



Carbon markets unleashed:

The global expansion of government-mandated programs and their impact on stakeholders

George von Waldburg, Director Environmental Markets, ICE (**Moderator**)

Dr. Robert Ritz, Economist at Cambridge University

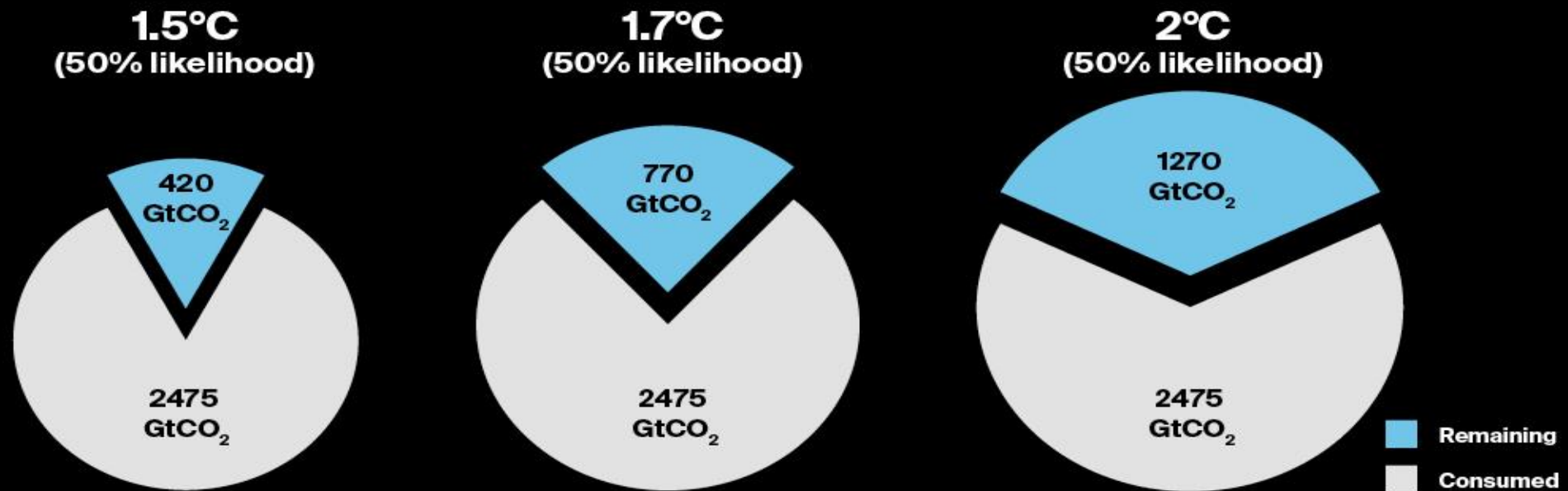
Marcus Ferdinand, Chief Analytics Officer, Veyt



What is net zero?

Conserving the carbon budget

The remaining carbon budget to limit global warming from 2022



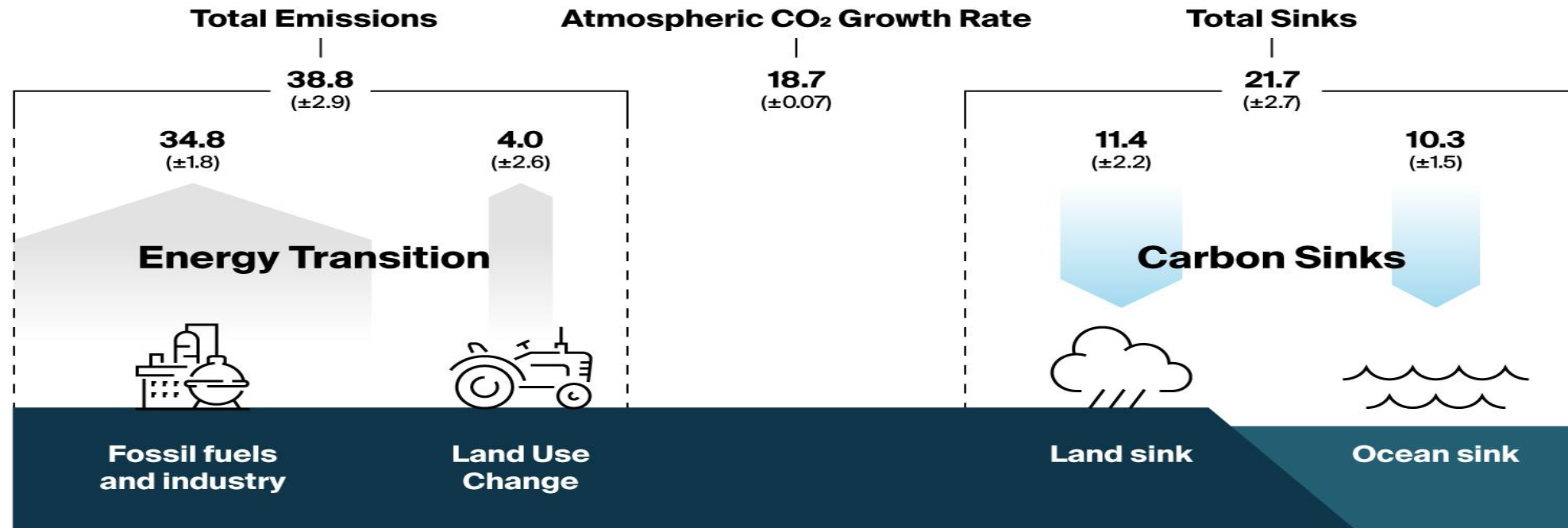
Quantities are subject to (additional) uncertainties e.g., future mitigation choices of non-CO₂ emissions

Source: IPCC AR6 WG1; Friedlingstein et al 2021; Global Carbon Budget 2021

What is net zero?

Global carbon budget | emissions and sinks

Global carbon budget 2011-2020



Emissions and Sinks

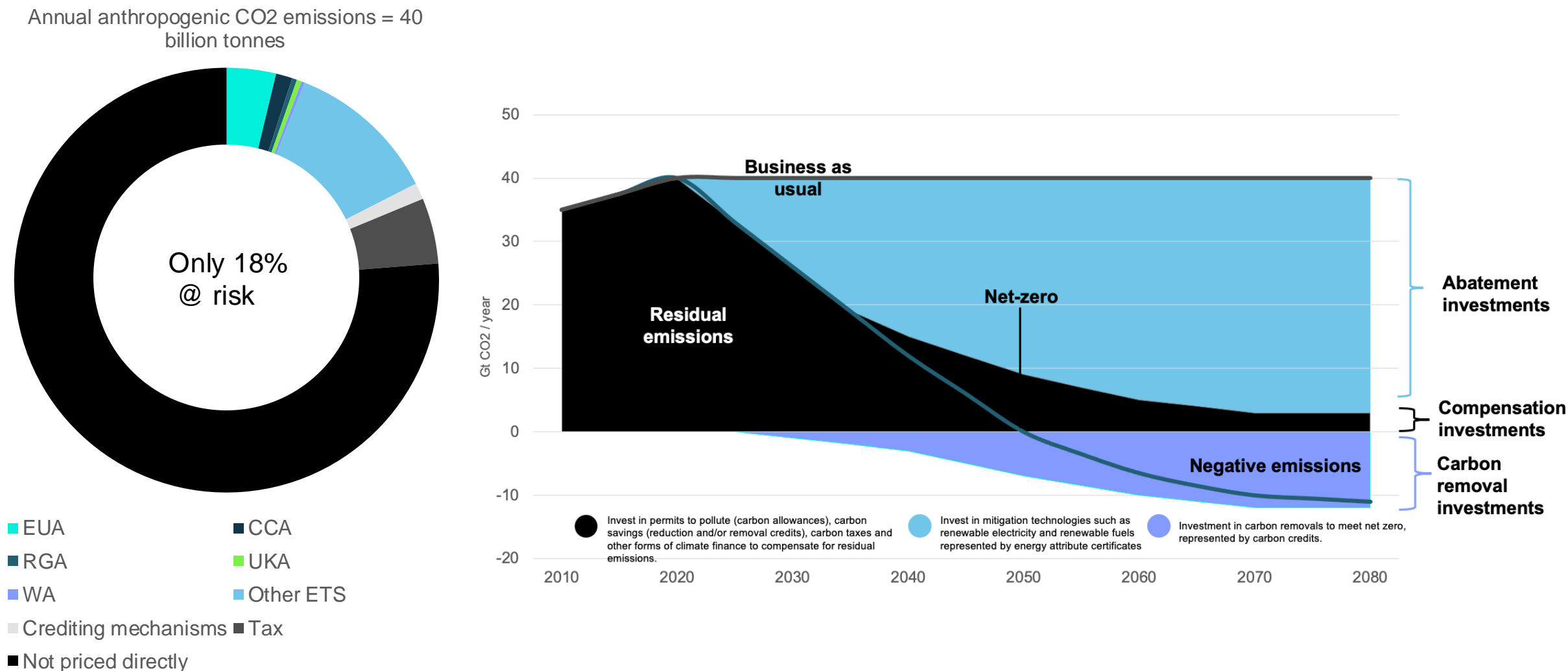
In billion-tons CO₂ per year (Pg CO₂ / yr), average 2011-2020

Anthropogenic emissions Sinks of anthropogenic emissions

Source: Global Carbon Project

Carbon pricing and carbon tonnes at risk

Annual emissions and net zero pathway



ICE host to the world's largest energy & environmental markets



>115 billion tonnes of allowances
equivalent to 3x world's annual CO₂ footprint



>350 million RECs
equal to the annual per capita energy consumption of nearly million people



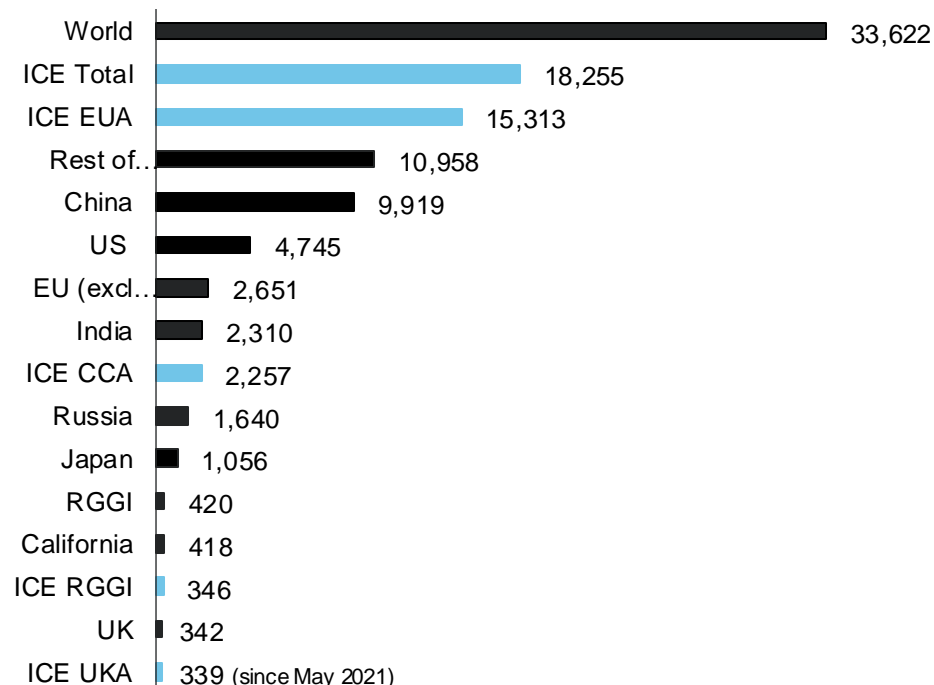
>5 billion RINs
equal to 118 million barrels of renewable fuels



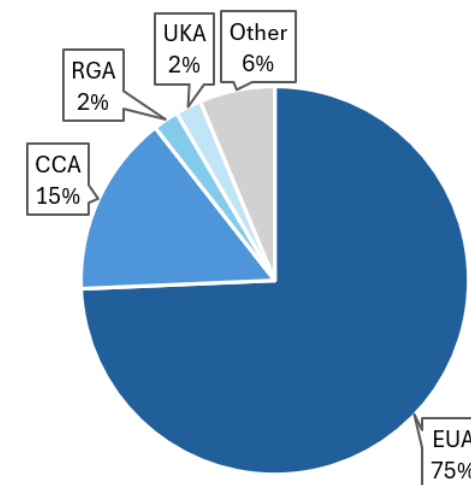
>6 billion tonnes of carbon credits
corresponding to the Co2 absorption of 6 billion trees



>50% of world's annual emissions footprint equivalent traded on ICE



2019 emissions per country/region in MtCO₂ (sources: IEA, California ARB, RGGI)
Emissions traded on ICE in 2021 in MtCO₂ (source: ICE)



\$1T annual notional value of environmental futures and options traded per annum since 2021

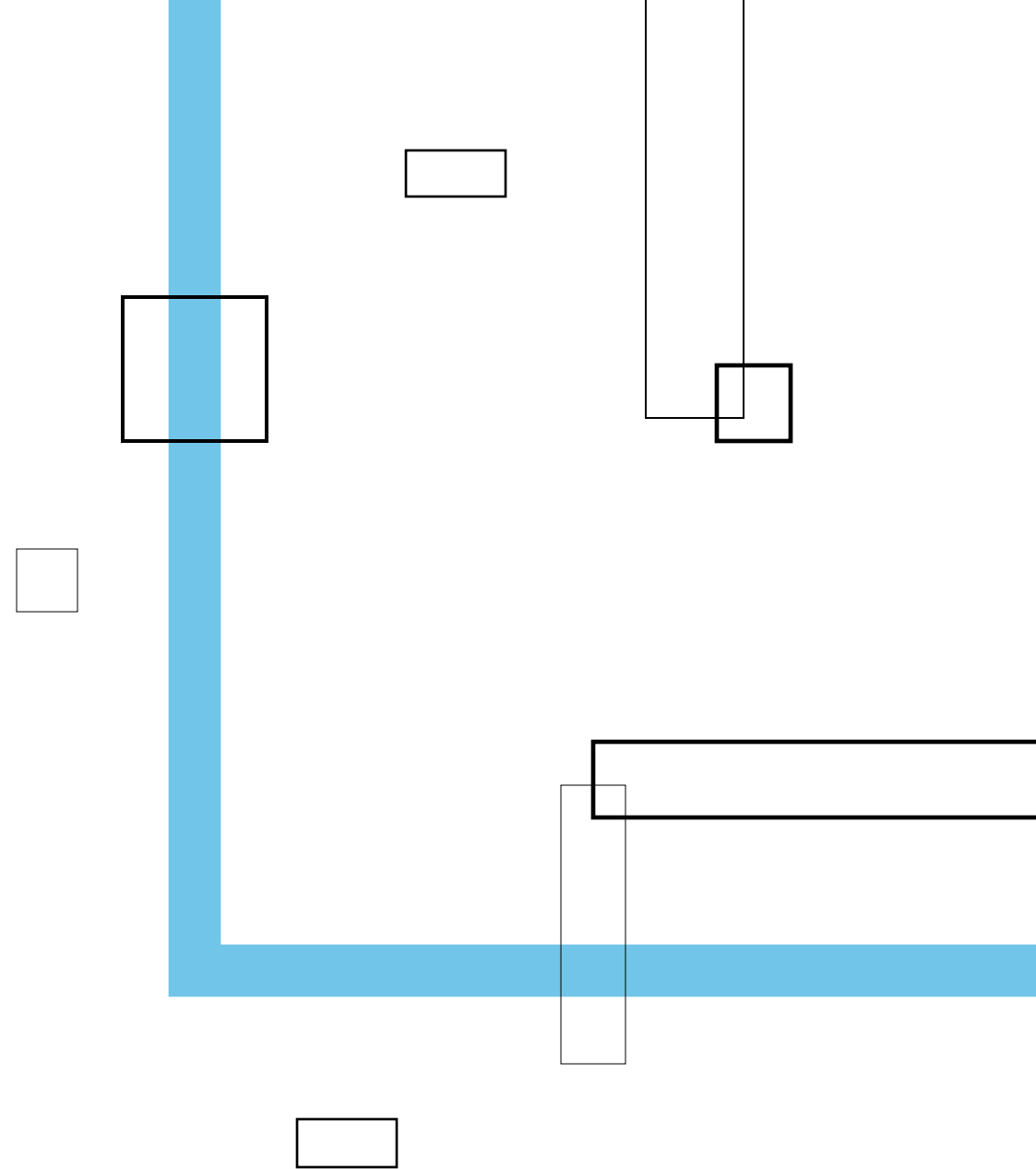


\$75B open interest of environmental futures and options risk managed at ICE

Today's speakers:

Dr. Robert Ritz, Economist at Cambridge University

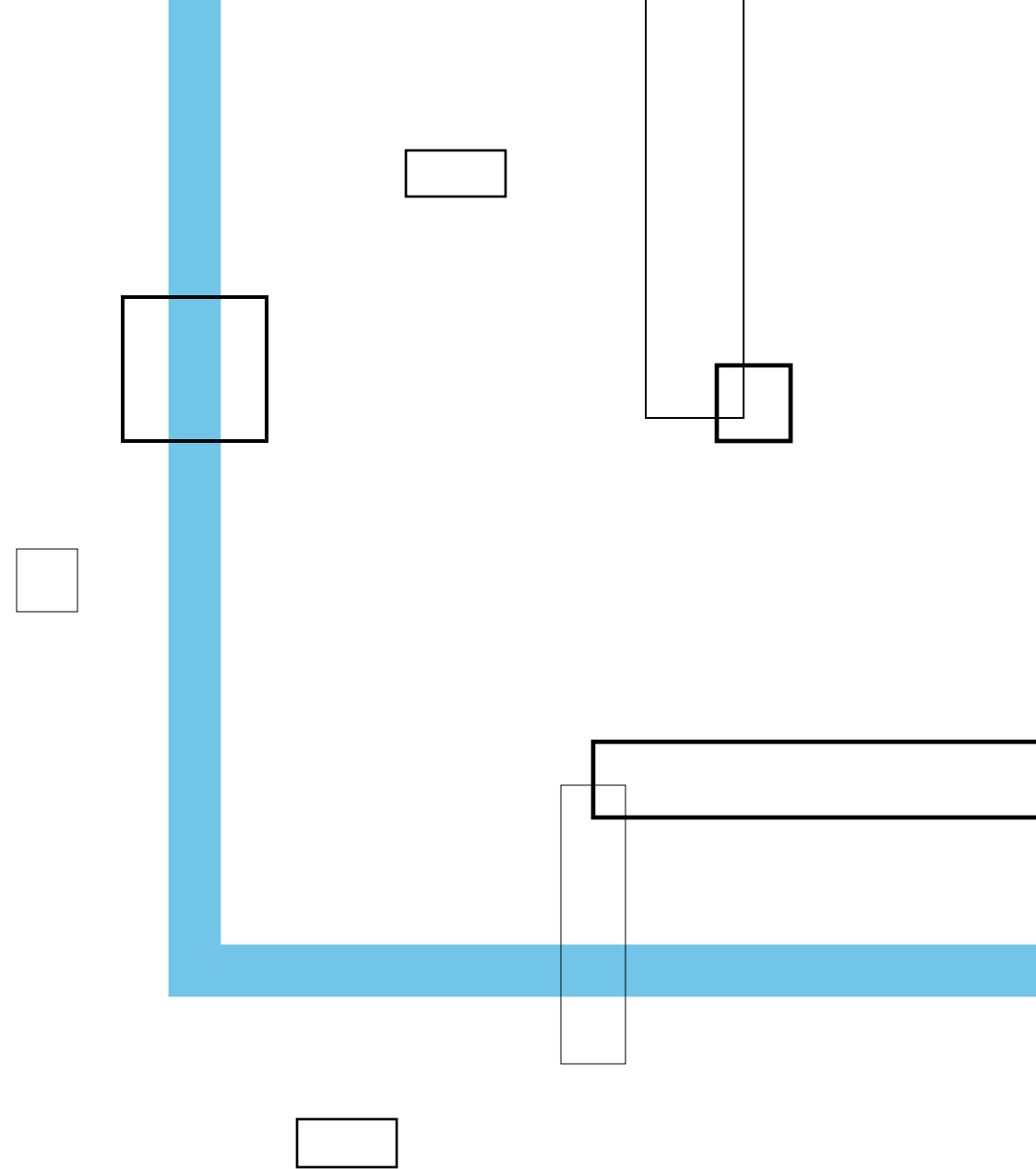
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Polling question

Are you currently active in allowance markets in

- a. Europe
- b. North America
- c. Asia
- d. Intending to become active in these
- e. Not active



The (predictable) global expansion of carbon allowance markets

Dr. Robert Ritz

Cambridge University



Views are mine & not necessarily those of any organization

www.eprg.group.cam.ac.uk

Global carbon should be (almost) as big as global oil

ILLUSTRATIVE

GLOBAL CARBON 2023

Quantity	~40 Gt
Price	~\$4/tCO ₂

Market size	~\$160bn
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Trading	~\$1tn
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GLOBAL OIL 2023

Quantity	~100m bbl/day
Price	~\$80/bbl

Market size	~\$3tn
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Trading	~\$20tn
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versus

Thought experiment:

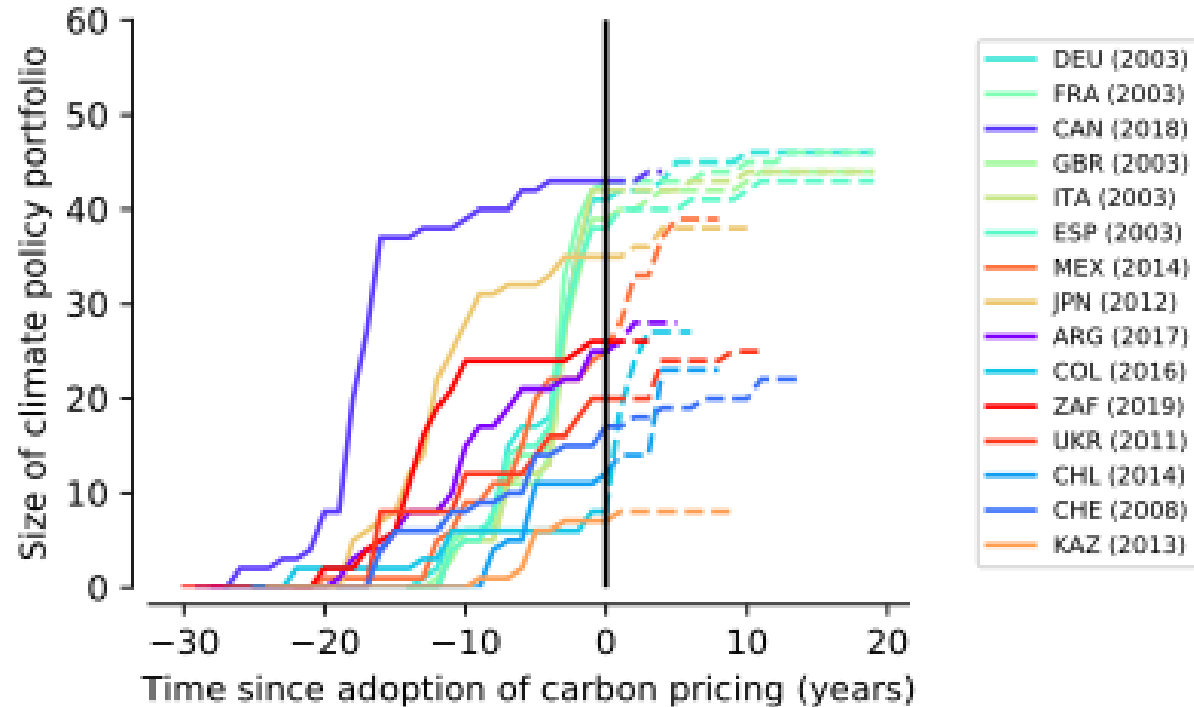
At a \$40/tCO₂ carbon price, global carbon market >\$1tn/year

⇒ *Carbon should be a US\$ trillion market today, like oil has been*

Source: [EIA](#), [Monash Real Carbon Index](#), [Credit Suisse: The Beginning of the Big Carbon Age](#) (numbers used are approximate)

History suggests a wave of carbon pricing in the 2030s

Carbon pricing is usually adopted after 5-18 years of other policies:



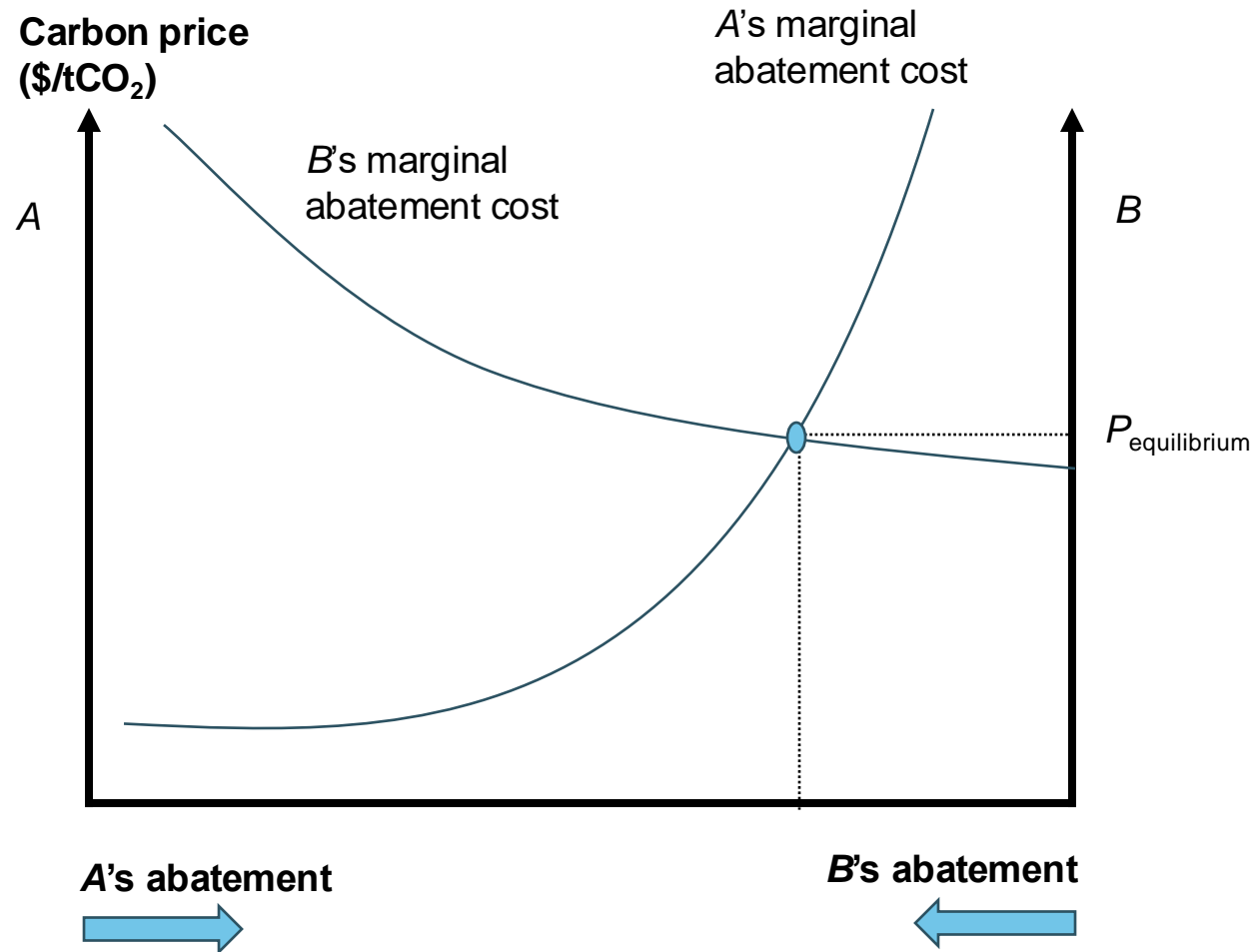
Climate policy portfolio

- Grants & subsidies
- Regulation
- R&D incentives
- Voluntary action
- Information campaigns

⇒ *2020s climate policy ramp-up → 2030s carbon pricing wave*

Source: Linsenmeier et al. (2022). [Policy sequencing towards carbon pricing: Empirical evidence from G20 economies](#). IMF Working Paper 22/66

The economic logic behind carbon pricing



Additional benefits

- ① Incorporate “externality” into **decision-making**
- ② Incentive to measure and **report emissions**
- ③ Incentive to pursue **green innovation**

⇒ Carbon pricing delivers total abatement at lowest social cost

Emissions caps need to be central to climate policy

What's the concern?



Global emissions are not going down - despite policy ramp-up since 2015 Paris Agreement

Why is this?



Policies often come with unintended consequences...

- ① Extra climate policy crowds out other policies
- ② Carbon leakage to less regulated entities

So what?



Seriously combatting climate change requires capping carbon emissions - declining cap implies price on emissions...

⇒ *Strong case for global use of compliance cap-and-trade*

Carbon pricing reduces emissions quickly & cheaply

Case study: Britain's carbon price on power sector had major role in historic exit from coal-fired generation on 1 October 2024



How effective is carbon pricing?—A machine learning approach to policy evaluation

Jan Abrell^{a,*}, Mirjam Kosch^b, Sebastian Rausch^{a,c,d,e}

nature communications

Article <https://doi.org/10.1038/s41467-024-48812-w>

Systematic review and meta-analysis of ex-post evaluations on the effectiveness of carbon pricing

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Check for updates

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Carbon pricing and power sector decarbonization: Evidence from the UK

Marion Leroutier^{a,1}



“the introduction of a carbon tax in the British power sector ... led to a substantial decline in electricity-related CO₂ emissions by 26% within only three years”



Carbon pricing and emissions: Causal effects of Britain's carbon tax

Klaus Gugler^{a,*}, Adhurim Haxhimusa^b, Mario Liebensteiner^c



⇒ **Growing causal evidence for effectiveness of market-based policy**

“Carbon pricing globally”, not a global carbon price

Strawman: “Global carbon price at social cost of carbon”

Multiple market failures

- Innovation spillovers
- Financial constraints
- Market power
- System effects
- Political economy



① ***Multiple climate policy instruments***

② ***Socially-optimal carbon price:***

⇒ *not necessarily set at social cost of carbon*

⇒ *not necessarily uniform across sectors or across countries*

Source: Ritz (2022). [Global carbon price asymmetry](#). Journal of Environmental Economics & Management

Europe & North America use hybrid market designs

	Emissions certainty	Price certainty	Political economy	Waterbed effect
Cap-and-trade	✓	✗	✓	✗
Carbon tax	✗	✓	✗	✓

⇒ *Case for “hybrid” carbon market designs*

1. **North America (California, RGGI) and UK ETS**
 - Cap-and-trade with carbon price cap/floor
2. **EU Emissions Trading System**
 - Cap-and-trade with Market Stability Reserve

⇒ *Complementary policies can reduce emissions*

because emissions cap is no longer fixed (“waterbed effect”)

Source: Perino, Ritz & van Benthem (2023). [Overlapping climate policies](#). NBER Working Paper 25643, October 2023

Key takeaways

1. **Emissions caps are critical** to climate policy
2. Carbon pricing yields **quick & cheap abatement**
3. Expect **wave of ETSs into 2030s**
4. “***Carbon pricing globally***” (not global carbon price)

Carbon markets – an investable asset?

Marcus Ferdinand

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veyt

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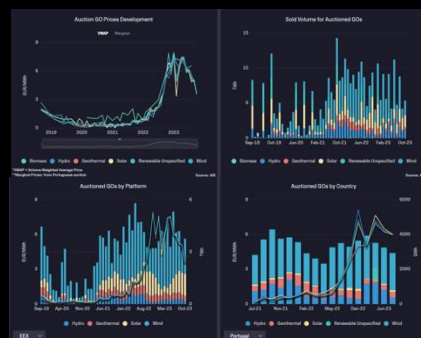


Veyt net zero market solutions

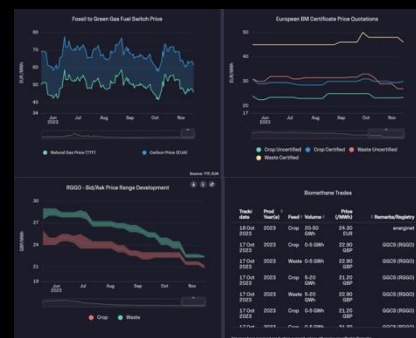
Veyt provides advanced analytical services and insights for informed decision-making in the dynamic low-carbon markets, empowering customers to stay ahead.



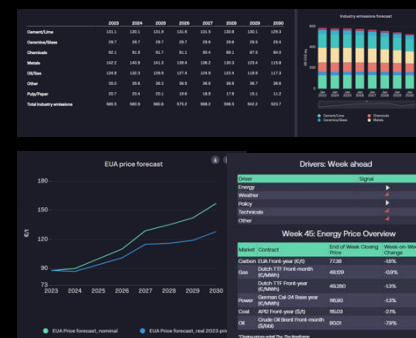
Our solutions – request a complimentary trial



Renewable Power



Renewable Fuels



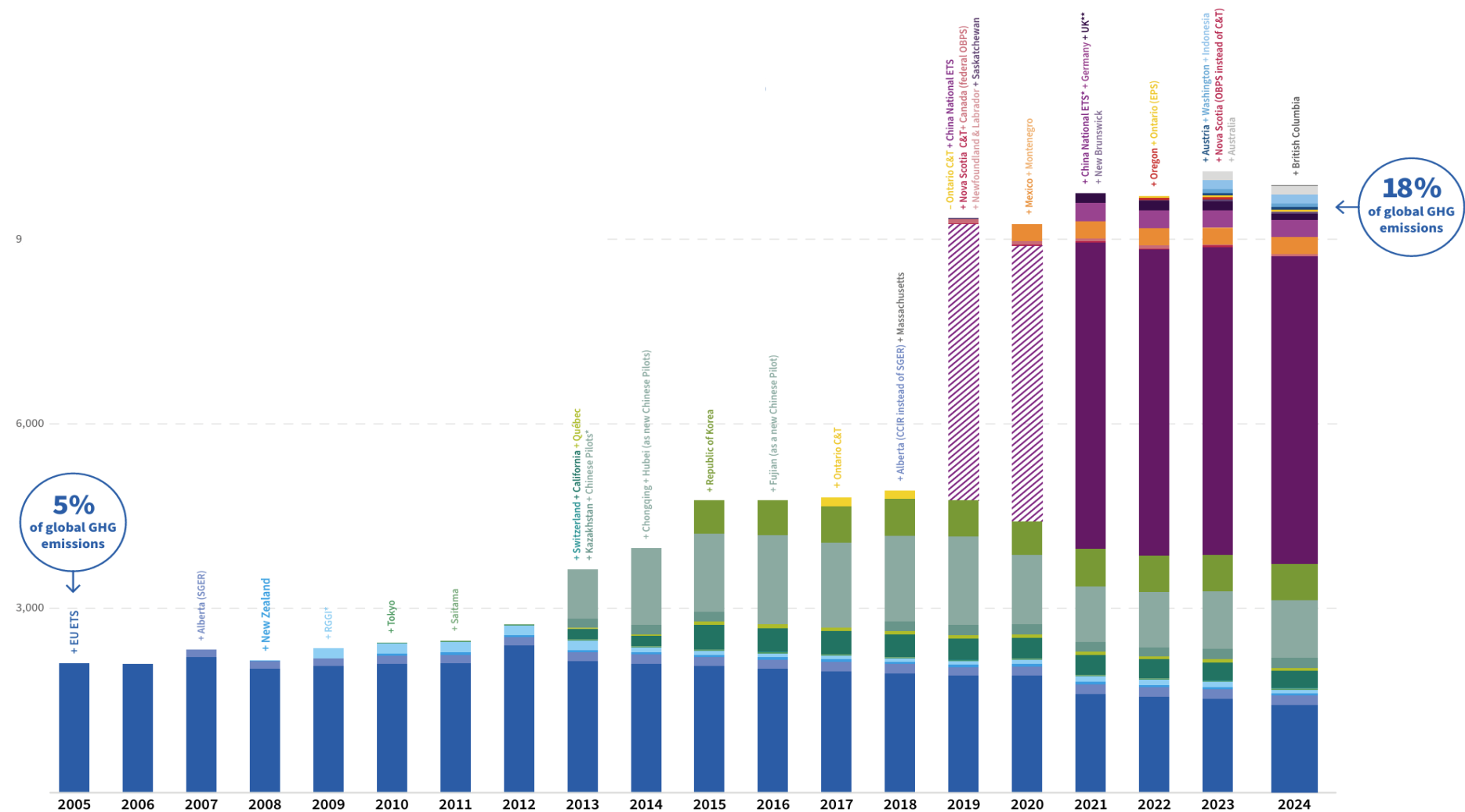
Compliance Carbon



Voluntary Carbon

Global expansion of ETS

The share of global GHG emissions under a carbon market has more than tripled since 2005



* As of 2020, RGGI includes New Jersey. Between 2021 and 2023, it also included Virginia

* Beijing, Guangdong, Shanghai, Shenzhen, Tianjin

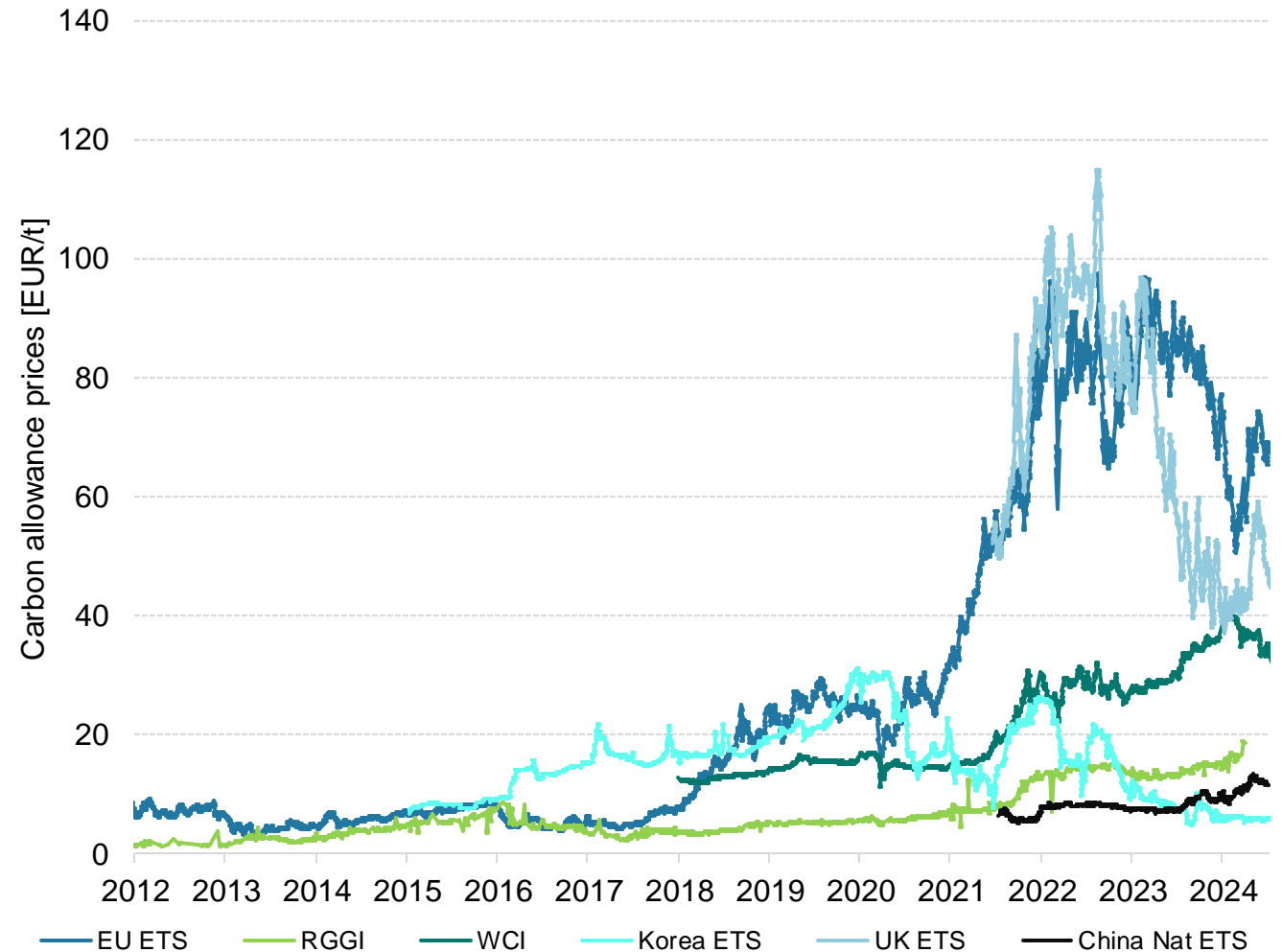
* The Chinese National ETS came into force in 2021 but has retroactive compliance obligations in 2019 and 2020, indicated above by the striped bar

** In 2021, the UK launched its own ETS which required an adjustment in the EU ETS cap.

Compliance carbon prices pointing upwards with tighter market balances

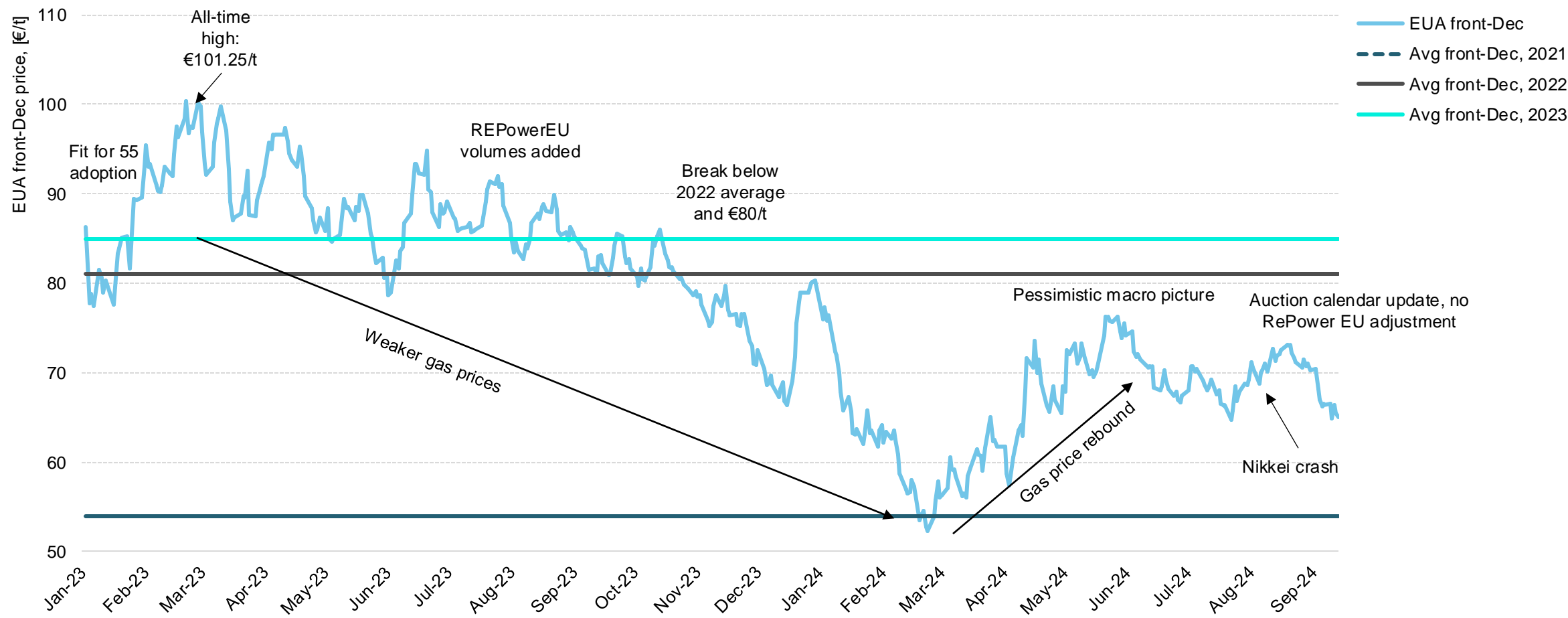
EU and UK systems show the highest prices in global comparison

- Carbon allowance prices are driven by changes in current and expected scarcities of allowances
- Variations in macroeconomic situation
- Political/regulatory framework
- Interactions with other climate and energy policies
- Stakeholder behavior



European markets

The EUA front-Dec contract reacts on softening gas prices, macro, myopia

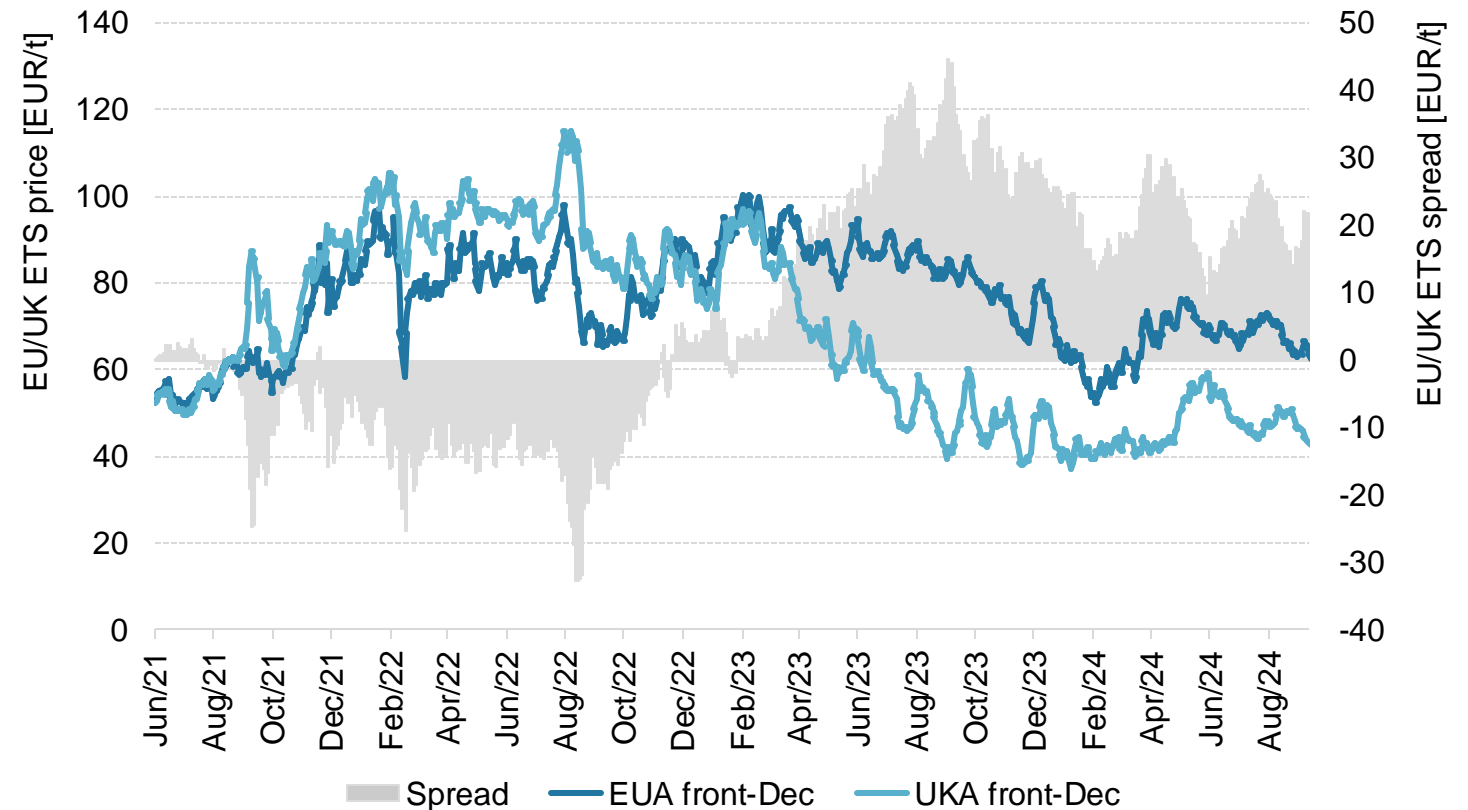


The UK carbon market – decoupling from its big brother

UK carbon price adjusting to political scenarios

- Market facing regulatory uncertainty with more ambitious climate targets for the period 2024-2030
- UKA prices fell steeply from March 2023
- July-24 election announcement sparked rally on expectations of more stringent climate policy and hopes of EU ETS linking negotiations

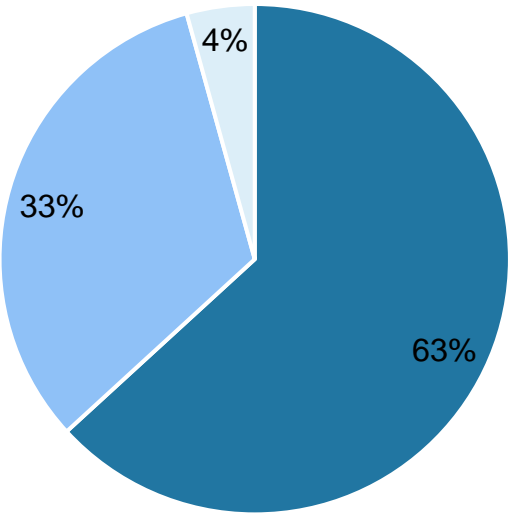
UK market takes a hit – spread blows out



EU ETS: From power to industry

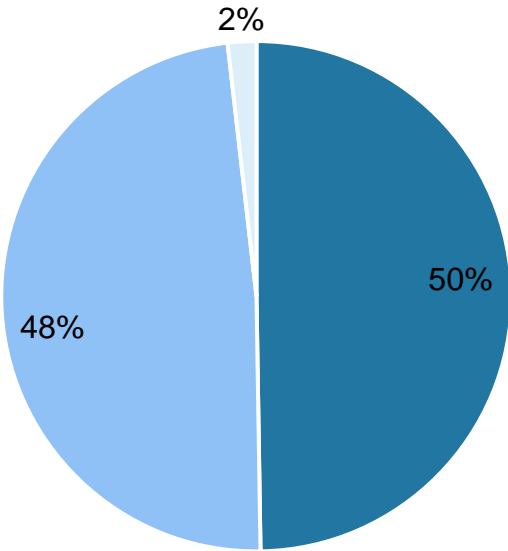
Emissions covered by the EU ETS

End Phase II
(2008-2012)



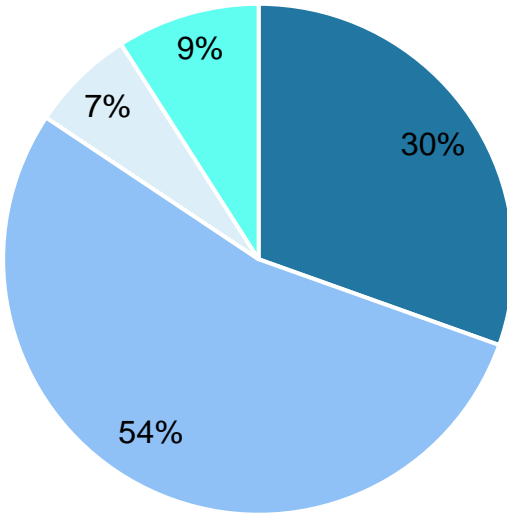
■ Power ■ Industry ■ Aviation

End Phase III
(2013-2020)



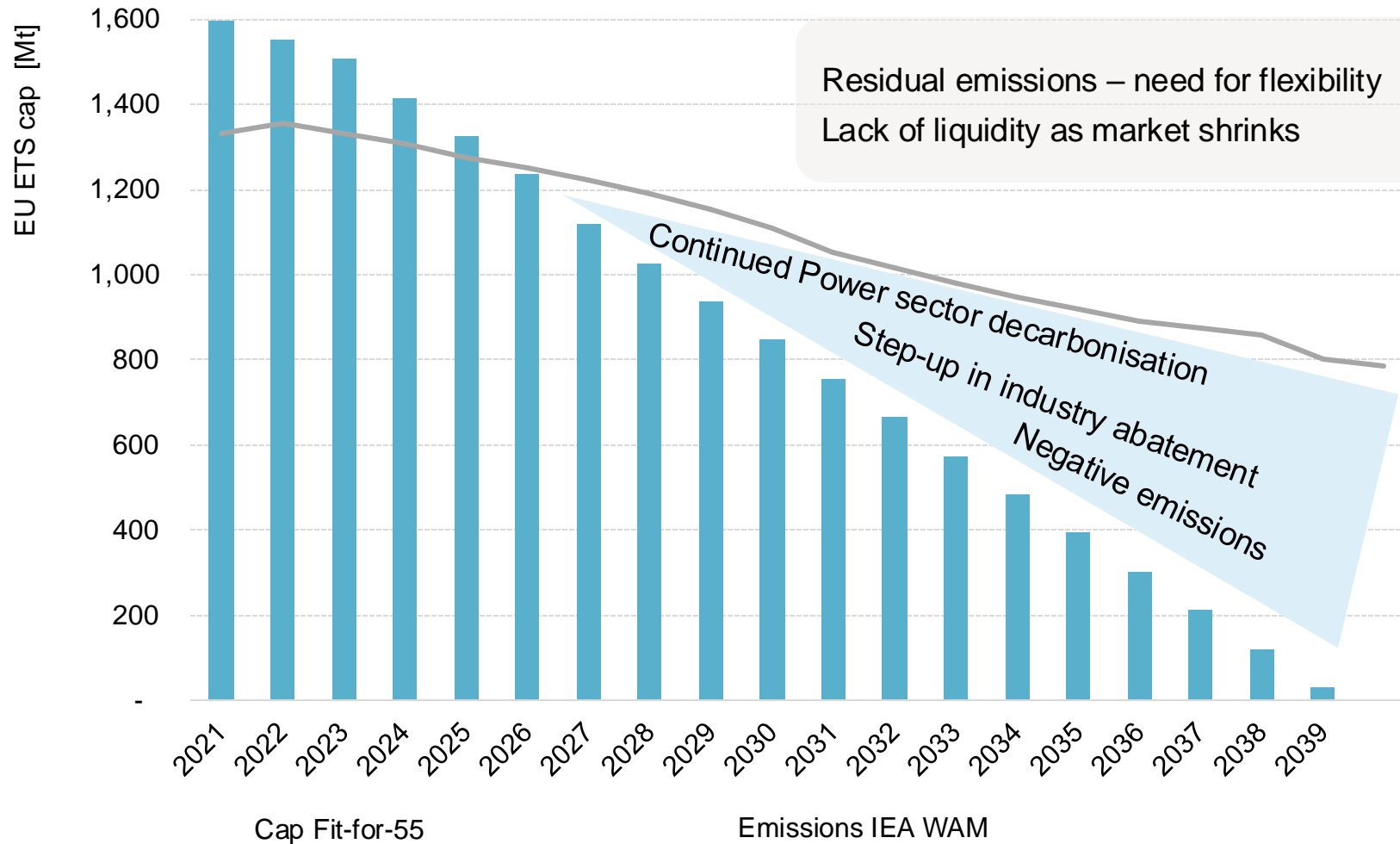
■ Power ■ Industry ■ Aviation

End Phase IV
(2021-2030)



■ Power ■ Industry ■ Aviation ■ Shipping

Mind the gap: How to address a zero cap in 2040?



Options

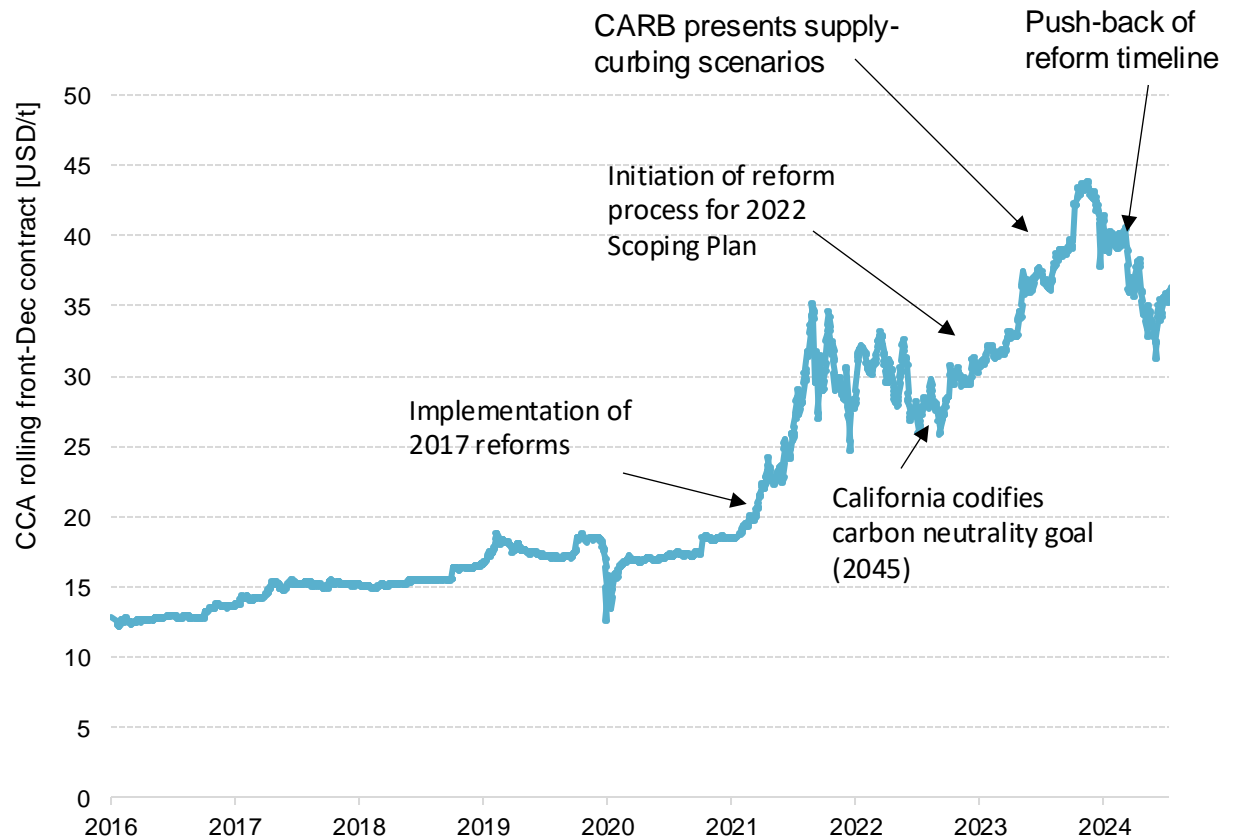
- Reduce: Massive industry effort required
- Add: Expand ETS to new sectors, link with ETS2
- Remove: Allow for negative emissions/removals
- Import: Import non-EU carbon credits

US markets

Price development and drivers – Western Climate Initiative (WCI)

WCI largely dominated by talks on more ambitious targets

- Participating WCI jurisdictions have some of the most ambitious climate initiatives in North America
- Regulators have been increasing the role their ETS alongside climate targets
- Volatility in the CCA contract has increased in conjunction with regulatory efforts to extend and strengthen the joint ETS.
- Ongoing regulatory reform measures – increasing program ambition has been the main driver in CCA prices

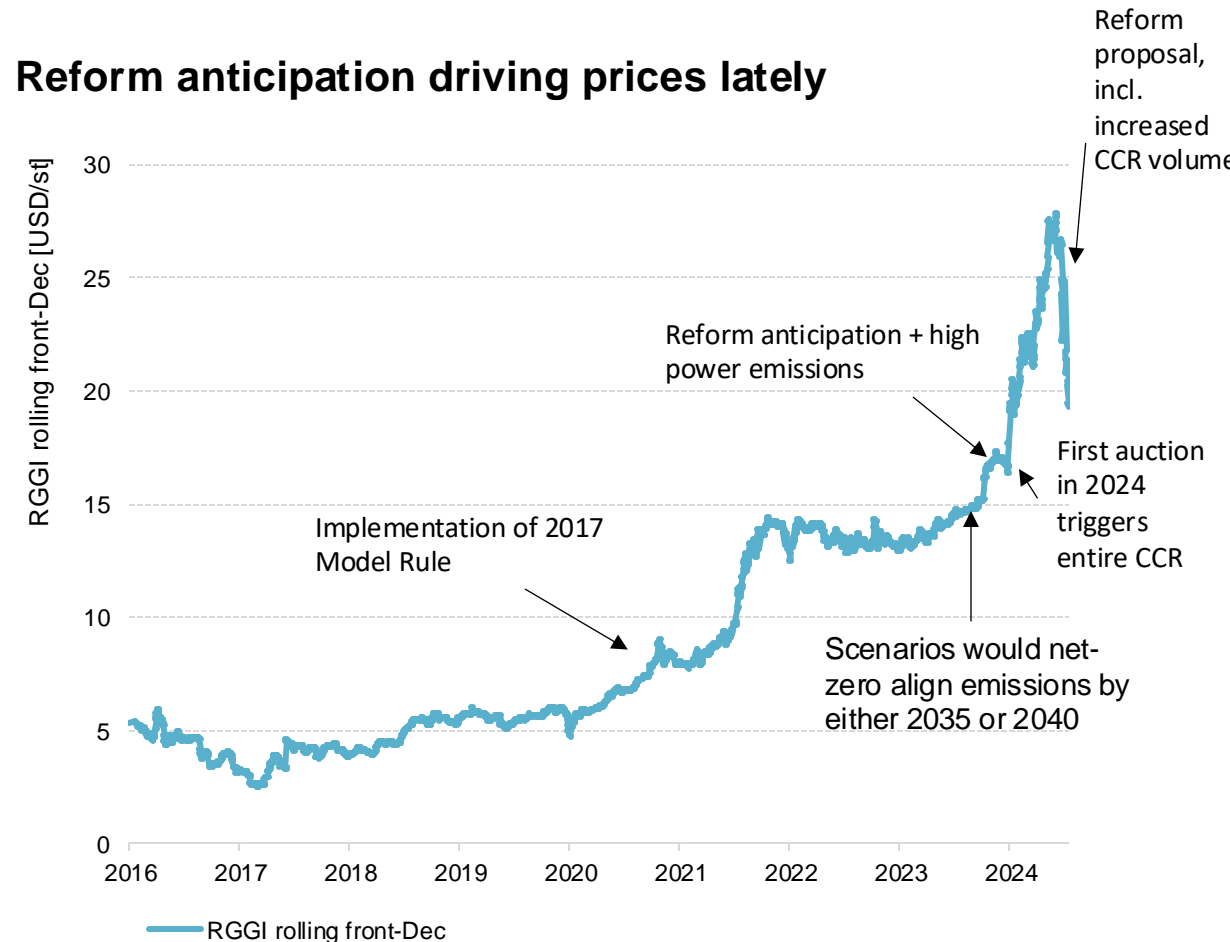


Price development and drivers Regional Greenhouse Gas Initiative (RGGI)

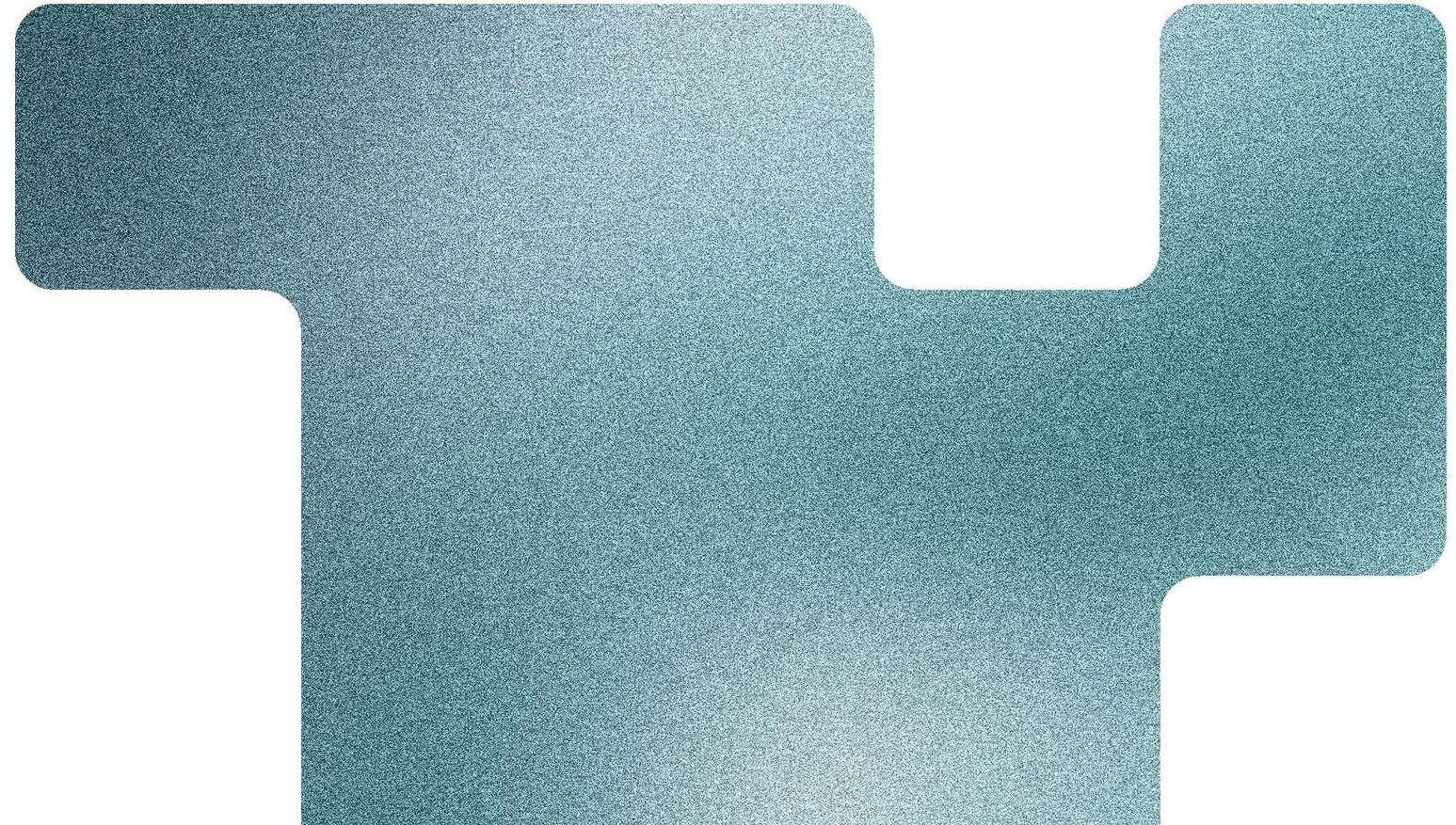
RGGI – a largely stable market since its 2009 inception

- Uptick in volatility from 2021 driven by program reviews, aimed at tightening the market
- This year:
 - Volatility injected into market from high compliance-side demand from increased summer power emissions
 - Benchmark contract has risen 70% since January 2024
 - Auction clearing prices have spiked along side trends in the secondary market

Reform anticipation driving prices lately

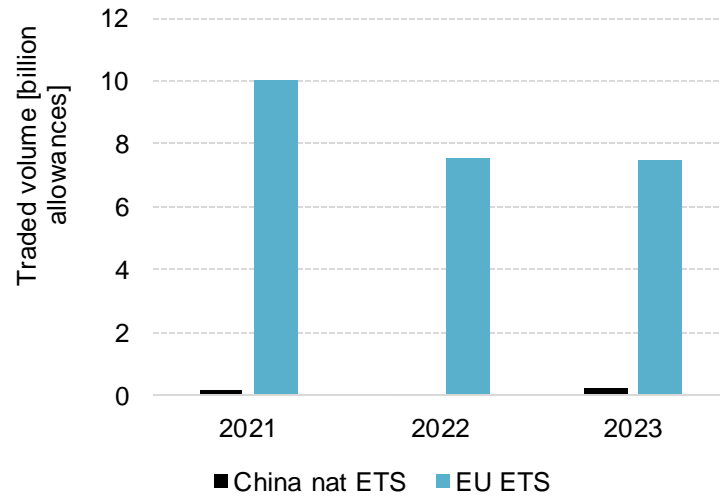


Global markets



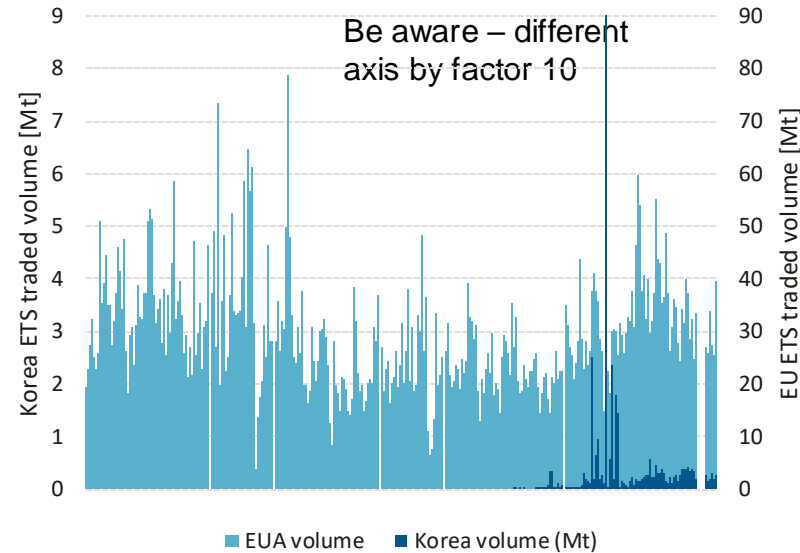
Are all carbon markets investable?

China national ETS



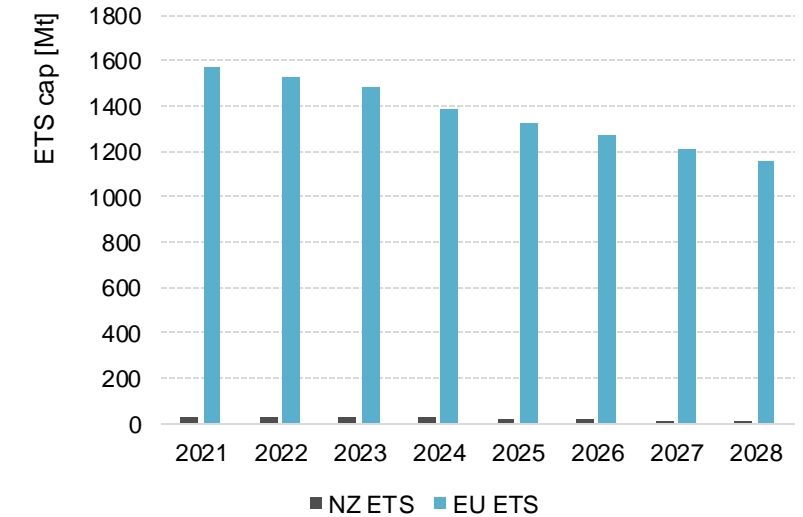
- Largest market by cap
- Intensity-based
- Only compliance entities, no derivatives
- Poor liquidity

Korea ETS



- Lack of liquidity, daily average traded V-23 contract y-t-d at 0.27 Mt
- Compares to 29.4 Mt for front-Dec EU ETS
- Restrictions on non-compliance entities to participate

New Zealand ETS

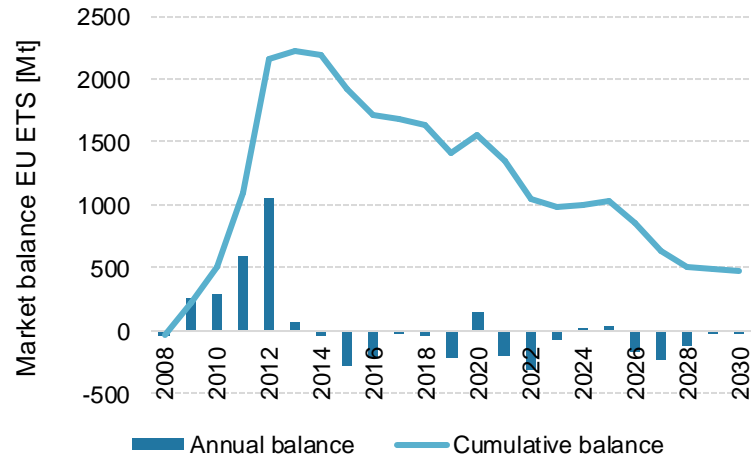


- Small market
- Oversupplied market
- There is no limit on NZUs generated from removal activities.

Carbon price forecasts

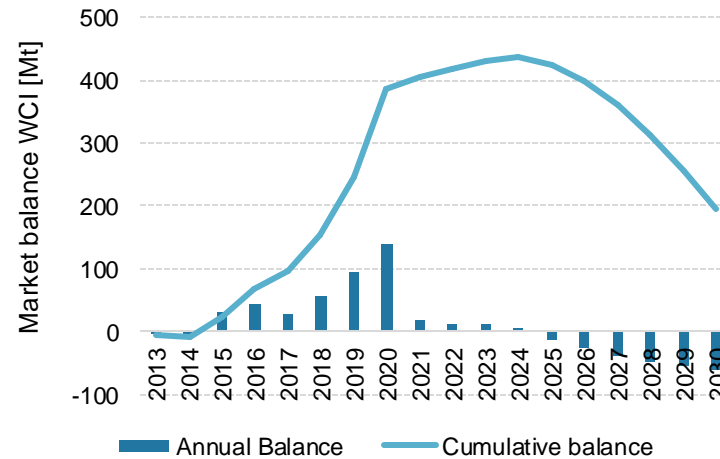
Carbon market balances in investable markets are turning tight

EU ETS



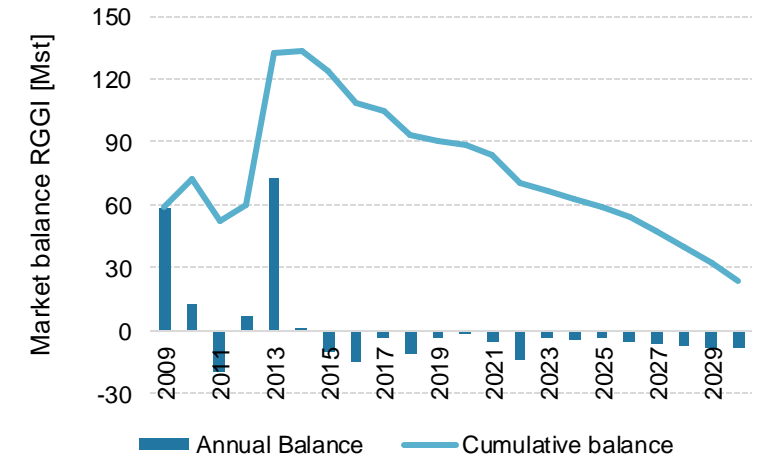
- Ambitious 2030 target in legislation, 2040 process upcoming
- Balance significantly short again as of 2026
- Beyond 2030 market gets extremely tight, not much flexibility to rescue

WCI



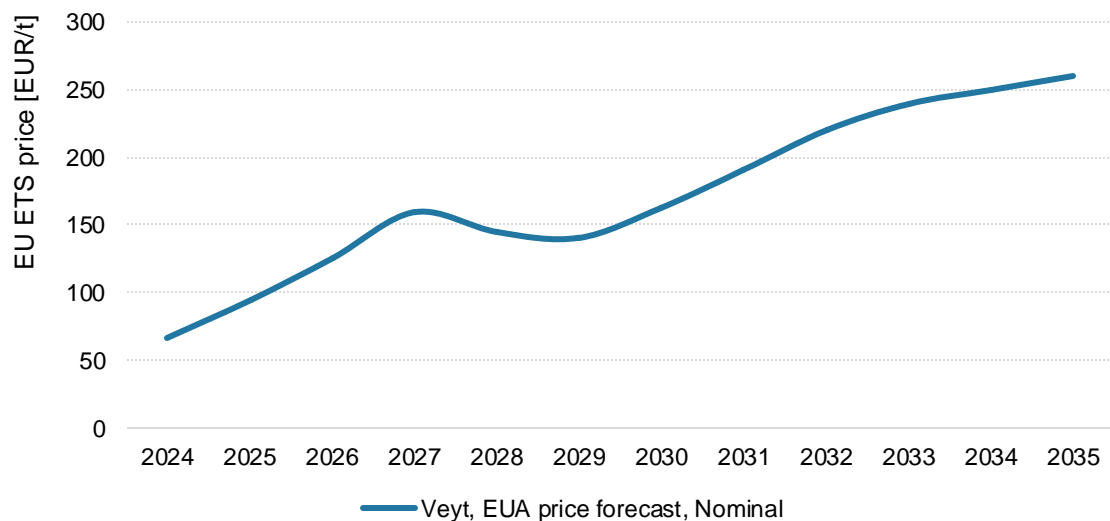
- Carbon market policy and wider policy mix provide uncertainty
- We assume a cap reduction of 265m through 2030 (plus 17 million from Quebec)
- We assume in this market balance an ICE sales ban from 2035

RGGI



- Regulators are reviewing the program
- Reduction in cumulative supply will lead to a significant increase in allowance prices
- Almost every state in RGGI will see net reductions in their power emissions towards 2030

EUA price outlook – recovery in 2025, bullish long-term



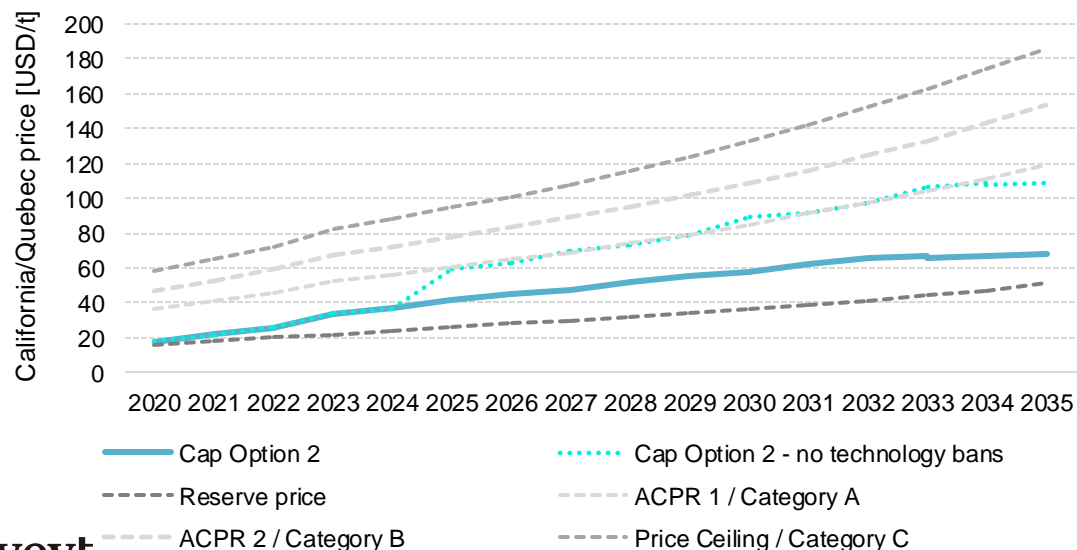
Short-term

- High-interest rates and sluggish economic growth disfavoring carry-trades
- Slow industrial recovery, dip-buying
- Low gas prices
- REPowerEU frontloading

Long-term

- Two-off re-basing and tightened LRF
- Baseload support from climate policy – the 2040 target debate tightens balance
- Very tight balance during the second half of phase 4

California – Quebec prices dependent on supply scenario and ICE vehicle ban



Short-term

- Concluding workshops by California-Quebec regulators
- November election on the future vitality of the Washington ETS

Long-term

- Cuts to 2026 – 2030 supply (Options 1 + 2)
- Program extension from 2030 to 2045
- Linkage with Washington
- Phase-out gas boilers and ICE vehicles

Key points

- **Climate ambition:** ETSs are expected to grow in importance as tools to meet countries' increasing climate ambition in respect of the Paris Agreement review cycle
- **Carbon prices:** With decreasing caps and tighter market balances, the overall trend is bullish while regional differences apply
- **Negative emissions:** Net-zero ambition and caps running towards zero will result in increasing need for negative emissions – new markets emerging
- **Investors** are crucial for liquidity and market depth as well as guaranteeing fair value pricing
- **Not all carbon markets are investable:** While the flagship markets show high degree of liquidity, several markets restrict participation.

We empower decision-makers towards a net-zero world.

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Thank you

