Essential and still evolving: The global voluntary carbon market outlook 2024

An EY Net Zero Centre report

Shape the future with confidence

Executive summary

This report from the EY Net Zero Centre provides guidance on the role of carbon credits in decarbonisation strategies and offers an outlook on the voluntary carbon market, building on the May 2022 edition.

Key findings include:

Carbon credits remain essential for limiting dangerous climate change and achieving emissions reductions consistent with the goals of the Paris Agreement.

Market arrangements will continue to evolve. The 'race to integrity' that we anticipated in 2022 has had a very rocky start. Scandals and shortcomings have shaken stakeholder confidence. While UN initiatives and other processes are well-positioned to deliver quality and restore confidence, they will take time. Together, these processes and the changes that underpin and enable large-scale operations will transform carbon markets over the coming decade.

Carbon credits will become increasingly more expensive, but will be valued for driving ambitious emissions reductions. As credit and abatement costs rise, regulation to prevent unfair competition will grow in importance.

Businesses and leaders that engage early will be best positioned to create and capture opportunities and manage risks.

Essential

Carbon credits play a distinctive and essential role in achieving global Paris Agreement commitments by bringing forward emissions reductions and 'offsetting' hard-to-abate emissions. Credits enable carbon removal from the atmosphere and support equitable, cost-effective climate action. This enables businesses to set more ambitious emission reduction targets and provides financial flows from higher-income to lower-income nations. Carbon credit markets also help underpin investment in abatement activities.

The best business decarbonisation strategy – incorporating the right use of carbon credits – will be shaped by stakeholder pressures, business risks and the opportunities for reducing direct emissions. Voluntary business commitments and targets that go beyond legal obligations can provide resources to 'build a better world' – and society should encourage these good faith commitments.

Evolving

Over the past two years, media scrutiny has threatened the social licence of voluntary credit usage. Multiple processes are underway to strengthen and standardise requirements to supply and use credits. This will help to address stakeholder concerns, and underpin crucial scaling and efficiency improvements in carbon markets. However, these processes are yet to deliver tangible outcomes, and progress remains slow.

Markets will remain fragmented, at least in the medium term, reflecting variations in allowable origination, supply, trade, use and retirement. Meanwhile, emerging regulation is sharpening business attention on emissions reductions and encouraging demand for credits. This will also influence future willingness and ability to pay higher credit prices.

Widespread future use of credits to meet compliance obligations can drive the world towards a well-regulated global market where carbon removals and recognised avoided carbon emissions are treated as a commodity class like oil, copper or wheat. This is particularly true for specific activities or industries in which technology abatement opportunities are not yet mature or cost-effective. The challenge will be to commodify carbon while meeting the needs of businesses committed to supporting sustainability and inclusive growth.

Expensive

Increasing demand, rising quality standards and escalating unit supply costs will make carbon credits both scarce and more expensive.

Our central estimate for credit prices projects a rise to US$75-125 per tonne by 2035 across Paris-consistent scenarios. While prices will vary across market segments, we project that 30-50% of credits will cost more than US$50 per tonne by 2035 in these scenarios.

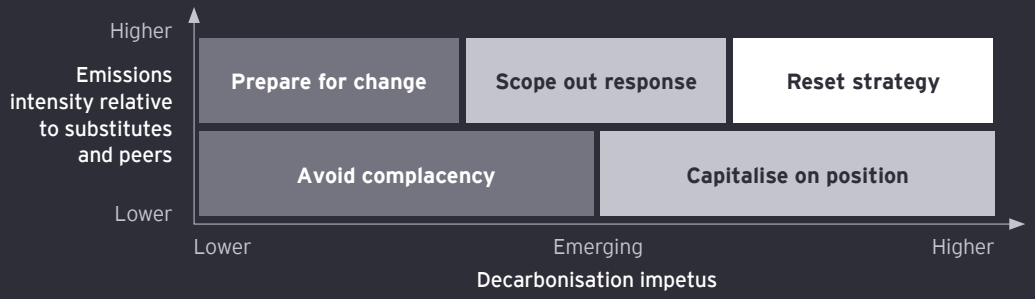
Credits will play a crucial long-term role in emissions reductions. The EY Net Zero Centre finds removal credits will become increasingly important over the long-term, and avoided emissions credits will contribute a declining share as emissions-intensive assets and processes are retired. Emissions-intensive businesses will only be able to pursue costly abatement if regulatory settings prevent unfair competition from other businesses with weaker abatement requirements.

Engage

Climate science, technology, markets, regulation and stakeholder expectations will continue to evolve rapidly – while shaping and being shaped by other megatrends.

To navigate these challenges, businesses must engage early and actively. Countries are competing to capture the benefits of the global low-carbon transition. Every leader will need a clear, current decarbonisation strategy that leverages carbon credits to create value, mitigate risks and seize the right opportunities.

Exhibit ES-1: Five default strategy postures for decarbonisation and the use of carbon credits



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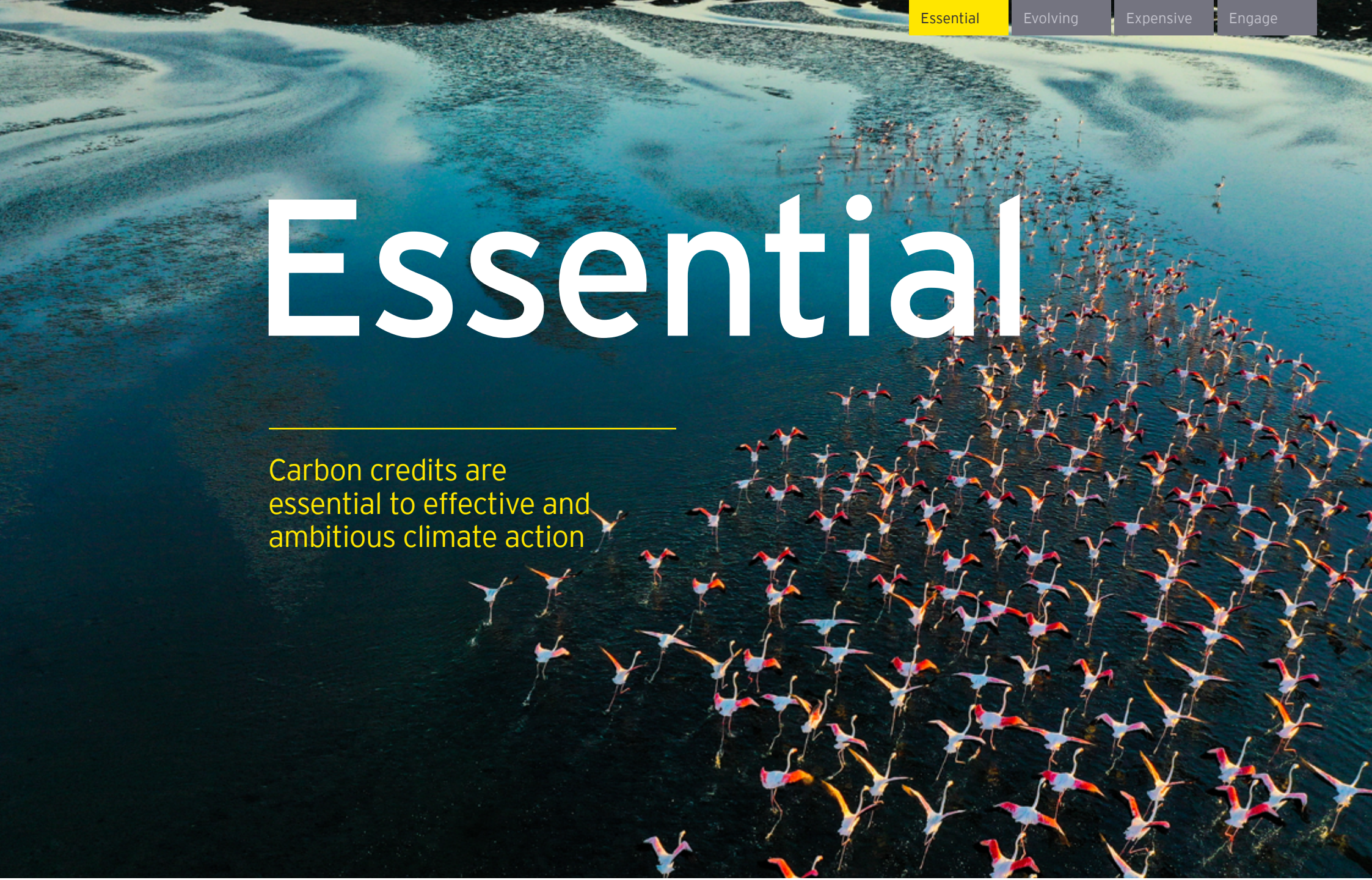


Essential

Carbon credits are essential to effective and ambitious climate action

Climate change is a defining challenge for all businesses

Addressing climate change is transforming every industry and every business. All businesses will be affected by the low-carbon transition, and all will be expected to contribute solutions. Carbon credits and carbon markets provide valuable support and flexibility as businesses decarbonise, but their optimal role and use will depend on the context and positioning of each business.

Every effective strategy to limit climate change requires a transition to net-zero emissions. But making and implementing a credible net-zero strategy is challenging for most businesses, particularly those in emissions-intensive sectors. The transition will require new ways of working (including new ways of deploying skills and resources), as well as new ways of thinking.

This report explores the role and outlook[1] for voluntary carbon markets, carbon credits and offsets as part of a sound net-zero strategy. Prepared by the EY Net Zero Centre, it equips business decision-makers with insights to identify and understand the best use of credits to support their business strategies.

This report updates our 2022 analysis and modelling, reflecting developments that are shaping voluntary carbon markets in 2024 and beyond. For this edition, we have complemented the Net Zero Centre analysis with perspectives from EY leaders actively engaged in voluntary carbon markets around the world.

The analysis and findings are presented in four sections:

The role of voluntary carbon markets, carbon credits and offsets, which finds that carbon credits have an essential role in achieving net zero, but that the best use of credits varies with the context and strategy of each firm.

The outlook for credit market rules and arrangements, which finds multiple processes and interacting trends will transform the nature and scale of voluntary carbon markets.

The outlook for credit prices and volumes, which finds that credits will be scarce and expensive across all Paris Agreement outlooks, driven by rising global demand, a race to quality, and increasing unit supply costs.

A call to action for business and leaders, which sets out practical first steps to engage and prosper through the net zero transition.

Carbon credits can be used to 'offset' emissions, and are created by projects that avoid or remove greenhouse gases

How we define carbon credits, offsets and voluntary carbon markets

A range of terms are used when discussing offsets. This report defines:

- **Carbon credit:** A certified and transferable instrument representing the avoidance or removal of one metric tonne of CO_2 or equivalent greenhouse gases.
- **Avoidance:** Emissions that would have occurred under a defined 'business-as-usual' scenario, but that were prevented due to an offset project.
- **Removal:** CO_2 or other gases that have been extracted from the atmosphere and safely stored.

Carbon credits are created by offset projects and can be retired to counterbalance the equivalent volume of residual emissions by the credit retirer.

Voluntary and compliance carbon markets serve distinct purposes

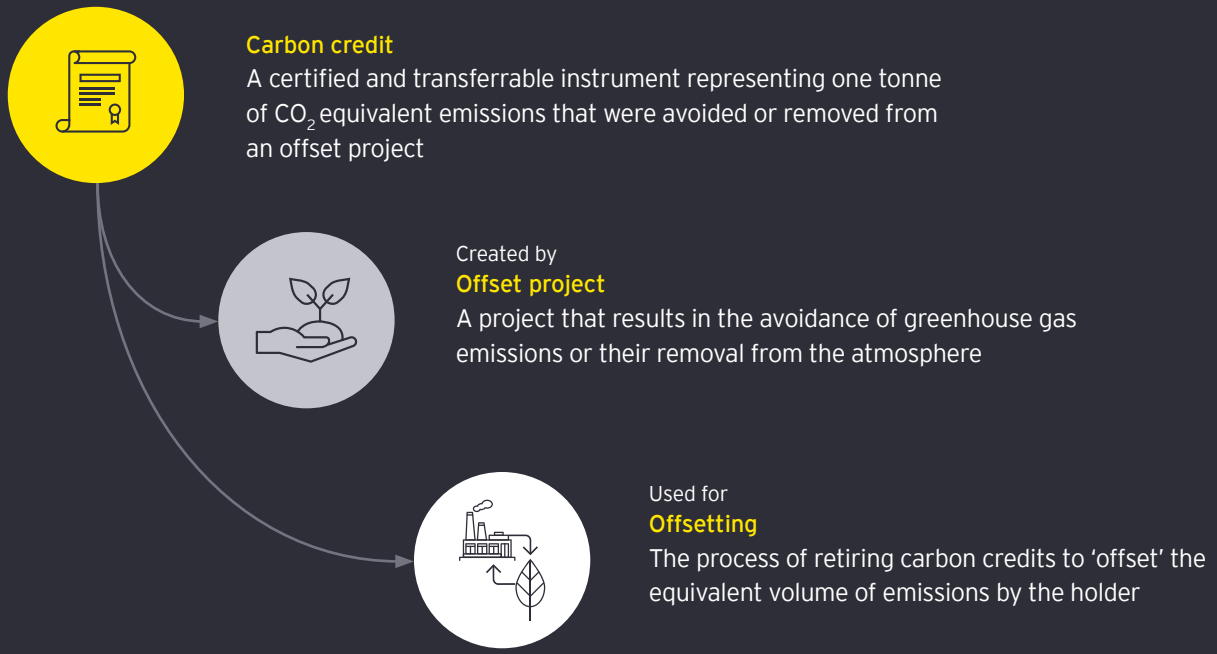
- **Voluntary carbon markets:** Allow organisations and individuals to use carbon credits to offset their emissions to meet voluntary goals, typically driven by corporate social responsibility or sustainability objectives.
- **Compliance carbon markets:** Regulated by government mandates, these markets are designed to meet legally-binding emissions reduction or intensity targets.

Jurisdictions are starting to allow compliance through use of voluntarily supplied credits

This report finds, as predicted in our 2022 report[2], the distinction between these markets is beginning to blur, as governments allow compliance obligations to be met using credits created by voluntary supply.

This report focuses on voluntary supply of carbon credits and evolving market arrangements to support the creation and use of high-quality credits at scale, regardless of whether credit demand is motivated by voluntary commitments or compliance requirements.

Exhibit 1: Understanding carbon credits and offsets



Source: EY Net Zero Centre analysis

Paris commitments to limit dangerous global warming require advanced countries to achieve net-zero emissions no later than 2050

The United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement, which was negotiated in December 2015 and entered into force in November 2016, commits 196 countries to limit climate change to "well below 2°C" and establishes an aspiration of the much more difficult challenge of limiting global warming to around 1.5°C.

The world is committed to ambitious action

The Intergovernmental Panel on Climate Change Sixth Assessment Report[3] was released in March 2023. This report finds human activities, principally through emissions of greenhouse gases (GHG), have unequivocally caused global warming.

Human-caused climate change is already affecting weather patterns and climate extremes around the globe. Some future changes are irreversible and there is a rapidly closing window of opportunity to limit the worst impacts of climate change.

Limiting human-caused global warming requires deep, rapid and sustained global GHG emissions reduction.

Advanced countries are putting words into action, but more is needed

Advanced countries are expected to take the lead to reduce their emissions, reflecting equity issues and their capacity to pay, as well as supporting adaptation, mitigation and climate-resilient development in other countries.

Advanced countries have made high level commitments – referred to as nationally determined contributions (NDCs) in the Paris Agreement – that are broadly consistent with limiting temperatures to below 2°C, but that fall short of a global 1.5°C outcome.

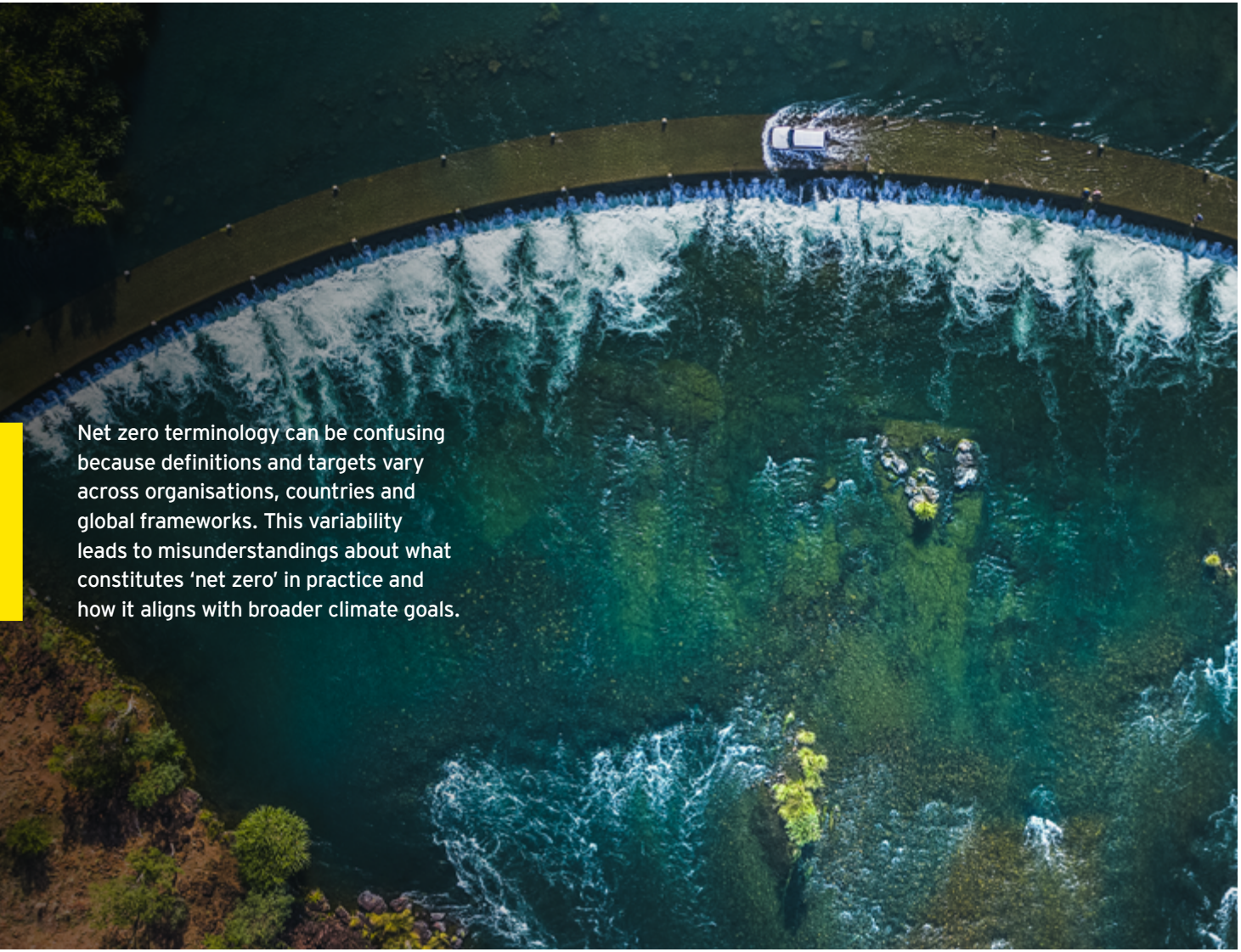
This implies OECD (Organisation for Economic Co-operation and Development) countries will need to achieve net zero greenhouse emissions no later than 2050, and perhaps significantly earlier as part of global action to keep long-term temperature rises closer to 1.5°C.

However, in most cases the detailed policies and frameworks required to achieve these commitments are not in place. In aggregate, announced policies and NDCs by all nations are not sufficient to limit global warming to below 2°C.

Delivering on our global aspirations will require cooperation and capital

Finance, technology and international cooperation are crucial enablers for effective action to limit dangerous climate change, and carbon markets are crucial enablers for deploying finance and technology, within and across countries and sectors.

Net zero is both transformational and 'the least we can do' – but can also be confusing



Net zero terminology can be confusing because definitions and targets vary across organisations, countries and global frameworks. This variability leads to misunderstandings about what constitutes 'net zero' in practice and how it aligns with broader climate goals.

Net zero refers to balancing out residual emissions with removals from the atmosphere

Global net zero means balancing the total emissions produced with the total emissions removed on a planetary scale.

However, individual companies and countries have varied opportunities to reduce emissions. Some have greater responsibility for current and historical contributions, and some have greater capacity to invest in technologies or actions that reduce their emissions today. If those with the greatest capacity to act only meet, or slightly exceed, the average targets set, global aggregate reductions will fall short. This is because those with less capacity will struggle to match these reductions.

Advanced economies and high-capacity companies must not only meet but sustain deeply net-negative CO_2 emissions.

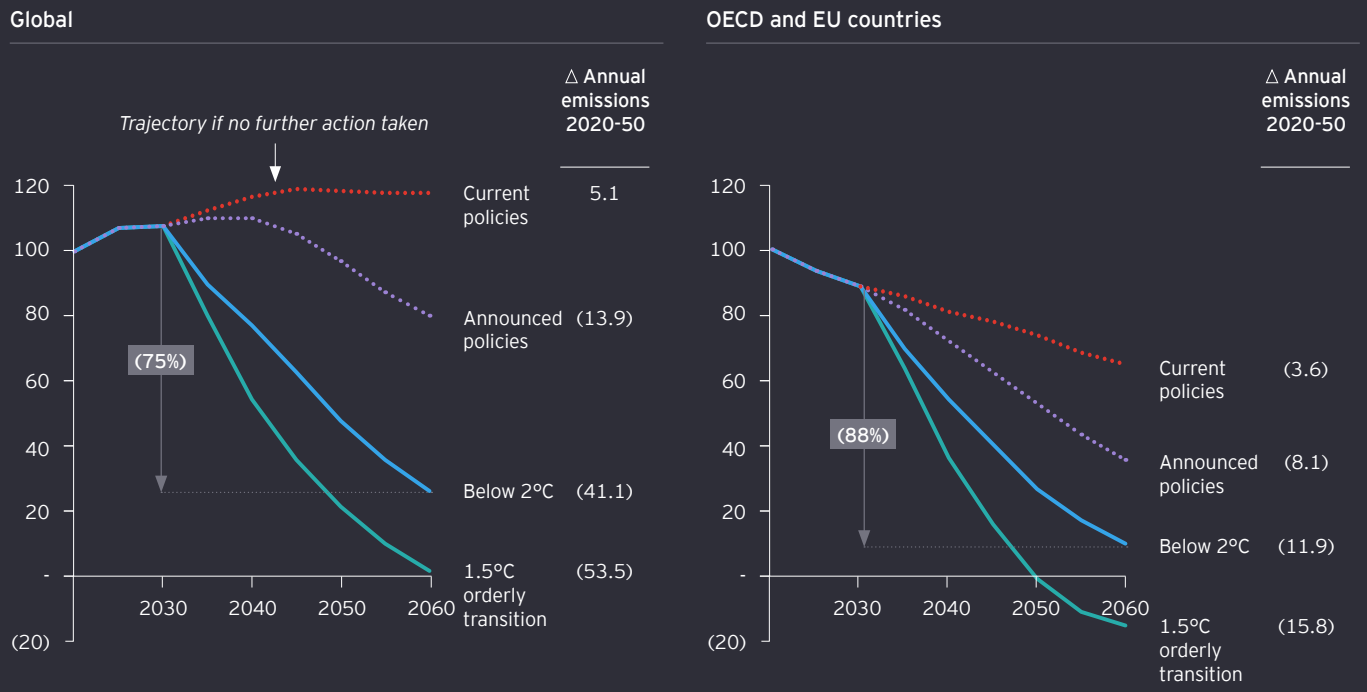
Therefore, alongside the rules and benchmarks set by international agreements and science-based targets, we need a nuanced approach that encourages those organisations and countries that can do more to do more.

Achieving a 1.5°C pathway requires net zero greenhouse emissions globally in the decades after 2050

However, scenarios with the best chance of limiting temperatures to 1.5°C typically involve reducing carbon emissions from fossil fuels and other sources to net zero by 2050, along with deep cuts in methane and other non-carbon emissions.

Exhibit 2: Radical change is required to deliver on Paris commitments – including eliminating emissions in key sectors and ramping up removals of emissions from the atmosphere

Emissions trajectory required across different scenarios (index of net emissions, 2010 = 100)



Dotted lines indicate temperature outcomes well above 2°C, solid lines indicate temperature outcomes consistent with the Paris Agreement and are modelled assuming an orderly transition.

Source: Network for Greening the Financial System, REMIND-MAgPIE model with Net Zero 2050 scenario

Stakeholders expect business to take climate action and to have a credible path to achieving deep emissions cuts

Businesses around the world are under pressure to act on climate change from five sources: governments, customers, shareholders, employees and physical climate risks.

Governments are influencing the business environment through new regulations and actions. Customers and consumers are paying attention to organisations' climate credentials. Investors are scrutinising environment, social and governance (ESG) of investments, and are looking to access new low-carbon opportunities and to minimise transition risks and stranded assets. Employees are increasingly seeking out businesses that align with their values. And last of all, some businesses and households are feeling the physical effects of climate change.

These pressures are increasing as the accumulation of real-world events highlight the consequences of climate change. These factors also influence the context in which governments make decisions. As consensus for climate action grows, businesses that choose not to respond are increasingly likely to have action forced upon them by government, investors and other stakeholders.

Exhibit 3: Stakeholders expect business to act on climate change and decarbonisation

Stakeholder pressures, business risks and ability to directly eliminate emissions will determine the best decarbonisation strategy for each business

The strategic context of emissions reductions is different for each business and is shaped by emissions intensity and stakeholder pressure. This context can be used to identify five default 'decarbonisation postures' as a first step in developing a robust decarbonisation strategy.

Strategy is best grounded in understanding risks and opportunities

The vulnerability and opportunity space of any business depends on two dimensions:

1. **Emissions intensity relative to peers and to substitute products:** This considers how much carbon a business emits for every dollar it earns, relative to other businesses in the same sector. It also considers how the emissions from a sector's products compare to alternatives with lower emissions, such as plant-based alternatives to red meat. Emissions intensity relative to peers contributes to relative competitiveness within an existing sector. The feasibility and attractiveness of substitutes shapes the outlook for an emissions-intensive sector as a whole.
2. **Pressures to decarbonise:** This considers the expectations of key stakeholders, such as governments, customers, investors and employees, and the range of potential responses they might have to commitments and actions aimed at reducing both direct and indirect emissions.

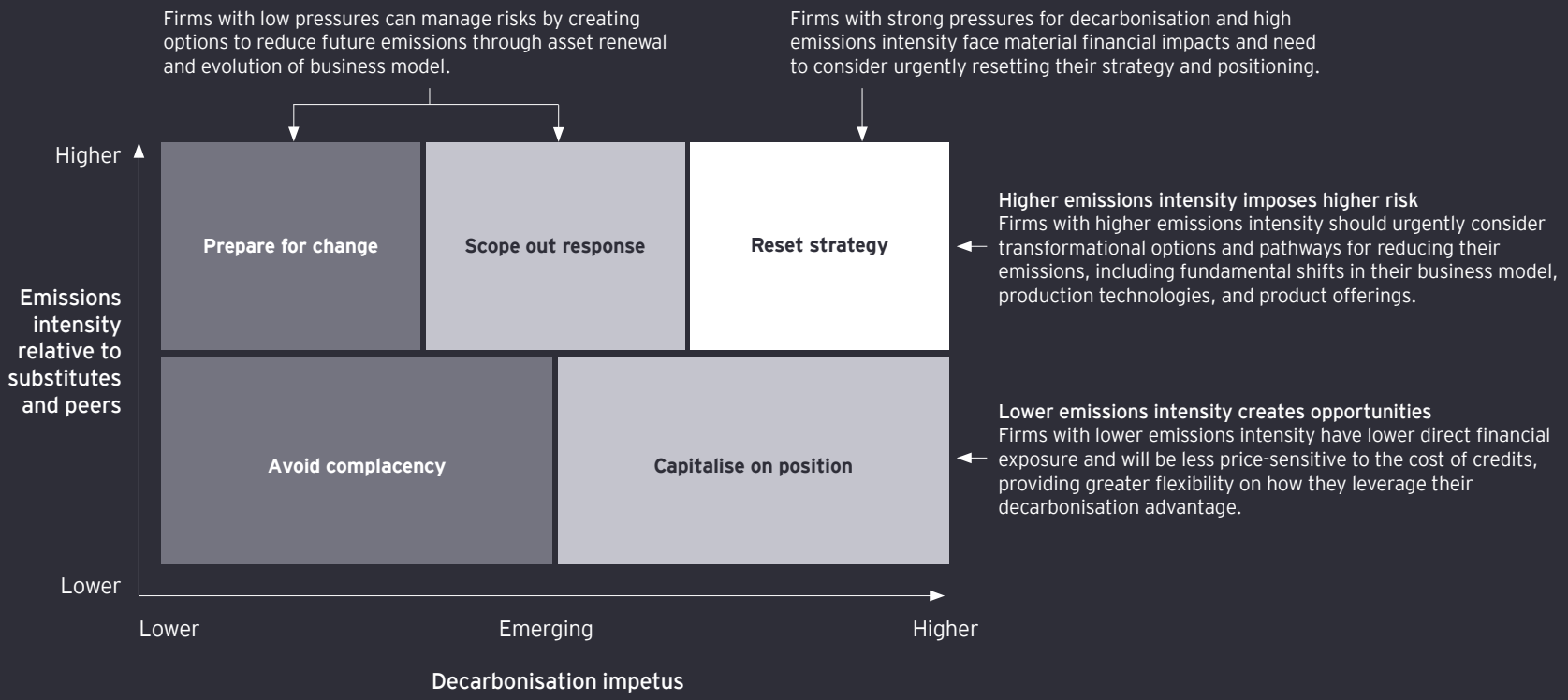
Five general decarbonisation postures provide a starting point for business strategy

Mapping context in this way provides a framework to identify the most appropriate strategic approach to decarbonisation. We suggest this diagnostic gives rise to five stylised carbon postures, summarised in order of advantage:

- **Capitalise on your position where high pressures** create an advantage for businesses with low relative emissions.
- **Avoid complacency**, being conscious that decarbonisation impetus is largely determined by stakeholders (not management) and can change quickly.
- **Prepare for change** by scanning for potential shifts in stakeholder pressure and exploring the merits and costs of decarbonisation options.
- **Scope out your response**, with awareness that the time available for action may be limited (including for announcing new commitments), and that emerging pressures generally imply larger than usual uncertainties about the competitive context of a business.
- **Reset your strategy** and consider substantive actions to reduce emissions intensity, including shifts in business models, production technologies and the set of product offerings.

Exhibit 4: The strategic context of emissions reductions is shaped by emissions intensity and stakeholder pressure

Identifying the default strategic approach to decarbonisation



Source: EY Net Zero Centre analysis 2022[2]

Carbon credits allow earlier and more ambitious commitments, supplementing direct emissions reductions

Carbon credits are an essential part of the toolkit for achieving decarbonisation commitments, and smoothing the net zero transition. Credits can and do enable faster and stronger action on climate. Contrary to fears that credits are used as cover for inaction, the evidence shows that credit users have stronger targets for reducing their own emissions before offsetting than businesses that don't use credits.

Credits allow every business to take climate action

Credits allow organisations to reduce their emissions now through offsets, while they pursue cost-effective action to reduce future emissions through asset turnover and business model evolution. This approach supports immediate beneficial action, while allowing the necessary time to develop and implement more effective and cost-competitive internal abatement strategies.

In the longer term, credits play an essential role in offsetting hard-to-abate emissions from products which lack low or zero emissions alternatives.

Businesses that use credits have stronger emissions targets

This additional flexibility enables businesses to set, and achieve, more ambitious emissions reductions. EY research finds that the largest buyers of voluntary carbon credits have more ambitious targets than average commitments aligned with the *Science-Based Targets* initiative.[4]

Other research finds that companies using credits cut their Scope 1 and 2 emissions by almost twice as much as comparable companies that do not use credits.[5]

Regulation that allows for the use of credits is likely to drive more ambitious reductions than would be politically or technically achievable otherwise.

Exhibit 5: Carbon credits can ease the transition to net zero and balance out hard-to-abate emissions

Two primary uses of carbon credits

	Ease transition timing to net zero	Balance out hard-to-abate emissions
Primary use	Transition role to allow cost-effective abatement through early use of credits to offset emissions, along with increasing reductions in own emissions through asset turnover and evolution of business model	Long-term role to balance out emissions from products that currently lack low or zero emissions technologies or substitutes
Examples	*Transport company reaching net zero before fossil fuel-based assets reach end of life*	*Balancing out methane emissions from meat-producing cattle*
Timing	Transition role is likely to diminish over time	The need to offset emissions that are hard-to-abate is likely to increase to 2040 or 2050

Source: EY Net Zero Centre analysis

Carbon credits support cost-effective action, as well as providing co-benefits of value to stakeholders

Carbon credits give businesses flexibility and control, supporting stronger alignment with their specific needs and competitive position. Analysis by the EY Net Zero Centre and others finds that offsets are essential for cost-effective emissions reductions.

Flexibility supports cost-effective action, and a stronger value proposition

Voluntary supply of carbon credits will remain important as companies aim to better manage their emissions intensity and market positioning. Carbon credits offer flexibility by enabling companies to reduce their emissions cost-effectively and address emissions that are difficult to eliminate directly.

Credits also provide flexibility to match the attributes and wider co-benefits of abatement activities to business needs.

These same co-benefits are often of value to project proponents and the countries and communities that host offset projects.

Exhibit 6 provides a summary of the main determinants of quality, key attributes and major types of co-benefits associated with carbon credits. When sourcing credits, businesses should also consider how to secure units with the desired characteristics, such as location where the credit is produced, and the best way to manage future price risks associated with alternative abatement and offset strategies.

Exhibit 6: Characteristics of carbon credits

Carbon credits give businesses flexibility and control

Determinants of carbon credit quality	Specific attributes of carbon credits	Types of co-benefits
▸ Integrity of accounting and governance including the degree of third-party underwriting ▸ Legitimacy of baseline against which emission reduction or avoidances are measured ▸ Additionality, or probability that emissions reduction would not have occurred without the project ▸ Risk of future release including permanence and length of carbon storage for removals	**Examples of specific features:** ▸ Location of the project that is supplying credits ▸ Vintage or year that the credits were produced ▸ Standard or method that underpins the project/projects and credits	Non-carbon co-benefits can provide additional value to buyers of credits when aligned to brand. **Examples of types of co-benefits:** ▸ Social benefits such as empowerment of under-represented groups, or increased employment opportunities for local people ▸ Economic benefits such as income streams for Indigenous populations ▸ Environmental or sustainability outcomes beyond emissions reductions, such as restoration of native vegetation and biodiversity ▸ Cultural benefits for specific communities, such as traditional farming practices

Source: EY Net Zero Centre analysis

Low integrity credits are untrustworthy – and must be eliminated

Credits must be high quality to deliver genuine emissions reductions, either by avoiding emissions that would otherwise occur or by removing emissions from the atmosphere.

Unfortunately, early use of credits has sometimes fallen short of these standards.

To build stakeholder confidence in the legitimacy of carbon credits as a decarbonisation tool, significant improvements in their quality, integrity and assurance processes are necessary.

We discuss international processes already in train to address these needs (see pp. 19-21 below on how carbon markets will evolve in the coming years).

The cost savings from using credits to complement direct emissions reductions are material

EY Net Zero Centre analysis finds the use of high integrity credits in combination with ambitious internal abatement lowers the cost of decarbonisation by 45%-65% in Paris-consistent scenarios compared to relying on internal abatement measures alone.

Credits offer lower costs, despite accounting for a minority of abatement

Analysis finds that credits support cost-effective abatement across all sectors, not only those with hard-to-abate emissions. Indeed, demand from sectors with lower emissions intensity is crucial to support credit volumes and support climate action in lower-income countries (as outlined below).

Cost savings in Paris-consistent outlooks are larger in the less stringent *Below 2°C* scenario, where credits offer average savings of around 65% relative to achieving the same emissions reduction through internal abatement alone (see Exhibit 7).

Importantly, the analysis finds that these cost savings are achieved despite credits accounting for less than one quarter of abatement effort, with internal abatement delivering more than three quarters of total reductions (see Exhibit 16 on page 40).

Credits provide resources to lower income countries and support removals, as well as cost-effective abatement

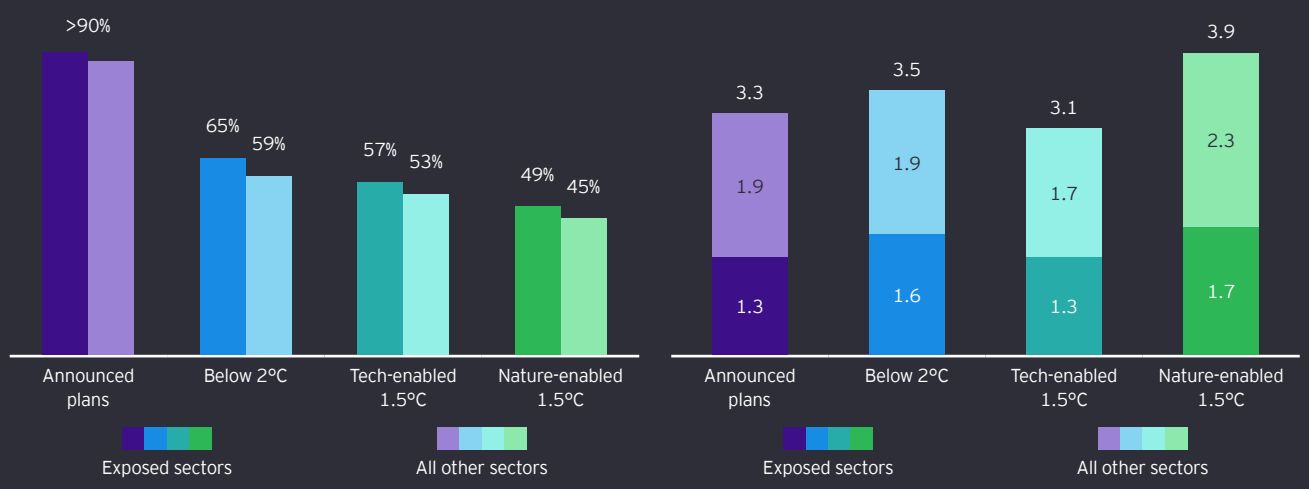
This implies carbon credits have an enduring – and essential – role in supporting decarbonisation and the net zero transition at multiple scales.

In addition, the logic of achieving net zero implies that removals-based credits will become increasingly important for offsetting emissions from products that lack low-emissions or zero-emissions production methods.

More information on our analysis of carbon credit markets is provided in the Appendix.

Exhibit 7: Credits provide substantial cost savings

Using carbon credits cuts decarbonisation costs by over 50% in most scenarios



Please note: Scenarios are defined in more detail on pp.35-36. Lifetime costs and savings assume a 5% real discount rate.
Exposed sectors include steel, aluminium, chemicals and cement producers. Right panel shows total savings at the top of each column.
Source: EY Net Zero Centre analysis

Voluntary commitments provide resources for activities beyond legal obligations that "build a better world" – and society should encourage these good faith commitments

"We need to return to first principles. What is the purpose of a voluntary carbon market? It is to unleash capital that otherwise would not be deployed and drive activities that otherwise wouldn't occur to reduce greenhouse gas emissions overall.

Mathew Nelson
EY Regional Chief Sustainability Officer, Oceania

Scepticism threatens market engagement

Recent scrutiny has cast doubt on the integrity and verification of carbon credits, and the benefits provided to local communities. This has placed additional pressure on organisations, including EY, as they navigate evolving carbon management standards and stakeholder expectations.

While scrutiny is important, EY Regional Chief Sustainability Officer, Oceania, Mat Nelson warns that growing scepticism undermines confidence. Many companies are now unwilling to engage in voluntary carbon markets, he says. "The alternative to action isn't more progress; it's inaction."

"There are flaws in voluntary carbon markets that must be addressed. But the debate has shifted from how we fix the problems to whether we should have voluntary carbon markets at all. This misses the point of their purpose." Mat suggests a new perspective on the purpose of voluntary carbon markets: "Does it unlock capital that otherwise would not be deployed?"

Voluntary projects typically deploy capital from developed to developing regions. However, several factors now impede this capital flow. "Carbon removal is preferable to avoidance, but we also need to halt deforestation. Investing in projects that protect endangered habitat, support local communities and reduce greenhouse gas emissions should be seen positively."

Focus on co-benefits can accelerate voluntary action

The role of co-benefits plays an important role in the value of voluntary action. "Companies are willing to pay a premium when they can highlight qualitative co-benefits, especially those that benefit developing communities. The socio-economic impacts of these projects are real and significant."

Given the essential role of carbon credits in avoiding dangerous climate change – and supporting a just transition – the challenge is to address current shortcomings while supporting the distinctive contributions of voluntary credit supply. This includes the benefits to host communities and countries.

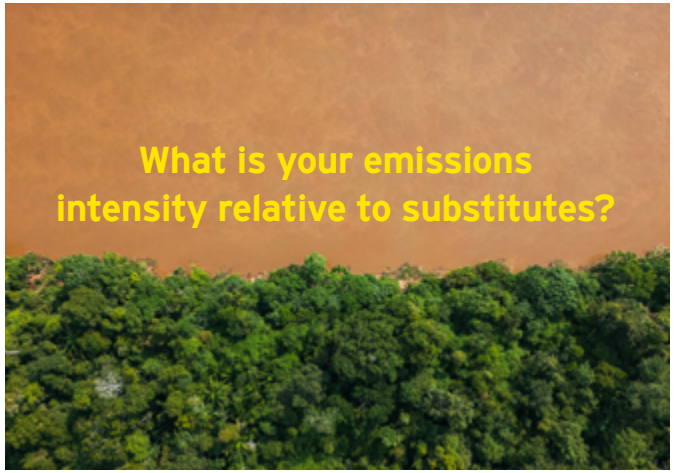
Market infrastructure and a degree of pragmatism are required

Work is required to improve the way the market functions. Pricing structures are often opaque, transaction costs high and verification pathways inconsistent. "But if costs are too high or the reputational risks too large, companies won't participate."

EY is now undertaking additional on-the-ground due diligence before purchasing offsets, and Mat believes more companies will adopt this approach. "But it adds another layer of cost as most projects are in remote locations."

Charting a course for voluntary carbon markets will require a "degree of pragmatism," Mat says. "We won't meet the Paris Agreement targets without them, so we have to make them work."

The best use of credits will be shaped by the same factors as a robust decarbonisation strategy: business exposure, desired pace of change and direct abatement opportunity



Seek to understand your emissions profile now and into the future under different outlooks. How will emissions intensity change over time? What are the key decision points and options, including in relation to equipment and asset life, and to the evolution of your organisation's product offering and business model? How does this compare to peers and competitors, and to global leaders in your sector? Think broadly about current and potential substitutes for the goods and services you offer.

Issues to consider:

- Potential financial exposure across different outlooks for the cost of credits and the volume required
- Desired balance between internal emission reductions versus use of credits over time

Seek to understand the underlying drivers of stakeholder attitudes and their implications. If these pressures are not yet immediate, it is useful to consider the potential pace of change, and possible triggers or tipping points that could increase or decrease the pressure to act.

Issues to consider:

- Extent and nature of constraints to using credits to reduce emissions intensity
- Potential importance of specific co-benefits or attributes to brand and market positioning

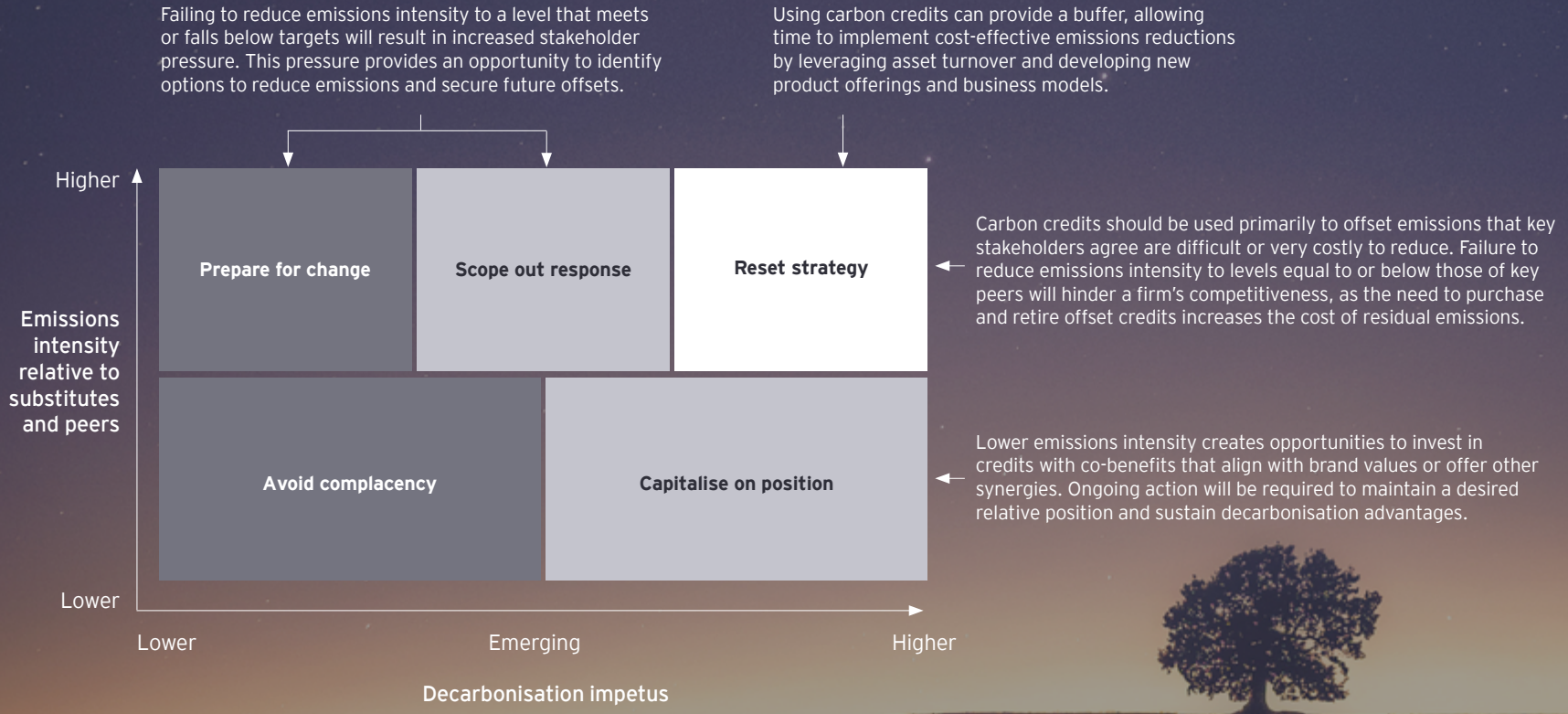
Seek to identify the most salient types and sources of emissions (including attitudes towards Scope 3 emissions). How well does your asset lifecycle align with the desired timeframe for reducing emissions? To what extent do technology solutions exist for your organisation's main sources of emissions?

Issues to consider:

- Cost and technical feasibility of internal abatement options
- Access to credits that meet business needs (including quality, supply timeframe, likely cost, alignment, co-benefits)
- Mechanisms or strategy for securing credits

Exhibit 8: The role and contribution of carbon credits

Carbon credits should be aligned to a sound decarbonisation strategy

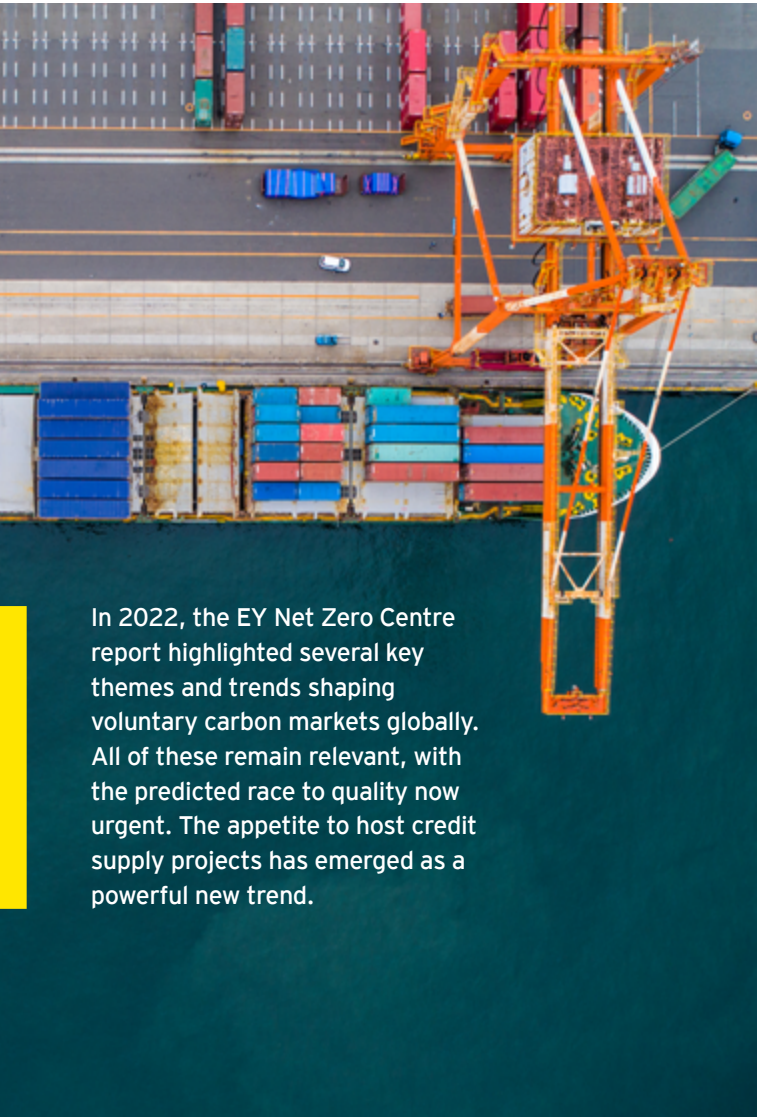


Source: EY Net Zero Centre analysis

Evolving

Voluntary credits and markets need a step change in social licence and scale to fulfil their role and survive

The fundamental drivers for carbon credits have not changed since 2022



In 2022, the EY Net Zero Centre report highlighted several key themes and trends shaping voluntary carbon markets globally. All of these remain relevant, with the predicted race to quality now urgent. The appetite to host credit supply projects has emerged as a powerful new trend.

An accelerated race to quality

The first and most pressing theme was the race to quality. The report emphasised that the legitimacy of carbon credits was dependent on their quality, and this imperative now overshadows all other concerns in the market. Ensuring high quality of credits and robust verification processes is now the cornerstone of stakeholder trust and market credibility.

Clear, trustworthy standards

The second key theme in 2022 was the urgent need for clear, trustworthy standards to improve transparency and consistency across all carbon markets. Since then, several UN-backed initiatives have emerged, although most are still in train. These initiatives are essential for guiding market participants and reinforcing the reliability of carbon credits.

Scale, underpinned by financial infrastructure

A third significant point was the challenge of achieving efficient scale. This challenge is being addressed by the Global Carbon Market Utility (GCMU), which is currently establishing the necessary infrastructure to enable financial intermediaries, like banks and insurance companies, to enter the voluntary carbon market. Projects to improve data transparency and management, establish consistent approaches to contracts, audits, verification and dispute resolution are now underway.

Voluntary demand driven by regulation

Typically, most businesses using voluntary carbon markets are not subject to climate-based regulation, and offsets only have minimal crossover. However, the 2022 report predicted that tighter national emissions budgets would lead to increased demand for voluntary carbon credits, as stricter emissions cuts become more costly. This, the report outlined, would lead to greater connectivity and overlap between voluntary and compliance aspects of carbon markets. The first signs of this trend are now evident, with businesses giving more attention to using voluntary credits to achieve climate and sustainability goals as a result of new compliance obligations, including in relation to disclosure. The EY Net Zero Centre now predicts that regulation will play a crucial role in maintaining a level playing field.

A sharper focus on host communities pursuing scale and fair benefit sharing

One notable shift has occurred since 2022: growing interest from Global South countries in participating in the supply of carbon credits and ensuring they receive a fair share of the benefits. This development is being supported by the practical application of Article 6 of the Paris Agreement, which promotes international cooperation in achieving climate goals.

Nature-based solutions on the horizon

Finally, the 2022 report highlighted the potential for long-term carbon removals through nature-based solutions, particularly after 2030. While we stand by this prediction, concrete evidence for this shift is yet to materialise. However, the groundwork is being laid, and we expect the role of nature-based solutions to expand in the years ahead.

> We are at a point of high uncertainty. I don't think the voluntary carbon market will disappear. There will continue to be significant activity and companies will use offsets to reach targets. That said, I am very sceptical about the bullish projections about the likely scale of a purely voluntary market.

Rob Bradley
Managing Director, Climate Change and Sustainability Services, Ernst & Young LLP

The voluntary market is at a turning point

Net zero has become the 'new normal'

By the end of 2023, more than half of the world's biggest companies had set net zero targets, according to the Net Zero Tracker.[6] This is an "incremental but important" factor driving demand in voluntary carbon markets and forms the essential "bedrock" of market activity, says Rob Bradley, Managing Director, Climate Change and Sustainability Services, Ernst & Young LLP.

… but carbon credits have not yet earnt their social licence

Despite growing demand, significant policy and philosophical divisions impede progress: debate between carbon removal and avoidance; preference for nature-based or technology-based projects; and the equitable distribution of benefits to local communities.

Addressing integrity concerns will also require better and more rigorously enforced standards, to avoid arbitrary restrictions on the use of carbon credits.

Article 6 provides the foundation, but progress is slow

A key development in addressing these challenges was the ratification of Article 6 – the Paris Agreement's rules governing carbon markets – at the COP26 climate summit in Glasgow in 2021. Article 6 establishes the structure and framework that underpin the legitimacy and operation of voluntary carbon markets.

However, progress on Article 6 has been slow; countries were unable to reach consensus on draft texts at COP28 in Dubai in 2023. "Some countries have in-principle objections to offsetting which makes agreement on Article 6 very difficult," Rob notes.

… and will drive new attention to regulation and oversight of credits

Looking ahead, Rob expects governments to begin questioning the rationale of allowing voluntary markets to operate independently, what oversight is appropriate, and whether supply should be subject to taxation or royalty payments. Some governments may assume sovereignty of significant sites, which "may achieve the spirit of the voluntary market but will change its structure significantly."

More broadly, carbon is "a proxy" that indicates how effectively the world addresses climate change by transitioning away from fossil fuels. "There are those that hope carbon will be commoditised, where once you have printed a carbon credit you don't care where it has come from. I don't think that day will ever come. Other attributes of voluntary carbon credits are also vitally important to the narrative and value proposition - like the role they play in enriching communities, protecting vital ecosystems and conserving water."

The international community is laying the foundations for carbon credits that can be supplied, traded and used with confidence

The need for better quality is driving several international initiatives aimed at the supply, use and trade of carbon credits. These initiatives will address shortcomings and strengthen confidence over time.

VCMI will underpin high quality supply while ICVCM deals with appropriate use

The Voluntary Carbon Markets Integrity Initiative (VCMI) and the Integrity Council for the Voluntary Carbon Market (ICVCM) are making progress. VCMI is establishing principles and frameworks for high-quality carbon credits, while ICVCM aims to enhance the overall efficiency and effectiveness of the voluntary carbon market on an international scale.

… while mandatory climate disclosures will illuminate relative business performance …

The International Sustainability Standards Board (ISSB) published its first global sustainability reporting standards in 2023. These standards are now being adopted around the world. IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information and IFRS S2 Climate-related Disclosures will provide investors, regulators and the public with clearer insights into the climate-related strategies and risks faced by individual companies. This increased transparency will not only enhance accountability but also enable a more informed comparison of performance, increasing incentives for businesses to accelerate their efforts to reduce emissions.

… and the GCMU seeks to lay the groundwork for consistency and scale

Meanwhile, the Global Carbon Market Utility (GCMU) is looking to operationalise consistency.

Mike Zehetmayr, EY Area Sustainable Finance Technology and Data Leader, EMEIA, sees this playing a crucial role: "We need to recognise the importance of translating principles into operational and data standards, so all parts of the carbon market can align. Along with VCMI and ICVCM, the GCMU is looking to address this gap in the market which will enable critical capital flows.
We need to remove up to a billion tonnes of carbon a year. Trillions of dollars of climate finance must be deployed. But businesses seek standardised market practices, transparent data, clear regulatory frameworks and financial intermediaries to deploy this funding and stand behind industrial scale-removal."

These initiatives will strengthen confidence in the supply, trade and use of credits … but laying the foundations will take time.

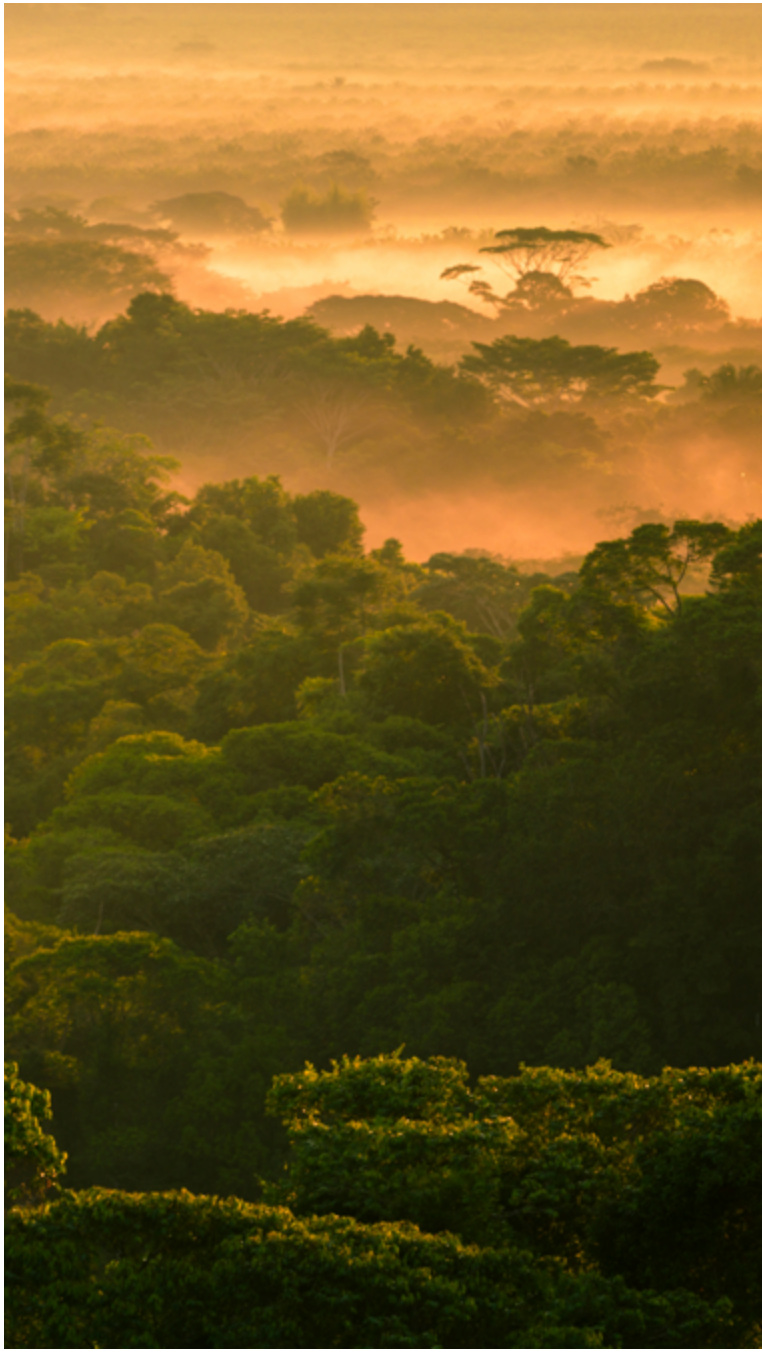


Exhibit 9: The carbon credit value chain, from project development to final purchase, is a complex ecosystem

The carbon credit value chain involves multiple players

Carbon credit value chain	Origination	Trade	End use
Primary stakeholders	Offset project developer	Trading and brokerage	End buyer (own use)
	Carbon credit standard organisation		Re-seller (secondary market)
Other actors and service providers	Registry services	Clearing houses	Emissions reporting
	Third party audit and assurance		Third party audit and assurance

Commentary:

Project developer
- Originator and issuer of carbon credit after third party validation
- Equity owners of carbon offset project

Carbon credit standard/scheme
- Sets standards for offset quality, certification and credit issuance

Registry services
- Registry of information to track projects and issued credits, generally linked to standard or exchange

Third party auditors
- Audit and verification of emissions

Trading and brokerage
- Trade through (1) direct sale to buyers, (2) Exchanges, (3) over-the-counter (OTC) brokers

Clearing houses
- Settlement of cash and change of ownership of credits in registry

End buyer
- Individual, company or government stakeholders, either compliance buyer or voluntary buyer
- Purchase credit to offset own emissions by retiring credits

Re-seller
- Purchase credits for resale in the secondary market

Emissions reporting
- Account for Scope 1, 2 and 3 emissions as required

Source: EY Net Zero Centre analysis

International and domestic regulations are re-emerging as a crucial demand driver for voluntary credits

> “If the EU stays on pace, we can expect to see a material increase in prices in the voluntary carbon market. Most manufacturers selling into the EU don’t yet understand the real dollar impact, but Singapore’s carbon tax gives an indicator of future price increases.

Arina Kok
EY Area Climate Change Advisory Leader, Asia-Pacific, Partner, EY Malaysia

Regulatory incentives cut across national borders

The “CBAM Effect” – a response to the European Union’s Carbon Border Adjustment Mechanism (CBAM) – is prompting countries outside the EU to reconsider their regulatory approaches to carbon offsets.

According to Kasia Klaczynska Lewis, a professional in emissions trading and sustainable finance with the EY Center for Climate Policy, companies exporting to the EU must re-evaluate their use of offsets to meet CBAM requirements. Effective from 2026, CBAM aims to prevent ‘carbon leakage’ by pricing emissions associated with carbon-intensive imports, protecting EU producers from competition with cheaper, less regulated imports.

CBAM provides an incentive for jurisdictions with emissions-intensive exports to consider establishing their own carbon prices or markets. It is also likely to encourage companies outside the EU to explore the extent to which voluntary credits can be used to meet CBAM requirements.

Arina Kok, EY Area Climate Change Advisory Leader, Asia-Pacific, expects CBAM and ISSB climate disclosures to have the biggest impact on voluntary carbon markets in the next few years. “If there is no delay with the introduction of CBAM, then we will see material carbon price increases. If there is no motivation through a carbon levy, then change will happen at a slower pace.” CBAM will influence the Asian region’s steel, aluminium and fertiliser manufacturers in the short-term, many of whom are now looking at internal carbon pricing and nature-based solutions, Arina adds.

New local carbon taxes can be partly met through voluntary credits

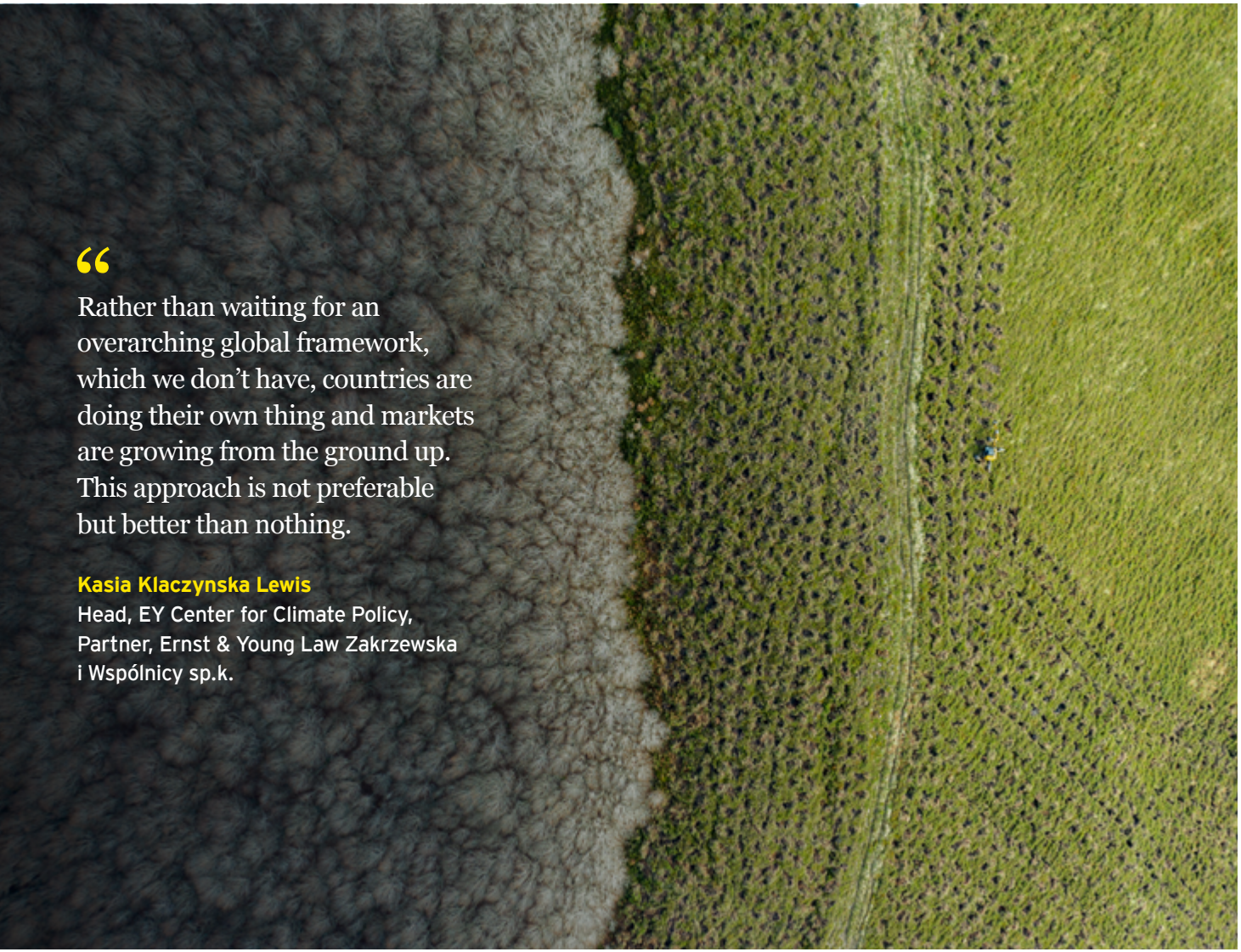
The evolution of jurisdiction-level carbon taxes are a valuable indicator of the pricing pressures and market dynamics ahead for voluntary carbon markets.

Singapore: Introduced in January 2019, Singapore’s carbon tax set a S$5 per tonne of CO_2 equivalent, which covered around 80% of the country’s total greenhouse gas emissions from its top 50 emitters. The tax rate increased to S$25 per tonne in January 2024, with a future target of S$50-80 per tonne by 2030. Companies subject to this tax can offset up to 5% of their taxable emissions using carbon credits. (Thailand is set to follow Singapore’s move with a carbon tax expected to be introduced in 2025.)

Taiwan: Carbon pricing regulation was introduced in December 2023, with companies able to use credits from voluntary offset projects to reduce their taxable emissions by up to 10%. Taiwan stands out for its progress in implementing recommendations from the Taskforce on Nature-related Financial Disclosures, positioning it as a market to watch.

South Africa: After introducing a carbon tax in June 2019, South Africa’s government allows companies to partially fulfill their obligations through voluntary carbon credits market. Up to 10% of taxable emissions can be covered by credits, encouraging activity in South Africa’s voluntary carbon market.

Markets are not yet converging on allowable sources, uses and requirements for carbon credits



> “Rather than waiting for an overarching global framework, which we don’t have, countries are doing their own thing and markets are growing from the ground up. This approach is not preferable but better than nothing.

Kasia Klaczynska Lewis
Head, EY Center for Climate Policy, Partner, Ernst & Young Law Zakrzewska i Wspólnicy sp.k.

Carbon credit supply chains and markets are fragmented

Voluntary carbon credit markets are currently highly fragmented, characterised by large numbers of buyers and sellers with different needs and value propositions. Credits are administered by schemes, and sold through exchanges, or through traders and brokers.

Most credits are linked to specific supply projects. Third-party auditing provides verification and validation. Exchange-based products are now emerging which pool credits from a single carbon standard that meet specific criteria, such as vintage (the year of creation) or types of co-benefits, to provide more liquid and predicable ways to access carbon credits.

Regulation also varies across jurisdictions

Every government is pursuing its own regulatory path to shape the future of voluntary carbon markets and offset projects. However, policy approaches are “extremely fragmented,” making voluntary carbon markets “highly complex to navigate,” says Kasia Klaczynska Lewis.

Countries continue to introduce legislation, drawing on international experience. “When I advise governments on how to set up their own schemes, the most common question I encounter is: ‘What are other countries doing?’” This suggests harmonisation is possible, Kasia notes, but “we are seeing country-driven, not UNFCCC-driven process, which creates complexity and fragmentation.”

Carbon market architecture will continue to evolve

Over time, as national emissions budgets tighten, governments are likely to impose more stringent regulatory requirements on businesses, particularly in advanced countries. This will reshape voluntary credit markets.

Evolving use of credits will have implications for market architecture

Fundamentally, tightening emissions budgets will blur the current distinction between voluntary and compliance markets for carbon credits. This is because businesses will increasingly rely on the voluntary supply of high-integrity carbon credits (often created in other jurisdictions) to meet regulatory obligations, especially after 2035.

This will create new challenges for registry functions responsible for tracking, verifying and managing carbon credits. To preserve system integrity, stakeholders will want confidence that credits are not double counted, and that a credit generated by a project is only used once.

Accounting and acquittal arrangements must recognise various commitments and obligations:

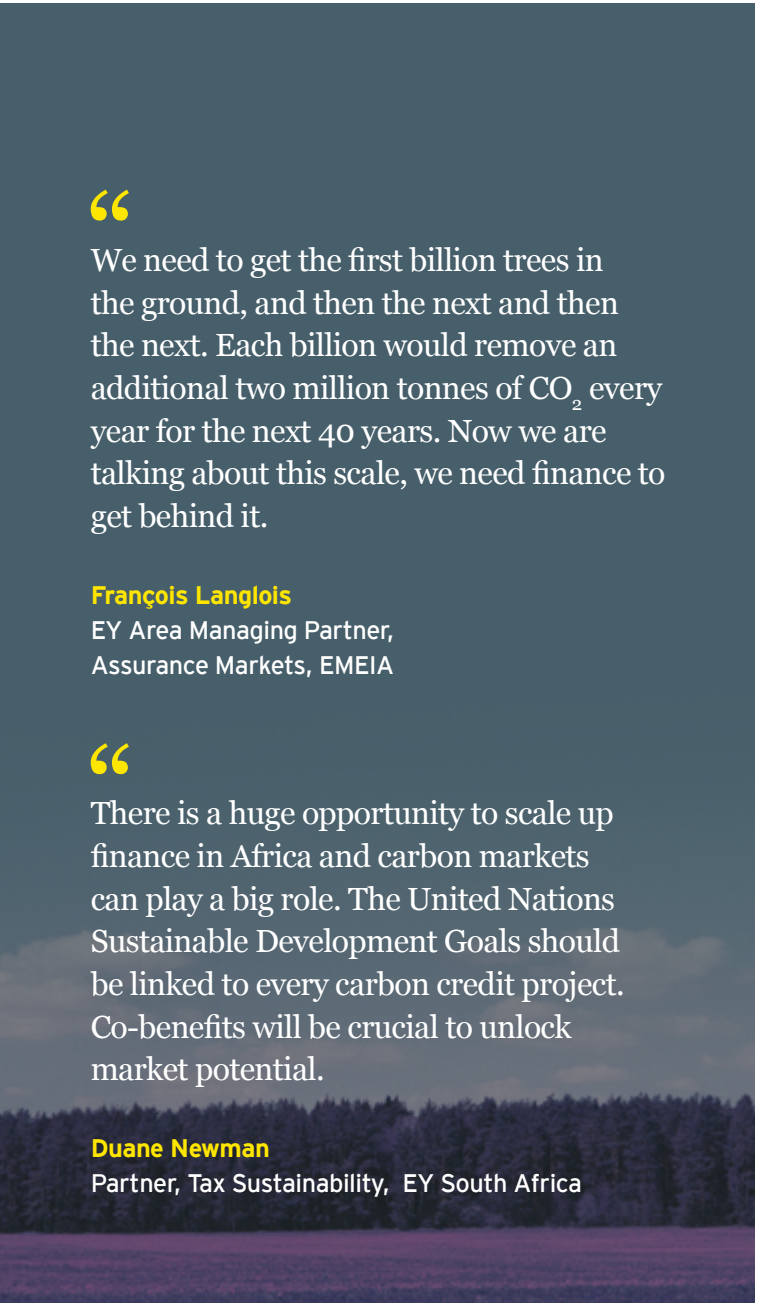
- National government commitments covering all emissions sources and sinks within their jurisdictions, adjusted for trade or reallocation consistent with Article 6 rules.
- Commitments by, and obligations of, businesses and other organisations for their direct (Scope 1 and 2) emissions.
- Commitments by businesses and other organisations for emissions generated in their supply chain (Scope 3) and total net emissions, which may include Scope 1 and 2 emissions from other organisations or offsets created and sold by third parties.

Exhibit 10: The biggest challenge will be to ensure rules and standards evolve to support confidence and transparency, while avoiding unnecessary cost and restrictions

Market impacts of increasing compliance requirements will be shaped by multiple factors

Underlying driver	Consequence	Countervailing pressures	Impact and market outcome
Compliance requirements on businesses will increase	Increased compliance requirements may crowd out the space for voluntary commitments	Desire for flexibility and control will maintain support for voluntary supply and non-government intermediaries	Units created and supplied on a voluntary basis will increasingly need to be used for compliance requirements, as well as supporting voluntary demand
		Achieving net zero will require removal-based credits, which will be almost entirely from discretionary supply	Total volume of credits traded will continue to be large in absolute terms
		Desire for market differentiation will drive voluntary demand for credits and associated co-benefits	Units may need to be recorded in multiple registries, without double counting, particularly where used to acquit national regulatory requirements
		Integrity imperatives will encourage registries to develop and operate within a coherent global framework	Registries and compliance obligations may become localised by jurisdiction

Source: EY Net Zero Centre analysis



> We need to get the first billion trees in the ground, and then the next and then the next. Each billion would remove an additional two million tonnes of CO_2 every year for the next 40 years. Now we are talking about this scale, we need finance to get behind it.

François Langlois
EY Area Managing Partner,
Assurance Markets, EMEIA

> There is a huge opportunity to scale up finance in Africa and carbon markets can play a big role. The United Nations Sustainable Development Goals should be linked to every carbon credit project. Co-benefits will be crucial to unlock market potential.

Duane Newman
Partner, Tax Sustainability, EY South Africa

Host countries and communities are pursuing the benefits offered by carbon projects

Carbon markets are beginning the transition from a cottage industry to an industrial powerhouse

Work is underway to help African economies unlock billions for their communities. The Africa Carbon Markets Initiative (ACMI) was launched in November 2022 at COP27. Its goals include producing 300 million carbon credits annually by 2030, attracting US$6 billion in revenue and supporting 30 million jobs.

ACMI, rolled out in partnership with the United Nations Economic Commission for Africa, provides structure and a platform for dialogue, says Duane Newman. An EY Tax Sustainability Partner in South Africa, Duane is actively assisting NGO, government and private clients through the carbon credit value chain.

Article 6 of the Paris Agreement introduces Internationally Transferred Mitigation Outcomes (ITMOs) and offers a structured process for cross-border carbon credit transfers, he says. "The global banking sector is starting to take note of the size of the market in Africa" and Duane suggests the market is being mainstreamed with huge growth potential.

Despite lofty goals, on-the-ground action is moving slowly. Legislation is patchy, agreements sometimes poorly structured and taxation often prohibitively high and uncertain.

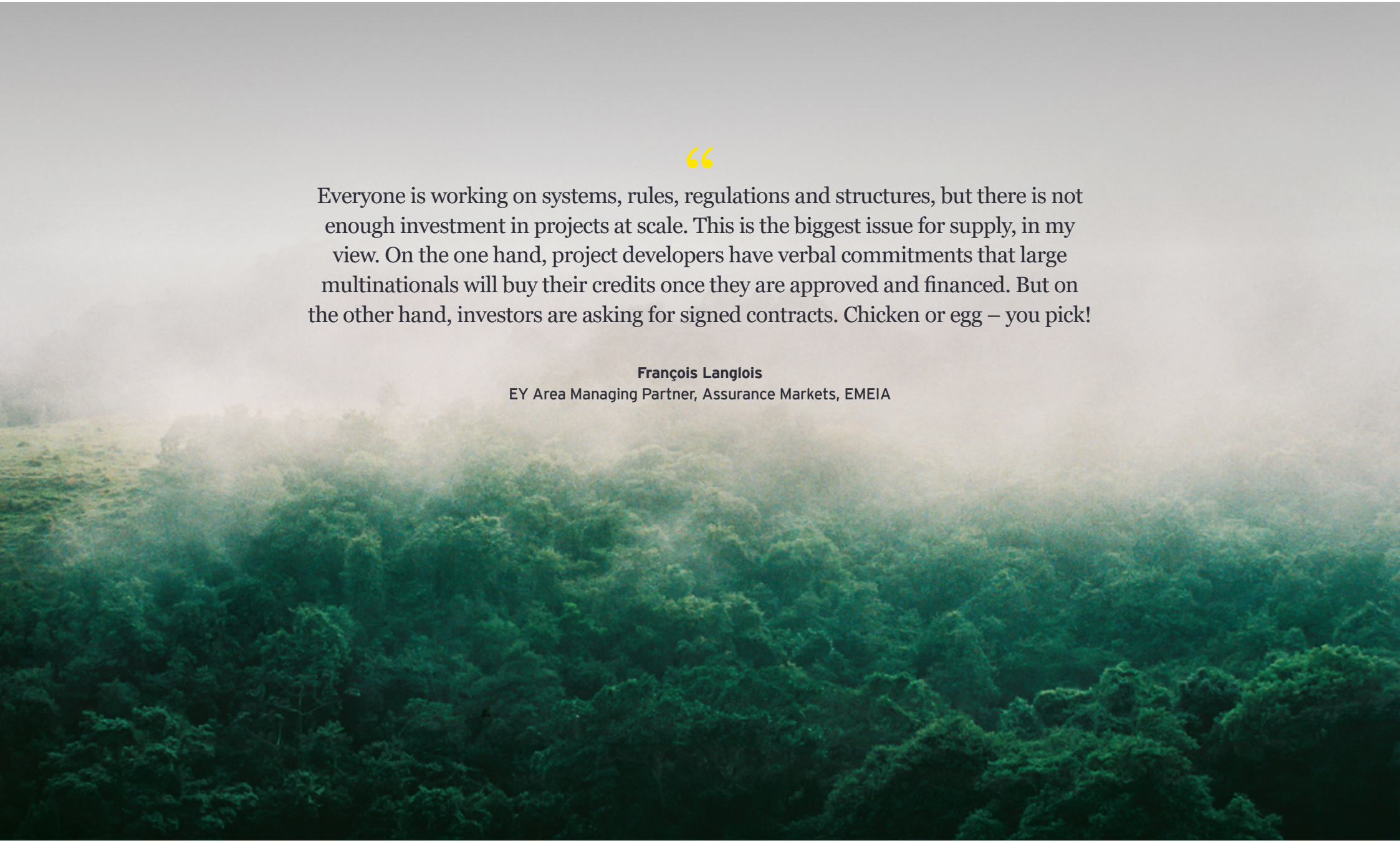
Supplying carbon credits could become a major industry, providing substantial benefits to host communities

François Langlois, EY Area Managing Partner, Assurance Markets, EMEIA, is passionate about the opportunities for voluntary carbon markets to further the UN's Sustainable Development Goals.

"The carbon market could be the number one industry for most African nations, overtaking every other industry and creating millions of jobs if we set this up right. The benefits – better health, better education, better everything – are enormous."

The scale of the opportunity also brings risks, and policy makers are paying attention.

African countries have legitimate concerns about "green grabs," reflecting historical experiences with colonisation, and it is crucial that environmental initiatives do not repeat past patterns of exploitation and inequity. Some governments "understand what they need to do to make themselves attractive to OECD countries" and "slowly but surely are building their capability."



> Everyone is working on systems, rules, regulations and structures, but there is not enough investment in projects at scale. This is the biggest issue for supply, in my view. On the one hand, project developers have verbal commitments that large multinationals will buy their credits once they are approved and financed. But on the other hand, investors are asking for signed contracts. Chicken or egg – you pick!

François Langlois
EY Area Managing Partner, Assurance Markets, EMEIA

Carbon and non-carbon benefits must be real and able to be demonstrated

The success of voluntary carbon markets depends in part on fair distribution of benefits. This is vital for host countries and communities, and for the businesses that purchase credits.

Delivering local benefits creates a virtuous circle that supports project outcomes

A growing number of governments in Global South countries recognise the potential for carbon markets to provide revenue streams and social benefits to local communities.

The projects that return a fair portion of credit values to host communities are likely to be the most successful, as these communities are incentivised to take care of their asset.

As François Langlois notes, "the forest living and standing is worth a lot more to these communities than the denuded land or the harvested raw materials, provided the benefits are shared."

This will inevitably mean revenue flows to governments, but Duane Neman says, "more money will also flow to communities as custodians of projects – and I think getting the co-benefits right will be the key to unlocking these markets."

Developing regulation and measurement frameworks can be difficult

The Taskforce on Nature-related Financial Disclosures could be a significant driver for voluntary carbon projects. Malaysia, where 55% of total land area is covered by forest, is an instructive example. Malaysia lacks a carbon tax system, and nature-based credits priced at around US$1.50 struggle to motivate climate-positive forest investment.

Forest management in Malaysia is decentralised and primarily governed by state authorities that rely on logging as a source of income. The immediate economic gains from timber extraction frequently overshadow the long-term benefits of preventing deforestation or reforesting areas that were previously logged.

However, Malaysia's first nature-based carbon offset project, the Kuamut Rainforest Conservation Project, achieved its first verification in March 2024. This protects and restores 83,381 hectares of tropical forest in Sabah. How this project will demonstrate the wider value of nature-based offsets, such as benefits to biodiversity, social wellbeing or emissions reduction, is yet to be seen.

However, clarifying and demonstrating those wider benefits is crucial to advancing voluntary markets.

Scaling up requires a new market architecture to support investible carbon commodities with diverse attributes

> “Most organisations today want to buy a tonne of carbon, because that is what they want to offset. This should be the same as buying a tonne of nickel or a kilowatt hour of electricity. For this to happen, financial intermediaries need to be willing to intermediate between carbon removal projects, that should be treated as an extractive industry, which need capital investment to extract atmospheric carbon and provide liquidity into the market with provision of tonnes of carbon as a commodity. Adopting the existing pattern for other commodities markets will support the development of a transparent, liquid, orderly and efficient carbon market.
>
> **Mike Zehetmayr**
> EY Area Sustainable Finance Technology and Data Leader, EMEIA, Partner, Ernst & Young LLP

Standard weights and measures have always been foundational to trade

Hundreds of thousands of businesses are committed to the net zero transition and are prepared to invest. But voluntary carbon markets can only work efficiently if these companies can buy a tonne of carbon.

The world’s carbon debt is at such a scale that it must be matched by “industrial scale” removals, says Mike Zehetmayr, EY Area Sustainable Finance Technology and Data Leader, EMEIA. That carbon removal must be underpinned by a functioning and efficient carbon market. Mike describes the current voluntary carbon market as being “disorderly.” It is not really a market, but “a value chain of people with good intent.”

We need a high integrity voluntary carbon market where all participants have confidence in the atmospheric impact of reducing greenhouse gas emissions. Existing market structures can be used to build this confidence, direct capital flows and create an orderly market.

A tonne must be a tonne

“A carbon credit represents a future commitment to remove carbon. Instead, we should treat carbon as a tangible commodity that has a verified impact on the atmosphere.” Projects should be audited to confirm their actual carbon removal, and only then would carbon credits be issued.

A comparison with the oil industry is instructive. In the case of an oil well, an auditor will apply S&P Global Platt’s model, an established and trusted methodology, to assess, validate and certify the energy reserves. These validated reserves are then recorded on the company’s financial balance sheet. “We don’t do this for carbon removals – and we should,” Mike says.

Transparent data and processes are also essential to mobilising capital

Transparent data and standardised processes are essential for financial markets to function effectively. Transparent data builds trust and supports informed decision-making, reliable pricing and robust risk management. Standardised processes for trading, reporting and auditing ensures all market participants operate under the same rules.

The bottom-up evolution of the voluntary market has encouraged the growth of competing standards and processes, rather than convergence on a single universally-accepted approach. As a result, Mike says, “existing arrangements generally operate like the private equity market; the buyer carries all the risk without the benefit of auditing or standardisation.” Without a consistent way to measure, report or verify carbon credits, financial intermediaries, such as investment banks and brokers, are hesitant to participate.

The primary task of carbon offset projects is to avoid emissions or remove carbon from the atmosphere. This essential and necessary foundation can be treated as a commodity.

However, to harness the full value of voluntary credits, we need effective mechanisms in place. These mechanisms should assess and demonstrate specific attributes, such as project location, as well as broader non-carbon benefits like nature repair and community empowerment. Any claims should be able to verified, but it will not always be necessary or useful to seek to ‘commodify’ these aspects of carbon credits.

Progress towards net-zero emissions will require greater weight to removals credits in the future

Tightening emissions budgets, combined with falling technology costs, will influence the mix of credits and encourage greater use of credits for carbon removal projects over coming years and the longer term.

Tighter emissions budgets will drive a shift towards removals-based credits

Changes in technology costs and policy context will continue to shift baselines for offset projects and make it harder to create credits based on avoided emissions, increasing the role of removals-based credits.

This is important because avoidance-based credits dominate current supply and use of carbon credits globally. In 2020, avoidance-based credits accounted for more than 80% of all credits issued and more than 90% of all credits used (or retired) across the four largest voluntary standards and registries: Climate Action Reserve; American Carbon Registry; Verified Carbon Standard; and Gold Standard.

Many early credits were created through projects that avoided emissions by establishing new renewable electricity generation to replace gas or coal-fired generation. The emission reductions from these projects were judged additional because using wind and solar would not have been commercially viable without credit revenues.

However, wind and solar projects are now commercially attractive without credit revenues in many markets. Where this is the case, wind and solar generation becomes the 'baseline' and these projects no longer meet the additionality criteria for generating offset credits.

Policy context is also relevant. As national commitments become more ambitious, the context of what constitutes a 'business as usual' scenario also changes. For example, a light rail and electric bus service may be eligible but earn fewer credits because the baseline assumes greater uptake of electric road transport in line with global trends.

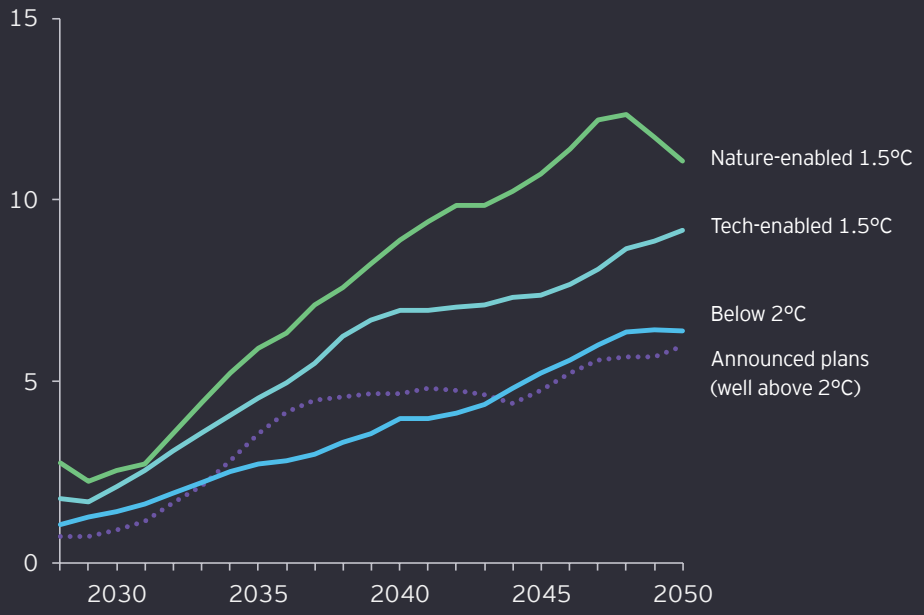
Consistent with this, the Net Zero Centre analysis projects removals credits will increase to 3-6 times current levels by 2035, and to 6-12 times by 2050, in Paris-consistent scenarios (see Exhibit 11).

Exhibit 11: Removal credits are essential in net zero scenarios

Projected volume and contribution of removal-based credits

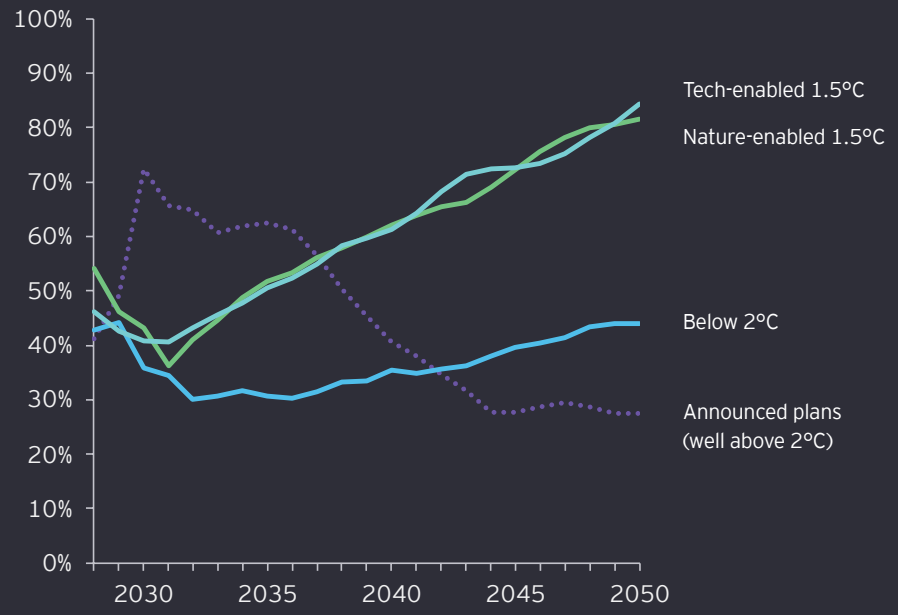
Removal credits retirement, 2028-2050

Relative to total voluntary credit retirements in 2023



Share of annual retirements from removals, 2028-50

Percentage



Source: EY Net Zero Centre analysis

Achieving large-scale carbon removals will be challenging, and the outlook for removals is uncertain

Technologies that permanently remove carbon from the atmosphere will be an essential part of humanity's long game to limit the extent and impact of climate change.

The outlook for large-scale carbon removal is uncertain

However, it is still unclear which technologies will be viable, which approaches to funding will be considered attractive, and what scale of deployment will eventuate.

Planting trees (or reforestation) is a well-established approach but can compete with other land uses, such as with food production. Restoring ecosystems and other nature-based solutions offer a range of valuable non-carbon co-benefits (including cultural benefits for Indigenous people) but require greater expertise and more careful governance. Ultimately, the volume of credits generated by land and nature-based solutions will be constrained by the availability of suitable land and other natural resources.

While there are many options for technology-based removals, none are currently well demonstrated or financially attractive. The two most common large-scale removal technologies explored in climate modelling and policy literature are Bioenergy with Carbon Capture and Storage (BECCS), which requires land to produce short rotation energy crops or other forms of biomass, and Direct Air Capture (DAC). Neither of these technologies has been demonstrated at scale.

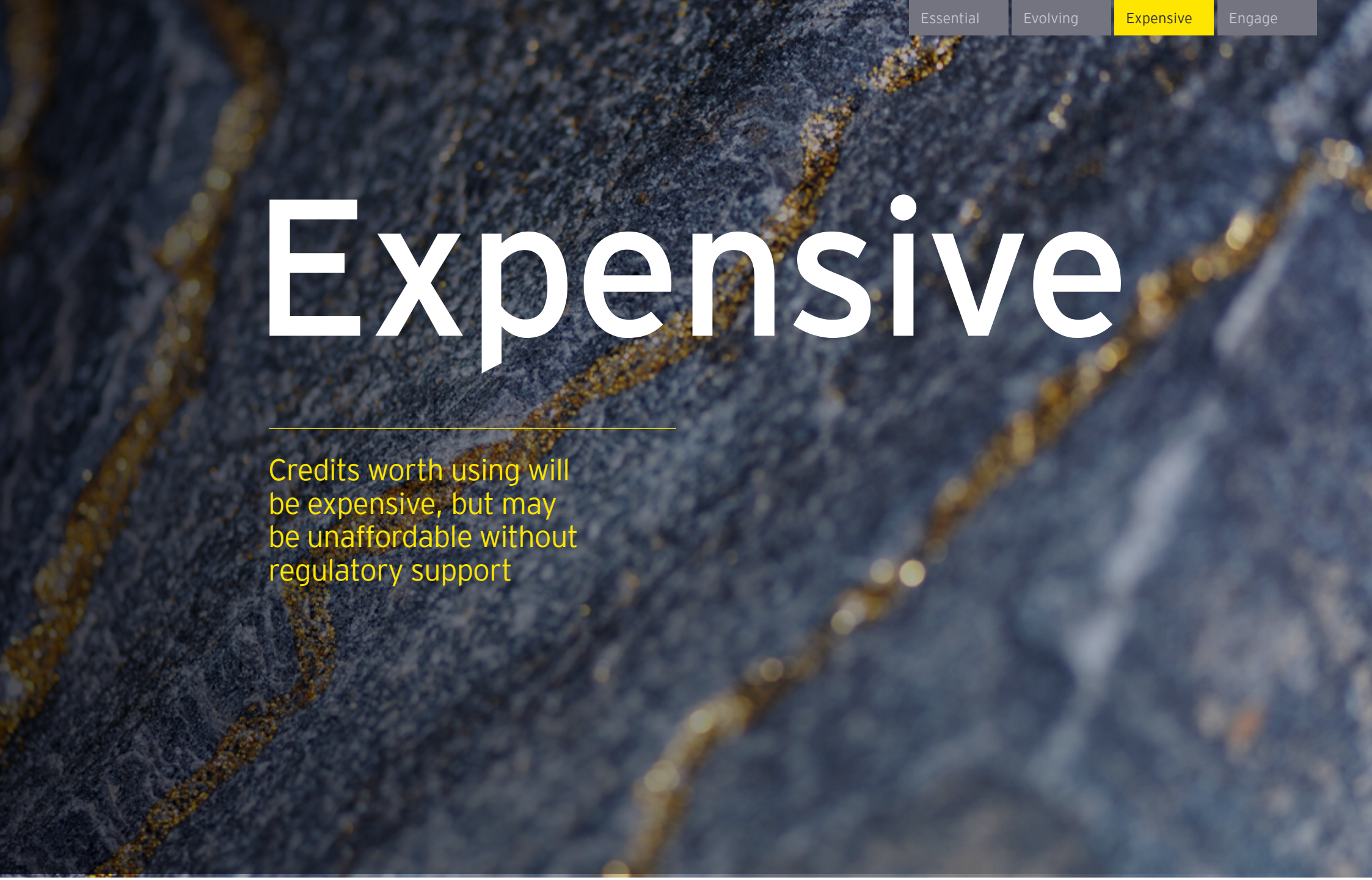
The Intergovernmental Panel on Climate Change highlights the crucial role of removals technologies in scenarios that limit global warming to 1.5°C above pre-industrial levels. These include peak and decline scenarios that assume long periods of 'net negative' global emissions where the volume of removals is larger than total global emissions, gradually reducing atmospheric concentrations of greenhouse gases.

Overall, 90% of the most stringent sub-set of IPCC 1.5°C scenarios involve 0.3 to 15.5 $GtCO_2e$ of removals annually by 2050.[3]

More ambitious climate scenarios with lower cumulative net global emissions and long-term temperature outcomes, including 1.5°C scenarios, typically find that land and carbon storage constraints will make it impractical to rely on reforestation and BECCS alone, and so DAC or alternative non-land removal technologies will also be required. This implies that failure to develop and deploy technology-based removals, including carbon capture and use solutions, would significantly constrain society's long-term options for responding to climate change.

> "Failure to develop and deploy technology-based removals at scale would significantly constrain society's long-term options for responding to climate change.

Steve Hatfield-Dodds,
Associate Partner,
EY Port Jackson Partners



Expensive

Credits worth using will be expensive, but may be unaffordable without regulatory support

Four future scenarios present a range of potential carbon credit market outlooks

The EY Net Zero Centre modelled four future scenarios to explore the role and outlook for carbon credits and markets across key uncertainties.

The scenarios are designed to assess the implications of several major uncertainties: levels of global ambition; future abatement technology costs; future offset project costs; and stakeholder preferences for different types of carbon credits.

The modelling framework provides projections for the volume, cost and mix of credits each year to 2050, based on detailed data on the commitments and abatement costs of more than 3,000 major global companies.

We anchor our analysis in three scenarios from the Network for Greening the Financial System.[7] A 'hothouse world' scenario based on Nationally Determined Contributions provides the context for Announced plans. The Below 2°C NGFS orderly transition scenario provides the context for our scenario with the same name. The NGFS Divergent Net Zero disorderly transition scenario provides the context for the Nature-enabled 1.5°C and Tech-enabled 1.5°C scenarios.

Shifts in policy context are most pronounced for the Tech-enabled 1.5°C and Nature-enabled 1.5°C scenarios. Consistent with differences in national commitments, the modelling assumes the majority of avoidance credits are generated in low- or middle-income nations, and are purchased and retired by businesses based in high-income nations. Achieving a 1.5°C net zero trajectory requires deeper and more rapid reductions in low-income and medium-income nations relative to the Below 2°C scenario. This constrains the space for all nations to create avoidance-based credits and increases the contribution of removals-based credits.

The assumptions for each of the scenarios are summarised in Exhibit 12, and more details on the EY Net Zero Centre offset modelling framework are provided in the Appendix.

Exhibit 12: We model four future scenarios to explore and assess a range of potential carbon credit market outcomes

Announced plans scenario

Assumes that there is no increase in ambition or mitigation effort over time, with credits based primarily on avoided emissions

Below 2°C scenario

The core commitment of the Paris Agreement, with middle-of-the-road assumptions on technology costs, and credits based on a mix of avoided emissions and removals

Tech-enabled 1.5°C scenario

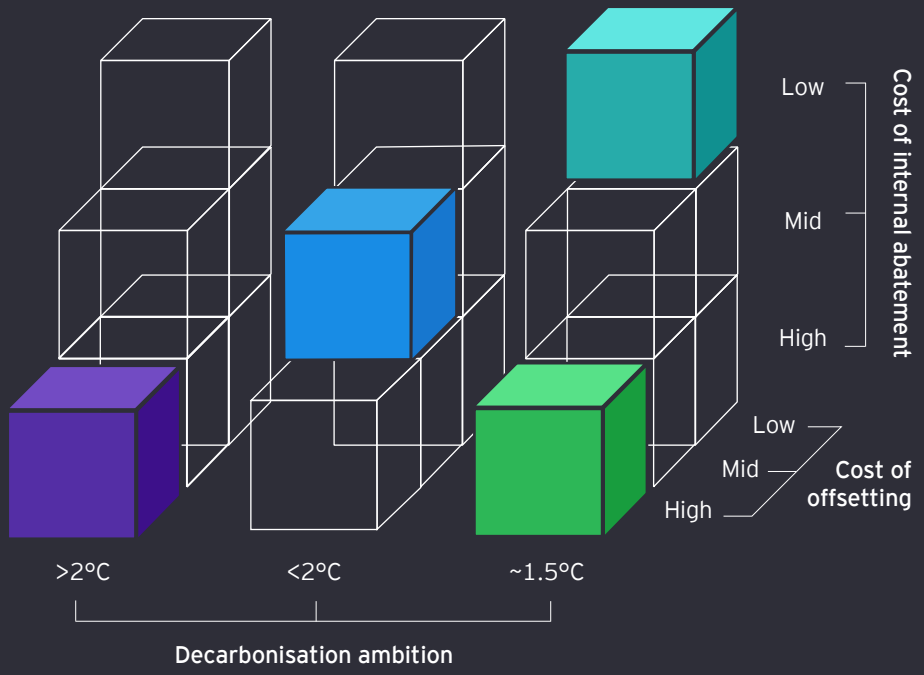
Involves more rapid and ambitious emissions reductions consistent with limiting climate change to 1.5°C, with more rapid innovation delivering low technology costs, and a mixed portfolio of technology-based and nature-based removals

Nature-enabled 1.5°C scenario

Assumes the same 1.5°C ambition and global emissions trajectory as the tech-enabled scenario, but with high technology costs and a strong preference for nature-based removals

Exhibit 13: Four future scenarios to explore and assess potential credit market outcomes

Four scenarios for emissions reductions and offsets to 2050



Announced plans

Existing trajectory for emission reductions based on announced plans and policy settings

Below 2°C

The central scenario sees an orderly increase in the stringency of climate policies and actions to limit global warming to below 2°C

Tech-enabled net zero

More rapid cost declines and technological development enables greater abatement and a mix of types of carbon removal offsets

Nature-enabled net zero

Slower reductions in technology costs drive greater need for offsets, with a focus on nature-based avoidance and removals

Intent and design criteria

- Provide a diverse view of possible ambition and mix of types of credits used to achieve net zero
- Link to most relevant NGFS scenarios
- Derive insights into the implications of key uncertainties for prices and volumes
  - Technology trends
  - Paris commitments and aspirations
  - Types of credits used

Exclusions

- A forecast of all carbon credit supply and demand or system constraints

Source: EY Net Zero Centre analysis

Incremental cost of supply will rise as volume increases, with up to 50% of credits to cost more than US$50 per tonne by 2035

Increasing demand, a race to quality and rising unit supply costs will result in carbon credits being scarce and expensive across all outlooks

Our analysis finds that scaling up credit volumes will quickly exhaust available low-cost supply, driving rapid increases in credit prices to 2035 across all scenarios.

In principle, rapidly growing demand for goods or services may not result in higher prices over the long term, if the supply requirements are elastic and relatively unconstrained. Indeed, the real cost of many consumer items has fallen dramatically over the last 50 years, driven by innovation, learning by doing and economies of scale.

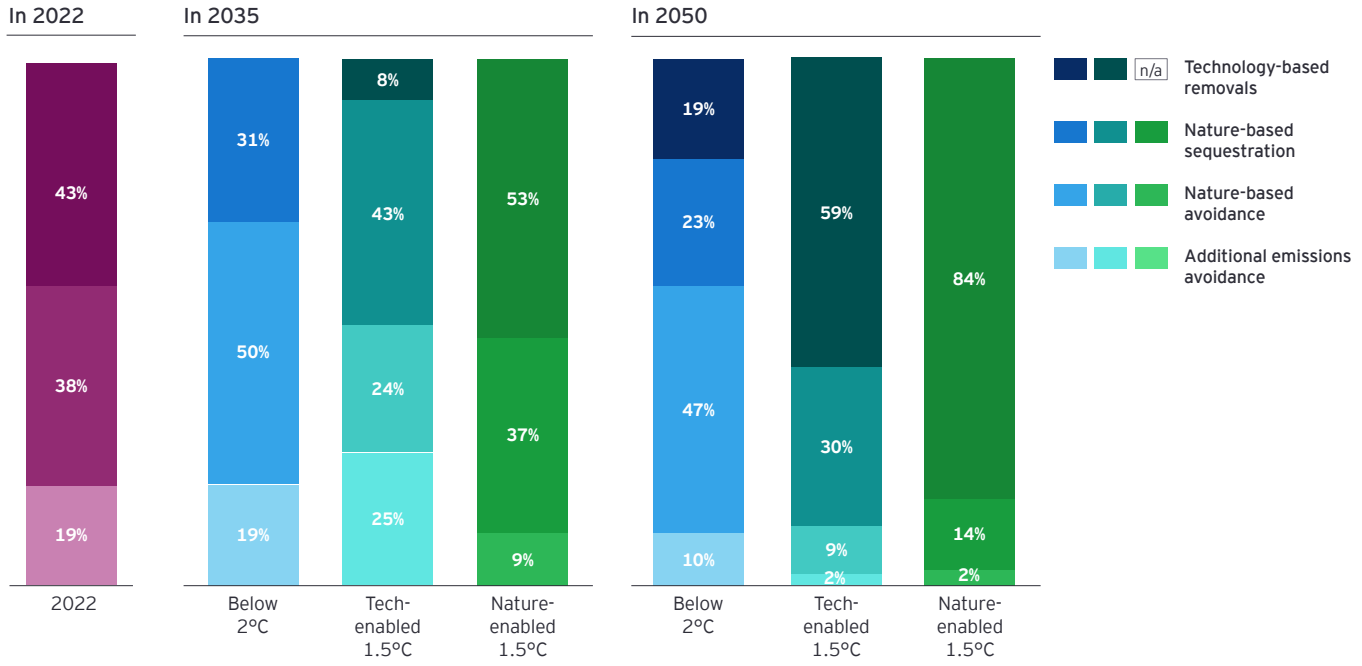
However, this is not expected to be the case for the supply of high-quality carbon credits, which is subject to multiple constraints. These constraints include the geopolitics of climate commitments (such as the notion of common but differentiated responsibilities) and the increasing importance of more costly removals-based credits. It also includes the evolving cost of "additionality", which influences the price of avoidance credits over time. As benchmarks for what qualifies as "additional" emissions reductions shift over time, this creates a baseline cost for avoidance credits, while removal credits are primarily driven by the expense of the technology required.

Average costs of high-quality carbon credits are expected to increase significantly to 2035 across all scenarios. These price increases are projected to continue after 2035 in most scenarios, as the cumulative increase in emissions reductions intensifies competition for avoidance-based credits and increases demand for removals-based credits. Price increases are projected to plateau or moderate after 2030 or 2035 in the Tech-enabled 1.5°C scenario, reflecting the assumption of faster and larger reductions in technology costs.

Against this backdrop, the EY Net Zero Centre also finds that credits with non-carbon co-benefits will continue to command a price premium, with the value of different benefits varying across different types of buyers.

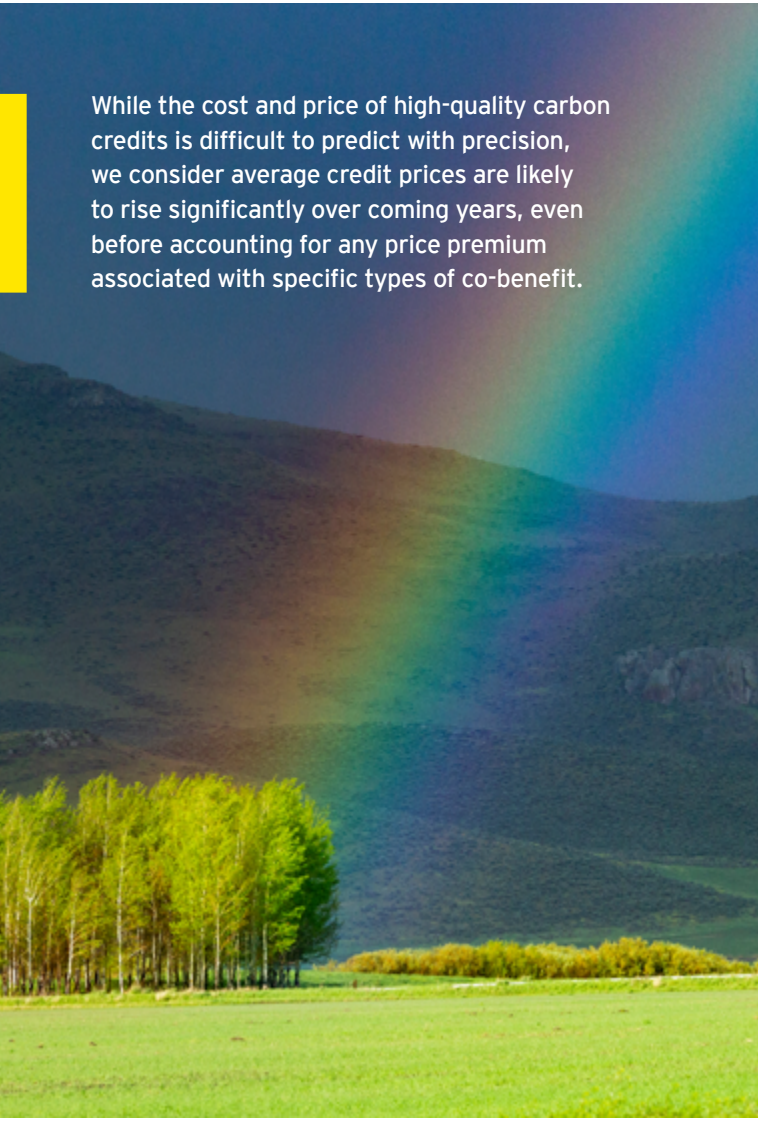
Exhibit 14: Nature-based and technological removals credits will play an increasing role across all outlooks, and have higher average costs than avoidance credits

Distribution of credit supply by type, 2022-2050



Source: EY Net Zero Centre analysis

Rising demand, quality standards and unit supply costs will make carbon credits scarcer and more expensive



While the cost and price of high-quality carbon credits is difficult to predict with precision, we consider average credit prices are likely to rise significantly over coming years, even before accounting for any price premium associated with specific types of co-benefit.

Credit prices are projected to rise to US$75-125 per tonne by 2035 in our central outlooks

Voluntary carbon credits are priced depending on a range of factors, including supply and demand, project quality and standard, and regional variation. Credits from lower-quality projects, those that fail to meet stringent verification standards or that do not demonstrate strong additionality often sell at prices well below US$25/$tCO_2$-e.

The modelling framework used to assess the volume and price of carbon credits assumes organisations move quickly to deliver on their announced emissions reductions (de-risking supply), and that there is little or no market friction. However, in practice bankable demand growth will take time to emerge (as shown across different scenarios on page 39), and markets could be subject to significant friction and inefficiencies for several decades. For this reason, we treat the model-based price projections as a lower-bound estimate of likely credit prices, given the ambition and technology cost trajectories for each scenario.

Our analysis suggests credit prices could rise from well under US$25/$tCO_2$-e today to US$75-125/tCO_2-e in 2035, and continue to rise to US$125-175/$tCO_2$-e in 2050 (in real 2020 dollars).

This refreshed price outlook to 2035 is slightly lower than projected in 2022, reflecting stronger than expected integrity concerns which we anticipate will bring forward additional investment in internal abatement, reducing projected future demand slightly. Flow through of these impacts has reduced the central price estimate for 2050 by around US$25/$tCO_2$-e.

Greater global ambition would lift prices, while innovation could reduce price growth

The central price estimate assumes that countries and companies move reasonably quickly to implement on-ground actions and policies that are consistent in aggregate with the Paris Agreement to limit climate change to well below 2°C. The estimate also assumes that costs of abatement and supply of credits will be in the middle or lower end of the range explored, and that substantial market frictions and imperfections could persist through to 2050 or beyond.

Within this range, different assumptions would see:

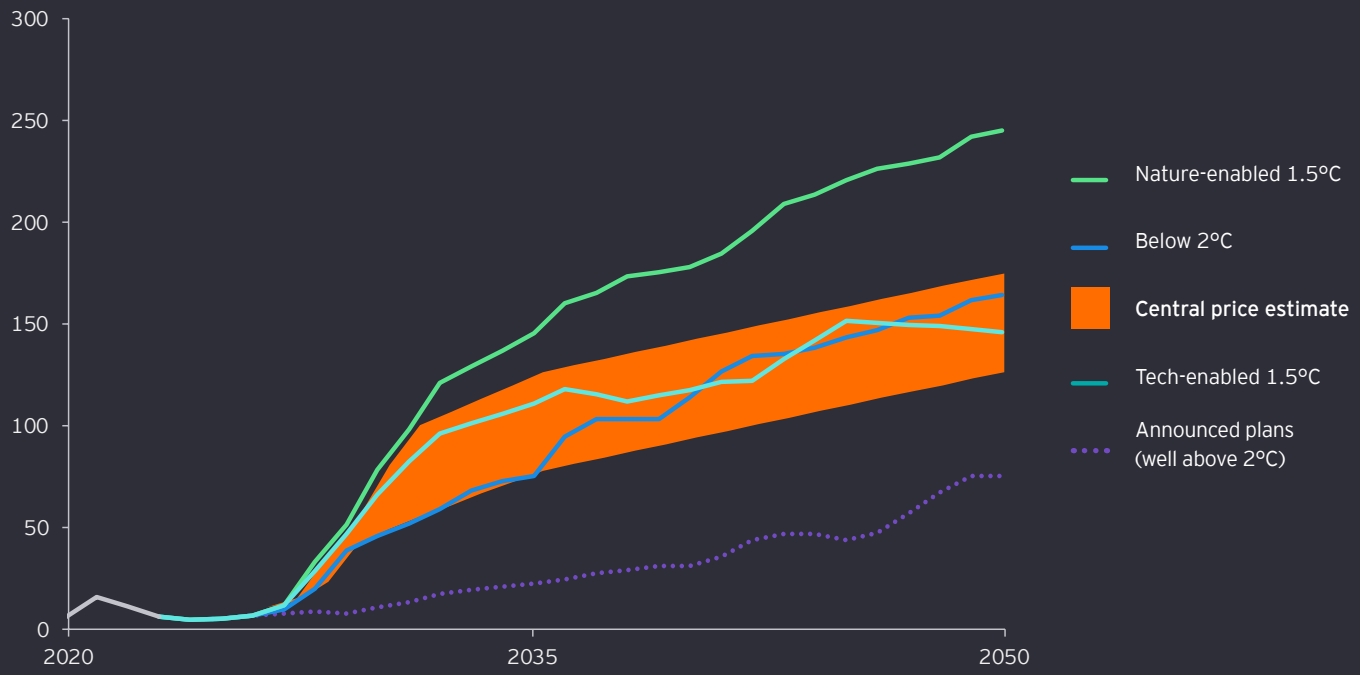
- Lower prices than projected for the Below 2°C scenario if technology costs fall more rapidly, or if total global abatement effort is less ambitious.
- Higher prices than projected for the Below 2°C scenario if total global abatement effort is more ambitious, or technology costs fall more slowly.
- Higher prices than projected for the Below 2°C and Tech-enabled 1.5°C scenarios if delayed or disorderly action requires greater 'catch-up' effort after 2035 (to achieve the same budget), or if market friction is more significant and persistent.

Projected prices do not account for the value of potential co-benefits.

Exhibit 15: Credit prices are projected to rise to US$75-125 per tonne in our central Paris-consistent outlooks

Carbon credit price outlook, 2020-2050

US$ per t-CO_2e; 2020 dollars



The **central price estimate** assumes:

- Countries and companies move reasonably quickly to implement on-ground actions and policies consistent in aggregate with the Paris Agreement
- Action may be 'back-loaded' requiring additional effort after 2035
- Substantial market frictions and imperfections could persist past 2050
- Technology costs could fall more quickly than assumed in the Below 2°C scenario

Credit volumes grow strongly but account for a relatively small share of abatement, as emissions-intensive assets retire

Credit volumes increase rapidly in Paris-consistent scenarios, despite credits accounting for a decreasing share of overall emissions reductions.

Avoiding dangerous climate change requires urgent deep cuts in emissions, driving increased use of credits

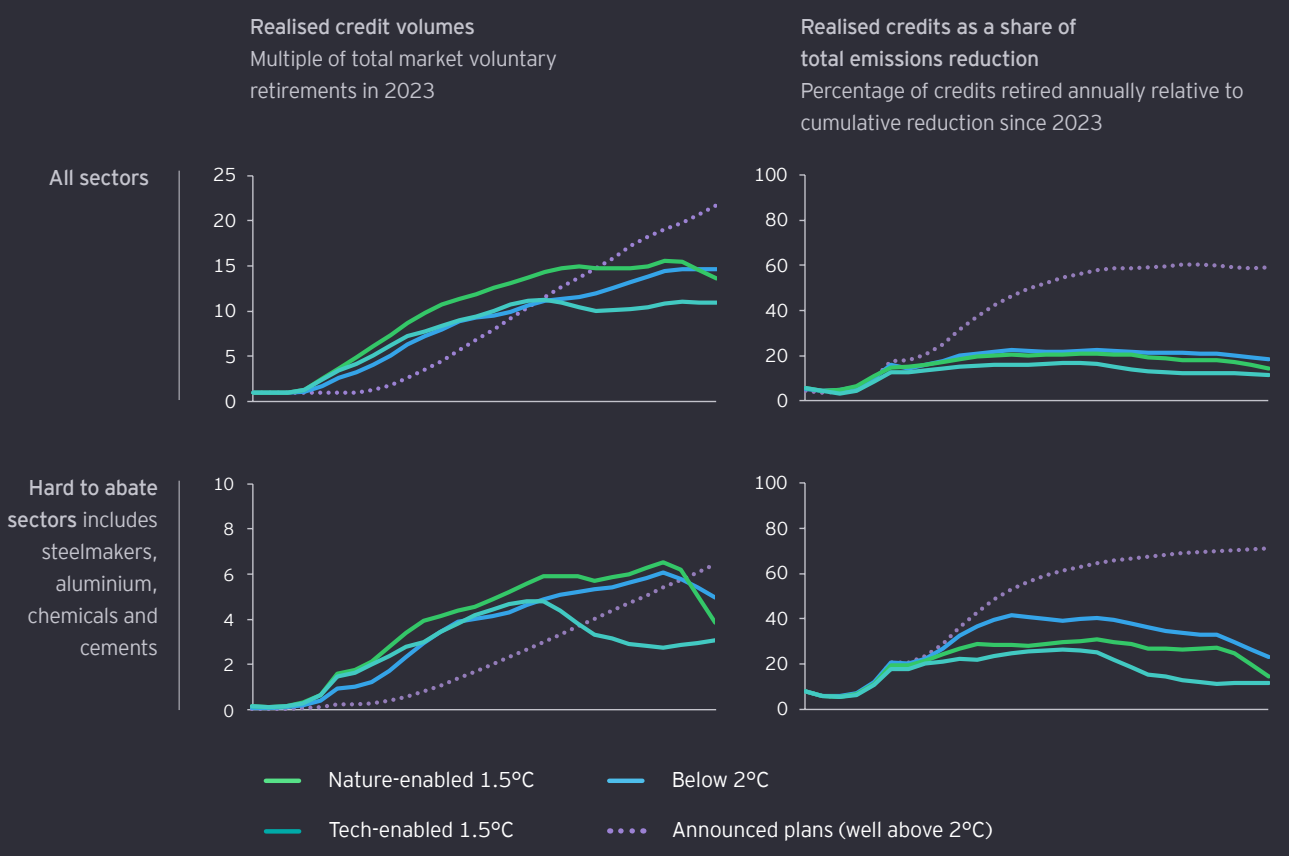
Analysis projects the use of voluntary carbon credits to increase to 9-12 times current levels by 2035 as businesses deliver on their decarbonisation strategies and commitments (in Paris-consistent scenarios). Volume growth from 2035 to 2050 is projected to be more modest (see Exhibit 16).

All sectors are projected to rely more heavily on internal abatement than the use of credits, with credits accounting for just 12%-20% of total abatement across all sectors in Paris-consistent scenarios.

Credits are particularly important for hard-to-abate sectors

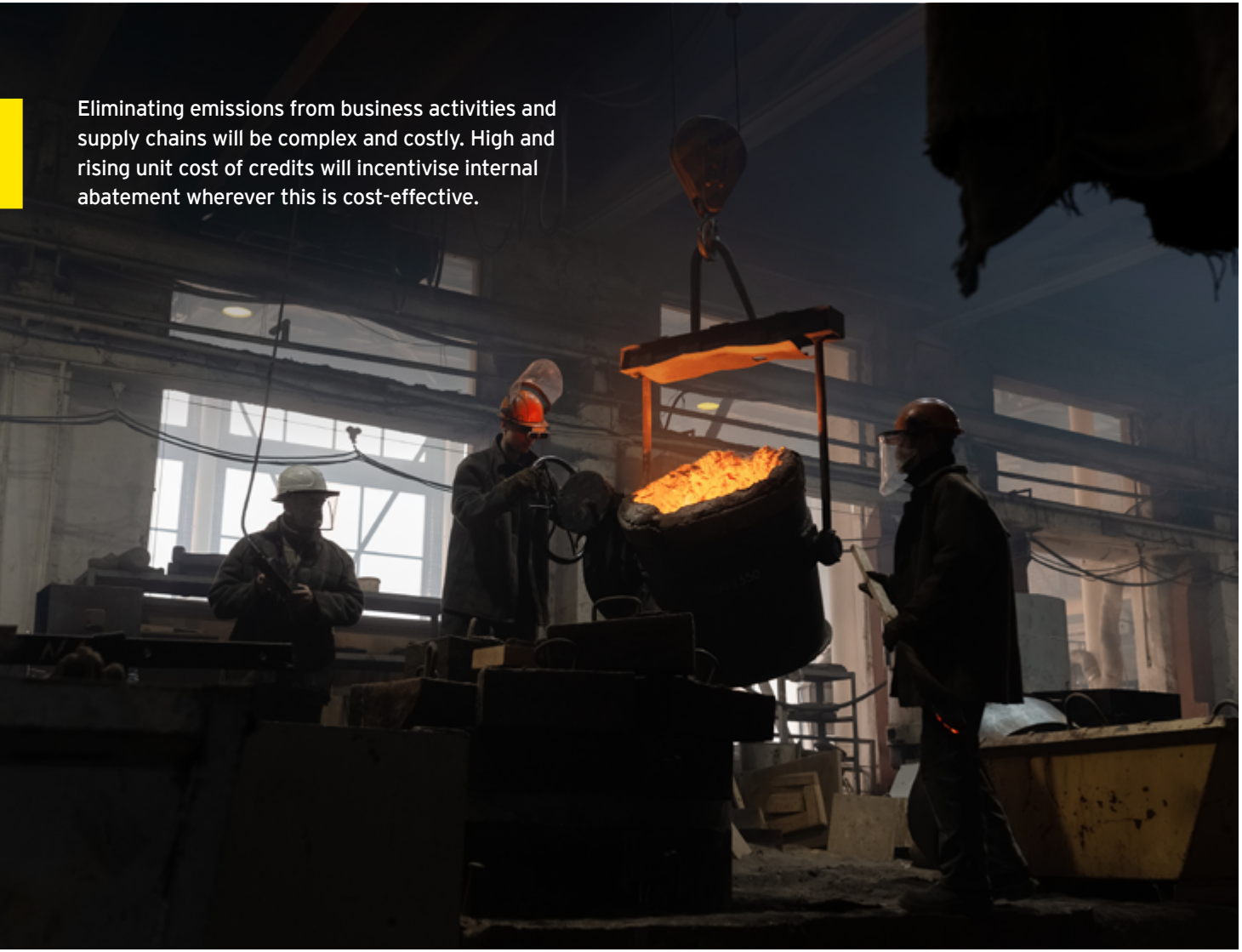
Credits are much more important for emissions-intensive hard-to-abate sectors, such as metal-making, chemicals and cement, where emissions from chemical processes are a material contributor to their overall emissions footprint. Analysis projects credits to account for 20%-40% of total abatement in these sectors to 2040.

Exhibit 16: Rising credit costs will reinforce incentives for businesses to pursue internal abatement



Source: EY Net Zero Centre analysis

Emissions-intensive businesses will be able to pursue costly abatement and net-zero emissions only if settings prevent unfair competition



Eliminating emissions from business activities and supply chains will be complex and costly. High and rising unit cost of credits will incentivise internal abatement wherever this is cost-effective.

Businesses will seek to pass on the cost of emissions reductions, including offsets

But even cost-effective decarbonisation strategies will be expensive, particularly for emissions-intensive industries, and organisations will seek to pass this through to customers as a cost of doing business.

Over time, this will change the competitive landscape of emissions-intensive sectors, motivating innovation and supporting decarbonisation of electricity, transport, heavy industry and agri-food industries.

Regulation may be required to support more costly abatement options

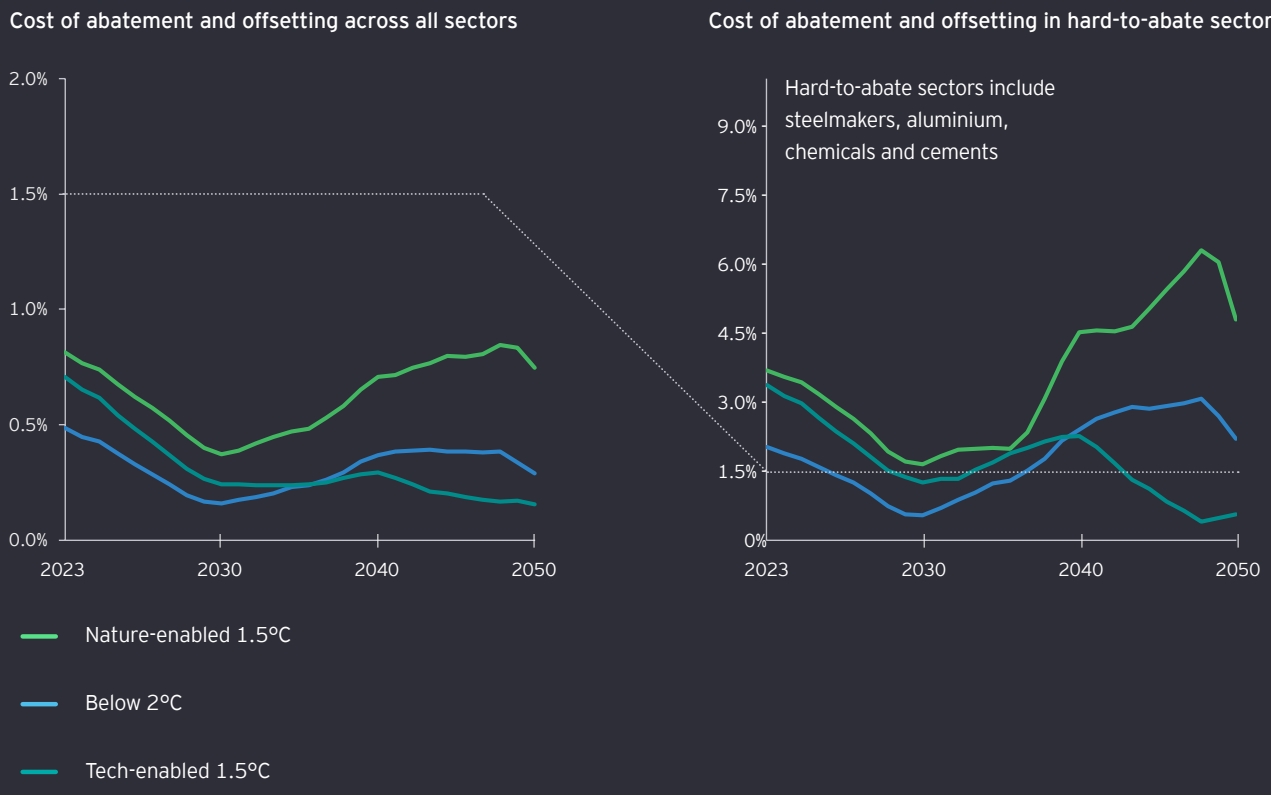
Reflecting decarbonisation costs in the prices of goods and services will increase the relative prices of products that are more difficult to decarbonise, at least in the short term, and encourage customers to shift to substitutes where these are available. For example, this is likely to result in additional consumption of chicken and poultry in place of red meat, and in train travel over flying for shorter journeys.

Cost pass-through is essential to signal the full supply chain impacts of different products, and reward innovation in reducing emissions.

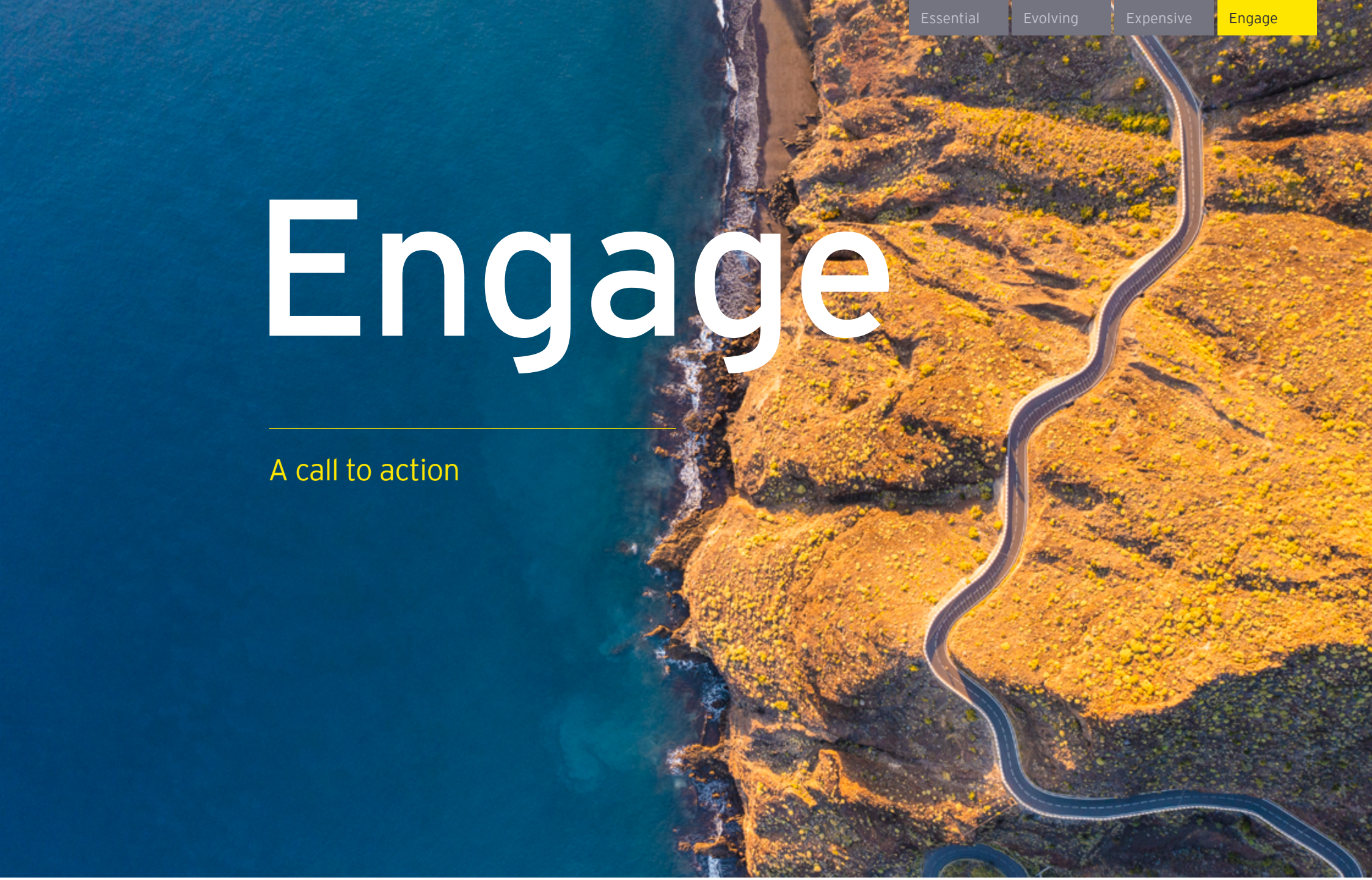
However, emissions-intensive businesses will be able to pursue costly abatement and net zero emissions only if regulatory or other settings prevent unfair competition from other facilities or businesses that would otherwise face weaker abatement requirements (including facilities operating in other jurisdictions).

Exhibit 17: Cost of abatement is material, particularly in hard-to-abate sectors, and likely to increase

Percentage of 2023 revenue spent on internal abatement and offsetting



Source: EY Net Zero Centre analysis



Engage

A call to action

Climate transition risks are best managed through early engagement

Stakeholder expectations, competitive pressures and carbon management options are all evolving rapidly. Early engagement and planning will help businesses explore issues and manage key uncertainties.

Expectations to act are intensifying, despite hesitation about credit integrity

The net zero transition has accelerated since 2022 and the urgency for businesses to engage and act has intensified.

Pressures from stakeholders will continue to increase and expectations to escalate. The scale and scope of required emissions reductions will expand, while timeframes will contract. Goals and perspectives of customers, investors and employees will vary, but aligning business strategies with broader climate goals will be key to maintaining stakeholder trust.

Government regulation will evolve, particularly around reporting and transparency. Physical climate variability and extreme events will intensify, creating diverse risks and opportunities across sectors and locations.

Business context will also shift, as peers and competitors adapt and reposition

New technologies will become cost-competitive, expanding the toolkit for managing emissions and carbon risks. Carbon credits will remain an essential component of this toolkit, but credits will become increasingly scarce and expensive, with prices likely to rise to US$75-125 per tonne by 2035.

Stricter national emissions budgets will lead to more stringent regulatory obligations and growing demand for removal-based carbon credits (which are typically more expensive). Advancing technology and evolving policy context will reduce the viability of avoidance-based credits.

Engage early to manage uncertainty

Business leaders who engage early will be better positioned to achieve a successful climate transition.

The nature and pace of action should always be informed by the specific pressures, risks and decarbonisation opportunities faced by businesses. But early engagement and planning will provide greater flexibility to explore issues and manage key uncertainties.

Success will require many businesses to compete in the current 'old world' while preparing for the new

To thrive in a net zero world, businesses must undergo transformative change.

Historically, companies have focused on efficiency at the expense of the environment. Now, they face mounting pressure to eliminate carbon emissions, even though the necessary incentives and supports are only beginning to emerge.

The challenge is substantial. Businesses must shift away from conventional energy systems and phase out carbon-intensive assets while investing in new technologies and approaches with uncertain returns. They must collaborate with competitors to move away from established, optimised supply chains and build new relationships that support carbon reduction. They must embrace significant risks and expand their focus from optimising existing advantages to forging new, uncertain paths, including the voluntary carbon market.

Meanwhile, countries are also vying to harness the benefits of the low-carbon transition. Nations in the Global South are increasingly recognising the opportunities presented by voluntary carbon markets and are in competition to attract investment and develop robust projects that not only capture carbon but capture economic benefits for their communities.

Change is coming, ready or not.

Businesses can take five steps to position and prosper through disruptive change

The EY Net Zero Centre analysis presented in this report highlights multiple disruptions that will transform how businesses should approach and implement their climate transformation strategies.

Five steps to position and prosper through disruptive change

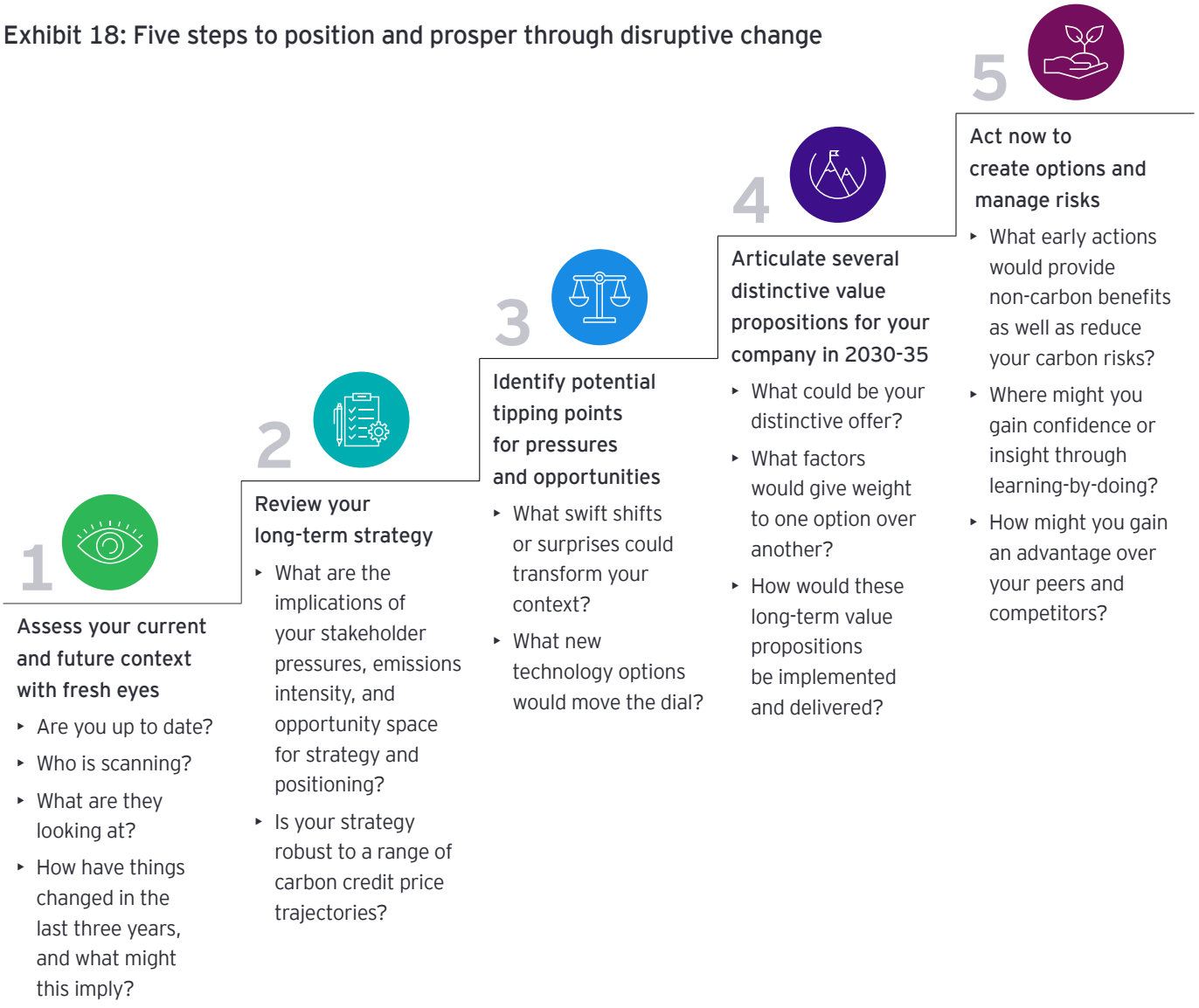
Businesses around the world are changing gear, signalling a shift to much deeper and faster emissions reductions in the future. Market forces and regulation are expected to enhance the integrity and quality of carbon credits, boosting their credibility and perceived legitimacy. As demand rises sharply, credits will become scarce and expensive. The price of carbon credits is expected to increase more than three-fold, to US$75 or more per tonne by 2035. This will dramatically impact the financial attractiveness of internal abatement options, accelerating the pace and ambition of internal actions and abatement strategies, while influencing the competitive landscape and market positioning. Carbon markets and the mix of credits supplied will continue to evolve.

The decades ahead will be very different to previous years. Business leaders who engage early will be most likely to achieve a successful climate transition.

Business leaders can consider the following five steps to position for disruptive change and the opportunities and challenges ahead.

More specific advice on developing a climate and energy transition strategy, including the role of carbon credits, is found on pages 8-12 and 16-17 of this report.

Exhibit 18: Five steps to position and prosper through disruptive change



A final word: Our climate future is not yet written

This report sets out how climate science, markets and politics are likely to influence future demand, supply volumes and prices of voluntary carbon credits and carbon markets across a range of outlooks. It has also assessed how the mix of credits might evolve, and the centre of gravity for carbon markets as their scope and structure adapt.

While the EY Net Zero Centre is confident that key drivers for carbon markets will intensify in the coming years, outcomes will be shaped by multiple megatrends. This makes the future inherently uncertain.

The future of climate change is unwritten. So is the future of carbon credits and carbon markets.

This is not unusual for businesses dealing with risk and return, threat and opportunity, every day. We do, however, encourage every business leader to clearly define their decarbonisation strategy, including the role of carbon offsets, and how they will minimise risks and maximise the right opportunities. In doing so, they will shape the future of their business with confidence.

Appendix

Lines of evidence used to inform this report

This report seeks to provide a robust multi-faceted assessment of the outlook for global voluntary carbon markets.

As noted in the introduction to this report, the analysis draws on several sources of expertise and experience:

- Deep expertise and engagement with private and public sector client issues associated with decarbonisation strategy and implementation, including understanding global and national climate scenarios, and their implications for business and government policy.
- Interviews with EY professionals with experience working in voluntary carbon markets conducted specifically for this edition of the carbon market outlook.
- Granular analysis of low-carbon technology and industry opportunities, drawing on EY work in business strategy and transformation.
- Development of a bespoke model of the global voluntary carbon credit supply and demand.

The rest of this Appendix details the scenario assumptions and implementation, and the EY carbon market modelling framework.

The EY carbon credit and abatement modelling framework

Carbon credit modelling framework for the global voluntary market

The EY Net Zero Centre has developed a bespoke model of the supply and demand for carbon credits for offsetting, based on the emissions profiles and emissions reduction commitments of 3,000 of the world's largest public and private companies by revenue.

Abatement and sequestration costs and potential are estimated from a wide variety of sources, with overall net emissions trajectory and mix of credit types calibrated to relevant climate projections.

The figure on page 50 shows the global abatement cost curve today, with current technology costs.

The model allows a range of assumptions for changes in technology costs for both internal abatement and credit creation, and for preferences for types of credits.

Based on these inputs, the model estimates:

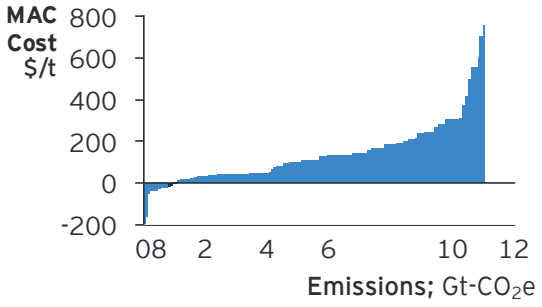
- Demand volume and willingness to pay for credits, by sector
- The most cost-effective portfolio of credits available to meet this total demand volume
- The market clearing price
- Each of these are calculated for each year from 2021 to 2050.

Exhibit 19: Our modelling approach determines the equilibrium price in offset markets by constructing offset supply and demand curves

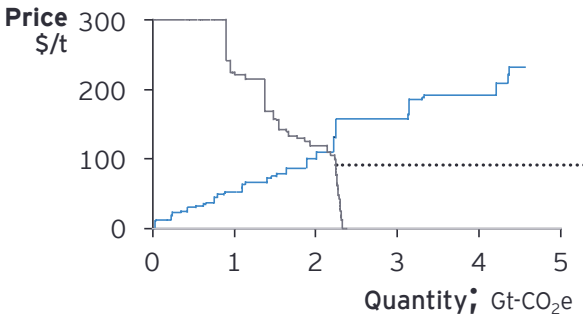
Overview of the EY Net Zero Centre carbon credit model

Modelling inputs	Method	Outputs
Define scenario properties: ▸ Global decarbonisation ambition ▸ Outlook for cost of offsets and abatement **Specify offset demand inputs:** ▸ Emissions, financials and decarbonisation plans of 3,000 largest firms globally ▸ Sub-sectoral marginal abatement costs **Specify offset supply inputs:** ▸ Maximum regional supply of offsets by type ▸ Current offset supply cost structure	**Evaluate buyer willingness to pay:** ▸ Defined by marginal abatement cost of buyer in a given year and if offsetting is cheaper firms won't abate **Calculate new credits issuances:** ▸ New credit supply is issued if past and forecast market prices make a project NPV **Determine market clearing price:** ▸ Clearing price is where demand for credits equals the supply of credits at that price	**Show price outcomes:** ▸ Price outlook for offsets ▸ Avoided cost of internal abatement **Supply-side outcomes:** ▸ Issuances, retirements and inventory ▸ Composition of offset supply by type, method and project region **Demand-side outcomes:** ▸ Emission reduction trajectories and relative spending on emissions reductions by sector

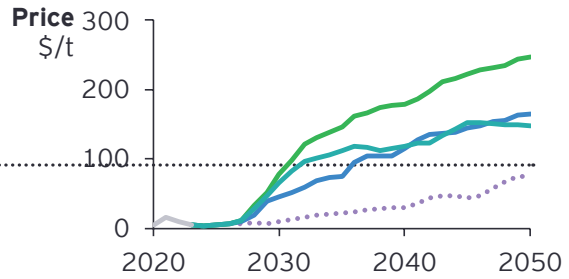
Example: marginal abatement costs in 2026



Example: market clearing price in 2035



Example: market clearing price in 2035

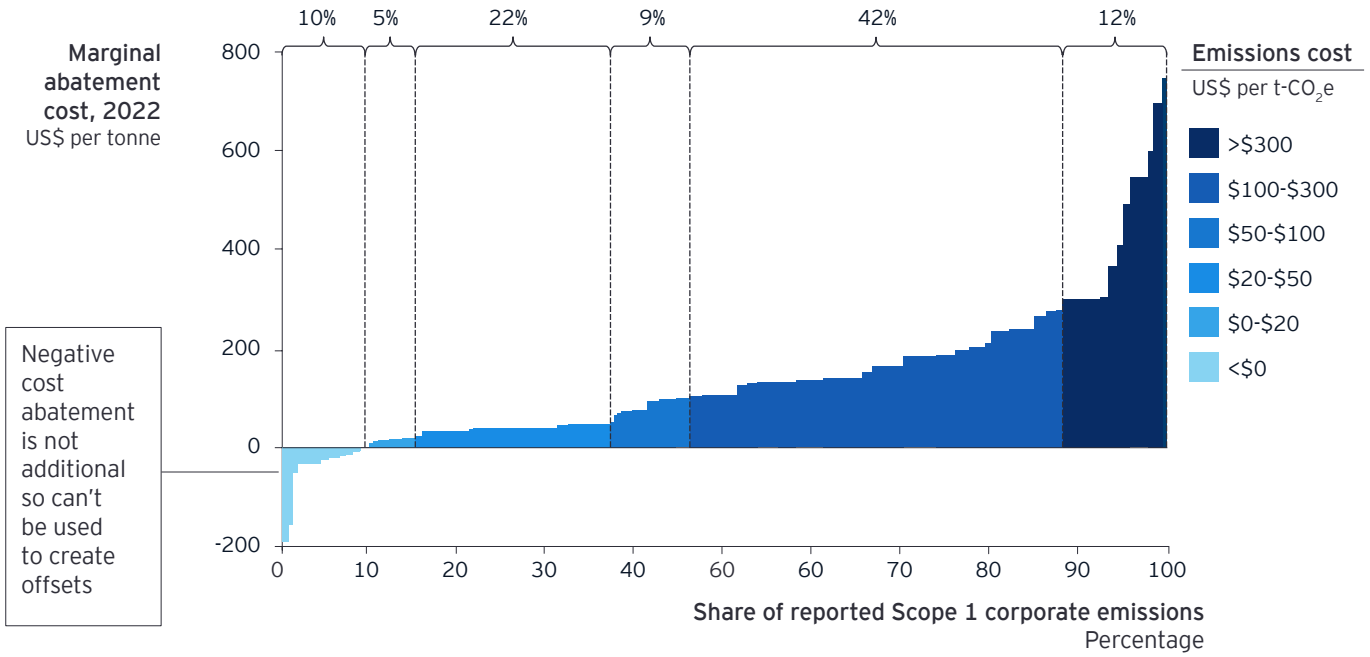


Interpreting marginal abatement cost curves

The figure shows all available emissions reductions options, ordered from the lowest cost options on the left to the highest cost options on the right. The height on the vertical axis shows the average cost for each option, while the width on the horizontal axis shows the volume of abatement available. Some options, such as energy efficiency, provide net savings to the business that implements them and are often described as 'negative cost' abatement.

Exhibit 20: Interpreting marginal abatement cost curves

Estimated global marginal abatement cost curve, large corporations, 2022



Source: Financial and emissions reporting of 3,000 largest public and private companies by revenue; EY Net Zero Centre analysis

Modelled scenarios explored in this report

The modelling uses four scenarios to explore and assess how carbon market outcomes could evolve across a range of uncertainties. The scenarios are located within the framework developed for the NGFS Climate scenarios 2021.[7, 8]

The intent and design criteria for the scenarios is to:

- Provide a diverse view of possible ambition and mix of credit types to achieve emissions reductions
- Link to the most relevant NGFS scenarios
- Derive insights into the implications and economic consequences of key uncertainties for carbon market prices and volumes:
  - Technology cost and availability
  - Evolution of action in relation to Paris commitments and aspirations
  - Mix of types of credits used.

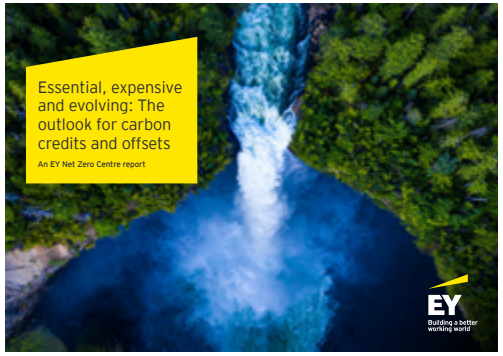
Exhibit 21: Four future scenarios assess different combinations of climate, technology and institutional drivers

Drivers across four scenarios

Scenario drivers	Announced plans	Below 2°C	Tech-enabled 1.5°C	Nature-enabled 1.5°C
Ambition	~2.5°C	~1.7°C	~1.5°C	~1.5°C
Pace of technology cost decline	●○○	○●○	○○●	●○○
Preferences for type	Avoidance	Both avoidance and removals	All types of removals	Nature based removals
Credits share of abatement task	Low	Medium	Medium	High
Market maturity and policy coherences	✥	≫	≫	≫
International trade opportunity	Low	Medium	High	High
NGFS Scenario relationships	*Aligned to NDCs*	*Aligned to Below 2°C*	*Adapted from Divergent Net Zero 1.5°C*	*Adapted from Divergent Net Zero 1.5°C*

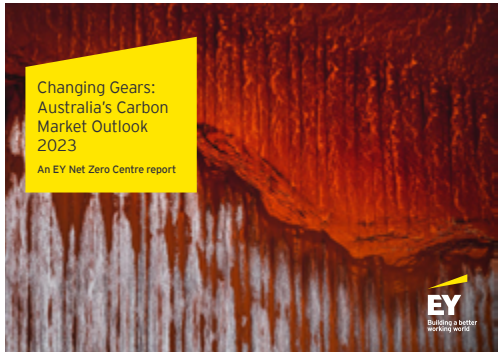
Source: EY Net Zero Centre analysis

Other thought leadership from the EY Net Zero Centre



Essential, expensive and evolving: The outlook for carbon credits and offsets

** Revised and refreshed by 2024 update*



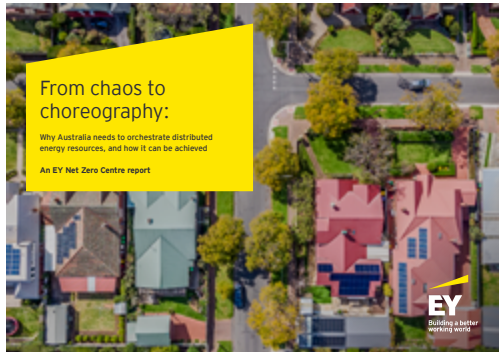
Changing Gears: Australia's Carbon Market Outlook 2023

Seizing Australia's energy superpower opportunities

Creating a nature-positive advantage

Zeroing in on net zero buildings

Energy Infrastructure Series



From chaos to choreography: Why Australia needs to orchestrate distributed energy resources and how it can be achieved

Powering progress: How Australia can fast-track energy transmission projects for a renewable future

Endnotes

1 This report uses 'outlook' to refer to the full range of potential future trends, risks and opportunities, and 'scenarios' to refer to a specific combination of assumptions that have been modelled.

2 Ernst & Young Australia (2022) *Essential, expensive and evolving: The outlook for carbon credits and offsets*, https://assets.ey.com/content/dam/ey-sites/ey-com/en_au/topics/sustainability/ey-net-zero-centre-carbon-offset-publication-20220530.pdf.

3 Intergovernmental Panel on Climate Change (IPCC) (2023) *Climate Change 2023 Synthesis Report,* https://www.ipcc.ch/report/ar6/syr/resources/spm-headline-statements/

4 Burzec, M. and Klaczynska Lewis, K. (2021) *Voluntary Carbon Market: Challenges and Promises of the Green Transition Tool*, EY Poland, www.ey.com/en_pl/law/voluntary-carbon-market

5 Sylvera (2023) *Carbon Credits: Permission to Pollute, or Pivotal for Progress?,* https://www.sylvera.com/resources/carbon-credits-and-decarbonization

6 Net Zero Tracker, 2024, *Data Explorer,* https://zerotracker.net/

7 NGFS (2022) *NGFS Scenarios for central banks and supervisors, Network for the Greening of the Financial System,* https://www.ngfs.net/sites/default/files/medias/documents/ngfs_climate_scenarios_for_central_banks_and_supervisors_.pdf.pdf

8 Richters, O., Kriegler, E., Al Khourdajie, A., Bertram C., Bresch, D.N., Ciullo, A., Cornforth, E., Cui, R., Edmonds, J., Fuchs, S., Hackstock, P., Holland, D., Hurst, I., Kikstra, J., Klein, D., Kotz, M., Kropf, C., Lewis, J., Liadze, I., Mandarouz, R., Meinshausen, M., Min, J., Nicholls, Z., Piontek, F., Sanchez Juanino, P., Sauer, I., Sferra, F., Stevanovic, M., van Ruijven, B., Weigmann, P., Westphal, M.I., Zhao, A., Zwerling, M. (2024), *NGFS Climate Scenario Database: Scenario Explorer V4.2,* https://www.ngfs.net/ngfs-scenarios-portal/data-resources/

Glossary

Additionality: A principle ensuring that the emission reductions from a carbon offset project are above and beyond what would have occurred in a business-as-usual scenario.

Article 6 of the Paris Agreement: A provision in the Paris Agreement that outlines the framework for international cooperation on carbon markets and which allows countries to trade carbon credits.

Avoidance: Emissions that would have occurred under a defined 'business-as-usual' scenario, but that were prevented due to an offset project.

Baseline: The estimated emissions that would have occurred without the carbon offset project, used to measure additional reductions.

Carbon Border Adjustment Mechanism (CBAM): This policy of the European Union aims to put a fair price on the carbon emitted during the production of carbon intensive goods that enter the EU to ensure that the carbon costs faced by EU producers are not undermined by cheaper imports from countries with less stringent climate policies. In a transitional phase until 2025, CBAM will apply definitively from 2026 and could drive increased demand for carbon credits and offsets as businesses seek to mitigate their carbon footprint and comply with EU regulations.

Carbon credit: A certified and transferable instrument representing the avoidance or removal of one metric tonne of carbon dioxide (CO_2) emissions or an equivalent greenhouse gases.

Carbon footprint: The total amount of CO_2 and other greenhouse gases emitted by an individual, organisation, event or product over a specified period.

Carbon leakage: The consequence of businesses that shift their production to regions with less stringent climate policies to avoid higher carbon costs, undermining global emission reduction efforts.

Carbon market registry: A system that tracks the issuance, transfer and retirement of carbon credits to ensure transparency and prevent double counting.

Carbon neutrality: Achieving a net-zero carbon footprint by balancing emitted CO_2 with an equivalent amount of carbon offsets.

Carbon offset standard: Frameworks or certifications that set requirements for the verification and issuance of carbon offsets, such as the Verified Carbon Standard or the Gold Standard.

Carbon offset: A reduction in emissions of CO_2 or other greenhouse gases made in order to compensate for emissions produced elsewhere. See Exhibit 22, page 57 for characteristic use of offsets in emissions reduction pathways.

Carbon price: The cost assigned to emitting one metric tonne of CO_2, which can influence the trading value of carbon credits.

Carbon pricing: The practice of assigning a cost to carbon emissions, either through carbon taxes or cap-and-trade systems, such as emissions trading schemes, to incentivise emission reductions.

Carbon sequestration: The process of capturing and storing atmospheric CO_2, usually in forests, soils or geological formations.

Certified emission reduction (CER): A carbon credit issued under the Clean Development Mechanism (CDM) of the Kyoto Protocol.

Clean Development Mechanism (CDM): The CDM was designed to help countries meet their emission reduction targets under the Kyoto Protocol. Approved projects in developing countries were issued with credits which could be traded or used by developed countries to meet their emission reduction targets. Focus of international climate policy shifted away from the CDM following criticism of the mechanism, and with the adoption of the Paris Agreement in 2015 which emphasised nationally determined contributions (NDCs) and a broader range of market and non-market mechanisms.

Climate finance: Financial investments directed to climate change mitigation and adaptation efforts, often including funds for carbon offset projects and clean technology.

Climate risk disclosure: The practice of reporting potential financial risks associated with climate change, often in accordance with standards like those developed by the ISSB.

Compliance carbon markets: Regulated by government, these markets are designed to meet legally binding emissions reduction or intensity targets.

Core Carbon Principles (CCPs): These are 10 fundamental, science-based principles for identifying high-quality carbon credits that create real, verifiable climate impact. The CCPs aim to set a global benchmark for high integrity in the voluntary carbon market to raise it to a consistent level of quality and ensure it accelerates progress towards the 1.5°C target.

Emission reduction project: A project designed to reduce greenhouse gas emissions, often used to generate carbon credits.

Global Carbon Market Utility (GCMU): Launched at COP27 in November 2022, the GCMU aims to enhance the quality and transparency of carbon credits, and to scale the global carbon market.

Gold Standard: A certification standard for carbon offset projects that sets criteria for projects to achieve additionality, sustainability and community support.

Greenhouse Gas Protocol: An international accounting tool used for quantifying and managing greenhouse gas emissions, commonly used for carbon footprint assessments.

Integrity Council for the Voluntary Carbon Market (ICVCM): This non-profit, independent governance body was established to set and maintain a global standard for high integrity in the voluntary carbon market, unlocking private climate and carbon finance that would not otherwise be deployed. ICVCM has established the Core Carbon Principles (CCPs) to assess carbon-crediting programs and methodology types.

International Sustainability Standards Board (ISSB): An independent board established to develop and maintain a comprehensive global baseline of sustainability disclosure standards. ISSB aims to enhance transparency and consistency in climate-related financial disclosures, and influence how companies report their carbon emissions and offset activities, including the use of carbon credits.

Internationally Transferred Mitigation Outcomes (ITMOs): Under Article 6 of the Paris Agreement, ITMOs refer to the transfer of carbon credits between countries to meet their Nationally Determined Contributions (NDCs). They represent units of greenhouse gas reductions that can be traded internationally.

Nationally Determined Contributions (NDCs): Commitments made by each country under the Paris Agreement to reduce greenhouse gas emissions. NDCs outline the targets, policies and measures that nations must submit to the United Nations Framework Convention on Climate Change (UNFCCC) and which must be updated and enhanced over time to reflect increasing ambition.

Nature-based solutions: Projects that sequester carbon through nature, such as: reforestation or afforestation projects that also improve soil and water quality, and habitat for wildlife; wetland restoration that also improve water filtration and flood control; mangrove restoration that protect coastal areas from erosion and storm surges; grassland management that improves land management practices and reduces soil degradation from livestock.

Paris Agreement: An international treaty adopted in 2015 with the goal to limit global temperature increase to 1.5°C. It includes mechanisms for reducing greenhouse gas emissions and enhancing global cooperation on climate action.

Project developer: An individual or organisation responsible for designing, implementing and managing carbon offset projects.

Removal: CO_2 or other gases that have been extracted from the atmosphere and safely stored.

Renewable energy certificates (RECs): Certificates that represent the environmental benefits of generating energy from renewable sources, often traded alongside carbon credits in voluntary markets.

Retirement of carbon credits: The process of removing carbon credits from circulation to ensure they are not resold or reused, confirming that the associated emissions reductions are final.

The Science Based Targets initiative (SBTi): Established in 2014 to help businesses set targets to eliminate emissions in line with the Paris Agreement, SBTi was initially a collaboration between CDP (formerly the Carbon Disclosure Project), the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF). It has since expanded its paid-for validation services and raises funds from private philanthropic interests.

United Nations Framework Convention on Climate Change (UNFCCC): This international treaty provides a framework for global climate negotiations and is the parent convention of the Paris Agreement. It plays a key role in supporting the development of mechanisms for voluntary carbon markets.

Verified Carbon Standard (VCS): A certification standard for voluntary carbon markets, operated by Verra, that provides guidelines for the quantification, monitoring and verification of carbon emission reductions from projects.

Verified emission reduction (VER): A carbon credit issued under various voluntary standards, indicating that a project has achieved verified reductions in emissions.

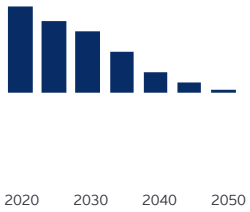
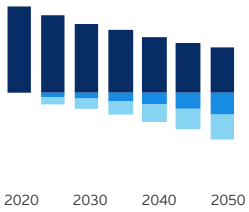
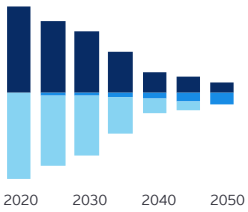
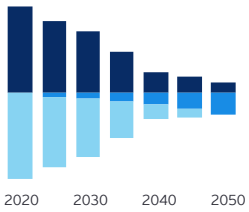
Verra: A non-profit organisation, established in Switzerland in 2007 and now headquartered in Washington DC, Verra publishes methodologies for the creation of carbon offsetting projects and authenticates the credits generated through the Verified Carbon Standard (VCS). Verra also operates the Climate, Community & Biodiversity Standards.

Voluntary Carbon Markets Integrity Initiative (VCMI): This independent not-for-profit, announced by COP26 President-Designate Alok Sharma in March 2021, is establishing robust principles and frameworks for the voluntary carbon market to ensure that carbon credits represent real, measurable and additional emissions reductions.

Voluntary carbon markets: Markets that allow organisations and individuals to use carbon credits to offset their emissions, to meet voluntary goals, typically driven by corporate social responsibility or sustainability objectives.

Exhibit 22: Understanding different types of emissions pathways and commitments

Characteristic use of offsets in emission reduction pathways

	Direct decarbonisation	Path to carbon neutral	Net zero emissions	Beyond net zero
Emissions profile tonnes CO_2e ■ Emissions ■ Removal credits ■ Avoidance credits				
Approach	Decarbonise your operations and value chain aligned with scientific consensus	Neutralise and compensate emissions within any given year	Reach a state of no net impact within a timeframe aligned with Paris ambitions	Overcompensate for your emissions. Equivalent to carbon negative/positive
Use of offsets	No use of offsets	High-quality removal credits and avoidance offsets	High-quality removal credits match and 'offset' residual emissions in 2050	High-quality removal credits exceed residual emissions in 2050, going beyond 'offsetting'
Standardisation alignment				

Source: EY Net Zero Centre analysis

How EY can help

The EY Net Zero Centre helps companies cut through the complexity, manage the uncertainty and create clear pathways to net zero emissions.

Headed by the region's leading climate change strategists, the Net Zero Centre supports EY clients to make the right decisions at the right times and set themselves on a pathway for success.

We can help you turn disruption into opportunity.

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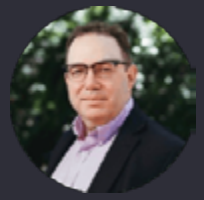

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