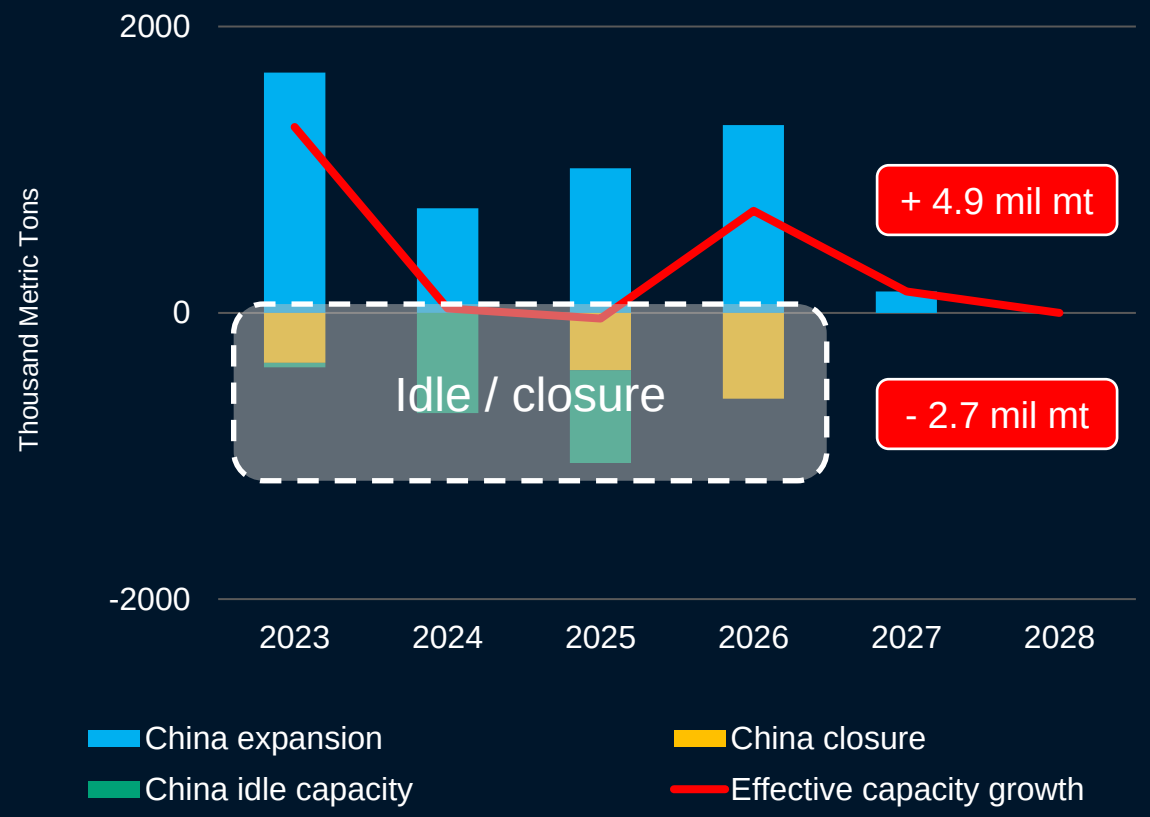
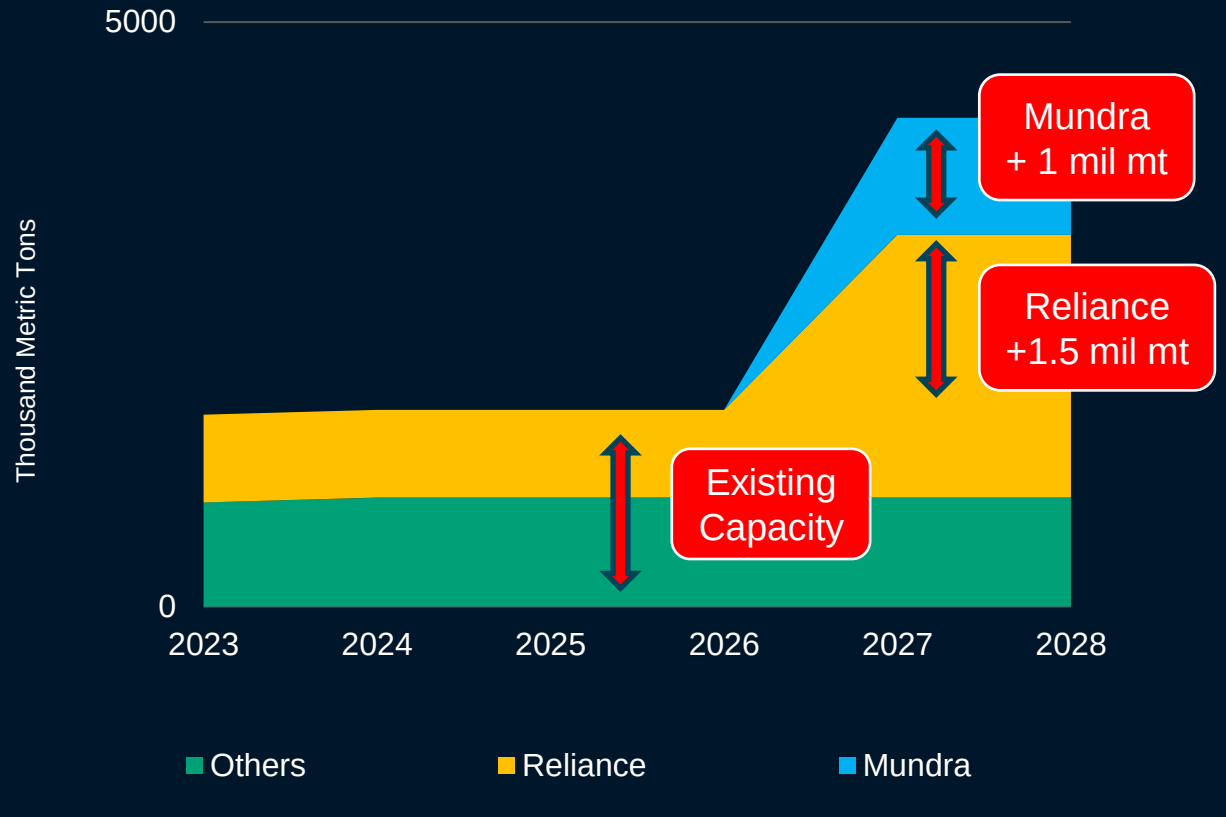
Mainland China effective PVC capacity growth



India PVC capacity growth by company



Source: Chemical Market Analytics by OPIS

China expansion peak in 2025/2026, starting rationalization

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Company	Process	Capacity	Note
SP Chemical	Ethylene-based	**250kt**	Ethane to ethylene, export caustic soda, near port
Qingdao Haiwan	Ethylene-based	**200kt**	Import ethylene, export caustic soda and PVC, near port
Fujian Wanhua	Ethylene-based	**400kt**	Import ethylene, export caustic soda and PVC, near port
Tianjin Bohua	Ethylene-based	**400kt**	Import ethylene, export caustic soda and PVC, near port
Gansu Yaowang	Carbide-based	**300kt**	Mercury free process

- Around 1 million mt PVC closure + Around 1.4 million mt PVC under idle
- No major expansion plan kicks in in beyond 2026

Carbide-based PVC cost advantage resurface, sustainable?

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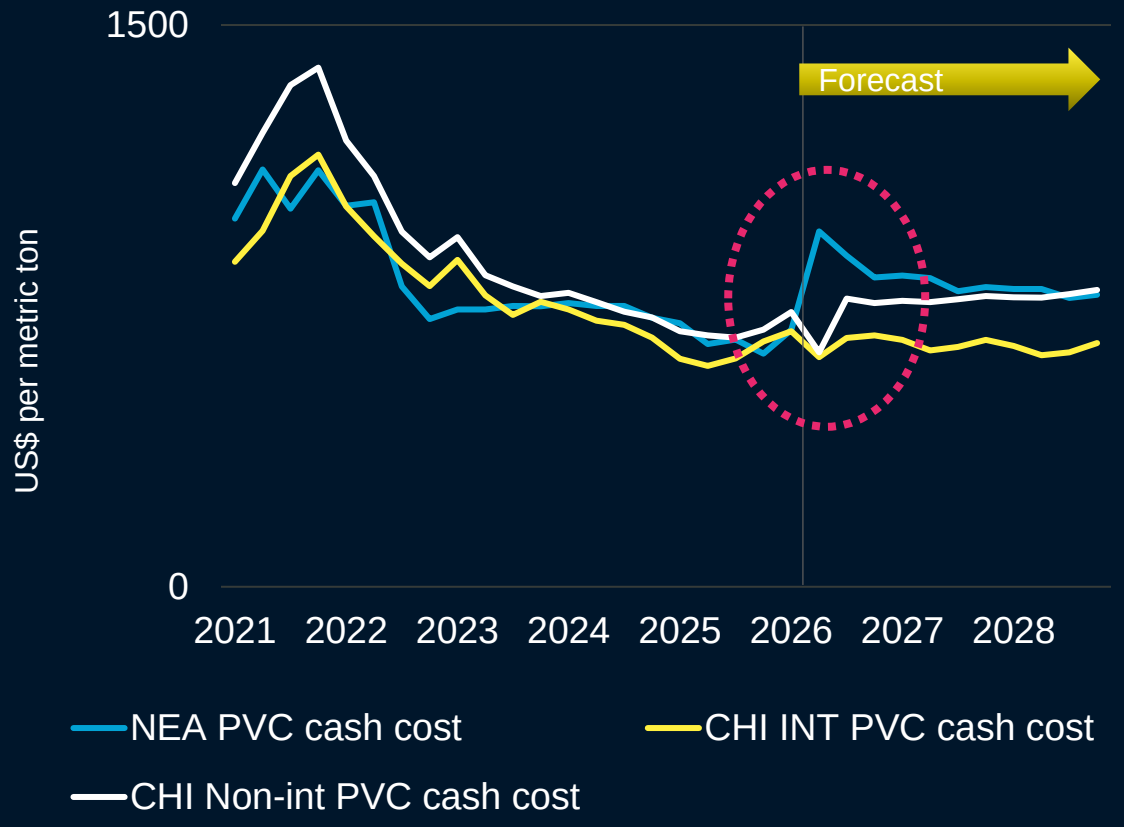
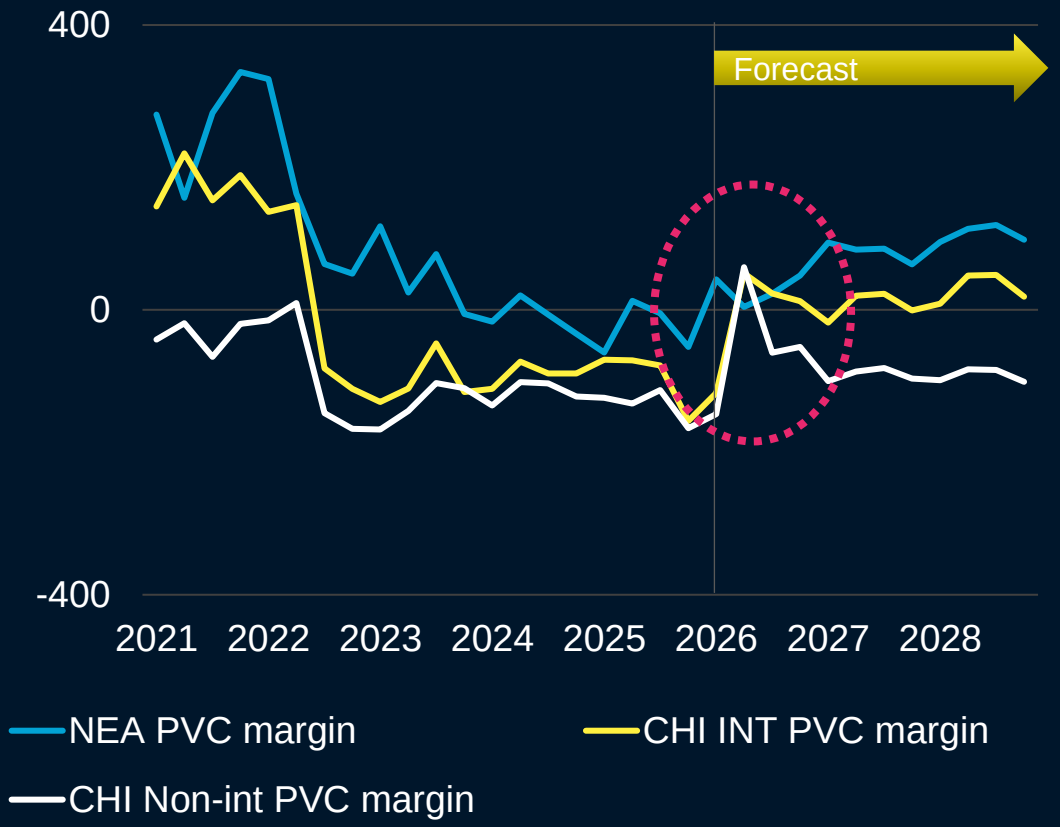
Cash Cost Comparison (NEA vs Mainland China)



Cash Margin Comparison (NEA vs Mainland China)



Source: Chemical Market Analytics by OPIS

Nonintegrated carbide-based PVC producers still under pressure

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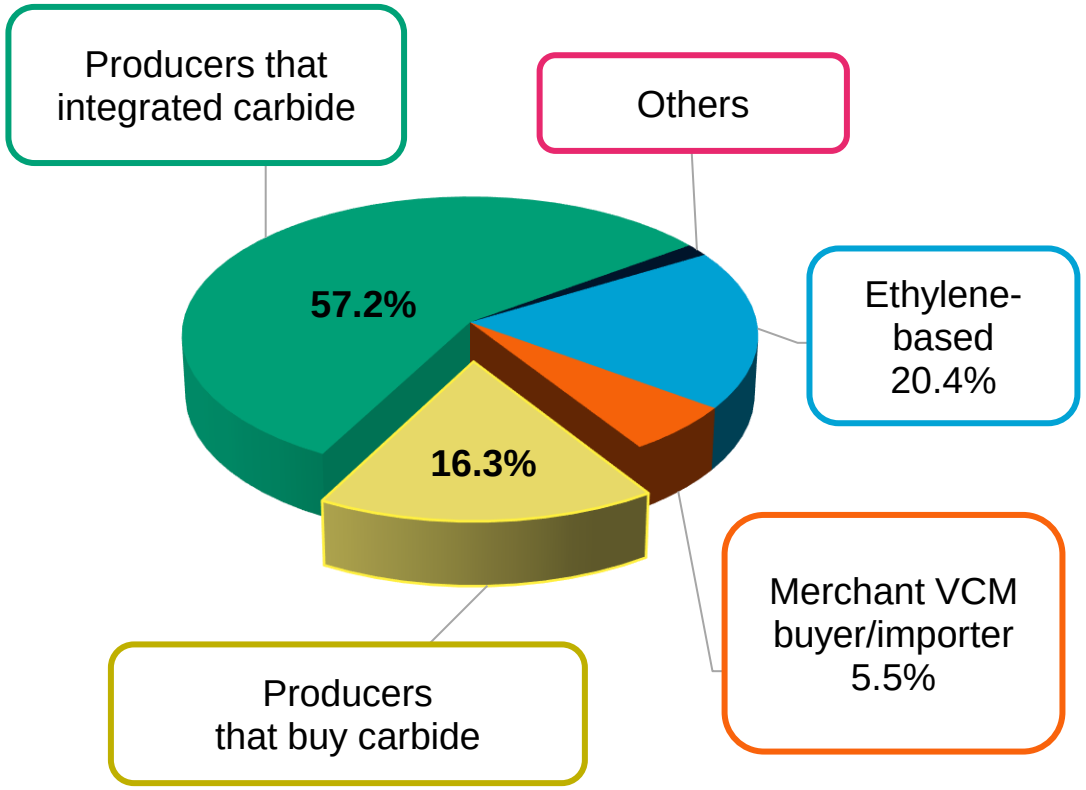
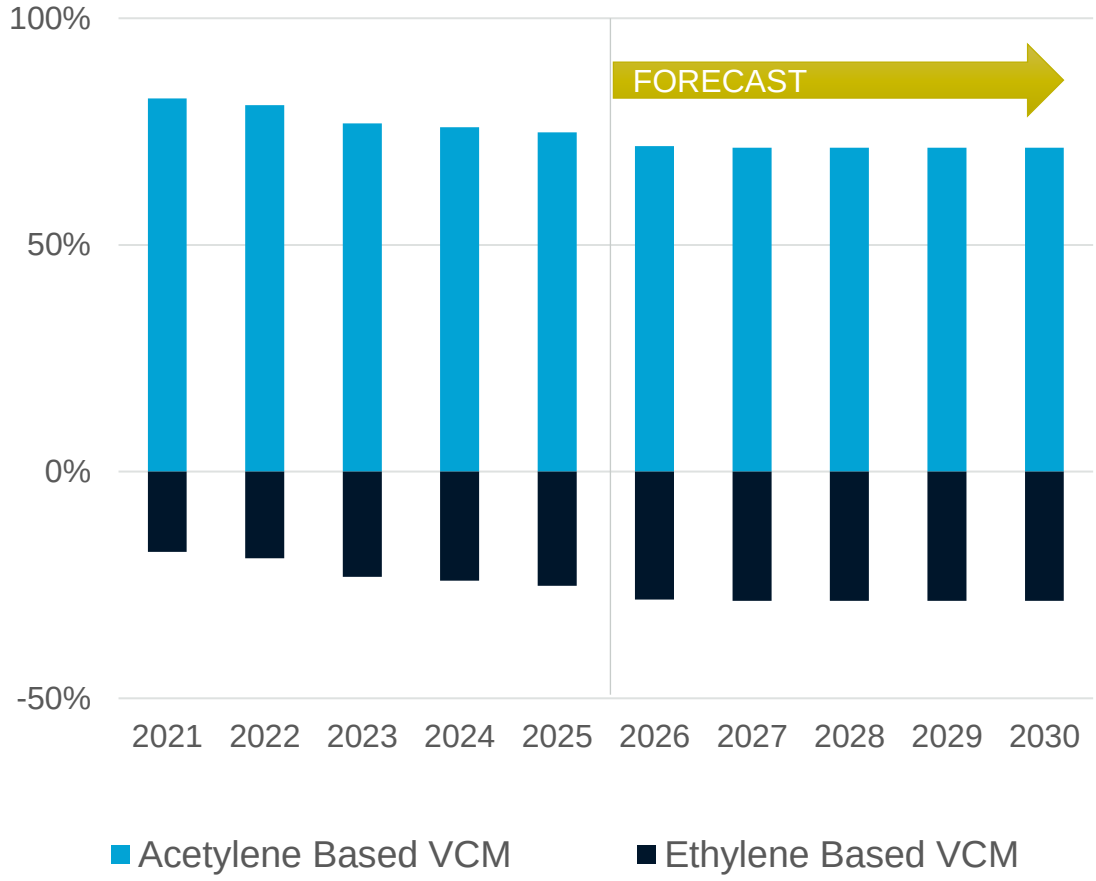
Mainland China PVC Capacity by Feedstock in 2025



VCM capacity percentage by process



Source: Chemical Market Analytics by OPIS

Supply side rationalization have started, but is it enough?

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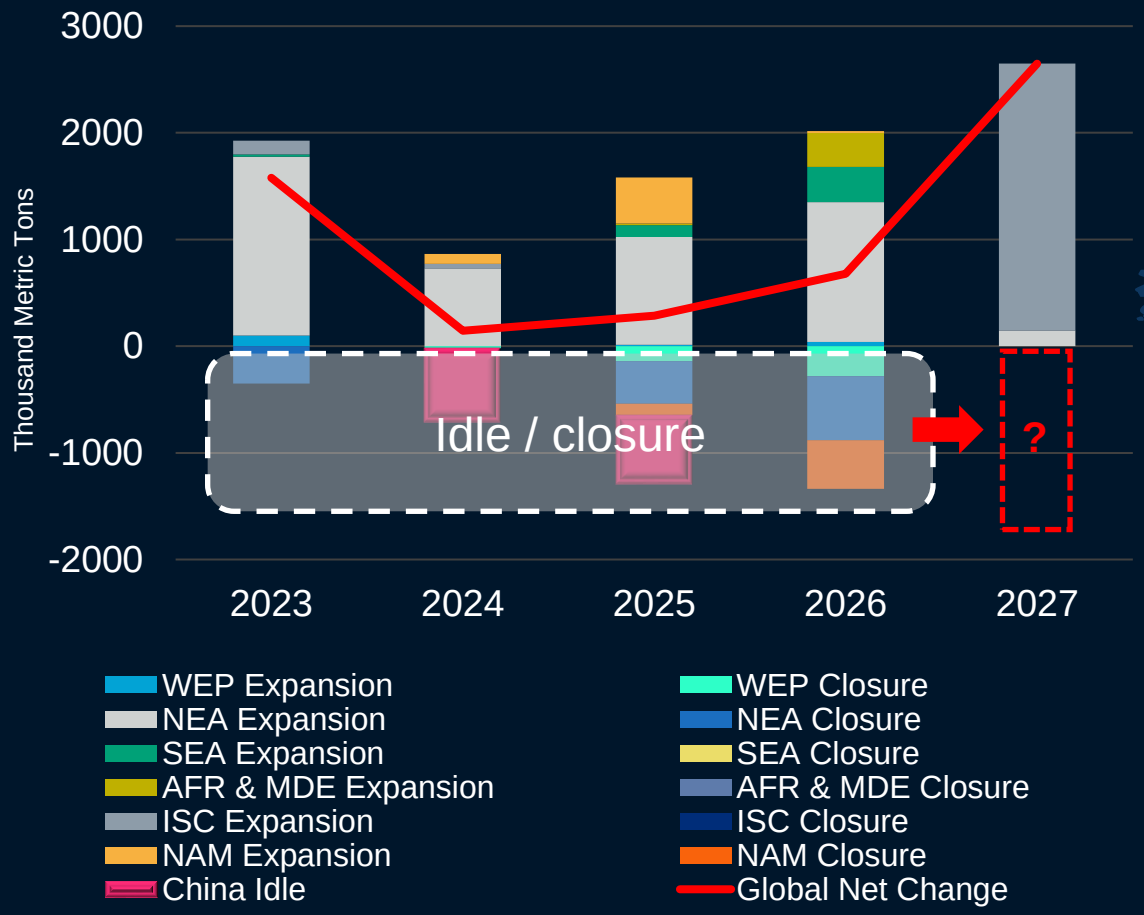
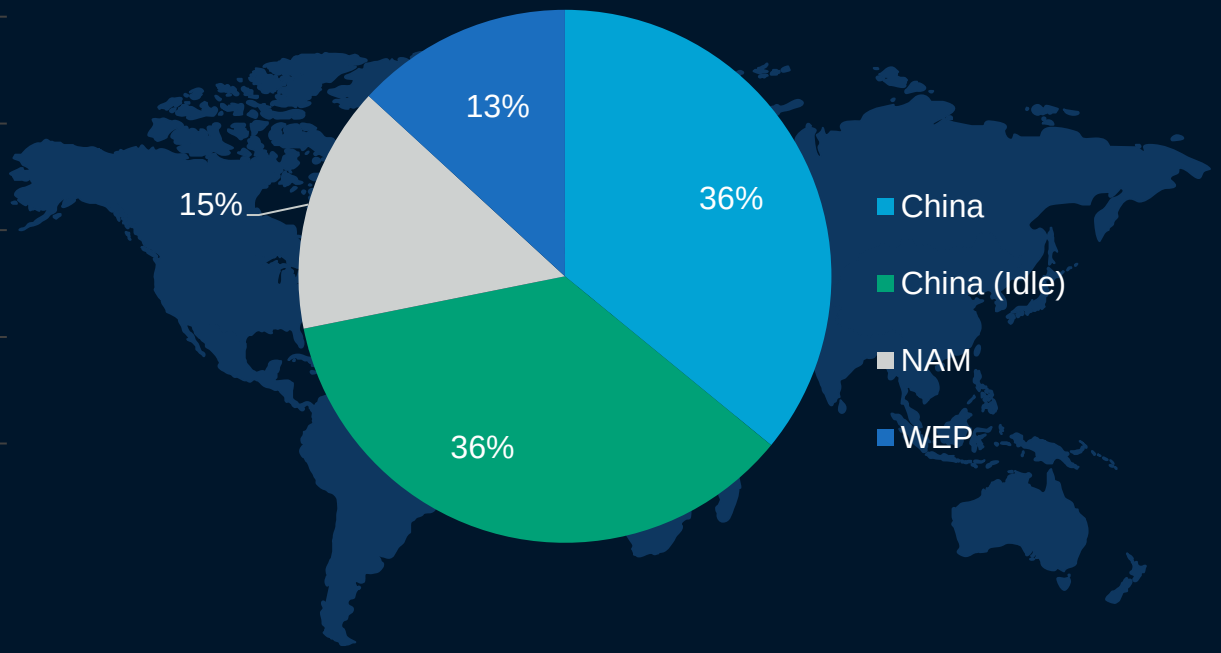
Year on year supply changes



Source: Chemical Market Analytics by OPIS

Cumulative 2023-2026 capacity closure & idle



Total: 4.3 million metric tons

Source: Chemical Market Analytics by OPIS

Investing in growth: government projects drive PVC demand

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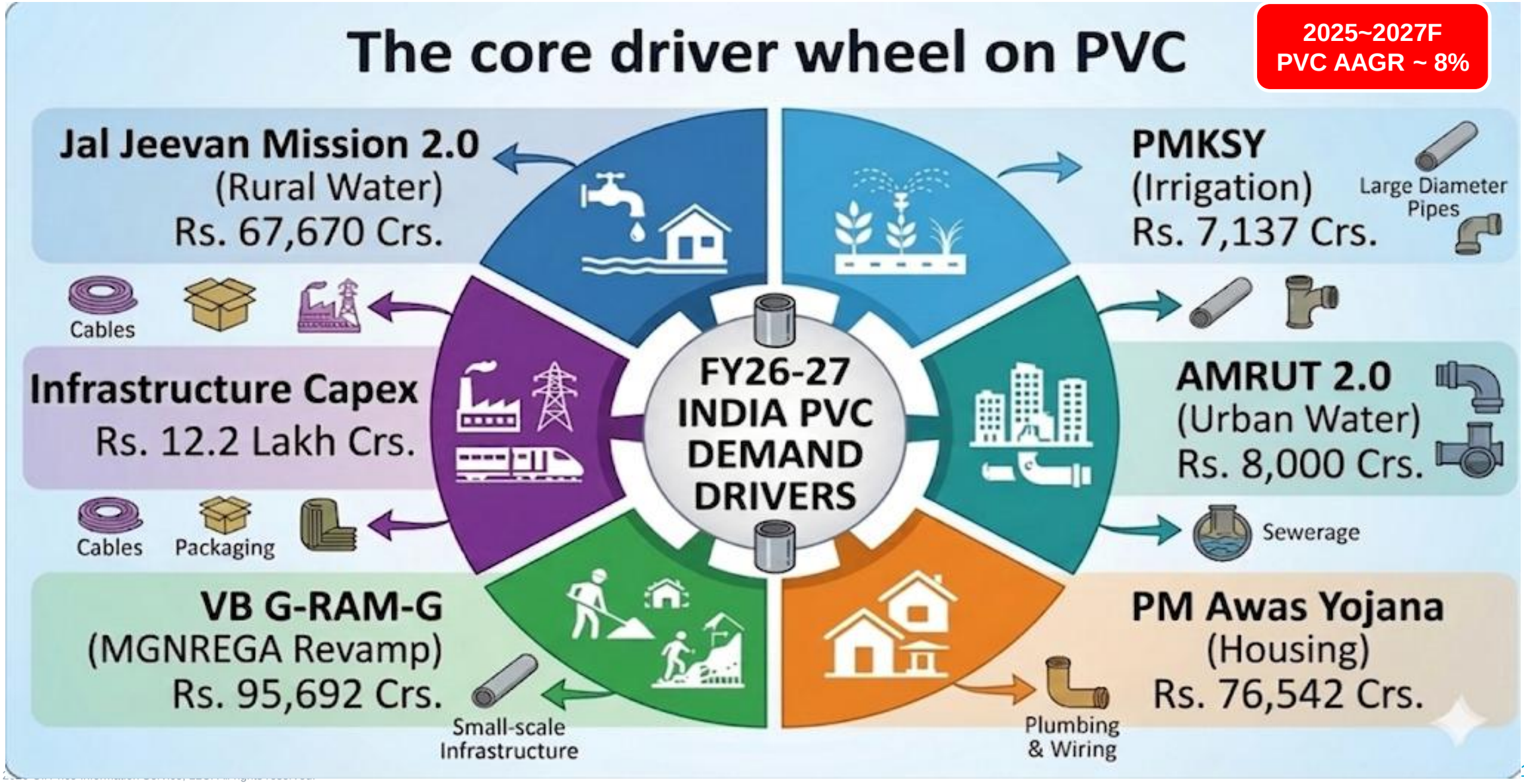

India’s expansion hurdles: The ethylene supply gap

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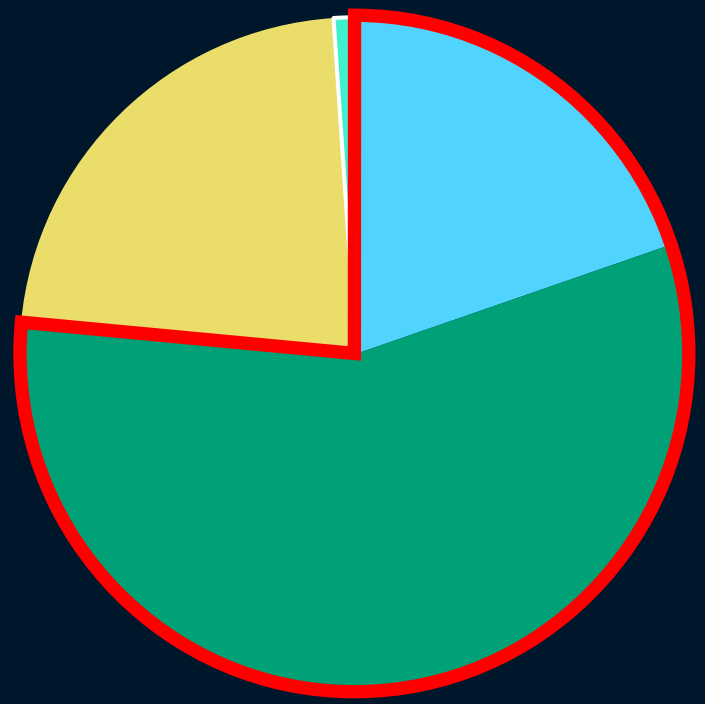
2025 ISC ethylene production by feedstock

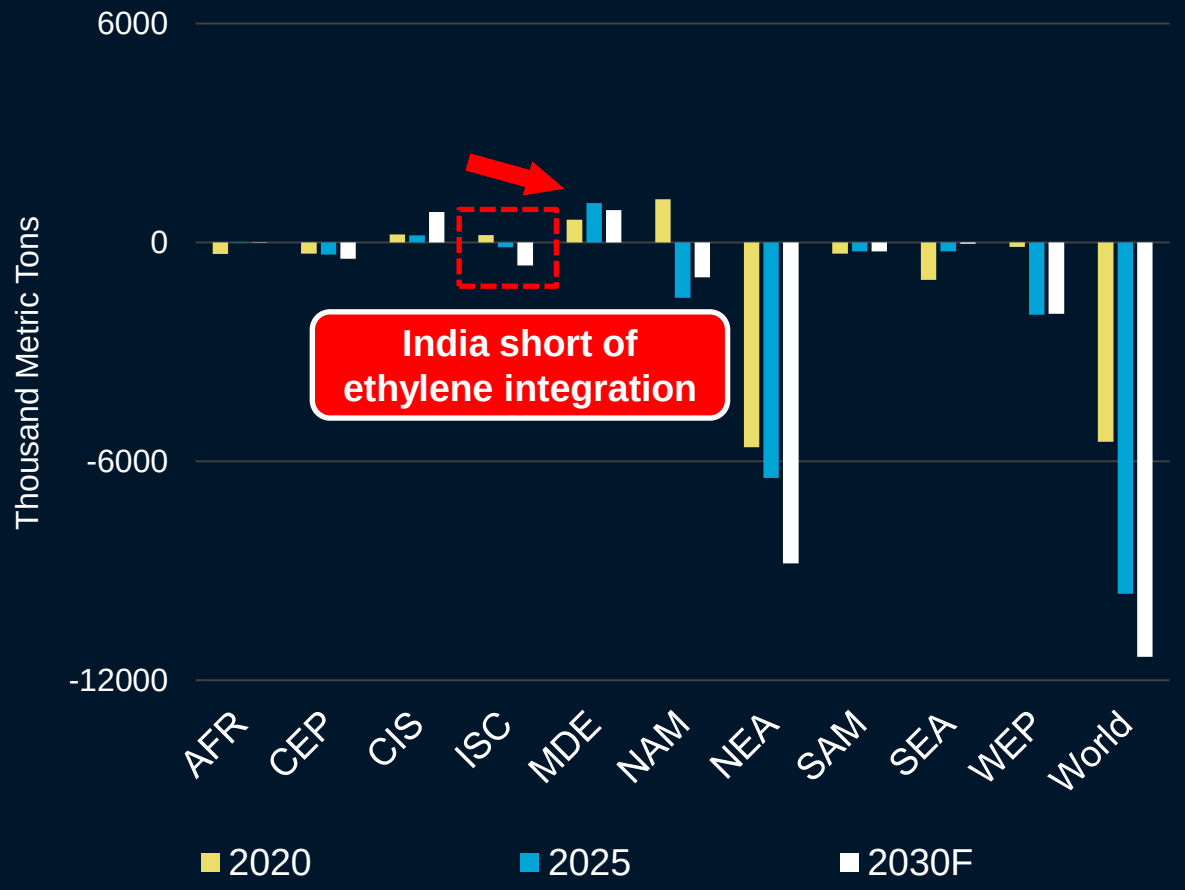


Naphtha ~77%

Naphtha
Naphtha Mix
Ethane/Propane
CTO
MTO
Gas Oil

Source: Chemical Market Analytics by OPIS

Regional Ethylene integration development



Different paths to self-sufficiency: ethylene-based vs. carbide-based

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	Ethylene	Carbide	C/A	EDC	VCM	PVC	Building Product	PVC Capacity (kta, 2027F)
Reliance	o		o	o	o	o		2250
Chemplast			o	o	Δ	o		436
Finolex				Δ	o	o	o	285
DCW			o			o		150
DCM (Carbide)		o	o		o	o	o	60
Mundra (Carbide)		o	o		o	o		1000

Reliance 1.5 mil mt PVC expansion

- More ethane cracker feedstock coverage
- 1.2 mil mt SPVC + 0.3 mil mt CPVC
- 100% renewables-led expansion
- CA/EDC in Dahej
- VCM/PVC in Nagothane

Mundra 1 mil mt PVC expansion

- First mega coal-to-PVC project in India
- Only consider 1st phase 1 mil mt now
- Coal imports through Mundra port
- Johnson Mathey's mercury-free catalyst
- 10% renewable energy commitment
- Group 24GW+ renewable energy ecosystem

- Reliance stands alone with a self-sufficient 'ethylene-to-PVC' chain, ensuring maximum cost immunity
- Chemplast, Finolex, and DCW remain heavily reliant on imported feedstock (Ethylene, EDC, and VCM)
- DCM and Mundra represent the only significant carbide-based PVC capacity and expansion globally outside of China

Bridging the deficit: why capacity expansion still imperative

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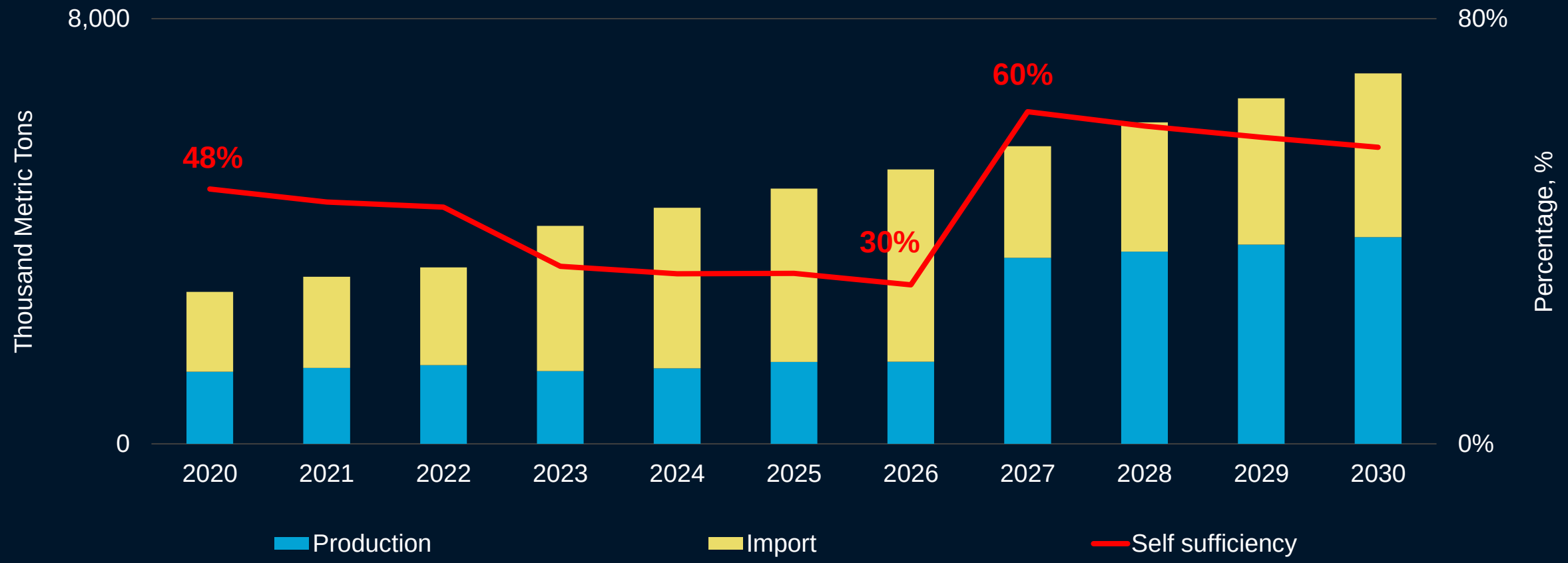
India PVC self sufficiency

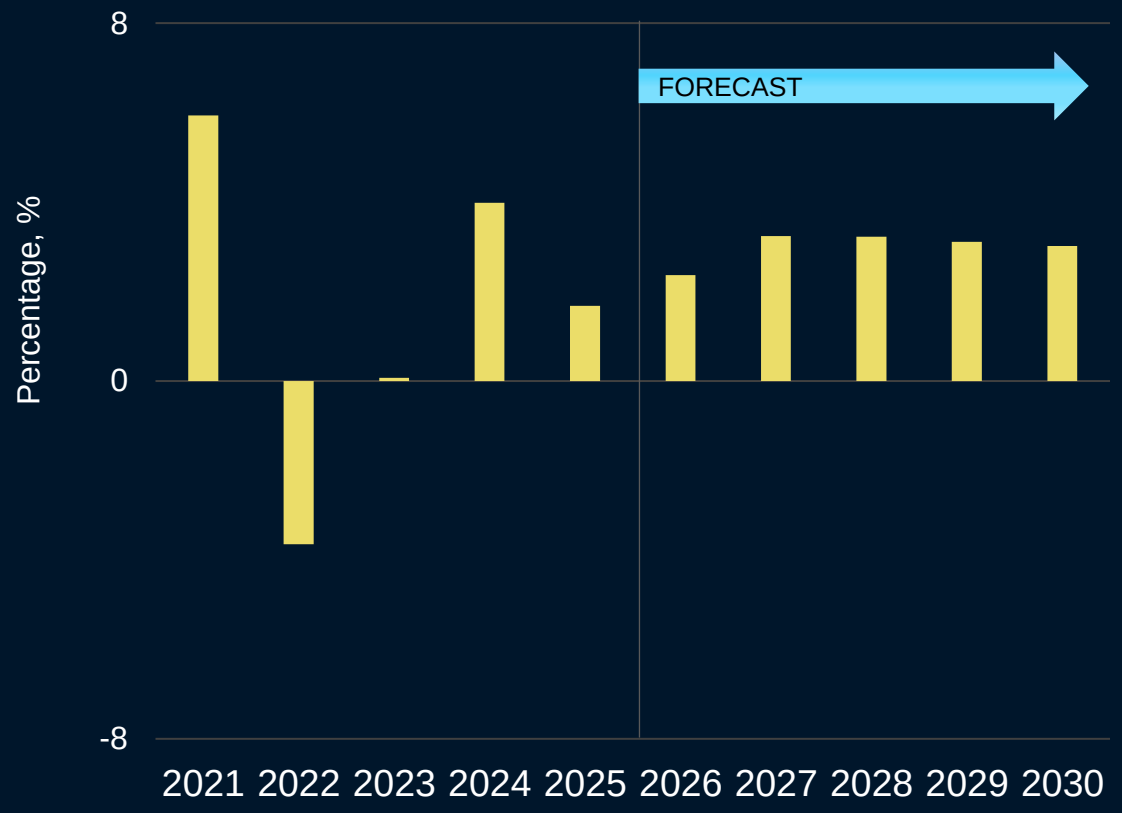


Source: Chemical Market Analytics by OPIS

India / SEA driving demand growth center with higher elasticity

	2026-2030 AAGR (%)	Demand Elasticity Over GDP
ISC	7.4	1.3
MDE	2.4	0.9
SEA	5.1	1.3
NEA	2	0.6
Mainland China	**2.1**	**0.6**
World	3.0	1.15

Global demand changes year-on-year



Source: Chemical Market Analytics by OPIS

Chances of quicker recovery?

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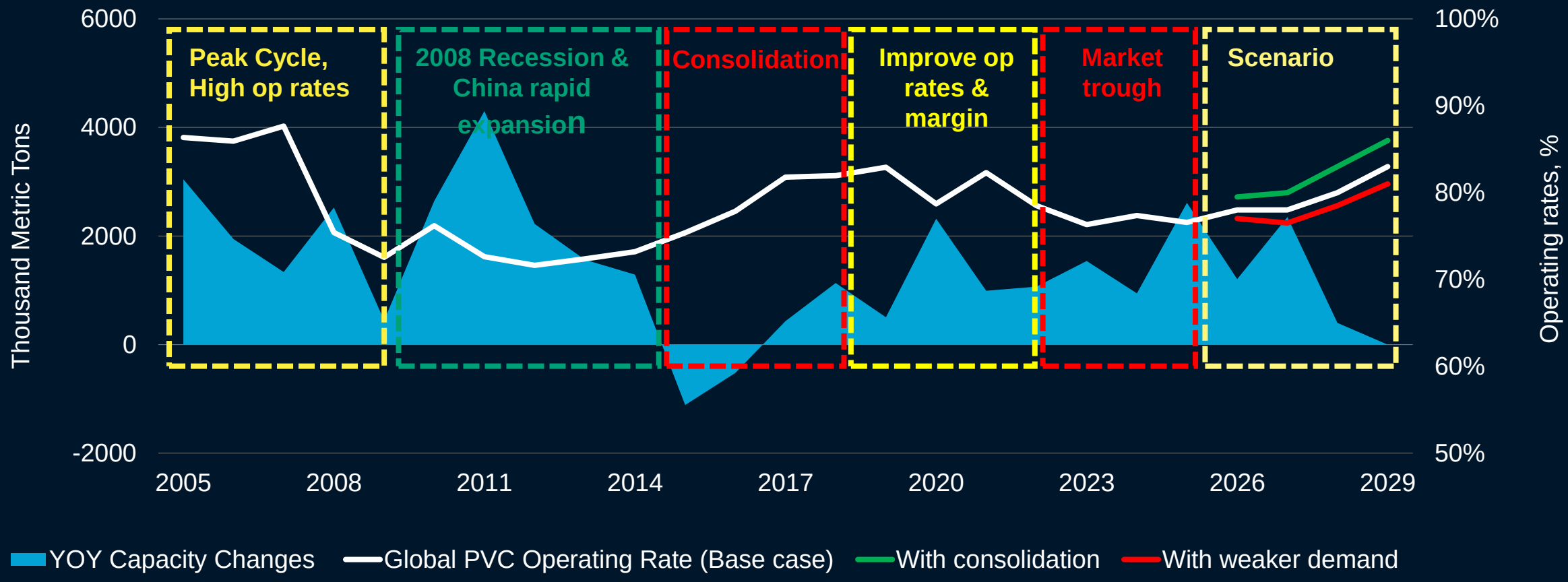
Global YOY capacity changes versus operating rate



Source: Chemical Market Analytics by OPIS

Key Takeaways

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- Integration (especially upstream) remain crucial for APAC
- Global rationalization has started based on policy and economics factors
- PVC demand center shifted from NEA to ISC/SEA, driving demand recovery
- Trough continues in 2026/2027 with existing expansion, recovery starts 2028

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Evolution of PVC Upstream value chain and its Decarbonization Pathway

Utkarsh Mishra
Chlor-alkali-PVC Team
29 May 2026, Fukuoka

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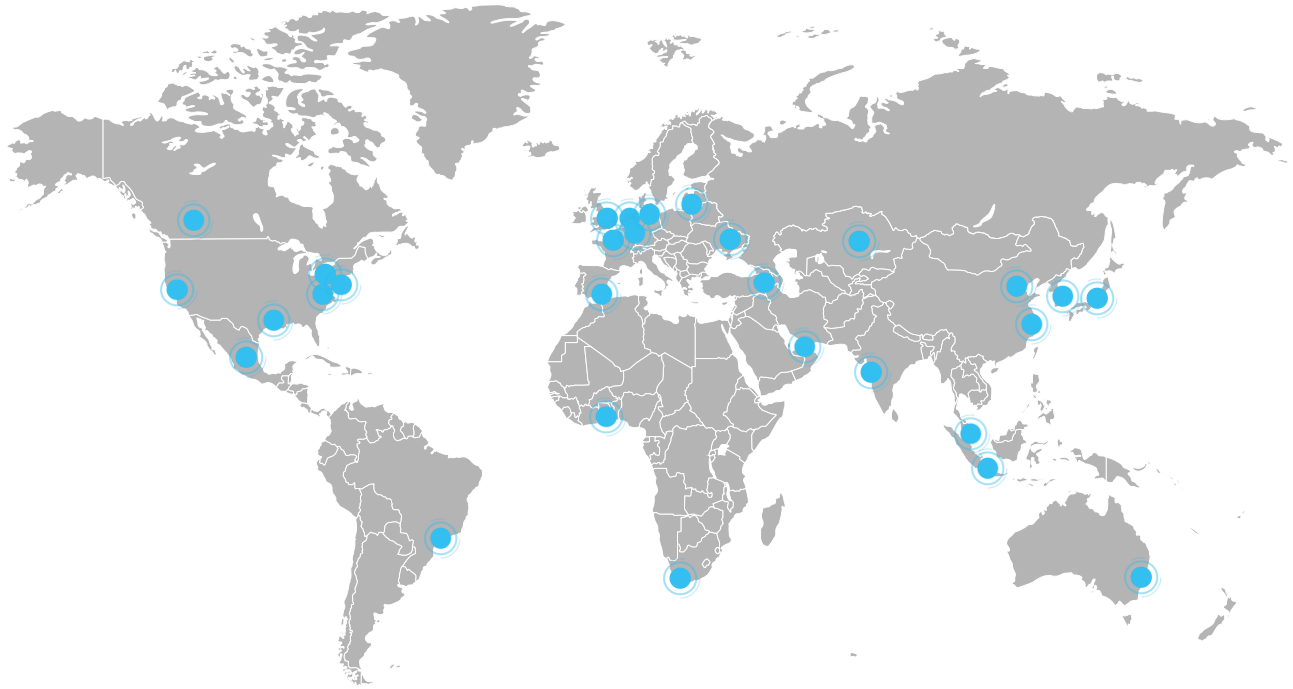
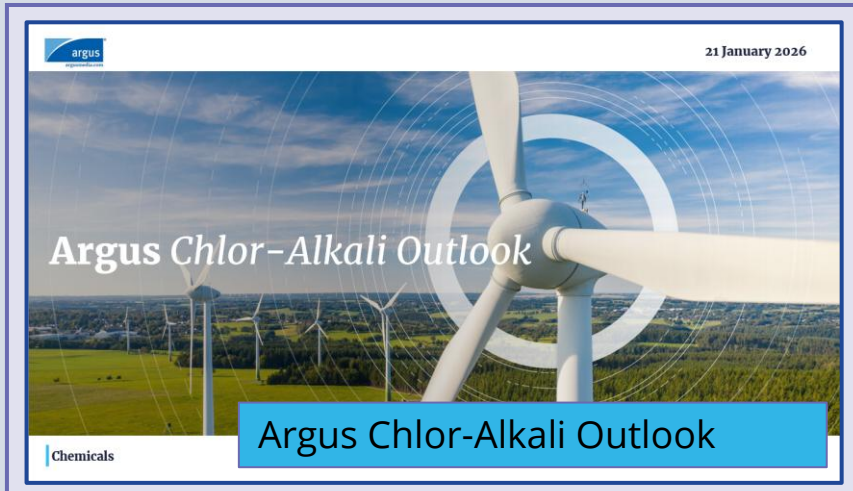


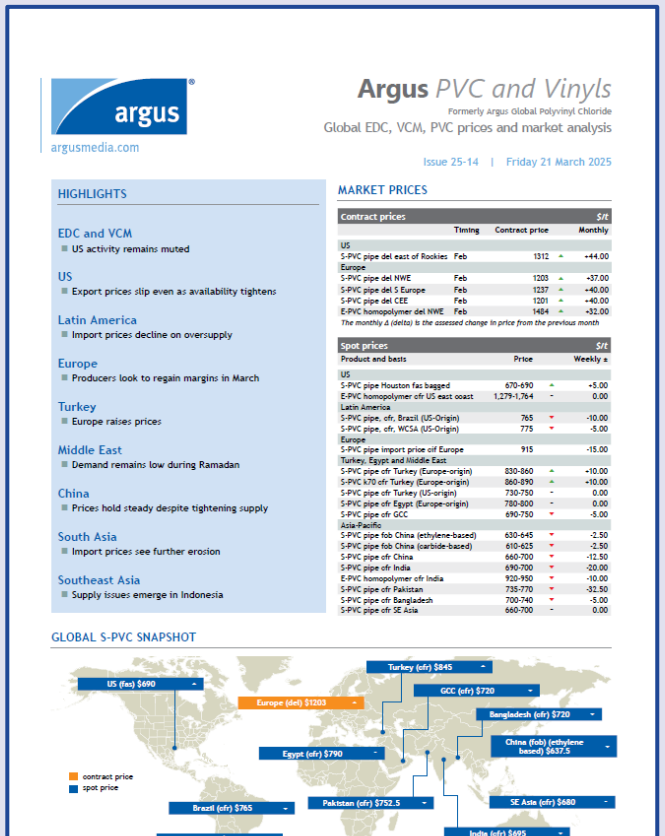
Full suite of chlor-alkali and vinyls products



Argus Chlor-Alkali Outlook

Argus Chlor-Alkali Analytics

Argus Chlor-Alkali Weekly



Argus PVC and Vinyls Weekly

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Vinyl Chain Overview: Ethylene vs Carbide

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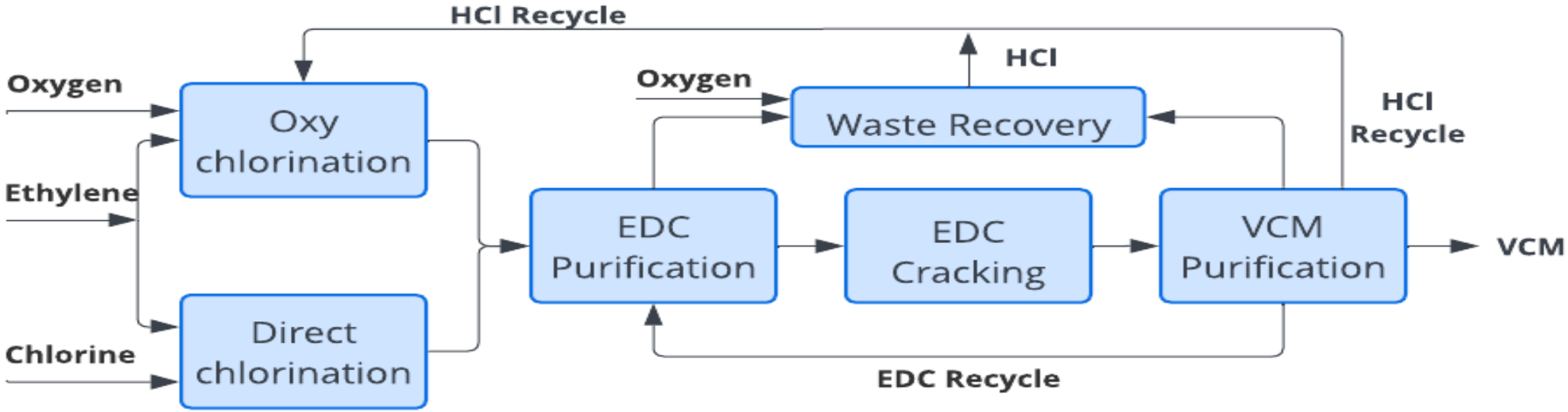
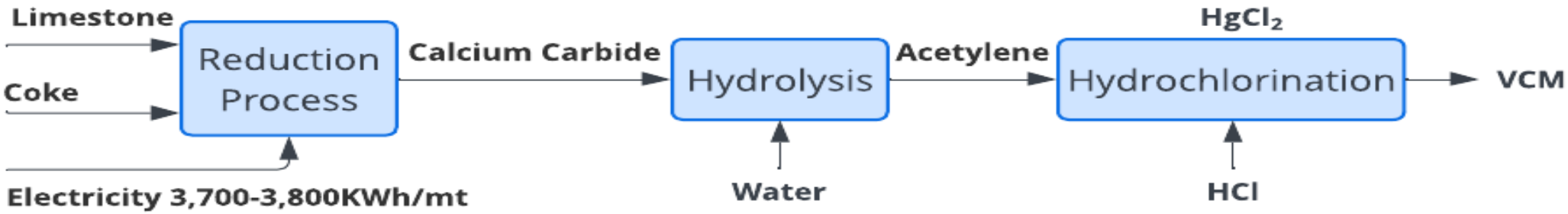
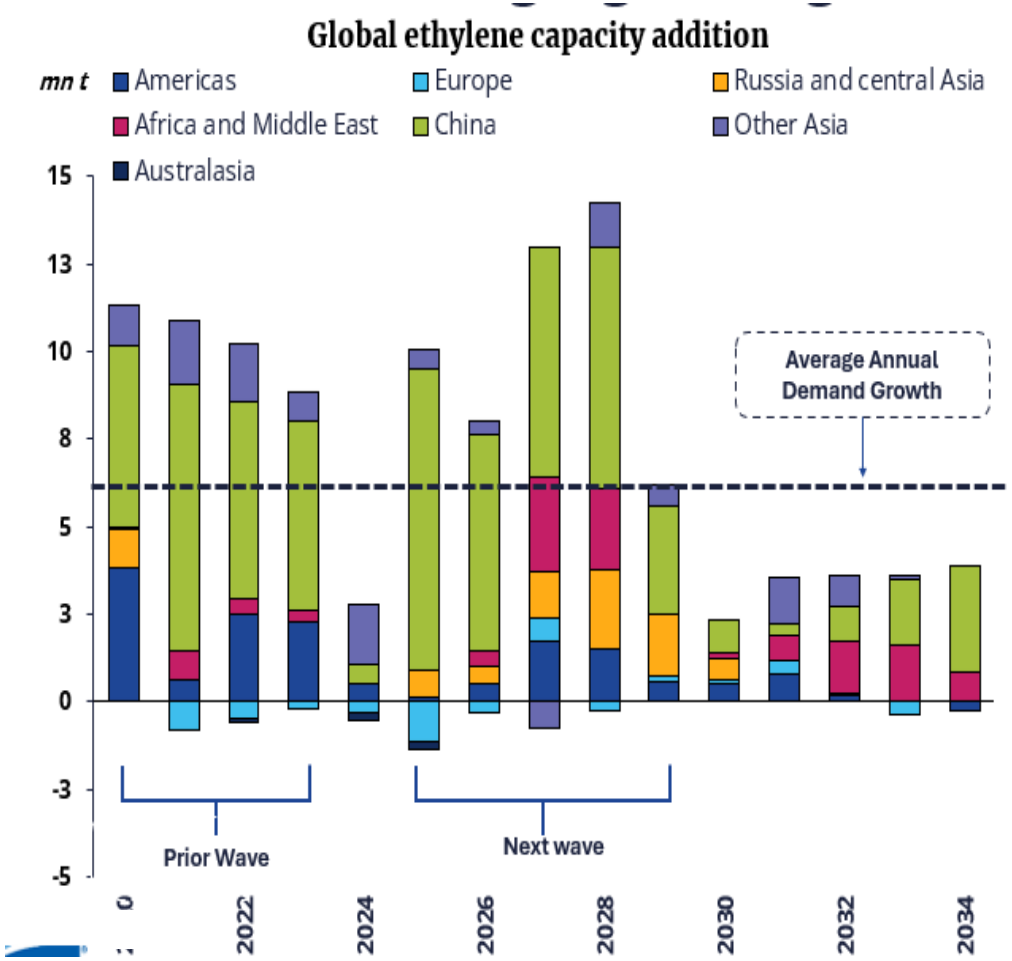
PVC process – Ethylene vs Carbide-based

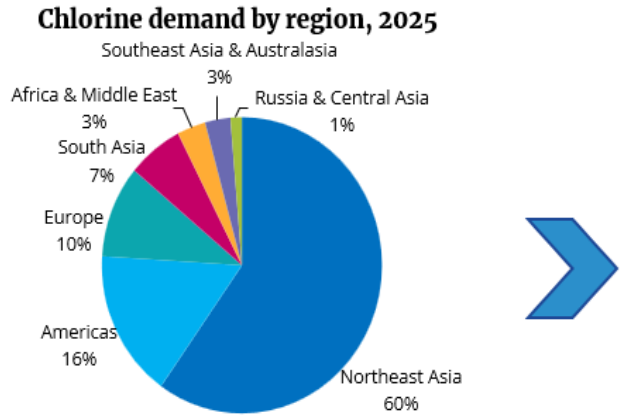


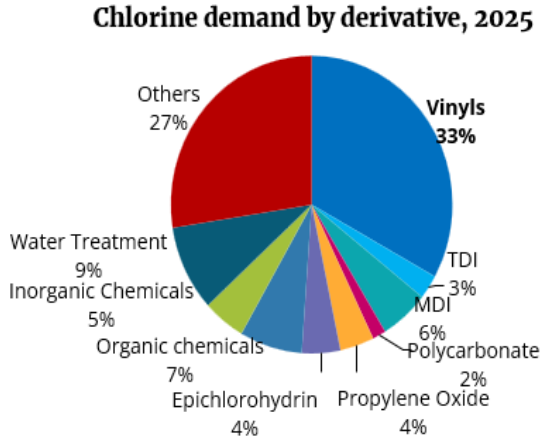


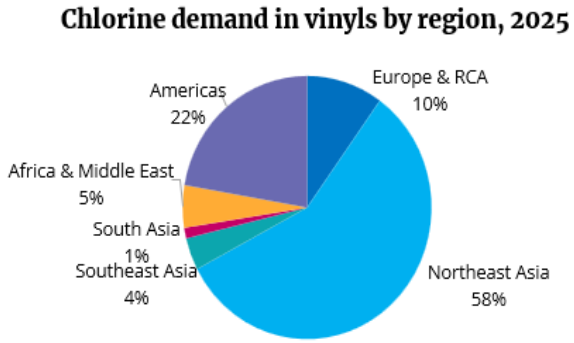
Two routes—integration vs coal—define PVC's cost and carbon intensity

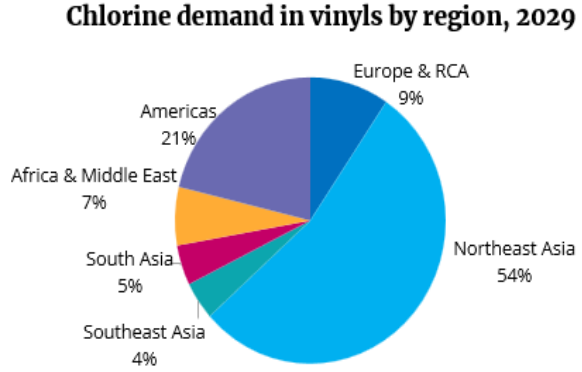
Supply-Demand- Ethylene & Chlorine









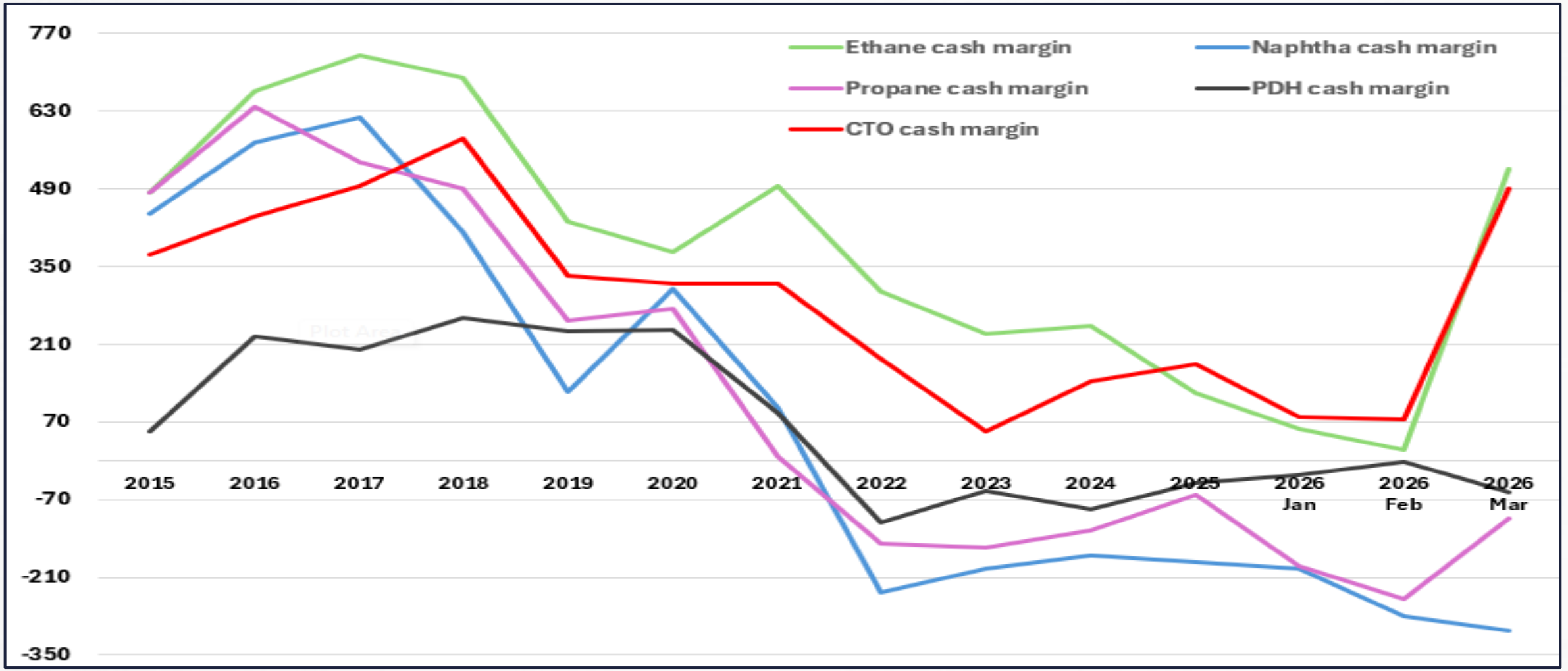


Ethylene oversupply meets vinyl-driven chlorine demand, reinforcing NEA dominance.

Source: Argus Ethylene & Chlor-Alkali Analytics

NEA Olefins margins remain stressed for 5 years!

Yearly average feedstock to olefin cash cost margin, $/t



NEA margins structurally compressed—only ethane and CTO retain relative advantage.

Source: Argus Olefins Margin

Integration wins as ethylene prices rise

- High ethylene prices compress polyolefin margins disproportionately.
- Integrated players redirect value into the chlor-vinyl chain.
- PVC benefits from chlorine utilization and caustic co-product credits.
- Advantage is relative-PVC outperforms, not structurally strong.
- Incremental caustic supply adds export pressure to global markets.

FEEDSTOCK	1 MT OF ETHYLENE		
	HDPE Route	Chlor-alkali-PVC Route	
		ePVC	NaOH
Stoichiometry	1 mt	2.2mt of PVC (1.26mt of Cl_2)	1.4dmt
Ethylene price	$1,450/t cfr NEA (13/4/2026)	$1,450/t cfr NEA (13/4/2026)	
Conversion cost	Ethylene to HDPE - $100-120/t	Chlorine to PVC - $220/t	ECU - $420/ECU
		Cl_2 → EDC → VCM → PVC	
Ex-plant cash cost	$1,550-1,570/t	$1,670/t	$588/dmt
Total	$1,550-1,570/t		
Current fob/cfr prices	$1,330/t cfr China	$890/t cfr China	$460/dmt
Gross revenue/t of C2	$1,330	$1,958	$644
Operating Margin	($230/t)	$110	$56

PVC chains preserve value as polyolefin margins collapse.

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Market and Trade flow evolution

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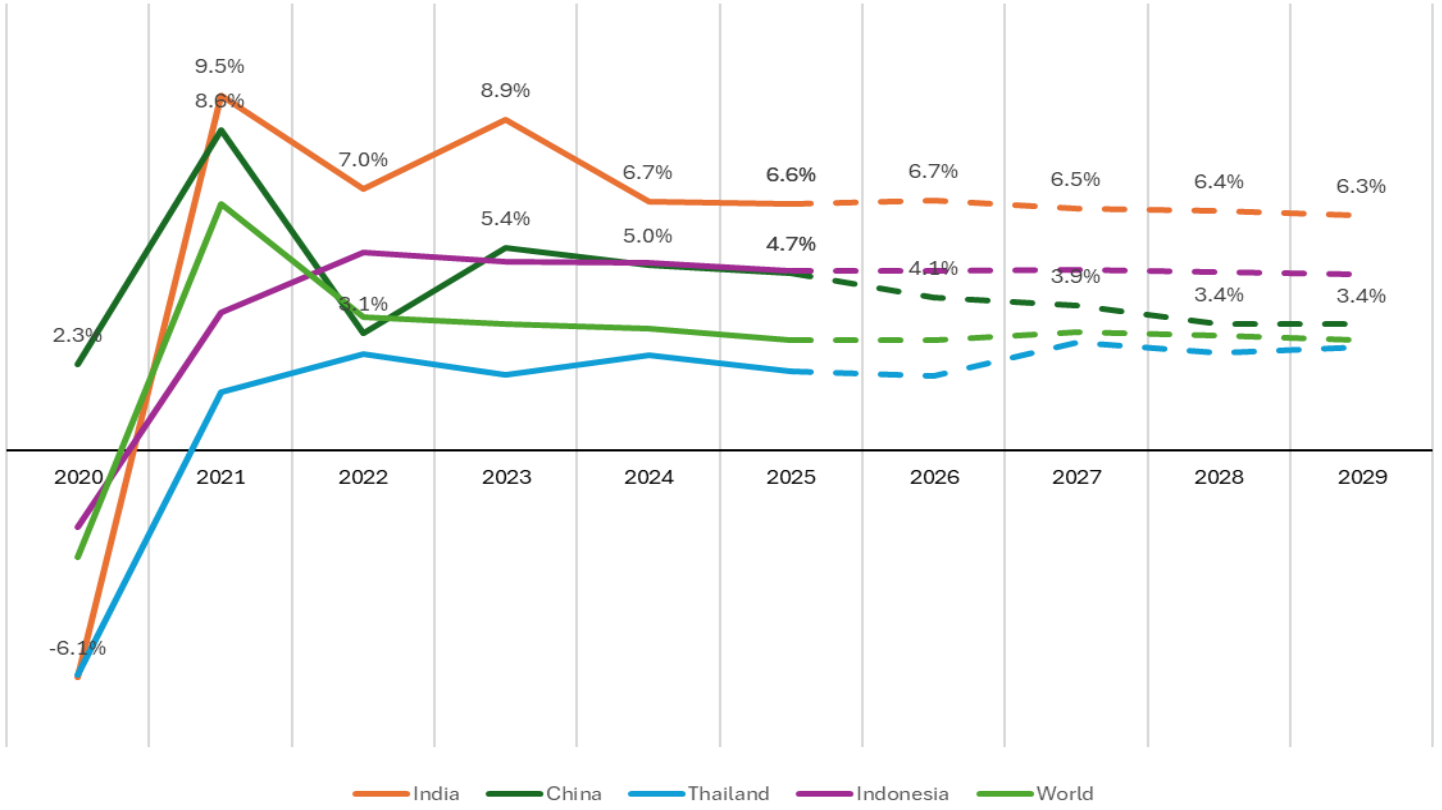
India emerges as the key demand engine for PVC

- India set to lead global GDP growth, underpinning PVC demand expansion.
- China demand moderates structurally with slower GDP growth.
- Global PVC demand outlook increasingly dependent on India's growth trajectory.
- Ongoing ME crisis & closure of the Strait of Hormuz cast shadow in near term.

Key countries GDP, %



Source: Argus Media – Consulting Services, Oxford Economics

India is set to become the marginal driver of global PVC demand.

EDC trade flows reflect structural West-to-Asia imbalance

2025 Importer¥Exporter ('000 tonn)	North America	Latin America & Caribbean	Western Europe	Central and Eastern Europe	Russia and Central Asia	Northeast Asia	South Asia	Southeast Asia	Australasia	Africa	Middle East	Total
North America												-
Latin America & Caribbean	235											235
Western Europe	55		528									583
Central and Eastern Europe			1									1
Northeast Asia	244					447		7			20	718
South Asia	150		175			5		31			430	791
Southeast Asia	140		11			135		158			5	449
Africa	60		229				5	104			53	451
Middle East	77										4	81
Total	961	-	944	-	-	587	5	300	-	-	512	3,309

Exports	961	-	416	-	-	140	5	142	-	-	508
Imports	-	235	55	1	-	271	791	291	-	451	77
Net Exports	961	(235)	361	(1)	-	(131)	(786)	(149)	-	(451)	431

- USGC acts as the swing supplier, enabled by cost advantage.
- South Asia is the largest structural deficit.
- NEA and SEA add scale to Asian demand.
- Middle East is a secondary export hub.
- Africa acts as a balancing market.
- Latin America is a stable US-linked import sink.

South Asia anchors demand; USGC anchors supply of EDC.

Source: Argus Media – Consulting Services

VCM trade reflects regional imbalances and integration gaps

2025 Importer¥Exporter ('000 tonn)	North America	Latin America & Caribbean	Western Europe	Northeast Asia	South Asia	Southeast Asia	Middle East	Total
North America	131							131
Latin America & Caribbean	1,064							1,064
Western Europe	-		893					893
Central and Eastern Europe								-
Russia and Central Asia								-
Northeast Asia	1			844			-	845
South Asia	-		-	223		16	293	532
Southeast Asia				559		126		685
Australasia								-
Africa								-
Middle East	4		71				-	75
Total	1,200	-	964	1,626	-	142	293	4,225

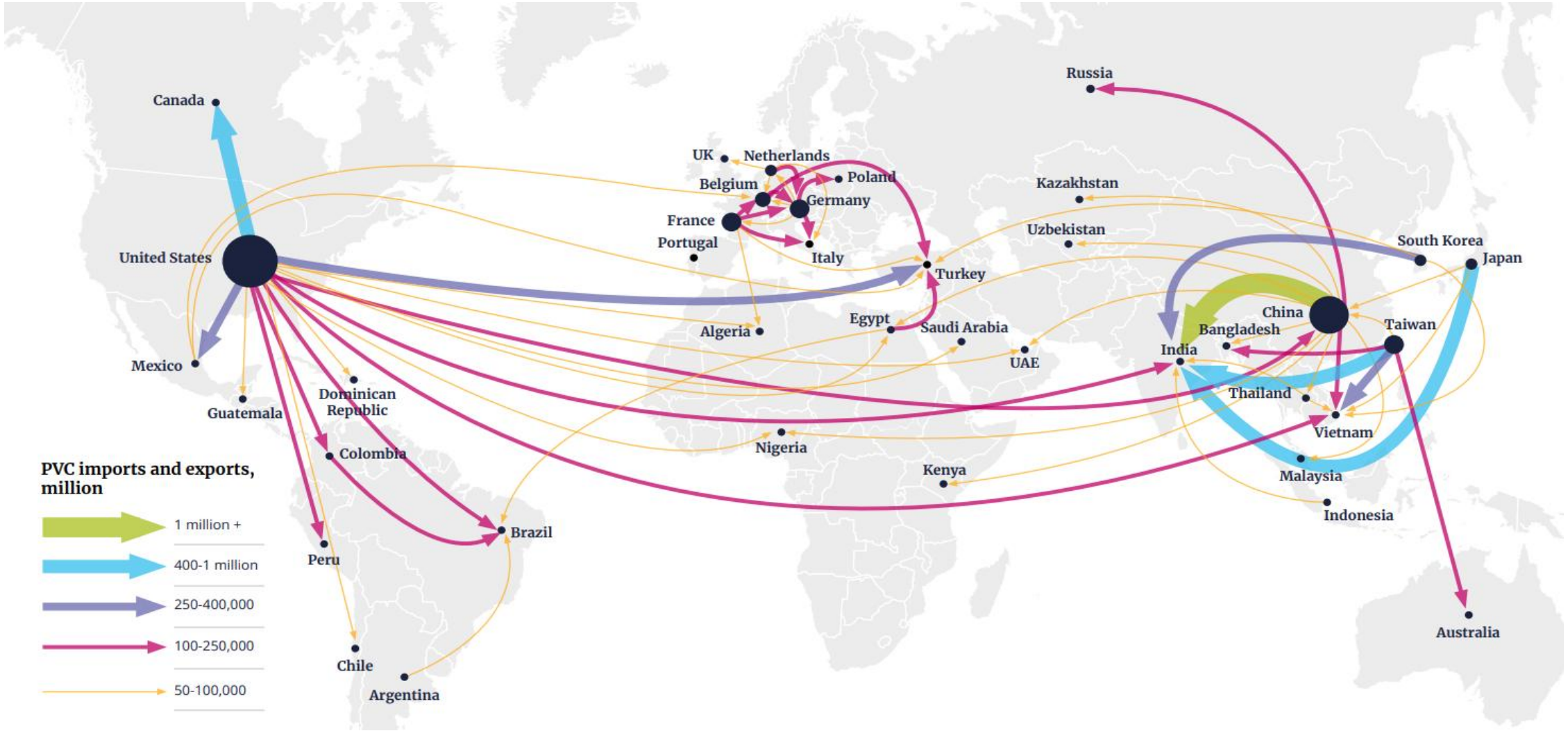
Exports	1,069	-	71	782	-	16	293
Imports	-	1,064	-	1	532	559	75
Net Exports	1,069	(1,064)	71	781	(532)	(543)	218

- USGC remains the dominant supplier.
- Latin America structurally import-dependent due to limited integration.
- Asia shows mixed trade flows with intra-regional balancing.
- Trade patterns more fragmented vs EDC due to localized VCM/PVC integration.

No single deficit anchor—fragmentation defines VCM trade.

Source: Argus Media – Consulting Services

PVC trade is Asia-centric, with NEA at the core



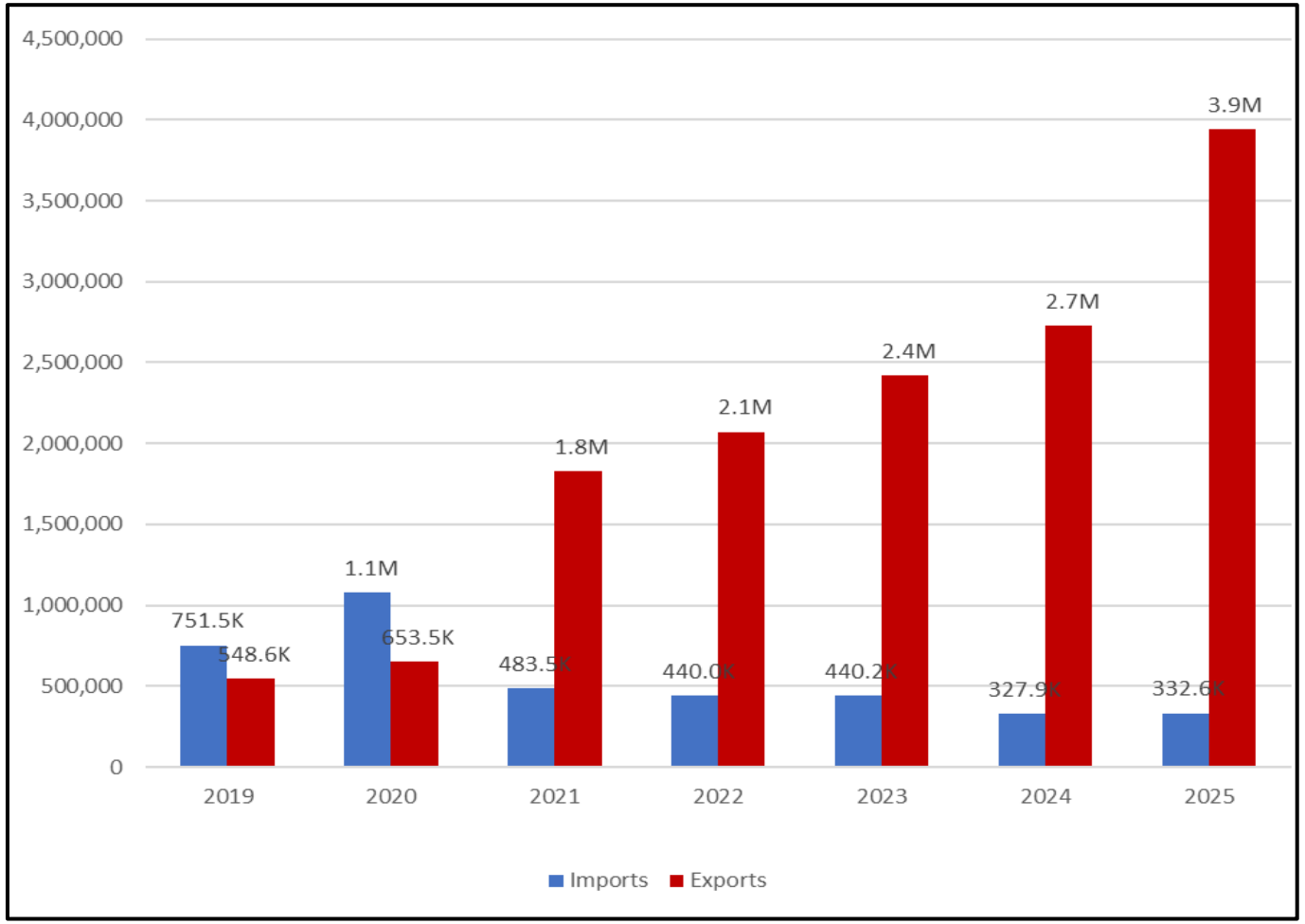
Asia drives demand, with India as a key growth center.

Source: Argus Media – Consulting Services

China emerges as the dominant PVC exporter

- China's PVC exports surge to ~3.9 Mt in 2025, overtaking the US.
- Capacity expansion outpaced domestic demand, forcing export growth.
- Carbide-based cost advantage sustains export competitiveness.
- Imports collapse as China becomes structurally long PVC.

China's PVC imports and exports by year, t

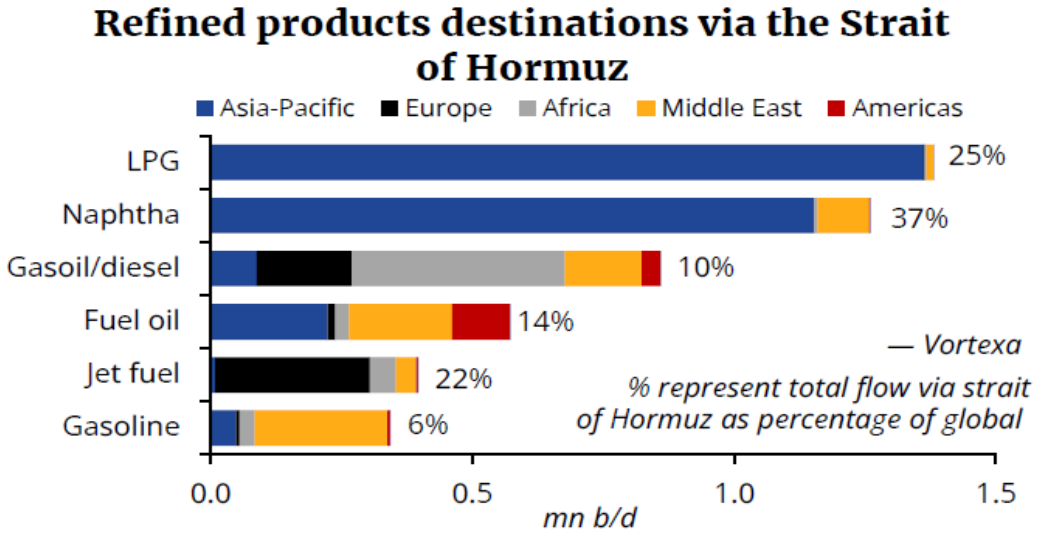


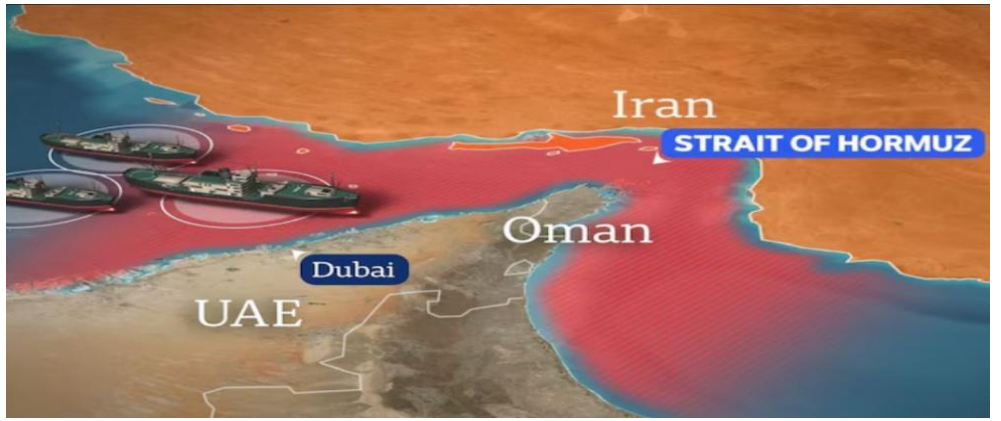
China's surplus is reshaping global PVC trade.

Source: Argus Media – Consulting Services

Impact of Middle East crisis on vinyl value chain

Strait of Hormuz dominates Asia's supply chain

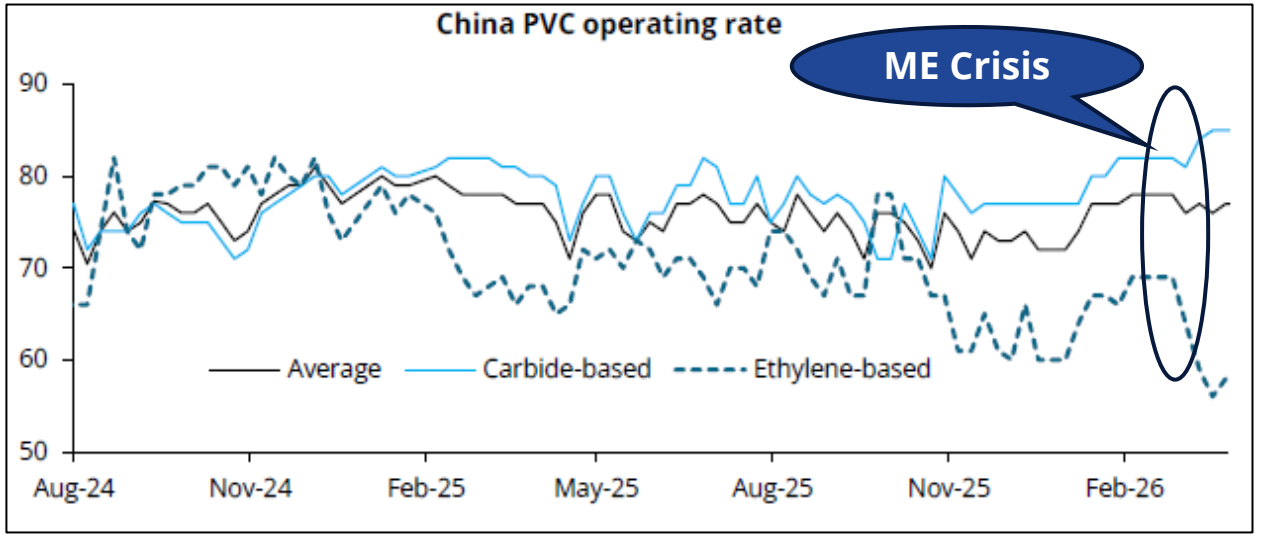




Source: Argus Chemicals Analytics services

Share in Global & Asian Market Supply

Sr No	Commodity	Global	Asia
1.	Crude Oil	20 %	80 %
2.	LNG	20 %	80 %
3.	LPG	25 %	85 %
4.	Naphtha	37 %	80 %



Feedstock disruption benefitted carbide-based PVC over naphtha-linked production.

Middle East disruption is driving short-term PVC tightness

On Supply Front

- Ethylene and naphtha tightness driven by ME disruption raises PVC cost base.
- Feedstock disruptions risk supply outages across integrated chains.

On Demand Front

- Higher feedstock costs pass through to downstream PVC prices.
- Demand likely to soften as inflationary pressure builds.

Uncertainties

- Geopolitical escalation and shipping disruptions (Hormuz exposure).
- Freight volatility and vessel availability constraints.
- Unplanned outages across crackers and downstream assets.

ME disruption is driving cost inflation and tightening PVC supply.

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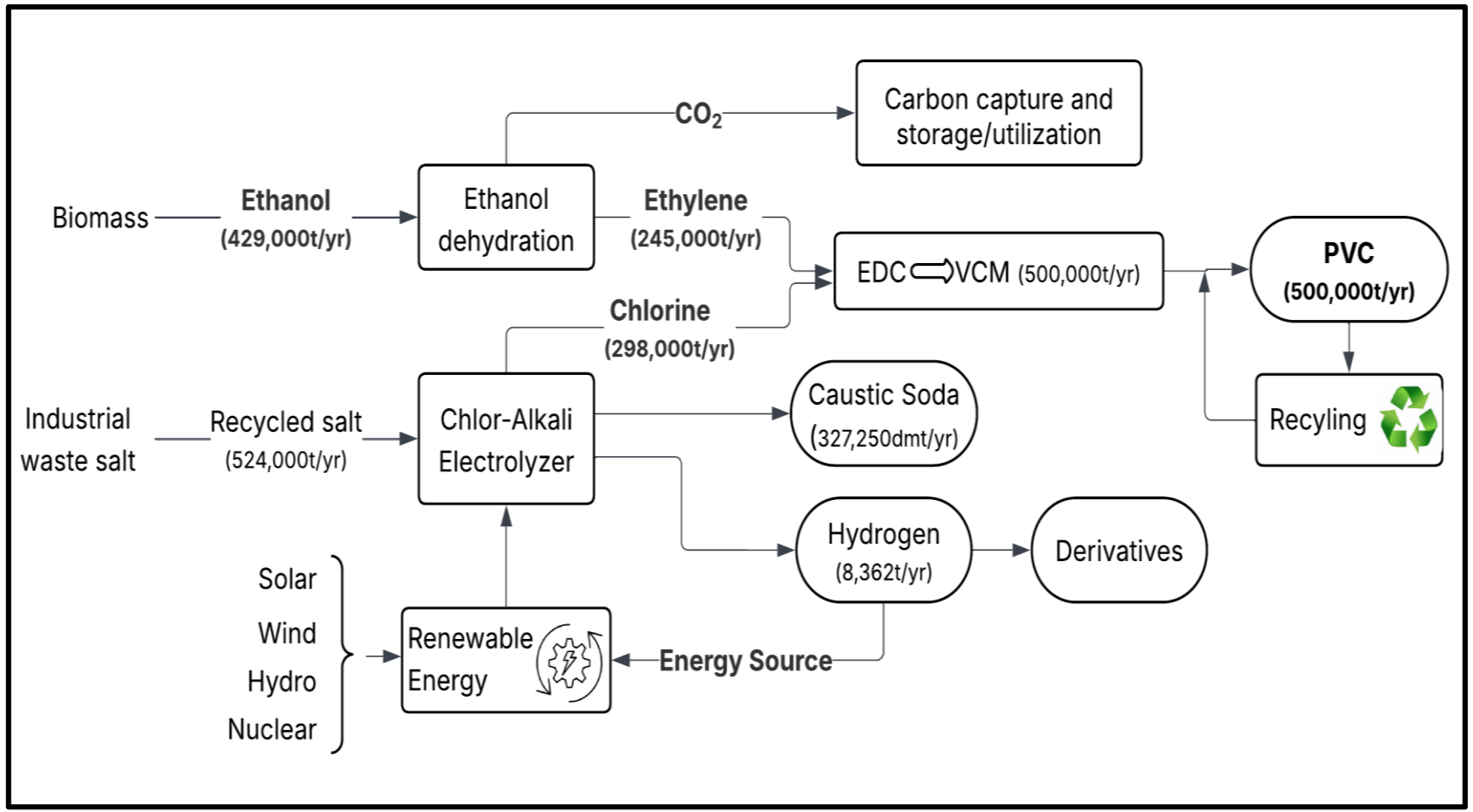
Decarbonization pathway of CA-PVC value chain

Decarbonization is driven by feedstock and energy choice



Ethylene route:

- Low-carbon ethylene (bio / electrified cracking).
- Decarbonized power for chlor-alkali.

Carbide route:

- Power decarbonization (coal → renewables).
- Efficiency + CCUS.

Cross-cutting

- PVC Recycling.
- Process integration.

Route choice sets the decarbonization ceiling. The ethylene route offers greater flexibility for deeper emission reductions.

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Industrial waste salt: Emerging circular feedstock in China's PVC chain

What is happening?

- Industrial waste salt is increasingly reused in chlor-alkali production.
- Adoption driven by NDRC guidelines and environmental regulation.

Why it matters?

- Reduces reliance on virgin salt and disposal burden.
- Supports circularity within chlorine and PVC value chains

Constraints to scale:

- Impurity removal remains technically complex.
- Economics depend on treatment cost vs virgin salt.
- Feedstock variability limits consistent operation.

Promising circular pathway—constrained by cost and process complexity.

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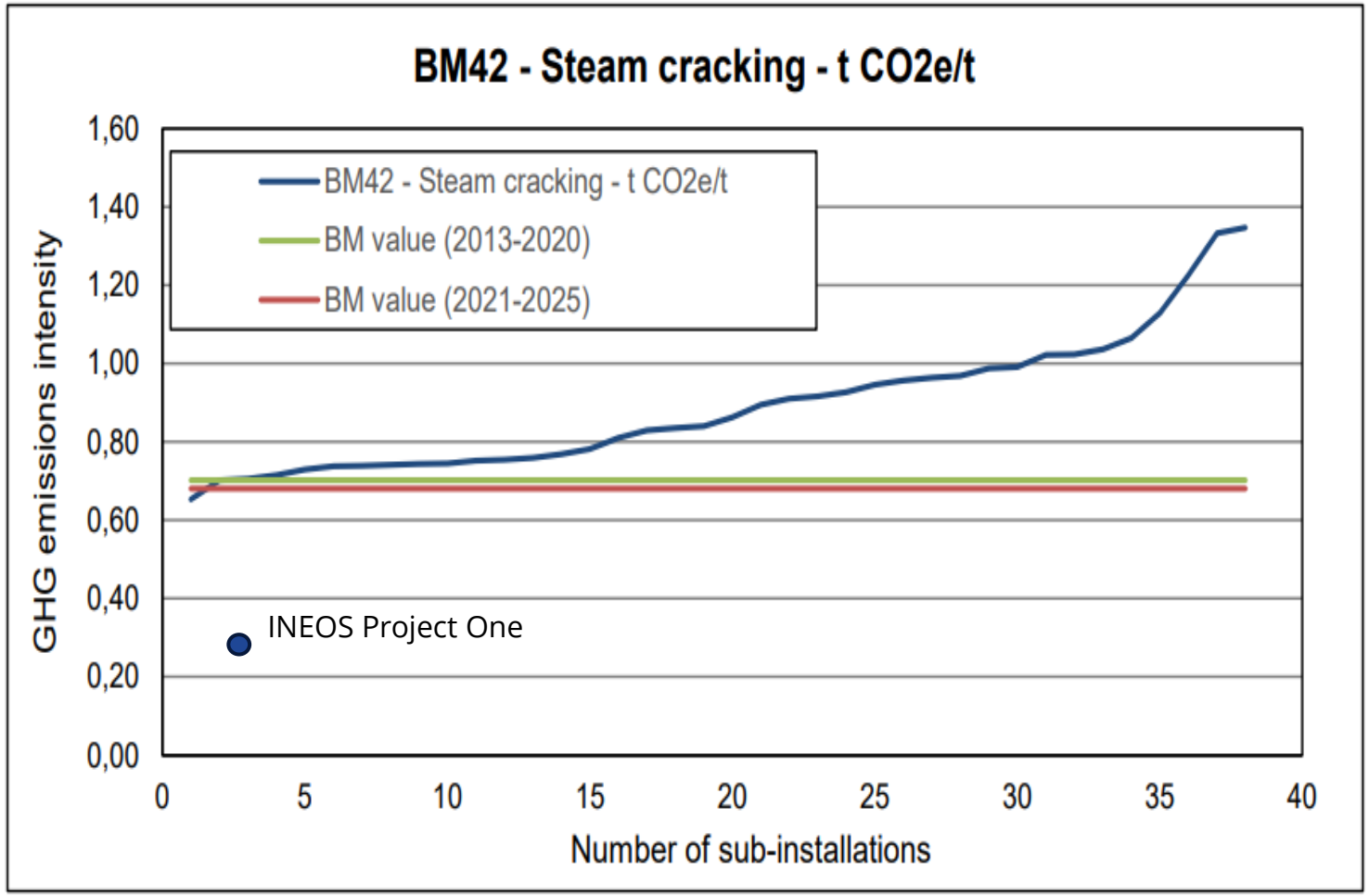
EU ETS exposes structural cost divergence across ethylene assets



- Emissions intensity varies widely (~0.6 to >1.3 tCO_2e/t).
- Most legacy assets operate above benchmark, increasing carbon cost exposure.
- New-build low-carbon assets (e.g., ethane-based INEOS Project One) materially reduce emissions (~0.23 tCO_2e/t).
- Cost divergence widens between best vs worst assets as ETS tightens post-2030.
- Cost differentiation propagates into EDC/VCM/PVC chains.

Source: European Commission – Directorate –General: Climate Action: Directorate B European and International Carbon markets

Source: Argus Media – Consulting Services

ETS converts emissions intensity into structural cost divergence.

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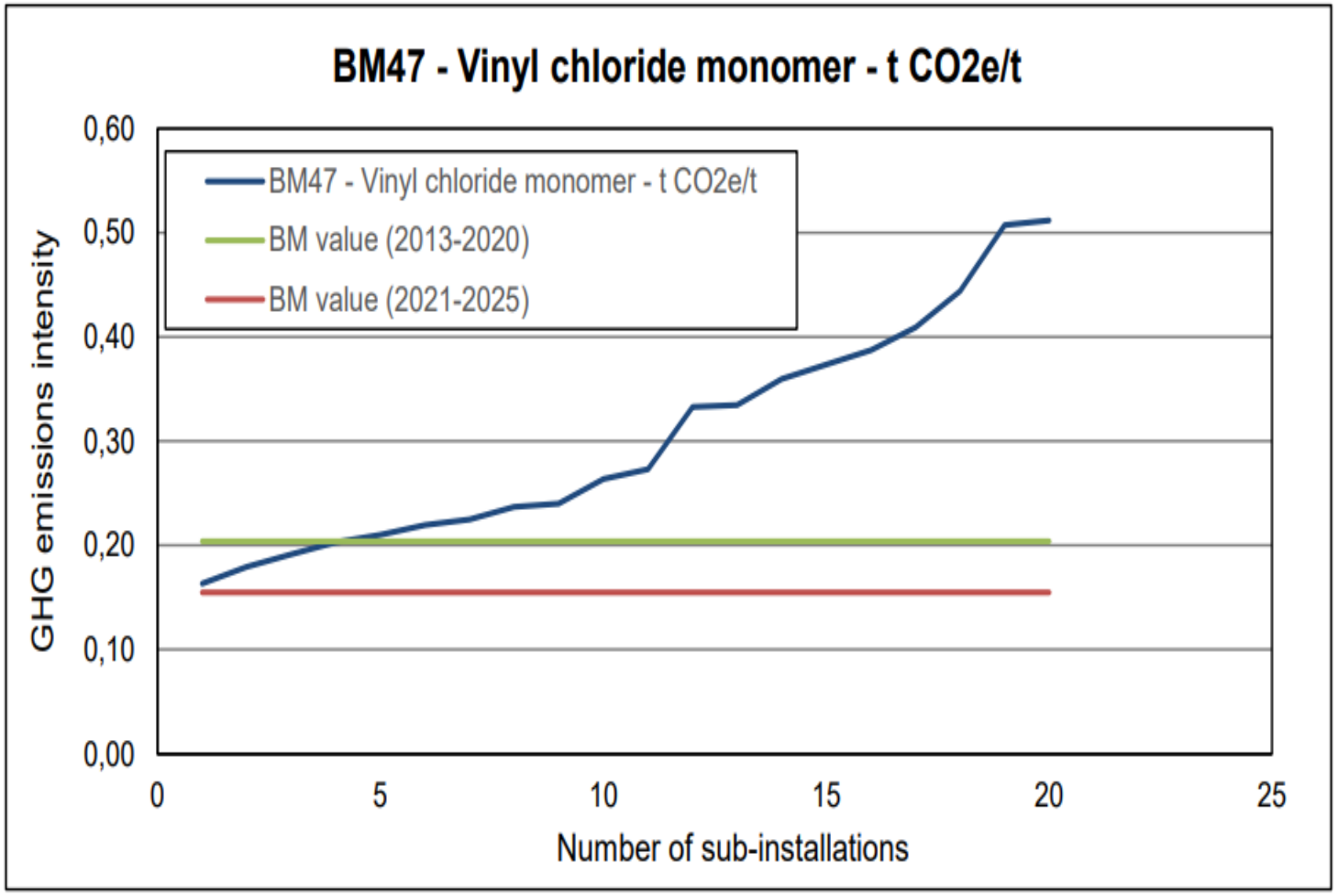
EU ETS limits flexibility in VCM and shifts cost pressure downstream



- Lower than ethylene but still significant emissions spread (~0.15 to >0.50 tCO_2e/t).
- Limited revamp potential locks in emissions for legacy VCM assets.
- Competitiveness depends increasingly on upstream ethylene and integration.
- Shipping VCM remains more economical vs upstream feedstocks (ethane/ethylene).
- Carbon cost passes through into PVC production.
- High-emission assets face rationalization or forced modernization.

Source: European Commission – Directorate –General: Climate Action: Directorate B European and International Carbon markets

Source: Argus Media – Consulting Services

VCM cannot absorb ETS—cost pressure moves downstream to PVC.

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Goal – Mercury free catalyst in Carbide PVC process

Is this achievable?

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Mercury phase-out: Policy-driven but structurally constrained

Context:

- China's carbide PVC traditionally relies on $HgCl_2$ catalysts for acetylene hydrochlorination.
- Minamata Convention restricts mercury use in new VCM capacity, pushing the sector strongly toward mercury-free processes.

Current status:

- Transition away from mercury is underway but incomplete.
- Existing assets continue to operate under increasing scrutiny.

Target:

- Full compliance deadline 2032.

Policy is forcing the transition; technology & execution will determine the pace.

Is complete phase-out possible?

Transitional Phase – Shift toward low Hg catalyst:

- China has revised 9 regulations and policies to strengthen the oversight and phase-down of high-mercury catalysts.
- Hg consumption in China reduced by around 65-70pc since historical high.
- National inspections and training programs have been implemented to ensure compliance and accelerate the phase-out.
- Low-Hg option are functioning reliably at commercial scale but still rely on Hg.
- It‘s the main transitional solution in use today but do not eliminate Hg risks.

Low-mercury catalysts enable transition—risk is reduced, not eliminated.

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Mercury-free Options.

Current options:

- Gold-based catalysts are commercial in select new plants.
- Commercial adoption is accelerating in major plants, supported by partnerships and strong regulatory push.

Emerging technologies (Beyond Gold-catalyst):

- Copper, ruthenium, and non-metal systems under development.
- Electro-thermal and tandem catalytic routes not yet industry-ready.

Scaling constraints:

- Higher catalyst cost and shorter lifetimes vs Hg systems.
- Process stability and selectivity still under optimization.
- Not yet universally retrofittable to existing assets.

Mercury-free is possible—but not yet scalable across the installed base.

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Impact of VAT Withdrawal on PVC export in China

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VAT Rebate withdrawal on PVC

Background:

- China's Ministry of Finance (MOF) and the State Taxation Administration announced (STA); widely reported on 9 January 2026)
- Policy content
    - Cancellation of the 13% VAT export rebate on PVC resin powder, unplasticized PVC, plasticized PVC.
- Effective Date : April 1, 2026.

Why this matters:

- Overcapacity, reducing trade friction accusations of subsidies and forcing a shift away from low-margin, volume-driven exports.

Impact of VAT Rebate withdrawal on ePVC and cPVC

Immediate cost impact:

- It creates a direct margin loss for carbide-based PVC exports (*fundamentally speaking*).
- High-cost carbide producers face reduced export competitiveness, particularly standalone assets.
- Ethylene-based PVC is less exposed, with integrated structures and lower export dependence helping preserve margins.

Market response & Structural implications:

- Chinese carbide exporters are incentivized to raise prices in key deficit regions (India, Africa, SE Asia).
- Policy accelerates divergence between carbide and ethylene routes.
- Reinforces shift toward more efficient and lower-carbon production pathways.
- Middle East disruption added market tightness, allowing VAT-driven cost increases to translate into price rather than margin compression.

VAT rebate removal acts as a structural margin reset for carbide PVC.

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Key takeaways

Key takeaways

- PVC value chain is structurally fragmented—feedstock, integration, and geography drive distinct competitive models.
- Trade flows are shaped by imbalance:
  - ✓ US acts as swing supplier upstream (EDC/VCM).
  - ✓ Asia anchors demand and PVC trade flows.
- Carbon pricing is redefining competitiveness in Europe, creating cost divergence that cascades downstream.
- Policy actions (VAT removal, mercury phase-out) are accelerating structural shifts away from inefficient and high-emission production.
- Market outcomes are increasingly driven by interaction between policy and disruption—not fundamentals alone.

The PVC market is no longer driven by cost alone—policy, carbon, and disruption now define competitiveness.

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Comprehensive price assessment coverage across PVC chain

Ultimately, understanding PVC market requires price visibility across the entire chain—that's where Argus fits

Caustic soda
fob USGC contract $/dst
fd NWE contract €/dmt
fob NE Asia export $/dmt
EDC
EDC fob USGC
EDC cfr Europe
EDC fob Europe
EDC cfr NE Asia
EDC cfr SE Asia
VCM
VCM cfr NE Asia
VCM cfr SE Asia

Contract prices	
	Timing
US	
S-PVC pipe del east of Rockies	Apr
Europe	
S-PVC pipe del NWE	Apr
S-PVC pipe del S Europe	Apr
S-PVC pipe del CEE	Apr
E-PVC homopolymer del NWE	Apr
The monthly Δ (delta) is the assessed chang	

Spot prices
Product and basis
US
S-PVC pipe Houston fas bagged
E-PVC homopolymer cfr US east coast
Latin America
S-PVC pipe, cfr, Brazil (US-Origin)
S-PVC pipe, cfr, WCSA (US-Origin)
Europe
S-PVC pipe import price cif Europe
Turkey, Egypt and Middle East
S-PVC pipe cfr Turkey (Europe-origin)
S-PVC k70 cfr Turkey (Europe-origin)
S-PVC pipe cfr Turkey (US-origin)
S-PVC pipe cfr Egypt (Europe-origin)
S-PVC pipe cfr GCC
Asia-Pacific
S-PVC pipe fob China (ethylene-based)
S-PVC pipe fob China (carbide-based)
S-PVC pipe cfr China
S-PVC pipe cfr India
E-PVC homopolymer cfr India
S-PVC pipe cfr Pakistan
S-PVC pipe cfr Bangladesh
S-PVC pipe cif Vietnam

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From feedstocks to polymers—bringing transparency to PVC markets

Thank you

Further information

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